INTEGRATED NATIONAL ENERGY AND CLIMATE PLAN

Italy

Italian Ministry of the Environment and Energy Security

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Summary

SECTION A: NATIONAL PLAN

1 OUTLINE AND PROCESS OF SETTING UP THE PLAN

1.1 Summary

I. Political, economic, environmental, and social context of the plan

Italy fully shares the Community's approach to strengthening efforts to decarbonise Europe's energy and economic systems and to bring Europe to be the first regional area to have a social, economic and productive dimension entirely to net zero emissions, also with a view to achieving international leadership in this sector and thus leading other world economies.

However, this path is highly complex and does not lend itself to simple solutions or pre-established choices, but will require measures to support the use of all available technologies, behaviours and energy sources that can decarbonise the country's economy, adapting the different choices to the needs linked to different productive, economic and social domains.

In this transition pathway, which requires a marked acceleration compared to what has been done so far, careful consideration should also be given to the various aspects of economic and social sustainability and compatibility with other environmental protection objectives.

The recent events that have affected social systems (the pandemic, Russia's war on Ukraine, the surge in energy prices) have indeed highlighted the fragility of the interdependence patterns of energy and economic systems, showing that the choices towards decarbonisation, which have become increasingly urgent in the light of the climate change already in place, with effects particularly in Mediterranean areas, will also have to address resilience factors in order to mitigate possible new adverse events.

Decarbonisation policies should be combined with those aimed at maintaining the quality of life and social services, combating energy poverty, and maintaining competitiveness and employment, given the structure of the Italian production and manufacturing fabric, not only with regard to non-European countries which are not yet implementing decarbonisation policies with equal determination and speed, but also avoiding intra-European competition as a result of national measures not harmonised at Community level.

The aim is therefore to develop the measures described in this Plan in terms of policy, by classifying them into operational instruments that together improve energy security, environmental protection and affordability of energy, contributing to European energy and environmental objectives.

The actions underlying this commitment will be explained in various forms and directions, including the measures transposing the Community Directives implementing the Fit for 55 package (FF55) and the various initiatives under way at Community level, to which Italy intends to actively contribute in their design phase with a view to ambition and concretely, promoting further and mutually reinforcing initiatives.

Looking at the scenarios in terms of emissions and the achievement of the global and sectoral targets for 2030 set out in the Integrated National Energy and Climate Plan (INECP) of 2019, we note that there was a distance in reaching them, due both to the fact that they were highly challenging in terms of the actual potential to achieve them in terms of investment and implementation times, as well as the obstacles encountered in their implementation, linked to the permit-granting difficulties for new renewable installations, and the slowing down of activities in recent times of crisis. This leads to a greater effort to safeguard the new emission reduction targets set at Community level in 2030, which will have to be set in a pragmatic and effective way.

The way forward will therefore require an extreme effort, in particular with regard to reducing consumption and emissions in the sectors linked to the Effort Sharing Regulation (ESR[1]) commitments, i.e. in sectors such as transport, civil, agriculture, waste and small and medium-sized industry. This means that, in addition to the decarbonisation actions of the energy-intensive and thermoelectric industrial sectors linked to the Emission Trading Scheme (ETS) objectives, for which it will be important to exploit all available technologies, extensive action will also be needed with drastic measures to reduce consumption and coal emissions in the tertiary sector, the residential sector, in particular transport through a strong modal shift towards public transport (LPT), and the reduction of mobility needs, without neglecting the replacement of public and private transport towards more efficient vehicles with reduced CO2 emissions.

There will therefore be a need for a substantial shift in lifestyles and consumption patterns towards more energy-efficient behaviour and lower emissions, to which new generations are certainly more sensitive, acting through the sources of public training and information, together with ways of promoting/discouraging behaviour according to their sustainability.

The circular economy must also be part of production and manufacturing standards; while some sectors are already very advanced in recovery and recycling, there is a need to step up the search for solutions that minimise the use of raw materials, as well as consumption in the production cycle, and reduce waste, implementing the circular economy strategy with concrete measures.

In the update of the INECP, Italy therefore intends to take advantage of the significant benefits of the widespread deployment of renewables and energy efficiency, linked to the reduction of pollutant and climate emissions, the improvement of energy security and economic and employment opportunities for households and the production system, and intends to continue vigorously on this path, through a stronger approach to diversifying available technological solutions for decarbonisation, continuing to finance the development of new energy technologies for the transition and their transfer to the business world.

Updating the INECP is also a moment to rethink the system in the light of what has happened in recent years, strengthening its security of supply and its central role at the Mediterranean and European level. The path undertaken to make Italy a ‘hub’ for energy generation and transit should be accelerated and strengthened, with an increasing contribution of renewable energy, fully reaping its benefits in terms of diversification, security and liquidity of supplies, as well as those of enhanced partnerships with supplier countries.

Italy has historically been among the most advanced European countries in terms of energy efficiency. This position is due both to the high energy costs that have always led businesses and consumers to conscious and rational use of energy, and to being one of the countries and for a longer time and with increased efforts has financed mechanisms to promote energy efficiency in all economic sectors.

The challenge to achieve the new 2030 targets is very complex. If the decarbonisation path is set and, as mentioned above, represents an opportunity for us to seize, the European trajectory for 2030 includes recently revised upward targets, through the REPowerEU programme and the F55 package; very ambitious targets, in particular, with regard to Italy, also because of the starting point in Italy and probably, also because the INECP drawn up by Italy in 2019 has set very ambitious sectoral and comprehensive targets, in some cases higher than the mandatory ones.

[1] *Regulation (EU) 2023/857*

II. Strategy relating to the five dimensions of the Energy Union

In updating the plan, the Ministry of the Environment and Energy Security (hereinafter MASE) started from an overview of the main energy and emission indicators to define the state of the art in 2022 (reference year for the construction of the new plan) and the forecast for 2030 of existing policies (trend scenario).

When compared with the objectives set out in the INECP 2019, these values highlighted distances from the objectives that were intended to be achieved. For example, as of 2030, the penetration of renewable sources into existing policies is 27 %, compared to a target of 30 % in the NECP 2019; final consumption under existing policies is 109 Mtoe, compared with an INECP 2019 target of 104 Mtoe; the reduction of emissions in the ESR sectors to existing policies is 29.3 %, compared to a target of 33 % in the NECP 2019. These "gaps" can mainly be attributed to the excessive optimism of the 2019 Plan as to whether the objectives can be achieved, the incomplete implementation of the planned measures and the changed context (pandemic, economic recovery, war).

The reference framework, as compared to the period 2019-2 020 in which the first plan was drawn up, has changed significantly.

Energy security and the speed of the decarbonisation process appear to be dimensions that are strengthened at European level, also to take into account the extraordinary investment plans introduced by Europe under the National Recovery and Resilience Programme (NRRP), to relaunch the post-Covid economy and to address the impact of Russia's war on Ukraine. Similarly, measures to make the transition sustainable from the point of view of energy costs and the volume of investments needed are linked to the choice of the technology mix that will be considered to be introduced.

The delicate geopolitical situation in Europe, as a result of a conflict affecting natural gas supply routes in northern Europe and through Ukraine, involving what was the Union's main supplier, led the European Council to endorse the proposal for a Regulation, aimed at increasing Europe's security of energy supply. This is achieved through the reduction of dependence on Russian fuels and the initiatives foreseen in the new RePowerEU programme[2], with a view to increasing the resilience, security and sustainability of the European energy system, by rapidly building new LNG supply infrastructure, by installing floating regasification and storage units, and accelerating the development of renewables, energy efficiency and energy storage capacity.

Record energy prices since the second half of 2021, exacerbated by the Russian-Ukrainian conflict and an imperfect functioning of markets, have also given a strong impetus to accelerate the implementation of the European Green Deal and strengthen the resilience of the Energy Union by accelerating the transition.

While the crisis has accelerated some processes and introduced new tools, resources and reforms (e.g. through the RRP, the RepowerEU Plan, etc.), it has created a complicated macroeconomic situation (inflation, supply chain bottlenecks, etc.) that demonstrate the limits of excessive acceleration of infrastructure works.

A realistic and technology-neutral approach has been followed in the process of updating the plan. However, it provides for a strong acceleration on: renewable electricity sources; production of renewable gases (biomethane and hydrogen) and other biofuels including HVO (hydrotreated vegetable oil); building renovations and electrification of final consumption (heat pumps);

[2] *COM (2022) 108 REPowerEU and COM (2022) 230 REPowerEU Action Plan*

deployment of electric cars and policies to reduce private mobility; CCS (CO2 capture, transport andstorage).

This was done by providing for: updating and developing existing policies (regulation, simplifications, incentives); full implementation of what is already foreseen in the RRP and the new REPowerEU chapter[3] approved by the EU Council Implementing Decision at its meeting of 8 December 2023 and most recently by Council Implementing Decision at its meeting of 7 May 2024; the definition of further policies identified with Ministries responsible for transport, industry, agriculture, research and the economy.

This revision of the INECP therefore takes into account the above situation, also considering the updated European decarbonisation targets and the simultaneous need to maintain the safety and adequacy of the national energy system.

In this context, based on data from the **National Platform for a Sustainable Nucleare**, set up by MASE in November 2023, long-term scenario assumptions (from 2035 to 2050) containing a share of nuclear generation, as a possible further contribution to decarbonisation, in addition to the low emission energy sources mentioned above (*see Chapter 2.1.1 – section 'Nuclear energy'*). These analyses aim to assess the possible usefulness/convenience of energy production through the new nuclear technologies under development and are well framed by different dimensions set out in this paragraph, which are set out in the following paragraphs.

The contextual nature of the energy crisis, with the need to ensure the post-COVID economic recovery, has increased the sensitivity to ensure that the sustainability of the energy system, including environmental sustainability, of the energy system, is pursued with careful attention and attention to the economic impacts on consumers, a share of which is not only in energy poverty and is worthy of protection. On the other hand, the cost of energy (gas, fuel and electricity) paid by companies still shows a positive spread compared to the European average and this is a further reason for a particularly cost-sensitive approach to the energy transition.

In addition, due attention will be paid to ensuring compatibility between the energy and climate objectives and the objectives of landscape protection, air quality and water bodies, biodiversity conservation and the protection of soils and green heritage of large carbon dioxide removals such as forests and agricultural areas, which are of particular relevance as recent meteoclimatic events have shown.

The actions needed for the increasing decarbonisation of the system will require the widespread construction of installations and infrastructure that can also have environmental impacts. Some of these impacts can be mitigated, for example by promoting the deployment of photovoltaic on surfaces already built or otherwise unsuitable for other uses, but in order to ensure the stability of the energy system, a number of physical infrastructure (enhanced interconnections, grid resilience, large-scale energy storage, carbon capture and storage systems) will have to be built in the medium term, which will necessarily have to have shorter permitting times, while respecting dialogue and sharing with the territories. The example of the six-month emergency authorisation of the two new floating regasification and gas storage units that are allowing us to ferry the gas system over two years to an acceptable safety situation even in the absence of Russian gas, should be the rule, and not the exception, in the case of e.g. wind farms and water storage for energy storage, without which the decarbonisation pathway will be unachievable.

The process leading to the development of the mix of solutions and instruments that are more compatible with the objectives of the updated INECP and the needs for assessment of environmental impacts involved various interlocutors, including through the public consultation carried out in May 2023.

[3] *Commission Notice Guidance on Recovery and Resilience Plans in the context of REPowerEU*

The broad adherence of citizens and businesses to the instruments for promoting distributed generation and energy efficiency suggests that support policies on these issues will need to be strengthened, with a strong focus on minimising burdens. However, forms of involvement must also be implemented to build large installations (additional to those distributed but still necessary) and other physical infrastructure, so as to ensure the smooth and timely implementation of the measures, in line with the path towards achieving the objectives.

The plan aims to contribute to a broad transformation of the economy, in which decarbonisation, the circular economy, efficiency and the rational and equitable use of natural resources together represent objectives and instruments for a more people-friendly and environmentally-friendly economy, in a framework for the integration of national energy markets into the single market and with an appropriate focus on affordable prices and security of supply and supply.

In the update of the policies and measures contained in the Plan, particular attention has been given to their feasibility and the need to combine energy security, the affordability of energy costs, the economic and social sustainability of the energy transition, including through a stronger approach to diversifying the technological solutions available for decarbonisation.

Italy is well aware of the need for the continuous focus on improving energy security, industrial spillover effects and economic and social sustainability of renewable energy and energy efficiency measures linked to the new and more ambitious European energy and climate targets.

As regards the strategy for each of the five dimensions of the Energy Union, the objectives and measures set out in the relevant chapters are as follows:

❖ DECARBONISATION DIMENSION

♦ *GREENHOUSE GAS EMISSIONS AND REMOVALS*

The emission reduction target is regulated in three main regulatory areas.

1. The first regulatory framework is defined by the ETS Directive and related legislation. The EU ETS works according to the ‘cap and trade’ principle. The cap is a limit set on the total quantity of greenhouse gases that can be emitted by installations and aircraft operators covered by the scheme. The cap is reduced annually in line with the EU’s climate target, ensuring that emissions decrease over time. With the Fit for 55 package, the cap on emissions is tightened to reduce emissions covered by the ETS across the EU by 62 % by 2030, compared to 2005 levels.
2. The second is defined in Regulation (EU) 2018/842 recently updated by Regulation (EU) 2023/857 (the ‘effort sharing- ESR Regulation’), which established that for Italy and emissions from the transport, residential, tertiary, non-ETS industry, waste and agriculture sectors are reduced by 43.7 % by 2030 compared to 2005 levels. This reduction will have to take place on a clear trajectory setting maximum annual emission limits throughout the period 2021-2030, to be achieved mainly in the transport and civil sectors. It is crucial to stress that while ETS reduction targets fall directly on entities operating within the system, the ESR targets are the responsibility of the Member States.
3. Finally, in order to achieve the emission reduction targets, the so-called Regulation (EU) 2018/841, also updated in 2023 with Regulation (EU) No 839/2023, which lays down rules for the reduction of carbon emissions and removals in the land use, land use change and forestry (LULUCF) sector, should also be considered. To help achieve climate neutrality, the revised LULUCF Regulation provides for a European net removal target of 310 million tonnes of CO2 equivalent by 2030. this European target needs to be implemented through ambitious, fair and binding national net removals targets for the LULUCF sector. This

represents an increase of around 15 % in net removals in the EU compared to current levels and reverses the downward trend in net removals in recent years. For Italy, the target to be achieved is an absorption of more than 35 million tonnes of CO2 equivalent to 2030.

The Effort Sharing Regulation set an even more ambitious target for Italy, with emissions falling within its scope (transport, residential, tertiary, industrial activities not covered by Annex I to Directive 2003/87/EC, waste, agriculture) reduced by 2030 by 43.7 % compared to 2005 levels.

With regard to Effort Sharing, in order to comply with the 2021-2030 emissions trajectory, which will have to lead to the achievement of the new target, it will be necessary to start a significant reduction in emissions of more than 30 % compared to 2021 levels immediately, to be achieved mainly in the transport, civil and agriculture sectors.

While the increased competitiveness of renewable electricity generation technologies makes it possible to accelerate the decarbonisation process in electricity generation without significant burdens, in order to promote a reduction in climate emissions in Effort Sharing sectors, a change in the electricity mix leads to limited benefits if not accompanied by a change in final consumption.

For the sectors included in the ESR, the baseline scenario (i.e. considering the effect of policies adopted on 31 December 2021) shows that, also following the changed post-COVID-19 situation, linked to the economic recovery and behavioural change following the pandemic, and major changes in the geopolitical environment, despite the adoption of the measures foreseen in the NRRP, the previous emissions reduction target of -33 % by 2030 compared to 2005 levels is not met. Much more challenging and challenging is therefore the effort to reduce emissions in the ESR sectors in the light of the update of the target.

Given the crucial role of transport and civil society in reducing emissions from the ESR sectors, it was clear in the update of the Plan that additional policies and measures are needed to achieve greater energy efficiency in the civil sector (residential and tertiary), as well as to reduce demand for private mobility and to encourage the deployment of low-emission vehicles, including through the upgrading of the related infrastructure.

In any event, measures to reduce GHG emissions should be encouraged both to shift user travel from private to public transport through the modal shift, to promote soft mobility and to provide tools for mobility planning.

In order to achieve a reduction in the final energy consumption of the civil sector, policies and measures to promote energy efficiency in the residential sector will need to be strengthened by identifying new tools for involving private individuals and the public sector in the upgrading of the existing national building stock. A further important contribution to reducing emissions from buildings may be made by the increased use of heat pumps as the main heating system.

Greater involvement of non-energy sectors will also be necessary to achieve the objectives. Action will also be needed on agriculture, which is the most stable emitting sector, and on which the measures already in place have not led to significant emission reductions.

Finally, for the ESR sectors, the involvement of other central administrations and local authorities directly responsible for the transport, residential and tertiary sectors, both in the identification phase and in the implementation of new policies and measures, is crucial.

For the industrial sectors covered by the EU ETS – first and foremost thermoelectric and energy-intensive industries – the main contribution is the increase in renewables in the electricity mix.

In addition to electricity renewables, additional contributions to reduce emissionsfrom coal, increased energy efficiency in processing processes, use of alternative renewable gases, such as biomethane and hydrogen, in end and energy uses, including hard-to-abated industrial sectors, are reported.

The use of CO2 capture, transport and storage/utilisation (CCUS) will also be necessary to achieve the objective of reducing emissions, in particular from the industrial sector. To this end, specific targets for the capture and storage of CO_2 will be established on the basis of the geological characteristics of the relevant storage sites that will be made available operationally by 2030 and a regulatory and regulatory framework will be introduced to create favourable conditions for the development of projects relating to the capture, transport, storage and use of CO_2.

♦ *RENEWABLE ENERGY*

Renewable energy plays a leading role in national energy policy. Italy intends to continue promoting its development by accelerating the transition from traditional fuels to renewable sources, promoting the abandonment of coal for electricity generation towards an electricity mix based on an increasing share of renewables and, for the remaining part, on gas, and reducing imports.

The aim is to reduce the 40 % share of gross final energy consumption by 2030, in line with the expected contribution to the Community target.

As regards the electricity sector, a multitude of measures are already implemented and partly planned to support the further deployment of renewable installations.

Small installations are promoted through various lines of action, such as the development of renewable energy communities and individual or collective self-consumption, up to fiscal measures related to installations of small installations, or specific measures for contexts that deserve particular attention (such as, for example, small, non-interconnected islands).

For larger installations, both the development of contracts for difference (hereinafter CDF) to be concluded as a result of competitive procedures and the creation of a favourable framework for the conclusion of Power Purchase Agreements between private individuals (hereinafter PPA) will continue. Measures are also envisaged to support facilities based on innovative technologies, as well as to safeguard and enhance the production of still competitive existing installations.

Great attention is paid to the continuation of the simplification and acceleration of authorisation procedures at all levels, and on the process of identifying the suitable areas, and over the next two years, of the acceleration areas, in cooperation with the Regions through a process of sharing and allocating objectives on a regional scale.

Of course, the framework provides for other instruments to promote the use of renewable energy, such as the reinforcement of the guarantee of origin instrument.

In terms of technologies, the most likely to increase their contribution are photovoltaic and wind, due to their increased competitiveness leading to lower costs for the system.

It is also intended to stimulate the deployment of innovative solutions that maximise the synergy between energy and the environment, such as agestral and offshore installations (wind and photovoltaic). It is also intended to promote, from some small islands that are not interconnected to national networks, the deployment of systems where the decarbonisation of renewable energy consumption is more accelerated.

The issue of renewable energy in the electricity sector is related to the development of hydrogen, which is expected to be used in end uses in particular in industry as per the Community target (in particular in the hard to abate industry), as well as in the transport sector. Hydrogen production will be promoted both through the capital contributions under the RRP and through a new pricing measure that will make investments in a sector that is still far from competitiveness fairly profitable.

As regards the deployment of renewable energy in the transport sector, the Community context provides a favourable framework; indeed, the RED III Directive has increased the target to 2030 for the share of consumption in the transport sector covered by renewable sources, currently set at 14 %

by RED II, to 29 %. As a result, the obligation for suppliers to release renewable products for consumption will be gradually increased, extending their application to all transport sectors, and coordinating their effects with the FuelEU maritime and ReFuelEU aviation Regulations. At the same time, it is proposed to promote the use of multiple energy carriers, for example by aiming to release a quantity of renewable fuels of non-biological origin for consumption and to contribute to the use of pure biofuels.

As regards the thermal renewables sector, promotion instruments will continue to be coordinated with the multiple energy efficiency measures envisaged, in particular for buildings. In addition, other measures supporting thermal renewables are for example the obligation to integrate thermal RES into buildings, the promotion of district heating and the obligation to supply renewable heat. In the thermal sector, biomethane (primarily) and hydrogen (particularly in the industrial sector) will also increase, with a view to the possibility of cogeneration from nuclear production (*see Chapter 2.1.1*).

From a technology perspective, it will be important to continue to create an enabling framework to accelerate the decarbonisation of civil consumption through a wide deployment of heat pumps in the civil sector, leaving the choice of the most efficient option for each application to the market, while also enhancing cooling input.

- **DIMENSION ENERGY EFFICIENCY**

Energy efficiency is a key dimension for the plan, while contributing to reducing consumption, emissions, increasing the renewable share of the country's energy mix and increasing energy security.

The baseline, or deadweight scenario, developed by Italy, which internalises the measures already implemented, leads to a higher amount of final consumption than is necessary to help achieve the European Union's binding final energy consumption target (Article 4 and Annex I of the Energy Efficiency Directive III). The scenario with additional policies envisages the recruitment of highly technological and behavioural developments that can only be achieved if existing promotion instruments are maintained and strongly strengthened.

Given the extremely challenging objective of reducing emissions across the ESR sectors, particular emphasis is placed on energy efficiency measures in the civil and transport sectors.

In line with the energy performance of*Buildings Directive (hereinafter 'EPBD'), the energy performance of* buildings has been set to increase the rate of renovation of buildings by providing for a significant penetration of technologies for electrification of consumption, automation and control and a massive spread of insulation measures for dispersed surfaces.

With regard to building heating, it will be crucial to make full use of the consumption reduction potential offered by heat pumps as the main heating system to be installed both at deep requalification of buildings and as a complement to existing heat distribution systems. The development of heat pumps and electrification of other uses will be supported by the increasing deployment of domestic photovoltaic systems.

To enable this, it will be crucial to update existing policies in order to increase the relationship between the benefit and cost to the State. To this end, a reform of tax incentives will be put in place that identifies policy priorities (such as less performing buildings and situations of energy poverty) and differentiates the level of assistance according to the effectiveness in terms of improving the energy performance of the building both in terms of reducing consumption and increasing the use of renewable sources.

The leading role of the public administration will be of great importance, which will require the launch of a major plan for the efficiency of the building stock and the reduction of energy consumption, which will provide for the sharing of targets with regional and local authorities. Indeed, the policy scenario foresees the achievement of the EED III targets for the renovation of public buildings (3 % per year) and the reduction of public administration consumption (1.9 % per year). It will also be important to update existing measures to include the promotion of energy efficiency in private non-residential buildings, where there is still untapped savings potential.

The policy scenario is also particularly ambitious with regard to measures in the transport sector, for which priority was given to policies to contain mobility needs and to increase collective mobility, in particular by rail, including the shift of road freight to iron and soft mobility. In fact, it is necessary to complement measures relating to vehicle efficiency and emissions (‘improved’ measures) with instruments to reduce mobility needs (‘avoid’ measures) and shift measures. For the remaining needs for private mobility and goods, the aim is to promote the use of alternative fuels and the electricity carrier by increasing the share of renewables through economic and regulatory instruments coordinated with local self-government.

As far as industry is concerned, simplifications and extensions of the measures allowed under existing support mechanisms have been envisaged, as well as a green review of existing tax benefits.

❖ DIMENSION ENERGY SECURITY

Recent war events that are worrying for Europe, the volatility of markets with sharp surges in gas prices but also oil products, have had an impact on the European and national economy, with significant inflationary effects, and have raised concerns about energy supply problems, putting energy security at the heart of European and national policies.

The Repower EU Communication of May 2 022 highlighted the objective of reducing dependency on Russia by increasing renewable sources, energy efficiency and reducing consumption. The same Communication called on the Member States to introduce policies to diversify the sources of gas supply, using natural gas, including through LNG, with infrastructure consistent with the deep decarbonisation scenario in 2050 and above all indicating to the Member States the objective of reversing dependence on Russian gas imports.

In this context, during 2 022, Italy stepped up its efforts to diversify natural gas supply sources through the conclusion of new pipeline and LNG supply agreements, increasing the use of existing infrastructure, including storage facilities and regasification facilities, thereby redirecting gas supplies mainly from the Mediterranean Sea and thus achieving halving supplies from Russia in 2022.

The country has also taken steps to strengthen security of supply infrastructure: increasing the capacity of regasification terminals (through the new Floating Storage and Regasification Unit (FSRU) Piombino and Ravenna operating in 2023-25 and increasing the regasification capacity of existing terminals), also aiming at expanding south-north transport capacity along the Adriatica dorsal, increasing national production, including by optimising existing concessions. These measures may also lead Italy to refer to European countries, with a view to solidarity and the centrality of European cooperation.

Gas consumption and sources will be monitored in order to ensure compliance with Security Regulation No 1938/2017, including with regard to the risk analysis document and the subsequent update of preventive and emergency action plans. The new gas supply structure, characterised by the reduction of Russian gas import, requires a new risk assessment, given that the new balances need to be assessed in the light of the challenges facing the national energy system in the short and medium term.

As regards the safety of the electricity system, it must be considered that Italy is historically a net importer of electricity. In this context, the energy transition and decarbonisation targets set at

Community level are an important opportunity not only to limit the impacts of climate change, but also to reduce energy dependency through increased production from domestic renewable sources. However, there is a further strengthening of external electricity interconnections on both the North and South borders, which will not only increase the security of interconnected systems, but also promote both efficiency and competition through greater alignment of wholesale prices.

Great attention continues to be paid to the resilience of systems, in particular transmission and distribution networks, with preventive measures, commensurate with the foreseeable intensification of intense phenomena and pressures and management rules enabling the systems to restore operation quickly.

With a view to a possible recovery of domestic production, nuclear energy can also contribute to improving energy security by providing a stable and continuous source of energy and reducing vulnerability to external supply disruptions and dependence on fossil fuel imports.

❖ **DIMENSION OF THE INTERNAL MARKET**

The integration of the European Union's energy markets is a functional and necessary element in order to promote the efficiency and competitiveness of markets and, on the other hand, the security and adequacy of the energy systems of the countries of the Union. To achieve this objective, it is envisaged to enhance electricity interconnections and market coupling with other EU Member States, strengthening Italy's role as a European energy hub and renewable energy supply corridor in the Mediterranean area.

As regards transmission infrastructure, the operator of the National Transmission Network (RTN) has presented a new Development Plan (PdS) which addresses decarbonisation challenges and aims to achieve the ecological transition objectives efficiently. The PdS foresees a number of interventions and new tools to develop infrastructure that integrates renewable energy sources (RES) and increase transport capacity between different market areas, resolving electricity system congestion. The plan takes into account the current requests for connection to RTN, which indicate that market participants are concentrating the development of new RES mainly in the south and islands, i.e. areas with high availability of primary energy resources. One of the main objectives of the Development Plan is to expand interconnections with other countries, to improve the safety, quality and resilience of the electricity system, and to increase trading capacity between different market areas.

With the growth of intermittent renewable sources, it is necessary for consumers to have access to this energy at reasonable cost. In particular, the following needs arise from this objective: strengthening the process of market integration; promoting the active role of demand in order to increase the flexibility of the energy system; the development of new and more efficient contractualisation tools for renewable electricity and storage resources. Both renewables and accumulations require long-term price signals (CFDs or PPPs) needed to finance the construction of new RES installations.

It is important to stress that, in order to achieve the Community objectives, provision should be made for speeding up and simplifying the permitting process for both network development works and the connection of renewable installations, thus enabling the timely implementation of all the works necessary to achieve the decarbonisation targets.

The need for flexibility will benefit not only from the wide deployment of both centralised and distributed accumulation, but also from the integration of systems (electricity, water and gas in particular), to be undertaken on an experimental basis, also with the aim of exploring the most efficient ways of long-term renewable energy storage.

The expected cost reduction of electrolysis technology and the simultaneous launch of support measures will make it possible to have renewable hydrogen, including in *blending* with natural gas, for the decarbonisation of energy-intensive industrial sectors and long-haul commercial transport. Further hydrogen production may result from the possible resumption of nuclear power generation, especially with a view to generating small reactors and microreactors.

Nuclear installations can also help to ensure the adequacy and safety of the national and European electricity system, contribute to the stability of electricity prices, as the operating costs of nuclear power plants are relatively predictable and less prone to fluctuations in raw material prices compared to fossil fuels, and contribute to the diversification of energy sources, reducing dependence on fossil fuel imports. This can lead to more stable and competitive energy prices for consumers.

As regards energy poverty, as a complement to the measures described below, in-depth work has been undertaken to introduce efficiency measures and installation of self-consumed renewable energy installations.

❖ RESEARCH, INNOVATION AND COMPETITIVENESS DIMENSION

The identification of national R & S & I targets on energy technologies is a priority to accelerate the market introduction of the technologies needed to meet the objectives set out in the Green Deal and at the same time to strengthen the competitiveness of national industry. With this in mind, R & S & I targets identify those energy technology clusters that are considered to be able, on the one hand, to achieve the decarbonisation targets in 2030 and 2050, both because of their penetration potential and their contribution to making the transition technically feasible: on the other hand, they can maintain and strengthen the competitiveness of Italian industry.

The plan intends to set out a long-term strategy setting out the priorities and the determination of the measures needed to achieve the objectives, taking into account the country's guidelines and competitiveness assessments. The aim is to create the conditions for the participation of industry and research centres in future research programmes (SET Plan, Horizon Europe, Mission Innovation) to be less fragmented and more focused on common objectives.

In line with the Net Zero Industry Act, the strategic net zero technologies targets have been defined on the basis of three criteria: (1) technology Readiness Level (TRL); (2) contribution to decarbonisation, i.e. the technologies expected to make a significant contribution to the emission reduction target; (3) contribution to the competitiveness of the industrial system and to reducing security of supply risks, thereby strengthening the sectors where Italy has a low specialisation index and increasing production capacity in the value chain of zero-emission technologies.

The two time horizons of the Plan lead to the identification of different but complementary objectives for 2030 and 2050.

By 2030, the focus is targeted at net-zero technologies at TRL level 8[4] or above, which are expected to make a significant contribution to the Fit for 55 objective of reducing net greenhouse gas emissions by at least 55 % by 2030 compared to 1990 levels. In line with the net Zero Industry Act and the IEA assessments (Net Zero by 2050, A Roadmap for the Global Energy Sector), the objectives therefore relate to technologies that are already commercially available today: solar photovoltaic and thermal, onshore and offshore wind, batteries/storage, heat pumps and geothermal energy technologies, electrolysers and fuel cells, sustainable biogas/biomethane, carbon capture and storage, grid technologies.

[4] *Technology Readiness Levels (TRLs) are the different levels on a scale of 1 to 9 used to measure the progress or maturity level of a technology.*

By 2050, half of the emissions reduction needed to achieve climate neutrality requires the development of technologies that are currently still in the demonstration or prototyping phase, especially in hard-to-abated and heavy transport applications (IEA, Net Zero by 2050, A Roadmap for the Global Energy Sector). The objectives of R & I therefore target different technology clusters with a wider spectrum of maturity levels, including still prototype technologies.

There is also great potential to develop new nuclear technologies for Italy to help revitalise nuclear energy, not only at international level but potentially at national level. In this regard, the MASE has set up the *National Platform for a Sustainable Nuclear Nuclear (PNNS)*, the aim of which is to make available to the Ministry a tool for connecting and coordinating the various national actors dealing with nuclear energy, safety, radiation protection and radioactive waste management, at various levels, with the aim of facilitating the development of nuclear technologies with low environmental impact, with high safety and sustainability*standards*, in order to allow a path for the possible recovery of the use of nuclear energy in Italy through new sustainable nuclear technologies under development.

If the necessary changes are made to national law in this area, from the legislative and *governance* framework until the technical legislation in the sector is updated, the country's commitment to nuclear energy could therefore reduce the research dimension with a view to the possible use of nuclear sources on national territory. In line with this potential, Italian participation in international and European programmes and initiatives will be encouraged (but not limited to the recent *SMR Industrial Alliance initiative,* in which MASE participates together with several dozens of national operators, including businesses, utilities, research organisations and academies, and the EUROfusion programme, for which ENEA is the *national Program Manager*).

Another objective of the research activity is to help overcome two criticisms of the current Italian situation in different strategic technology clusters: Italian despecialisation in terms of innovative activity – measured by patent activity – in different strategic technologies; loss or failure to develop know-how (e.g. engineering geo); a situation of a high growth trade deficit.

III. Overview table with the main objectives, policies and measures of the plan

In order to provide an analytical basis for the Integrated National Energy and Climate Plan:

- a baseline scenario, describing the evolution of the energy system with current policies and measures;
- a policy scenario, which takes into account the effects of both the measures already planned to date and those still being defined on the path towards the 2030 strategic objectives.

The following tables set out the main 2030 targets of the plan on greenhouse gas emissions and removals, renewable energy sources (RES), energy efficiency and the main measures in place or planned to achieve the objectives of the Plan.

Table 1 - Main scenario indicators and targets for 2030

	unit of measurement	**Data found**	**PNIEC 2024: Reference case**	**PNIEC 2024: Policy scenario** [1]	**FF55 REPowerEU objectives**
		2022	**2030**	**2030**	**2030**
GHG emissions and removals					
GHG reduction vs 2005 for all installations bound by ETS legislation	%	— 45 %	— 58 %	— 66 %	— 62 % [2]
GHG reduction vs 2005 for all ESR sectors	%	— 20 %	— 29.3 %	—40.6 %	— 43.7 % [3, 4]
GHG emissions and removals from LULUCF	$MtCO_2eq$	— 21,2	— 28,4	— 28,4	— 35,8 [3]
Renewable energy					
Share of RES energy in gross final energy consumption (RED 3 calculation criteria)	%	19 %	26 %	39.4 %	38.7 %
Share of RES energy in gross final consumption of energy in transport (RED 3 calculation criteria)	%	8 %	15 %	34 %	29 % [5]
Share of RES energy in gross final consumption for heating and cooling (RED 3 calculation criteria)	%	21 %	24 %	36 %	29.6 % [3] – 39.1 %
Share of RES energy in final consumption of the electricity sector	%	37 %	53 %	63 %	not planned
Share of RES hydrogen in total hydrogen used in industry	%	0 %	4 %	54 %	42 % [3]
Energy efficiency					
Primary energy consumption	Mtoe	140	133	123	111
Final energy consumption	Mtoe	112	111	102	93
Cumulative annual savings in final consumption through energy efficiency obligation schemes	Mtoe	3,8		73,4	73,4 [3]

1. constructed scenario considering the measures foreseen in June 2024
2. binding only for overall emissions at European Union level
3. binding
4. binding not only on 2030 but on the whole route from 2021 to 2030
5. binding on economic operators

Table 2 – Main measures planned to achieve the objectives of the INECP

Summary name of policy or measure	Dimension Emissions	Dimension Renewables	Dimension Efficiency	Dimension Security	Dimension Market, Infrastructure, Consumers	Dimension Research, Innovation, Competitiveness
SME Guarantee Fund, Special Section for Tourism (NRRP)	Emissions	Renewables	Efficiency			R.I.C.
Partnerships for Research and Innovation – Horizon Europe (NRRP)	Emissions	Renewables	Efficiency			R.I.C.
Business investment facilitation for capital goods (new Sabatini)	Emissions	Renewables	Efficiency			R.I.C.
Industrial Transition Fund	Emissions	Renewables	Efficiency			R.I.C.
Sustainable investment 4.0	Emissions	Renewables	Efficiency			R.I.C.
Support for green investments and self-generation of renewable energy in SMEs (new Sabatini, Sabatini green)	Emissions	Renewables	Efficiency			R.I.C.
Support for the ecological transition of the production system and the strategic sectors for net zero technologies	Emissions	Renewables	Efficiency			R.I.C.
Transition 5.0 green	Emissions	Renewables	Efficiency			R.I.C.
Interventions for the environmental sustainability of ports – Green Ports (NRRP)	Emissions	Renewables	Efficiency			
Verdean Islands (NRRP)	Emissions	Renewables	Efficiency			
Plan for the safety and upgrading of school buildings (NRRP)	Emissions	Renewables	Efficiency			
National Innovative Programme for Residence Quality (NRRP)	Emissions	Renewables	Efficiency			
District heating systems (NRRPs)	Emissions	Renewables	Efficiency			
Call for parks	Emissions	Renewables	Efficiency			
The Termico account. MINISTERIAL DECREE NO 16/02/2016	Emissions	Renewables	Efficiency			
Tax deductions for energy renovation of buildings (Ecobonus)	Emissions	Renewables	Efficiency			
Tax deductions for energy retrofitting of buildings (Superbonus)	Emissions	Renewables	Efficiency			
Tax deductions for building renovations (Bonus Casa)	Emissions	Renewables	Efficiency			
Transition Plan 4.0	Emissions	Renewables	Efficiency			
National portal on the energy performance of buildings	Emissions	Renewables	Efficiency			
Promotion of efficient district heating systems	Emissions	Renewables	Efficiency			
Programme for the financing of energy efficiency measures in public housing	Emissions	Renewables	Efficiency			
White Certificates (update)	Emissions	Renewables	Efficiency			
Termico account (update)	Emissions	Renewables	Efficiency			
Decree of the Minister for the Environment and Energy Security laying down the modalities for the obligation to increase renewable thermal energy (OIERT)	Emissions	Renewables	Efficiency			

Tax deductions for energy retrofitting and building recovery (Ecobonus update, Sismabonus and Bonus casa)	Emissions	Renewables	Efficiency			
Decarbonisation Fund for Public Buildings (evolving Kyoto Fund)	Emissions	Renewables	Efficiency			
Termico account (extension and update)	Emissions	Renewables	Efficiency			
Financing zero-emission and circular production districts	Emissions	Renewables	Efficiency			
Strengthening the role and adoption of the Covenant of Mayors and the Mission Climate neutral cities	Emissions	Renewables	Efficiency			
Local energy contact points	Emissions	Renewables	Efficiency			
Technical support to public administration in calls for funding	Emissions	Renewables	Efficiency			
Development of Zero Energy Building buildings	Emissions	Renewables	Efficiency			
Facilities for the purchase of light goods vehicles powered by low carbon or electric fuels	Emissions	Renewables	Efficiency			
Update of Presidential Decree No 74/2013 on thermal management: minimum requirements and management of thermal installations	Emissions	Renewables	Efficiency			
Establishment of a social leasing/sharing mechanism for vehicles powered by low carbon or electric fuels (with possible expenditure ceilings and from ETS/Just Transition funds, etc.)	Emissions	Renewables	Efficiency			
Establishment of an incentive system based on the mechanism of release for consumption certificates for public charging stations (electric CIC)	Emissions	Renewables	Efficiency			
Improving energy efficiency and upgrading of social housing	Emissions	Renewables	Efficiency			
FSI Industrial Plan (new intermodal freight terminals, RES power plants, construction of charging stations, etc.)	Emissions	Renewables	Efficiency			
Reduction of fixed and variable costs linked to increases in available electricity power and/or compensation of charges	Emissions	Renewables	Efficiency			
Reform of electricity excise duties	Emissions	Renewables	Efficiency			
Obligation for public authorities to use low carbon fuels or power supply for their fleets	Emissions	Renewables	Efficiency			
Open data on the energy performance of buildings	Emissions	Renewables	Efficiency			
Mitigation of financial risk associated with renewable PPAs (Power Purchase Agreements)	Emissions	Renewables			Market	
Promotion of PPPs for large RES installations	Emissions	Renewables			Market	
Hydrogen use in hard-to-abate sectors (NRRPs)	Emissions	Renewables				R.I.C.
Hydrogen Research and Development	Emissions	Renewables				R.I.C.
DM thermal fer auctions	Emissions	Renewables				
Agestral (NRRP)	Emissions	Renewables				
Biomethane. MINISTERIAL DECREE NO 15/9/2022 (NRRP)	Emissions	Renewables				
Innovative installations, including off-shore (NRRPs)	Emissions	Renewables				
Agricultural Park (NRRP)	Emissions	Renewables				

Hydrogen production in brownfield sites – Hydrogen Valleys (NRRP)	Emissions	Renewables
Promotion of renewables for energy communities and self-consumption (NRRPs)	Emissions	Renewables
Hydrogen testing for rail transport (NRRP)	Emissions	Renewables
Hydrogen testing for road transport (RRP)	Emissions	Renewables
Biofuels. Sustainability certification. MINISTERIAL DECREE NO 14/11/2019	Emissions	Renewables
Biofuels. Obligation to release for consumption	Emissions	Renewables
Biomethane and advanced biofuels. MINISTERIAL DECREE NO 2/3/2018	Emissions	Renewables
Energy account for photovoltaic installations	Emissions	Renewables
Decree on smaller islands. MINISTERIAL DECREE NO 14/02/2017	Emissions	Renewables
Guarantees of renewable electricity and renewable gases	Emissions	Renewables
Incentivising collective self-consumption groups and renewable energy communities	Emissions	Renewables
Incentive for non-photovoltaic renewable electricity. MINISTERIAL DECREE NO 23/6/2016	Emissions	Renewables
Incentive for non-photovoltaic renewable electricity. FER-E. DM 6/7/2012	Emissions	Renewables
Incentivising electricity renewables. DM 4/7/2019 (FER-1)	Emissions	Renewables
Obligation to integrate renewables into new or existing buildings	Emissions	Renewables
Exchange on the spot (SSP)	Emissions	Renewables
Biofuels and other innovative energy carriers. Obligation to release for consumption (update for RED III transposition)	Emissions	Renewables
Biofuels. Sustainability certification (update)	Emissions	Renewables
Biofuels. Obligation to release for consumption (RED II update, Legislative Decree No 199/2021)	Emissions	Renewables
Criteria for the integration and integration of floating photovoltaic installations	Emissions	Renewables
Minor Islands Decree (update)	Emissions	Renewables
Evolution of the exchange on the spot	Emissions	Renewables
Guarantees of origin (update)	Emissions	Renewables
Tenders for electricity generation from large renewable installations with mature technologies. FER-X	Emissions	Renewables
Electricity generation from innovative renewable installations. ERF 2	Emissions	Renewables
Hydrogen Valleys (scale-up proposal)	Emissions	Renewables
Encouraging collective self-consumption groups, renewable energy communities and remote self-consumption (update)	Emissions	Renewables
Practical limitation of grouping and killing of plant materials at the place of production	Emissions	Renewables
Operational mechanisms to promote the production of renewable hydrogen	Emissions	Renewables

Renewable heat supply obligation (DM OIERT)	Emissions	Renewables			
National plan for the conversion of evening plants into agro-energy sites and forms and modalities of connection with the NRRP	Emissions	Renewables			
Projects for the transformation of traditional refineries into biorefineries	Emissions	Renewables			
Energy income	Emissions	Renewables			
Reduction of the costs of connection to the gas network of biomethane	Emissions	Renewables			
Reform of the authorisation system for hydrogen production facilities	Emissions	Renewables			
Simplification and reorganisation of permit-granting procedures, including by providing for a single text	Emissions	Renewables			
Tax credit for self-consumption of energy from renewable sources	Emissions	Renewables			
Promotion of certified biomass pathways for energy production	Emissions	Renewables			
Green energy supply (electricity, renewable gas) in public procurement	Emissions	Renewables			
National Innovation Fund	Emissions		Efficiency		R.I.C.
Investment and Infrastructure Development Fund	Emissions		Efficiency		R.I.C.
Sustainable Growth Fund	Emissions		Efficiency		R.I.C.
Cohesion policies	Emissions		Efficiency		R.I.C.
Advanced diagnostic, monitoring, energy management systems to facilitate effective planning and management at urban level	Emissions		Efficiency		R.I.C.
Efficiency of judicial buildings (NRRPs)	Emissions		Efficiency		
Energy efficiency of cinemas, theatres and museums (NRRPs)	Emissions		Efficiency		
Measures for the resilience, enhancement of the territory and energy efficiency of municipalities (NRRPs)	Emissions		Efficiency		
New charging stations in cities and highways to facilitate the use of electric vehicles (RRPs)	Emissions		Efficiency		
Safe and Sustainable Hospitals (NRRPs)	Emissions		Efficiency		
Plan for the replacement of school buildings and energy retrofitting (NRRP)	Emissions		Efficiency		
Infrastructure upgrade of regional rail transport and rapid mass transport systems (RRPs)	Emissions		Efficiency		
Simplification and acceleration of procedures for implementing energy efficiency interventions (NRRP reform)	Emissions		Efficiency		
Quay electrification, cold ironing (NRRP)	Emissions		Efficiency		
Facilitation of private electric charging	Emissions		Efficiency		
Energy audits in enterprises	Emissions		Efficiency		
Call for innovative integrated projects for non-interconnected smaller islands	Emissions		Efficiency		
White Certificates	Emissions		Efficiency		

Tax deductions: façade bonuses	Emissions	Efficiency	
Kyoto Fund. MINISTERIAL DECREE NO 14/4/2015	Emissions	Efficiency	
National Energy Efficiency Fund. MINISTERIAL DECREE NO 22/12/2017	Emissions	Efficiency	
Incentives for the renewal of private vehicles (vehicle eco-bonus)	Emissions	Efficiency	
Incentive Marebonus and Ferrobonus	Emissions	Efficiency	
Mandatory efficiency of public lighting networks	Emissions	Efficiency	
Urban Sustainable Mobility Plans – SUMPs	Emissions	Efficiency	
National infrastructure plan for electric vehicle charging – PNIRE	Emissions	Efficiency	
Cargo Bike programme	Emissions	Efficiency	
Sustainable Urban Mobility Incentive Programme (Primus)	Emissions	Efficiency	
Consumer Information and Training Programme (BIP)	Emissions	Efficiency	
Programme for Energy Renovation of Central Public Administration Buildings (PREPAC)	Emissions	Efficiency	
Case-work school experimental programme	Emissions	Efficiency	
Renewal of vehicles for freight transport	Emissions	Efficiency	
Modal shift in freight transport	Emissions	Efficiency	
Modal shift in passenger transport	Emissions	Efficiency	
Emission standards for new cars	Emissions	Efficiency	
LNG development in maritime transport and port services	Emissions	Efficiency	
LPT: fleet renewal	Emissions	Efficiency	
Sustainable school transport	Emissions	Efficiency	
LPT: measures for GLT and sustainable public mobility	Emissions	Efficiency	
Fund for the Sustainable Mobility Strategy for the years 2023-2034 (Decree-Law No 347 of 21/10/2022)	Emissions	Efficiency	
Investments in intermodality of goods (Decree-Law No 347 of 21/10/2022: scope 6)	Emissions	Efficiency	
Measures for the decarbonisation of the aviation sector (D.L. 347 of 21/10/2022: scope 4)	Emissions	Efficiency	
Measures for the decarbonisation of the rail sector (D.L. 347 of 21/10/2022: scope 3)	Emissions	Efficiency	
Measures to decarbonise the shipping sector (Decree-Law No 347 of 21/10/2022: scope 5)	Emissions	Efficiency	
Promoting modal shift and intermodality of people	Emissions	Efficiency	
Resources for metropolitan network and rapid mass transport (Decree-Law No 97/2022)	Emissions	Efficiency	
Support for charging infrastructure for electric vehicles within the TEN-T network (D.L. 347 of 21/10/2022: scope 2)	Emissions	Efficiency	

Support for initiatives to reduce climate emissions from urban mobility (Decree-Law No 347 of 21/10/2022: scope 1)	Emissions	Efficiency			
LPT: resource allocation decree (Ministerial Decree No 409/2022)	Emissions	Efficiency			
Rapid mass transport (metro, tramway, BRT)	Emissions	Efficiency			
Sustainable urban mobility and urban spatial management	Emissions	Efficiency			
Promotion of urban cycling and pedestrian networks	Emissions	Efficiency			
Extension and upgrading of single intermodal tickets for geographical areas (Treno, bus, light transport)	Emissions	Efficiency			
National Energy Efficiency Fund (update)	Emissions	Efficiency			
Measures to reduce charging costs for public electric charging stations	Emissions	Efficiency			
Modulation of tax benefit rates (deductions, deductions, etc.) for the purchase of company vehicles based on CO2 emission factors	Emissions	Efficiency			
Further increase and modulation of benefits based on vehicle emission factors	Emissions	Efficiency			
Phase out of coal	Emissions		Security		
Southern Growth Fund	Emissions				R.I.C.
Public Guarantee Fund for SMEs and professionals	Emissions				R.I.C.
Support for R & D projects for the conversion of production processes within the circular economy	Emissions				R.I.C.
National Indicative Code of Good Agricultural Practice for the Control of Ammonia Emissions	Emissions				
Guidelines for the environmental labelling of packaging	Emissions				
National air pollution control programme	Emissions				
Experimental programme for eaplastic	Emissions				
Circular Economy Strategy: (8) Minimum Environmental Criteria (CAM)	Emissions				
Circular Economy Strategy: 1) establishment of a national observatory	Emissions				
Circular Economy Strategy: (10) sustainable land use	Emissions				
Circular Economy Strategy: (11) sustainable use of water resources from a circular economy perspective	Emissions				
Circular Economy Strategy: (2) electronic waste traceability register	Emissions				
Circular Economy Strategy: (3) tax incentives to support recycling and use of secondary raw materials	Emissions				
Circular Economy Strategy: (4) revision of the environmental taxation system for waste	Emissions				
Circular Economy Strategy: (5) right to reuse and repair	Emissions				
Circular Economy Strategy: (6) reform of the EPR system	Emissions				

Circular Economy Strategy: 7) establishment of the national register of producers	Emissions					
Circular Economy Strategy: (9) industrial symbiosis projects	Emissions					
Measures to increase organic farming	Emissions					
Capture and transport of CO_2 for hard-to-abate sectors	Emissions					
Carbon capture and storage (CCS): hub for transport and storage of CO_2	Emissions					
Water desalination	Emissions					
National Climate Change Adaptation Plan (PNACC)	Emissions					
National forestry accounting plan	Emissions					
National waste management programme	Emissions					
Experimental programme of interventions for adaptation to climate change in urban areas	Emissions					
Public register of voluntary carbon credits from the agro-forestry sector	Emissions					
National Forest Strategy (NFS)	Emissions					
Abolition of excise duty exemption on energy products used in rail passenger and freight transport (SAD)	Emissions					
Abolition of exemption from excise duty on energy products used for the production of magnesium from seawater (SAD)	Emissions					
Financing measures for adaptation to climate change in urban areas	Emissions					
Capillary renuting of cities	Emissions					
IPCEI hydrogen and batteries		Renewables		Security	Market	R.I.C.
IPCEI Hydrogen (HY2 and INFRA)		Renewables		Security	Market	R.I.C.
Permanent working table for the adaptation of energy distribution infrastructure and smart grids		Renewables		Security	Market	
Aggregation of generating facilities and utilities (Legislative Decree No 102/2014)		Renewables			Market	
Hydrogen – Electrolyser production (NRRPs)		Renewables				R.I.C.
Renewable and Batteries (NRRPs)		Renewables				R.I.C.
National rules governing the Idonee areas		Renewables				
Regional discipline of the Idonee Areas and digital platform		Renewables				
Arrangements for the award of concessions for large hydroelectric derivatives		Renewables				
Single model for integrated photovoltaic systems on roofs of buildings		Renewables				
Simplifications to permit granting procedures for installations with renewable sources		Renewables				
Simplifications to permit granting procedures for renewable installations: unique models and digital platform		Renewables				

Support measures for energy efficiency interventions by low-income households	Emissions	Renewables	Efficiency		Market	
Local measures to combat energy poverty			Efficiency		Market	
Capacity market				Security	Market	
Diversification of LNG supply and reinforcement with new FSRUs				Security	Market	
Diversification and upgrading of electricity interconnections				Security	Market	
Diversification and enhancement of gas interconnections				Security	Market	
Increasing flexibility through accumulation and sector integration				Security	Market	
New LNG coastal connections and warehouses				Security	Market	
Strengthening internal network to support RES integration				Security	Market	
Installation and connection to the national gas network of a new FSRU				Security	Market	
Interconnection Sicily, Sardinia, Italian Peninsula (Tyrrhenian Link)				Security	Market	
Adriatic gas pipeline line (Phase 1)				Security	Market	
New Italy-Tunisia interconnection (tunita)				Security	Market	
Upgrading energy transmission infrastructure				Security	Market	
Project to increase gas export capacity to Austria (Export – Phase 1)				Security	Market	
Promotion of centralised accumulation				Security	Market	
Renewal and upgrading of the Sardinia – Corsica – Italian peninsula (SA.CO.I 3)				Security	Market	
Sustainable, circular and secure supply of critical raw materials (RAAE reform)				Security		R.I.C.
Digitalisation of networks projects					Market	R.I.C.
Interventions on Network Climate Resilience (NRRP)					Market	
Strengthening smart grids (NRRPs)					Market	
Social bonus gas					Market	
Social bonus light					Market	
Energy Decree					Market	
Active role of consumers and market liberalisation					Market	
Network resilience					Market	
Reform of the internal electricity market					Market	
Smart grids					Market	
PUN exceedance					Market	
Electric buses: production chain (NRRP)						R.I.C.
Hydrogen Research and Development (NRRP)						R.I.C.
Support for start-ups and venture capital active in the ecological transition (NRRP)						R.I.C.

Energy cluster	R.I.C.
Tax credit. Transition Plan 4.0	R.I.C.
Electricity System Research Fund	R.I.C.
Innovation Fund	R.I.C.
Mission Innovation	R.I.C.
Policies and incentive measures for research in the field: CCS, nuclear, wind	R.I.C.
Search for electrical system	R.I.C.
Clean energy transition partnership (CETP)	R.I.C.
European Partnership Driving Urban Transitions – DUT	R.I.C.
National Research Programme (NRP) 2021-2027	R.I.C.

1.2 Overview of the state of play of current policies

I. National and Union energy system and policy context of the national plan

Since the Kyoto Protocol was signed, the European Union and its Member States have embarked on a path towards combating climate change through the adoption of Community and national policies and measures to decarbonise the economy.

Path confirmed during the 21st Conference of the Parties to the Framework Convention on Climate Change, held in Paris in 2015, which adopted the Paris Agreement by Decision 1/CP21. The Agreement sets out the need to contain the increase in the global average temperature to well below 2 °C and to pursue efforts to limit the increase to 1.5 °C above pre-industrial levels.

The Paris Agreement was adopted by 196 Parties at the United Nations Climate Change Conference (COP21) and entered into force on 4 November 2016. Italy ratified this Agreement by Law No 204 of 4 November 2016 and entered into force on 11 December 2016. At the time of accession to the Agreement, each country must prepare and communicate its ‘ *Nationally Determined Contribution*’ (NDC) with the obligation to pursue policies and measures for its implementation. Each subsequent national contribution will need to be a step forward in terms of ambition compared to the previously submitted contribution, thus embarking on an increasing ambition path that should lead the Parties to the collective target.

On the basis of the conclusions of the European Council of 23 and 24 October 2014, the European Union therefore presented a NDC which requires an overall reduction in greenhouse gas (GHG) emissions by -40 % compared to 1990 levels. Subsequently, in line with the commitments undertaken under the Paris Agreement and in the light of the latest scientific evidence, upon a mandate from the European Council in December 2020, the European Union updated its NDCs, amending the binding target of reducing greenhouse gas emissions from -40 % to -55 % by 2030 (compared to 1990 levels).

This legally binding objective was incorporated into Regulation (EU) 2021/1119, ‘European Climate Law’ adopted on 30 June 2021, which also provides for climate neutrality by 2050.

In order to implement the net emissions reduction target of -55 % by 2030, and to make the EU’s decarbonisation path in line with the 2050 climate neutrality objective as set out in the ‘European Climate Law’, the Fit for 55 package was presented on 14 July 2021.

The so-called “package” includes a complex and interconnected legislative framework combining, inter alia, the application of the Emissions Trading system to new sectors and a revision of the existing system to make the target consistent with -55 % net by 2030; increasing energy and renewable efficiency targets, faster transition to low-emission modes of transport and strengthening the infrastructure needed for this purpose; aligning energy taxation policies with the objectives of the Green Deal; alternative measures to tackle carbon leakage (i.e. the relocation of production to countries without the same EU emission reduction obligations); tools to preserve and increase natural carbon sinks (e.g. forests).

As part of this international and European framework of increasingly challenging and ambitious targets, it should be noted that GHG emissions recovered significantly in 2021, largely due to the post-COVID-19 economic recovery and productive activities and the growth of private mobility. As regards the ESR sectors, the failure to reduce emissions in the transport and civil sectors, which account for the largest share, led in 2021 and 2022 to exceeding theannual emission allocations (AEAs) of 4,6 $MtCO_2$ eq. for 2021 and 5,5 $MtCO_2$ eq respectively.

From an energy point of view, total energy consumption (CFL) in 2021 (calculated according to RED II criteria) in Italy stood at 120,5 Mtoe with a non-negligible growth compared to 2020, mainly due to the recovery of consumption in the period following the COVID-19 health emergency restrictions.

This, in fact, brought back consumption in line with the trend observed in previous years. In 2021, Italy's final gross energy consumption by RES, still calculated pursuant to Directive (EU) 2018/2001 (RED II), was 22,9 Mtoe, slightly higher (+ 3.9 %) than for 2020, bringing the share of CFLs covered by RES to 19.0 %. Applying the RED II criteria also for 2020, the same figure would be 20.3 %: therefore, in 2021, there was a decrease in the RES share of the final gross energy consumption. The effects of the COVID-19 health emergency appear to be evident on this dynamic: as RES energy consumption grew relatively low (+ 3.9 %), overall energy consumption in the country grew more than twice as much as in 2020 (+ 10.6 % – it should be noted that the transport sector alone, particularly affected by the effects of the pandemic, increased by 20.7 % in 2 021).

As regards the electricity sector, gross domestic production from RES amounted to 116.3 TWh in 2021, or 40.2 % of total national production. By contrast, the RES share of the total gross domestic consumption, calculated in accordance with the RED II criteria, was 36 %. The renewable source that ensured the main contribution to total RES electricity production in 2 021 was hydropower (39 % of total RES), followed by solar sources (21.5 %), bioenergy (16 %), wind (18 %) and geothermal sources (5 %). At the end of 2021, the gross efficient capacity of the approximately 1.030.000 renewable installations installed in Italy was 58.0 GW; the increase in capacity compared to 2020 (+ 2.5 %) is mainly due to new PV (+ 944 MW) and wind installations (+ 383 MW).

In the thermal sector, just under 20 % of total energy consumption comes from renewable sources. In particular, around 11,2 Mtoe of energy from RES were consumed in 2021, of which around 10,3 Mtoe directly (through individual boilers, stoves, chimneys, solar panels, heat pumps, geothermal heat installations) and around 0,9 Mtoe in the form of consumption of derived heat (e.g. through biomass district heating systems). It should be noted that, since 2021, renewable energy for cooling is also taken into account in the heat sector, but not accounted for in the ordinary statistics, although its contribution is very small. The most renewable source used in the thermal sector is solid biomass (6,8 Mtoe), mainly used in the household sector in the form of firewood and pellets. Energy for heating and domestic hot water (ACS) provided by heat pumps (2,5 Mtoe) is also of great importance, while contributions from other sources (geothermal and solar) are still limited.

As regards the transport sector, more than 1,7 mln tonnes of biofuels (energy content of 1,55 Mtoe) were released for consumption in 2021, accounting for more than 90 % of biodiesel.

Italy has a high level of energy efficiency: in 2 021, Eurostat's energy productivity index for the Italian economy as a whole was EUR 10,14/kgep, the fourth most performing country in the EU 27, with an average of EUR 8,54/kgep. The level of primary energy consumption per capita of 2,4 toe/ab is also among the lowest in the EU 27 (eighth country) where the average is 3 toe/ab.

Final energy consumption (excluding non-energy uses) in 2021 was 113,2 Mtoe (Eurostat energy balance source), slightly down from 2015 (-3 %). The transport sector has the highest final energy consumption of 35,3 Mtoe (-3 % compared to 2015); consumption in the residential sector was 32,0 Mtoe (-1.4 % compared to 2015). The services and industry sectors consume 17,5 and 25,3 Mtoe respectively and recorded increases in consumption compared to 2015.

Italy's primary energy intensity was 2 021 toe/mlnEUR in 98,6; the decrease compared to 2015 of -2.6 % is rather low, compared with the highest level in Europe.

The progressive impact of RES and the reduction in energy intensity have contributed, in recent years, to reducing Italy's dependence on foreign sources of supply; the share of national energy needs met by net imports remains high at 73.5 %, but 8 percentage points lower than in 2011.

Primary energy demand increased significantly in 2021 compared to the previous year (+ 9 %) where there had been a significant contraction linked to pandemic restrictions; this is increasingly less satisfied by oil (which still accounts for one third of the total), solid fuels (3.5 %) and imported electricity (2.4 %). On the other hand, the contribution of gas is growing (at 40 %) and renewable sources (slightly less than a fifth) are confirmed.

Against this background, and in view of 2030 and the Roadmap to 2050, Italy is making an effort to equip itself with planning tools to identify policies and measures consistent with the European decarbonisation strategy, which serve to improve environmental sustainability, energy security and affordability, while promoting a just transition.

A number of key strategic and planning documents have been adopted in recent years, which create an enabling environment at national level for the implementation of the new and more ambitious energy and emission targets of the INECP. The most representative is mentioned below.

A new impetus for adaptation was promoted by the presentation by the European Commission in 2021 of the new Adaptation Strategy, which aims to achieve Europe's transformation into a climate resilient Union by 2050. At national level, in implementation of the National Adaptation Strategy adopted in 2015, **the National Climate Change Adaptation Plan (PNACC)** was adopted, the main objective of which is to provide a national framework for the implementation of actions to minimise the risks arising from climate change, to improve the adaptability of socio-economic and natural systems and to take advantage of any opportunities that may arise under new climate conditions. The PNACC was also subject to a Strategic Environmental Assessment (SEA) procedure.

In addition to the PNACC, it is important to mention**the 'National Forest Strategy for the forestry sector and its supply chains**' (SFN), whose mission is to bring the country to have extensive and resilient, biodiverse forests capable of contributing to mitigation and adaptation to the climate crisis, providing ecological, social and economic benefits for rural and mountainous communities. The SFN stems from a European commitment, the European Union Forest Strategy of July 2021 and was published in the Official Journal on 9 February 2022, valid for twenty years.

Another priority theme for decoupling economic growth from the environmental impacts of resource extraction and use, reducing climate-changing gas emissions, pollution and waste while fostering the creation of new markets and opportunities for green jobs is the circular economy. In this regard, Italy adopted in June 2022 the **National Strategy for the Circular Economy** to define new administrative and fiscal instruments to strengthen the market for secondary raw materials, so that they become competitive in terms of availability, performance and costs with respect to virgin raw materials, to contribute to the achievement of climate neutrality objectives and to implement a roadmap of measurable actions and targets by 2035.

Another relevant document for the INECP is **the National Waste Management** Programme, also adopted in June 2022, which has a six-year horizon (2022-2028) and is as follows: establish the macro-objectives, macro-actions and targets; defines the criteria and strategic lines to be followed by the Regions and Autonomous Provinces when drawing up waste management plans; offers a national survey of the plant and addresses the gaps between the regions; focuses on increasing the separate collection rate, reducing the number of irregular landfills and reducing the landfilling rate of municipal waste to below 10 % in 2035; indicates the need to adopt regional planning based on the quantification of waste streams and identifies the Life Cycle Assessment (LCA) methodology to compare management scenarios, taking into account all environmental impacts.

With regard to the need to promote a sustainable production and consumption model, the new **Action Plan for the Environmental Sustainability of Consumption in the Public Administration sector** was presented, which was updated by Decree of the Minister for the Environment and Energy Security of 3 August 2023, in agreement with the Minister for Enterprise and Made in Italy and the Minister for Economic Affairs and Finance (OfficialGazette, General Series No 193 of 19-08-2023). The purpose of the plan is also to bring the objectives into compliance with the Do No Significant Harm (DNSH) principle.

Within the framework of the Plan, the so-called Minimum Environmental Criteria (CAM) are adopted by decree, namely the environmental requirements defined for the various stages of the purchasing process, aimed at identifying the best environmental design solution, product or service along the life cycle, taking into account market availability.

It should be noted that national green public procurement policy is extremely relevant, to this end, for the effects of the legislative provisions of the Public Procurement Code which make it compulsory for contracting authorities at least to include the technical specifications and contractual clauses of the minimum environmental criteria in the project and tender documentation for all categories of supplies, services and works for which these criteria have been adopted.

In addition, the **Action Plan on Sustainable Consumption and Production (NAP) under preparation** should be noted and its adoption is expected by the first half of 2025. The Plan is part of international and national policies and strategies on circular economy, resource efficiency and climate protection, which implements the Community guidelines on the European Action Plan on Sustainable Consumption and Production and Sustainable Industrial Policy COM (2008) 397 and the UN Agenda 2030.

Another key planning tool is the **National Strategy for Sustainable Development (SNSvS)**, approved by the CIPE in December 2017 and updated by Decision of the Interministerial Committee for Ecological Transition No 1 of 2023 following a review process together with the system of institutional, territorial and non-state actors that are part of the implementation process. Under Article 34 of Legislative Decree No 152 of 3 April 2006, SNSvS is the reference framework for the strategic environmental assessment of plans and programmes and defines the need for **integrated monitoring** between the different territorial levels of the ability to achieve the sustainability objectives set by the Strategy and for assessing the contribution made by the different plans and programmes to their achievement. The Programme for Policy Coherence for Sustainable Development, annexed to the new SNSvS, aims to accompany administrations in this exercise, through the design of governance tools and mechanisms for sustainability, defined together with the OECD and DG REFORM (Directorate-General for Structural Reform Support) of the European Commission.

Policy Coherence for Sustainable Development is therefore one of the enabling conditions for the new SNSvS, defined as the ‘vectors of sustainability’, including education and training for sustainable development, as well as citizen participation and institutional collaboration. The role of the territories is central to the implementation process of the SNSvS: 18 strategies of regions and autonomous provinces are now approved, in continuity and coherence with SNSvS, as well as 9 metropolitan agendas for sustainable development. In many cases, regional strategies for sustainable development integrate the lines of action on energy, climate and in particular adaptation to climate change as priority areas for action, as integrated strategies. Finally, since 2019, the **National Forum for Sustainable Development has been established**, with 212 registered organisations, as a tool for the continuous involvement of non-state actors in multi-level processes for sustainable development.

Transport is affected by both the **National Infrastructure Plan for the Ricarica of Electric Energy Vehicles (PNIRE),** approved in 2012 and updated in 2016, through a route shared with the main departments responsible as well as with stakeholders in the sector, and the **National Control Programme for Atmospheric Pollution Control (PNCIA)**, approved in December 2021. The NIRP will need to be updated on the basis of the findings of the measures provided for in the RRP.

The NECP defines all measures and initiatives to be implemented at national level to achieve the reduction targets for sulphur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (NMVOC), ammonia (NH_3) and $PM_{2,5}$ required by Directive 2016/2284 (the so-called NEC Directive). The main lines of action cover all sectors that produce pollutant emissions (electricity, residential production, transport and agriculture) and can be implemented both through regulatory instruments (phase out of coal, energy efficiency, manure use in agriculture, use of renewable sources) and incentive programmes (incentives for the deployment of electric vehicles, replacement of old wood-fired heating systems, renewal of the TPL fleet, the use of agricultural fertilisers with a lower emission impact, and technological renewal in agriculture). As regards financial coverage, Law No 234 of 2021 (Article 1 (498)) established in the statement of estimates of the Ministry of the Environment and Energy Security a fund for the implementation of the measures of the National Air Pollution Control Programme, with a total budget of EUR 2.3 million, delegating the rules governing the use of the *Fund's resources to decrees of the Minister for Ecological Transition, in agreement with the Ministers for Economic Affairs and Finance, Economic Development, Agricultural, Food and Forestry Policy, Sustainable Infrastructure and Mobility and* Health.

For the civil sector, reference should be made to **the strategy for the energy retrofitting of the national building stock (STREPIN)**, drawn up pursuant to Article 2-bis of Directive 2010/31/EU on the energy performance of buildings, as amended by Directive (EU) 2018/844, which describes an overview of the building stock and then identifies the energy retrofitting rate of the current building stock and the target, also highlighting the opportunity to carry out energy retrofitting with an integrated approach that improves cost-effectiveness. The strategy will need to be updated to take into account the increased ambition of the European directives included in the Fit for 55 package.

On hydrogen, the **"National Hydrogen Strategy – Preliminary Guidelines"** has been developed, outlining the high-level vision on the role that hydrogen can play in the national decarbonisation pathway, in accordance with the INECP, the wider environmental agenda of the European Union, and the recently published EU Hydrogen Strategy, as part of the Lungo Terminal for full decarbonisation in 2050. The strategy also identifies the areas in which this energy carrier is considered to be competitive within a short period of time, but also to check the areas of intervention that best adapt to developing and implementing the use of hydrogen.

With regard to nuclear energy, as anticipated, the MASE has set up the **National Platform for a Sustainable Nuclear** (PNNS). The priority objective of the Platform is to **develop guidelines and a *roadmap***, until 2050, to monitor and coordinate developments in new nuclear technologies in the medium and long term, assessing, in the medium term (post-2030), the**possibilities for**the deployment of new fission modular modular reactors[5] and their possible national spillovers, if proven to an adequate level of safety, as well as, in the long term, fusion energy, with a viewto supportingthe increasing penetration of renewable energy generation, in line with the objectives set out in this document to achieve climate neutrality (*'Net Zero'*) by 2050. Chapter 2.1.1 –*' Nuclear energy'* – sets out a number of scenarios for decarbonisation in 2050, which include a share of nuclear energy, showing, from data, the advantage that the integration of the nuclear source would lead to the national energy system, alongside both renewable sources and other programmable low-carbon electricity generation technologies (partly reducing, inter alia, the need to use CCS gas and bioenergy generation).

The **National Ecological Transition Plan (ETP)** responds to the European Union's challenge with the Green Deal in order to: ensure growth that preserves the planet's health, sustainability and prosperity through the implementation of a range of social, environmental, economic and political measures. The objectives of the Plan, in line with Community policy, include climate neutrality, zero pollution, adaptation to climate change, restoration of biodiversity and ecosystems, the transition to the circular economy and the bioeconomy.

The Plan is subject to regular updates and, in line with the policy lines outlined in the RRP, provides for full achievement of the objectives in 2050, as is largely set out in the national long-term strategy. More specifically, the issues outlined and addressed in the Plan are divided into: decarbonisation, sustainable mobility, improving air quality, tackling land use and hydrogeological instability,

[5] *In this case, reference is made to the Small Modular Reactor Generation III +, the Advanced Modular Reactor Generation IV (AMR) and microreactors, according to internationally used conventions.*

improving water resources and related infrastructure, restoring and enhancing biodiversity, protecting the sea, promoting the circular economy, bioeconomy and sustainable agriculture.

With a view to climate neutrality by 2050, Italy submitted its **long-term strategy** to the European Commission in February 2021, implementing Article 15 of the Governance Regulation. The Strategy, which will be updated once the INECP has been finalised and will also include a forecast of the possible use of fission and fusion nuclear energy, identifies possible decarbonisation pathways, taking into account different technological options, including the most innovative ones, not yet fully developed, in order to achieve the 2050 climate neutrality objective.

In addition to these policy and planning instruments, as is well known, the coronavirus 19 pandemic crisis, as you know, led the European Union at the July 2020 Council meeting to activate a package of measures combining the resources allocated to the EU budget for the period 2021-2027 with an important additional amount called Next Generation EU, as a specific temporary financial mechanism for recovery with the aim of helping to repair the immediate economic and social damage caused by the crisis.

The heart of Next Generation EU is undoubtedly the Recovery and Resilience Facility (RRF), which makes EUR 672.5 billion of loans and grants available, at 2021 prices, to support reforms and investments carried out by Member States and through which the national plans submitted by the Member States are financed.

theItalian National Recovery and Resilience Plan (NRRP)**, submitted on 30 April 2021 within the statutory deadlines, was approved by Council Decision on 13 July 2021 and was rescheduled the last one with the inclusion of Mission 7 – REPowerUE (** see below) adopted by Council Implementing Decision of 8 December and then at the meeting of 7 May 2024. The NRRP was designed with the investment programme designed to make Italy a fairer, greener and more inclusive country with a more competitive, dynamic and innovative economy. The Decision contains an annex setting out, in relation to each investment and reform, precise objectives and targets, time-bound, to which the transfer of pre-defined resources is linked, on a semi-annual basis, following the assessment by the European Commission and the Council.

Italy's recovery effort, outlined in the NRRP, is structured around three strategic axes shared at European level, namely:

- digitalisation and innovation;
- ecological transition;
- social inclusion.

In particular, more than 39 % of the total financial resources (so-called climate tagging) are linked to the ecological transition. As regards investments and reforms, the wider allocation of resources was foreseen precisely for Mission 2 "Green Reform and Ecological Transition", to which 28.56 % of the total amount of the Plan was allocated, i.e. around EUR 55.53 million to step up Italy's commitment in line with the ambitious objectives of the*Green* Deal on the following topics:

- incentives for energy efficiency of buildings;
- increasing the share of renewable energy and innovation in the industrial supply chain, including hydrogen;
- strengthening electricity transmission and distribution infrastructure (smart grids and grid resilience);
- promotion of energy communities and self-consumption;
- development of biomethane and agrivoltaic;
- sustainable mobility with the enhancement of cycling, the development of rapid mass transport, the renewal of the railway fleet and buses and the installation of electric charging infrastructure;
- sustainable agriculture and circular economy.

Mission 2 consists of 4 components as development guidelines:

- C1. Sustainable agriculture and circular economy for financing of EUR 8.12 million;
- C2. Renewable energy, hydrogen, network and sustainable mobility for funding of EUR 21,97 million;
- C3. Energy efficiency and refurbishment of buildings for funding of EUR 15,57 million;
- C4. Protection of land and water resources for funding of EUR 9.87 million.

Further environmental and energy impact measures can be found in Mission 3 Infrastructure for Sustainable Mobility in Mission 1, in particular with regard to environmental reforms linked to the simplification of energy procedures and the Competition Law, and of course in Mission 7 – REPowerEU.

Specifically, the **REPowerEU Plan** aims to ensure Europe's energy security and independence by breaking European consumption away from fossil fuels, in particular from Russia.

The REPowerEU Regulation (Regulation (EU) 435/2023) adopted by the Council on 27 February 2023 amending Regulation (EU) 2021/241 as regards REPowerEU chapters in recovery and resilience plans and amending Regulations (EU) No 1303/2013, (EU) 2021/1060 and (EU) 2021/1755 and Directive 2003/87/EC.

Aspointed out above, the process of defining the chapter Reil was concluded by the Decision of the European Council of 8 December 2023 and most recently by Council Implementing Decision at its meeting of 7 May 2024. An overall additional contribution of EUR 11.18 MLD is foreseen for the new investments and reforms included in Mission 7 of the NRRP.

The REpowerEU Plan is a European response to the difficulties and disruptions of the energy market caused by Russia's invasion of Ukraine, with the priority objective of security and diversification of energy supplies together with increasing the use of renewable sources.

The main focus was on strengthening strategic energy infrastructure around the two priority lines: a more sustainable energy future and strengthening energy security.

In particular, in terms of security and diversification of supply, the necessary gas transmission lines have been upgraded to replace the reduction in imports from Russia.

In addition, projects of national and European relevance have been financed with the aim of improving the transport capacity of electricity and absorbing energy from renewable sources.

As regards the supply of strategic critical materials, currently produced outside Europe, research and experimentation activities have been funded in order to find these raw materials on our territory and recover them from disused products, with a view to circularity.

II. Current energy and climate policies and measures relating to the five dimensions of the Energy Union

Italy has and continues to pay much attention to the five dimensions of the Energy Union, having put in place numerous measures for sustainable energy development and combating climate change.

The table below shows the main measures in place in relation to the five dimensions of the Energy Union.

Table 3 - Main current energy and climate policies and measures related to the five dimensions of the Energy Union

Summary name of policy or measure	Dimension Emissions	Dimension Renewables	Dimension Efficiency	Dimension Security	Dimension Market, Infrastructure, Consumers	Dimension Research, Innovation, Competitiveness
SME Guarantee Fund, Special Section for Tourism (NRRP)	Emissions	Renewables	Efficiency			R.I.C.
Partnerships for Research and Innovation – Horizon Europe (NRRP)	Emissions	Renewables	Efficiency			R.I.C.
Business investment facilitation for capital goods (new Sabatini)	Emissions	Renewables	Efficiency			R.I.C.
Interventions for the environmental sustainability of ports – Green Ports (NRRP)	Emissions	Renewables	Efficiency			
Verdean Islands (NRRP)	Emissions	Renewables	Efficiency			
Plan for the safety and upgrading of school buildings (NRRP)	Emissions	Renewables	Efficiency			
National Innovative Programme for Residence Quality (NRRP)	Emissions	Renewables	Efficiency			
District heating systems (NRRPs)	Emissions	Renewables	Efficiency			
Call for parks	Emissions	Renewables	Efficiency			
The Termico account. MINISTERIAL DECREE NO 16/02/2016	Emissions	Renewables	Efficiency			
Tax deductions for energy renovation of buildings (Ecobonus)	Emissions	Renewables	Efficiency			
Tax deductions for energy retrofitting of buildings (Superbonus)	Emissions	Renewables	Efficiency			
Tax deductions for building renovations (Bonus Casa)	Emissions	Renewables	Efficiency			
Transition Plan 4.0	Emissions	Renewables	Efficiency			
National portal on the energy performance of buildings	Emissions	Renewables	Efficiency			
Promotion of efficient district heating systems	Emissions	Renewables	Efficiency			
Programme for the financing of energy efficiency measures in public housing	Emissions	Renewables	Efficiency			
Hydrogen use in hard-to-abate sectors (NRRPs)	Emissions	Renewables				R.I.C.
Agestral (NRRP)	Emissions	Renewables				
Biomethane. MINISTERIAL DECREE NO 15/9/2022 (NRRP)	Emissions	Renewables				
Agricultural Park (NRRP)	Emissions	Renewables				
Hydrogen production in brownfield sites – Hydrogen Valleys (NRRP)	Emissions	Renewables				
Promotion of renewables for energy communities and self-consumption (NRRPs)	Emissions	Renewables				

Hydrogen testing for rail transport (NRRP)	Emissions	Renewables				
Hydrogen testing for road transport (RRP)	Emissions	Renewables				
Biofuels. Sustainability certification. MINISTERIAL DECREE NO 14/11/2019	Emissions	Renewables				
Biofuels. Obligation to release for consumption	Emissions	Renewables				
Biomethane and advanced biofuels. MINISTERIAL DECREE NO 2/3/2018	Emissions	Renewables				
Energy account for photovoltaic installations	Emissions	Renewables				
Decree on smaller islands. MINISTERIAL DECREE NO 14/02/2017	Emissions	Renewables				
Guarantees of renewable electricity	Emissions	Renewables				
Encouraging collective self-consumption configurations and renewable energy communities	Emissions	Renewables				
Incentive for non-photovoltaic renewable electricity. MINISTERIAL DECREE NO 23/6/2016	Emissions	Renewables				
Incentive for non-photovoltaic renewable electricity. FER-E. DM 6/7/2012	Emissions	Renewables				
Incentivising electricity renewables. DM 4/7/2019 (FER-1)	Emissions	Renewables				
Obligation to integrate renewables into new or existing buildings	Emissions	Renewables				
Exchange on the spot (SSP)	Emissions	Renewables				
National Innovation Fund	Emissions		Efficiency			R.I.C.
Investment and Infrastructure Development Fund	Emissions		Efficiency			R.I.C.
Sustainable Growth Fund	Emissions		Efficiency			R.I.C.
Cohesion policies	Emissions		Efficiency			R.I.C.
Efficiency of judicial buildings (NRRPs)	Emissions		Efficiency			
Energy efficiency of cinemas, theatres and museums (NRRPs)	Emissions		Efficiency			
Measures for the resilience, enhancement of the territory and energy efficiency of municipalities (NRRPs)	Emissions		Efficiency			
New charging stations in cities and highways to facilitate the use of electric vehicles (RRPs)	Emissions		Efficiency			
Safe and Sustainable Hospitals (NRRPs)	Emissions		Efficiency			
Plan for the replacement of school buildings and energy retrofitting (NRRP)	Emissions		Efficiency			
Infrastructure upgrade of regional rail transport and rapid mass transport systems (RRPs)	Emissions		Efficiency			
Simplification and acceleration of procedures for implementing energy efficiency interventions (NRRP reform)	Emissions		Efficiency			
Quay electrification, cold ironing (NRRP)	Emissions		Efficiency			
Facilitation of private electric charging	Emissions		Efficiency			
Energy audits in enterprises	Emissions		Efficiency			
Call for innovative integrated projects for non-interconnected smaller islands	Emissions		Efficiency			

White Certificates	Emissions	Efficiency			
Tax deductions: façade bonuses	Emissions	Efficiency			
Kyoto Fund. MINISTERIAL DECREE NO 14/4/2015	Emissions	Efficiency			
National Energy Efficiency Fund. MINISTERIAL DECREE NO 22/12/2017	Emissions	Efficiency			
Incentives for the renewal of private vehicles (vehicle eco-bonus)	Emissions	Efficiency			
Incentive Marebonus and Ferrobonus	Emissions	Efficiency			
Mandatory efficiency of public lighting networks	Emissions	Efficiency			
Urban Sustainable Mobility Plans – SUMPs	Emissions	Efficiency			
National infrastructure plan for electric vehicle charging – PNIRE	Emissions	Efficiency			
Cargo Bike programme	Emissions	Efficiency			
Sustainable Urban Mobility Incentive Programme (Primus)	Emissions	Efficiency			
Consumer Information and Training Programme (BIP)	Emissions	Efficiency			
Programme for Energy Renovation of Central Public Administration Buildings (PREPAC)	Emissions	Efficiency			
Case-work school experimental programme	Emissions	Efficiency			
Renewal of vehicles for freight transport	Emissions	Efficiency			
Modal shift in freight transport	Emissions	Efficiency			
Modal shift in passenger transport	Emissions	Efficiency			
Emission standards for new cars	Emissions	Efficiency			
LNG development in maritime transport and port services	Emissions	Efficiency			
LPT: fleet renewal	Emissions	Efficiency			
Sustainable school transport	Emissions	Efficiency			
LPT: measures for GLT and sustainable public mobility	Emissions	Efficiency			
Phase out of coal	Emissions		Security		
Southern Growth Fund	Emissions				R.I.C.
Public Guarantee Fund for SMEs and professionals	Emissions				R.I.C.
Support for R & D projects for the conversion of production processes within the circular economy	Emissions				R.I.C.
National Indicative Code of Good Agricultural Practice for the Control of Ammonia Emissions	Emissions				
Guidelines for the environmental labelling of packaging	Emissions				
National air pollution control programme	Emissions				
Experimental programme for eaplastic	Emissions				
Circular Economy Strategy: (8) Minimum Environmental Criteria (CAM)	Emissions				
Circular Economy Strategy: 1) establishment of a national observatory	Emissions				
Circular Economy Strategy: (10) sustainable land use	Emissions				

Circular Economy Strategy: (11) sustainable use of water resources from a circular economy perspective	Emissions					
Circular Economy Strategy: (2) electronic waste traceability register	Emissions					
Circular Economy Strategy: (3) tax incentives to support recycling and use of secondary raw materials	Emissions					
Circular Economy Strategy: (4) revision of the environmental taxation system for waste	Emissions					
Circular Economy Strategy: (5) right to reuse and repair	Emissions					
Circular Economy Strategy: (6) reform of the EPR system	Emissions					
Circular Economy Strategy: 7) establishment of the national register of producers	Emissions					
Circular Economy Strategy: (9) industrial symbiosis projects	Emissions					
Measures to increase organic farming	Emissions					
IPCEI hydrogen and batteries		Renewables		Security	Market	R.I.C.
Aggregation of generating facilities and utilities (Legislative Decree No 102/2014)		Renewables			Market	
Hydrogen – Electrolyser production (NRRPs)		Renewables				R.I.C.
Renewable and Batteries (NRRPs)		Renewables				R.I.C.
National rules governing the Idonee areas		Renewables				
Regional discipline of the Idonee Areas and digital platform		Renewables				
Arrangements for the award of concessions for large hydroelectric derivatives		Renewables				
Single model for integrated photovoltaic systems on roofs of buildings		Renewables				
Simplifications to permit granting procedures for installations with renewable sources		Renewables				
Simplifications to permit granting procedures for renewable installations: unique models and digital platform		Renewables				
Capacity market				Security	Market	
Diversification of LNG supply and reinforcement with new FSRUs				Security	Market	
Diversification and upgrading of electricity interconnections				Security	Market	
Diversification and enhancement of gas interconnections				Security	Market	
Increasing flexibility through accumulation and sector integration				Security	Market	
New LNG coastal connections and warehouses				Security	Market	
Strengthening internal network to support RES integration				Security	Market	
Interventions on Network Climate Resilience (NRRP)					Market	
Strengthening smart grids (NRRPs)					Market	
Social bonus gas					Market	
Social bonus light					Market	
Energy Decree					Market	

Active role of consumers and market liberalisation					Market	
Electric buses: production chain (NRRP)						R.I.C.
Hydrogen Research and Development (NRRP)						R.I.C.
Support for start-ups and venture capital active in the ecological transition (NRRP)						R.I.C.
Energy cluster						R.I.C.
Tax credit. Transition Plan 4.0						R.I.C.
Electricity System Research Fund						R.I.C.

III. Key issues of cross-border relevance

❖ **ELECTRICAL SECTOR**

In 2022, Italy's electricity demand was 315 TWh, a decrease of 1.5 % compared to 2021. The energy demand was covered for 272.0 TWh from domestic production, of which 36 % from renewable sources (with a marked decrease in hydropower production). The remaining share of needs was covered by net imports from abroad (43 TWh).

In 2023, according to preliminary data from the TSO (Terna), the electricity demand in Italy was 305.0 TWh, a decrease of 3.2 % compared to 2022. The energy demand was covered for 253.7 TWh from domestic production, of which 44 % from renewable sources. The remaining share of needs was covered by net imports from abroad (51 TWh).

The modest contraction in electricity demand in 2022 is the result of a "two-speed" year, with positive trend changes in the first part of the year and negative since August, as a result of a number of concurrent factors: the high prices that have characterised energy markets, the measures taken by citizens and businesses to curb electricity consumption, including at government level, and the rather mild temperatures recorded in autumn and winter months. On the production side, the contraction in hydropower generation (-36.3 %), due to the long period of drought, was partly offset by the increase in thermal power generation (+ 5.0 %) and, in particular, by the increase in coal-fired generation as a result of the actions taken by the government to deal with the gas crisis. In this scenario, the external balance remained broadly unchanged compared to 2021, amid strong volatility in energy market prices over the course of the year.

The national electricity transmission grid is interconnected abroad through 30 interconnection lines:

- 9 lines with France, of which:
    - 4 HVDC lines: two at 320 kV (Piossasco-Grand'Ile) and two 200 kV with Corsica (SACOI);
    - 1 direct current line 150 kV between Sardinia and Corsica (Sarco);
- 4 lines in CA: one 220 kV in a single tank; one 380 kV in a single tank and one at 380 kV in double tank;
- 12 lines with Switzerland;
- 4 lines with Austria;
- 2 lines with Slovenia;
- an HVDC 500 kV Italy-Montenegro line (MONITA);
- an HVDC 500 kV Italy-Greece (GRITA) line;
- and a 220 kV connection to Malta.

Please find below the import and export data from the various countries with which Italy is interconnected.

Table 4 – Import and export data from the various countries with which Italy is interconnected

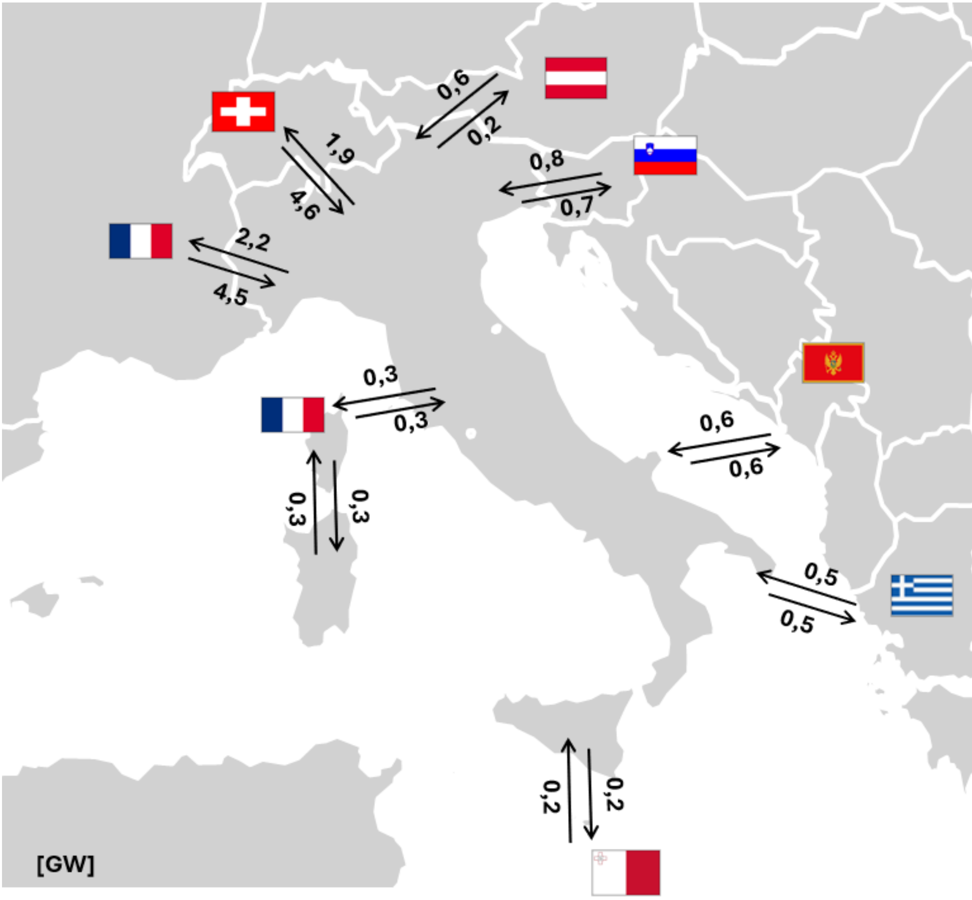
GWh	France	Switzerland	Austria	Slovenia	Greece	Malta	Montenegro
Import 2021	15.153	19.468	1.258	5.450	1.857	34	3.353
Export 2021	1.185	1.256	12	74	518	547	190
Import 2022	14.397	20.286	1.499	6.214	1.741	6	3.248
Export 2022	1.210	1.041	9	23	1.054	646	422
Import 2023	19.318	21.201	1.328	6.513	1.989	26	4.197
Export 2023	958	980	10	28	644	648	52

(Source: Terna)

The contribution of imports from the various countries with which Italy is interconnected is driven by two key factors: the hourly energy price differential between Italy and the interconnected country and cross-border interconnection capacity. The average electricity price on Italy's wholesale markets is historically higher than neighbouring countries with generation mix with lower production costs and less flexibility, which, at times of reduced load and higher renewable production, leads to even negative prices. Rather well-established dynamics, but may evolve in the following years to combine several factors, including: the clear prevalence of RES generation, high CO_2 prices, hydrogen production and changing market regulation, as well as the potential role of nuclear power generation.

Cross-border capacity has been developed predominantly on the north-west border (France and Switzerland), which can account for about three quarters of imported electricity volumes. It should be noted that during the three-year period 2021-2023 interconnection capacity increased by around 1.8 GW mainly linked to the border with France. For the French border, we would point out the entry into operation of the First Hub of the Italian-France HVDC interconnection in November 2022 (Interconnector PISA ex L.99/2009) and the Second Polo in August 2023, which made available a total of 1.200 MW of trading power between the two borders. In addition, in December 2023, a new 220 kV alternating current interconnection on the Italy-Austria border entered into operation, ensuring an increase of NTC by 300 MW (Interconnector RESIA ex L.99/2009). These reinforcements are in addition to the previous entry into operation of MONITA (Italy – Montenegro HVDC interconnection, partly developed as Interconnector ex L.99/2009) at the end of 2019. These projects were referred to in the previous INECP 2019.

Figure 1 – Cross-border import and export trading capacity of existing interconnections (maximum NTC 2024 processing, nominal integrated grid values – source Terna)



The national electricity system operator has identified medium- and long-term projects that will allow for an increase in external interconnection capacity; increase mainly located at the northern and southern border of the country. In the medium term (2030), the total estimated increase is around 1.000 MW, due to the planned entry into operation of the HDVC interconnection project with Tunisia "tunita" (NTC increase on the border of 600 MW), and the reduction of capacity limitations with Slovenia (with NTC increase on the border of 400 MW). In the long term (2040), an overall increase of more than 2.000 MW is expected as a result of the development of the second HVDC interconnection.

With Greece "GRITA 2" (NTC increase on the border from 500 MW to 1 000 MW[6]), the interconnection with Switzerland Valtellina – Valchiavenna and two additional interconnections with Austria.

In addition, there are several private merchant lines, some of which are already authorised.

[6] *Joint activities and studies with the Greek TSO IPTO, in view of the evolution of renewable generation in the policy scenario planned in the south of the country, showed efficiencies and synergies resulting from the implementation of a new 1.000 MW bipolar connection.*

❖ GAS SECTOR

As regards the natural gas sector, the budget for the three-year period 2021-2023 is shown.

Table 5 – Natural gas balance, 2021-2023

Natural gas balance – Italy (1) (standard million cubic metres at 38.1 MJ/mc)								
			January – December					
			2023	2022	2021	Variaz. 22 TO -21 %	Variaz. 23 TO -22 %
a)	**National production (2)**		2.988	3.316	3.343	— 0.8 %	— 9.9 %
b)	**Imports**		61.608	72.309	72.592	— 0.4 %	— 14.8 %
	Per entry point	Mazara del Vallo	23.040	23.554	21.169	11.3 %	— 2.2 %
		Gela	2.522	2.619	3.231	— 18.9 %	— 3.7 %
		Tarvisio	2.844	13.976	29.061	— 51.9 %	— 79.7 %
		Step Gries	6.567	7.587	2.170	250.0 %	— 13.5 %
		Melendugno	9.988	10.320	7.124	43.0 %	— 3.2 %
		Piombino	1242				
		Panigaglia (2)	2.603	2.205	1.054	109.1 %	+ 18.0 %
		Cavarzere (2)	8.873	8.277	7.219	14.7 %	+ 7.2 %
		Livorno (2)	3.860	3.718	1.416	167.2 %	+ 3.8 %
		Gorizia	41	26	39	— 34.4 %	+ 59.8 %
		Others	29	25	19	42.7 %	+ 5.7 %
c)	**Exports**		2.619	4.594	1.543	197.6 %	— 43.0 %
D)	**Variation in stocks (2)**		457	2.581	— 1.591	— 262.2 %	— 82.3 %
(e) = a) + b) -c) -d)	**Gross domestic consumption**		61.520	68.450	75.983	— 9.9 %	— 10.1 %

(1) Pre-balance net of transit
(2) Includes consumption and losses

The Russian war on Ukraine has seen Italy and other EU countries strongly engaged in a huge effort to reduce imports from Russia from the outset. Italy has succeeded in replacing the import of gas through the Tarvisio methane pipeline, increasing the use of regasification operators and imports from Mazara del Vallo (Algeria), Passo Gries (Norway, mainly) and Melendugno (Arzebaijan). It is also noted that gas exports increased (by almost 200 % in 2022). Italy is thus able to position itself as an energy hub towards Europe, so relations with Mediterranean countries become increasingly crucial.

Consumption in Italy in 2022 amounted to 68,52 bcm of Sm^3, a decrease of around 10 % compared to 2021 data (75,98 bcm of Sm^3). As mentioned above, 2022 was a particularly critical year due to the Russian war in Ukraine, which led to the orientation of European policies aimed at finding a substitution of Russian gas imports and, at the same time, aimed at achieving consumption reduction targets. A combination of factors, such as the high level of gas prices (leading to a reduction in consumption first in the industrial sector and then in the civil sector), mild winter temperatures in addition to the measures adopted led to a contraction in gas consumption, which in turn led to a reduced use of storage, the lowest that has been historically.

Consumption in Italy in 2023 amounted to 61,52 bcm of Sm3, a decrease of around 10 % compared to 2022 figures due to the fall in consumption in some sectors. In particular, gas demand reduction can be attributed to:

I. thermoelets, as a result of increased electricity imports (French nuclear recovery), increased renewable production (in particular hydropower), reduced electricity demand also as a result of the slow recovery of the industrial sector;
II. residential and tertiary sectors, compared with overall milder temperatures than in 2022, as well as energy efficiency and consumption containment actions that influenced the first months of the year;
III. industrial sector affected by commodity price developments and the unstable macroeconomic situation, which led to a decline in industrial production (in particular in the energy intensive sectors).

Gas from abroad is fed into the national pipeline network through 6 entry points at interconnections with the gas import pipelines (Tarvisio, Gorizia, Passo Gries, Mazara del Vallo, Gela, Melendugno) and LNG regasification terminals connected to the national pipeline network; ‘LNG Italia’ in the Ligurian Sea, which emits to Panigaglia, ‘Adriatic LNG’ into the offshore shore of the Upper Adriatic Sea, which it emits to Cavarzere, ‘OLT Offshore’ into the Tyrhenian Sea, which places Livorno and ‘FSRU Piombino’ into the port of the same city.

In order to accelerate independence from Russian import, in addition to FSRU Piombino, which has been operational since May 2023, a new FSRU unit was authorised to be placed in Ravenna. The two new regasification apparatus ensure an incremental regasification capacity of approximately 10 billion cubic metres per year.

Figure 2 – National gas grid and main entry points

This route also includes the so-called doubling of the Tap, which will make it possible to have more gas import capacity since 2026.

Finally, the project of interconnection with Malta via a new pipeline from Gela (PCI project) was authorised. This project will operate in export.

The current search for diversification of gas supply sources can lead Italy to become a *hub* in the Mediterranean, becoming a gas injection point and channelling to other European countries (Malta, Slovenia, Slovakia at present), including by strengthening certain cross-border and internal infrastructure (to Austria) (Adriatica).

The major natural gas discoveries in recent years in the Eastern Mediterranean area, including the Exclusive Economic Zones (EEZs) of Israel, Cyprus and Egypt, have laid the foundations for new forms of cooperation and a potential rebalancing of the regional and European energy market, including with a view to greater security and diversification of supply. Following the successes of these exploratory activities, Egypt has become self-sufficient, and exporter, Israel has become a natural gas producer and itself an exporter through Jordan. Many areas remain to be explored in the EEZ of Cyprus, but also in Egypt and the rest of the Levant. The significant quantities discovered will be fully marketable in the coming years and therefore concrete export options need to be identified both in the short/medium term and in the long term.

Italy is one of the founding countries of the East Mediterranean Gas Forum (EMGF), an initiative launched at the instigation of Egypt, which also brings together Greece, Cyprus, Israel, Jordan and the Palestinian Authority with the aim of creating a platform for cooperation, involving also the private sector, on common policies for the use of gas discovered and discovered in the Eastern Mediterranean, with a view to promoting a mutually beneficial and secure gas market in the region, with potential spill-over effects beyond the region itself. France has been added as a fully-fledged member country to the founding member countries of EMGF, while the United States, the European Union and the World Bank are members of it as observers.

The Forum, strongly promoted by Egypt – the headquarters is in Cairo and the position of Secretary General has been held by Egypt since its constitution – has been an important interlocutor between gas producing, importing and transit countries not only in order to make the significant quantities of gas discovered and discovered on the market, but also in promoting the energy transition and policies aimed at decarbonising the gas sector in the Levant Basin, also in the light of the recent presidency of Egypt at COP27.

The recent Russian-Ukrainian crisis and the consequent need to become independent from Russian gas supplies have required to maximise gas and LNG imports from supplying countries. In this regard, in coordination with ENI and SNAM, the national gas TSO, steps have been taken to secure new LNG supplies from Egypt (up to 3.5 billion cubic metres).

Finally, it is important to highlight the strategic role gas storage has played in ensuring energy security and ensuring seasonal demand modulation, with around 18.5 billion cubic metres of storage capacity.

❖ <u>OIL SECTOR</u>

♦ *TRANSALPINE PIPELINE (SIOT)*

The Transa-Alpine Pipeline (Transa-Alpine Pipeline) pipeline is an important raw oil transport infrastructure across the Alps, connecting the Port of Trieste to the city of Ingolstadt in Germany. The pipeline has a total length of approximately 752 km and a transport capacity of around 36 million barrels of crude oil per year and crosses Italy, Austria to Germany, connecting the Port of Trieste with the German Länder of Bavaria and Baden-Württemberg. The Italian part of the pipeline, managed by the Società Italiana per l’Oleodotto Transalpino (SIOT), which is part of the TAL group, is approximately 150 km long and also includes the San Dorligo del Valle reservoirs and the marine terminal located in the Port of Trieste.

Figure 3 – Translpine pipeline, traced

The oil tankers reach the two ponists of Terminale Marino in the Port of Trieste, where crude oil is unloaded and transferred to the San Dorligo del Valle Serbatoi Park (Trieste); since then, the Transalpino Oleoline crosses Friuli-Venezia Giulia, three regions of Austria (Carinthia, Salisburghurt and Tyrol) and Bavaria to arrive at Lenting Serbatoi Park near Ingolstadt. Two branches to the east and north west lead crude oil to German refineries.

There are eight refineries supplied by the infrastructure, six of which are only supplied (and can be supplied) by this pipeline: this is the entire Austrian, Czech and southern German refining sector.

The authorisation procedure, managed by the Friuli-Venezia Giulia Region, is currently under way in order to achieve energy self-sufficiency through the construction, on the route developed in Friuli, in the localities of Trieste, Reana del Rojale, Cavazzo and Paluzza, of four small thermal power stations needed to operate the oil thrust pumps, without having to feed through the electricity grid.

- ***San Dorligo del Valle reservoir***

The Serbatoi Park of San Dorligo della Valle, which is part of the SIOT infrastructure, consists of 32 floating roof tanks, with a total capacity of more than 2 million cubic metres, and various qualities of crude oil can be stored at the same time. Crude oil from the two ponds of Terminale Marino in the Port of Trieste is stored in the San Dorligo tanks, and within the Serbatoi Park, via the first pumping station, the crude oil is fed into the pipeline on its journey to the north.

The tank park is located in the south-east of the Trieste Industrial Zone and, as stated above, is used for the storage and handling of crude oil from Terminale Marino.

♦ *COASTAL STORAGE OF SEASTOCK MINERAL OILS*

In the Port of Trieste,Seastock **Srl,** a company of the Tosto group, which acquired the oil terminal of **Depositi Costieri Trieste SpA. The**facility for the handling and storage of petroleum, energy and mineral oils has a storage capacity of 130.000 m³ and consists of 26 tanks.
The plant is a key fuel refuelling *hub* throughout northern Italy and represents a close and accessible door for all markets in Central and Eastern Europe.

❖ FURTHER AREAS OF CROSS-BORDER COOPERATION

♦ *CROSS-BORDER COOPERATION IN CCS*

Italy intends to develop the Carbon Capture and Storage (CCS) sector. Together with France and Greece, a regional plan was drawn up and presented in March 2023 to support the development of CCS infrastructure in the Mediterranean Sea basin within the scope of the *Trans-European Networks for Energy*Regulation 2022/869. The cross-border plan is scalable and the development of CCS value chains, such as those presented below, allows for the promotion of further projects in the Mediterranean region. As a result, other Mediterranean countries could subsequently join to strengthen regional cooperation on CCS.
The role of CCS is widely recognised to achieve climate neutrality and the objective of limiting global warming by 1.5 degrees. CCS value chains have crystallised in northern Europe using oil & gas depletion deposits in the North Sea, and are in relatively advanced stages of development. The development of such infrastructure in southern Europe is lagging behind in 2024. France, Greece and Italy expressed common interest in facilitating CCS projects through enhanced collaboration: maximising synergies on CO2 liquefaction, transport and storage processes$_{\text{and}}$ promoting infrastructure with third party access are key factors for the uptake of CO_2 capture in the EU Member States intending to use this technology. The Mediterranean Plan for CCS, drawn up by Italy, France and Greece to support the application of the Callisto Mediterranean CO_2 Network, Prinos CO_2 storage and Augusta C2 projects, in accordance with the provisions of the TEN E Regulation, provides a framework for discussions and cooperation between its signatories, but does not impose any legal, regulatory or political constraints and does not replace national CCS policies and strategies.

The development of a CCUS (Carbon Capture Utilisation and Storage) hub, where many$_{\text{CO2}}$ emitters can benefit from common infrastructure and an open access cross-border transport network is crucial because not all Member States have access to adequate geological storage sites. The liquefied, transport and storage value chains of CO_2 will need to be developed at regional level, for reasons related to:

- diversity of routes and deposits;
- increased competition between alternative infrastructure;
- avoid dominant positions (which could create, for example, if CO_2 value chains occur only in parts of Europe);
- optimisation of CO_2 transport routes.

♦ *POTENTIAL NATIONAL AND CROSS-BORDER FLOWS*

With reference to international CO2 flows$_{\text{from}}$ other countries in the Mediterranean area, expressions of interest were received in Italy, in the context of the TEN-E Regulation procedures, from foreign emitters, totalling more than 1 Mton/year of CO_2, mainly from France, in addition to those relating to national installations of at least 3,6 Mton/year and a potential capture and export from Italy to Greece by mid-2030. Further developments are likely, as the potential expansion of the network and the large capacity of CO2 storage sites on Italian territory allow significant volumes of CO_2, taken from national and other Mediterranean industrial installations, in particular from France.

On the other hand, as mentioned above, the Italian volumes of CO_2 caught are also to be exported to other storage sites in the Mediterranean basin, in particular to Greece.

The PCI projects (projects of Community interest), included in the list that entered into force at the beginning of 2024, concerning the Mediterranean region (Callisto Mediterranean CO2 Network and Prinos CO2 storage), are specifically designed in a cross-border context and involve Italy at different levels. The CALLISTO Mediterranean CO2 Network project is part of the wider scope of the Italian Ravenna CCS project, which aims to provide large-scale open access infrastructure by offering industries and power plants located in both Italy and South Europe with CO2 emissions that are difficult to reduce a timely and economic decarbonisation solution on a transparent and non-discriminatory basis. The Callisto project involves Italy throughout the CCS sector, providing significant efforts to develop infrastructure for the capture, transport and storage of CO_2 in Italy. In this project, Italy is the country receiving CO2 emissions from other countries, becoming the pivot of the sector through its geological storage site in the Adriatic Sea. On the other hand, in Prinos CO_2 storage project, Italy is part of the process as a emitter country, as the storage of CO_2 is planned at the Prinos storage site (Greece).

Cooperation with France and Greece continues bilaterally also in the context of the provisional application of the 2009 amendment to Article 6 of the London Protocol.

♦ ***CROSS-BORDER COOPERATION FOR OFFSHORE RENEWABLE ENERGY AND PRIORITY OFFSHORE GRID CORRIDORS***

The policyscenario developed for this plan foresees that a total of around 131 GW of renewable installations (of which around 80 GW photovoltaic and around 28 GW wind) will be installed by 2030, with a capacity increase of around 74 GW compared to 2021 (of which approximately + 57 GW from photovoltaic and around + 17 GW from wind). This capacity could develop for a significant part of the centre-south of the country due to increased wind and solar production, while respecting regional burden sharing. In order to achieve these objectives, it will be important to use the different available renewable technologies, including offshore (including floating) technologies in order to exploit additional sunshine and sunshine areas by limiting land take and landscape impact.

At European level, as is well known, the Offshore Renewable Energy Strategy (COM (2020) 741 final) highlights the need to reach at least 300 GW of offshore wind and 40 GW of ocean energy by 2 050 in the EU as a key means of achieving climate neutrality. To facilitate the development of offshore renewable energy, the 2022 TEN-E Regulation requires Member States within their specific priority offshore grid corridors, taking into account specificities and development in each region, to conclude a non-binding agreement to cooperate across borders on offshore renewable energy targets to be achieved by 2050 within each sea basin, with an indication of the intermediate steps in 2030 and 2040, in line with the NECPs and the offshore renewable potential of each sea basin.

Italy, covering both the Eastern Mediterranean basin and the western Mediterranean basin, adopted in January 2023 two non-binding agreements of this kind together with the other Member States concerned (with specific regard to Italy, the collaboration takes place with Greece, Spain, France, Malta, Croatia and Slovenia), with a commitment to connect to the Italian national network by 2030 up to 4 GW in the priority offshore grid corridor “South and West Offshore Grids” and 4.5 GW in the priority offshore grid corridor “South and East Offshore Grids”.

♦ ***COOPERATION ON THE DEPLOYMENT OF CROSS-BORDER HYDROGEN INFRASTRUCTURE***

The ‘SoutH2 Corridor’ infrastructure, to be implemented by SNAM and the Austrian and German TSOs, is part of the European Hydrogen Backbone and provides for the development of a series of hydrogen pipelines in Italy, Austria and Germany for the transport of the energy carrier from possible renewable hydrogen production sites in North Africa, and looking ahead from the Italian midday, to the main areas of potential Italian and European consumption. Specifically, SoutH2Corridor is a 3.300 km long hydrogen backbone, focusing on the use of existing midstream infrastructure for hydrogen transport, including some new dedicated infrastructure where necessary.

The Italian Hydrogen Backbone – Dorsalt Italiana dell’Idrogen, the Italian segment of the corridor, will use existing gas infrastructure, adapted to the transport of hydrogen, together with new sections to be built, with a view to opening up to North Africa’s renewable resources through further development along the route of the Trans Tunian Pipeline (‘TTPC’) and Trans Mediterranean Pipeline (‘TMPC’) pipelines connecting Algeria/Tunisia and Italy.

By Delegated Regulation (EU) 2024/1041 of 28 November 2023, the European Commission included the hydrogen corridor linking Italy, Austria and Germany on the Union list of Projects of Common Interest (PCI), in accordance with the new Trans-European Energy Infrastructure (TEN-E) Regulation (EU) 2022/869.

To support the deployment of the infrastructure, a working group was launched in 2023 with technicians from the Ministries of the countries concerned. On 30 May 2024, the Joint Declaration of Political Intent between the Energy Ministries of Italy, Germany and Austria aimed at strengthening cooperation for the development of the Southern Hydrogen Corridor was signed.

A number of other EU Member States, in addition to Italy, Germany and Austria, have expressed interest in the SoutH2 Corridor and the possibility of connecting to the infrastructure in the future.

IV. Administrative structure of implementing national energy and climate policies

The reform of Title V of the Constitution, and in particular Article 117 thereof, places the subject of ‘national energy production, transport and distribution’ among the competences shared between the State and the Regions.

The text of Article 117 of the Constitution retained the exclusive power of the State in matters relating to the energy sector, including:

- relations with the European Union;
- the protection of competition;
- the protection of the essential levels of benefits relating to civil and social rights;
- the protection of safety and public security;
- environmental and ecosystem protection.

Within the principles laid down by national law, the functions entrusted to the Regions include:

- the formulation of regional energy policy objectives;
- the location and construction of district heating installations;
- the development and exploitation of indigenous resources and renewable sources;
- the granting of hydroelectric concessions;
- energy certification of buildings;
- ensuring environmental and territorial safety and compatibility conditions;
- the security, reliability and continuity of regional supplies.

Moreover, in view of the three constraints shared by the State and the Regions in legislating – compliance with the Constitution, compliance with Community law and compliance with international obligations – the Regions are jointly and severally called upon to meet the binding energy and climate targets set by the European Union for 2030. A method of linking the State and the regions to share and achieve national targets agreed at EU level has been tested with reference to the 2020 RES targets. Under the 'burden sharing Decree' (Ministerial Decree of 15 March 2012), the contribution that the various regions and autonomous provinces were required to provide in order to achieve the national objective, allocating specific regional objectives for the use of RES in 2020 to each of them. An approach based on the division of effort between the different regions should, at least in certain areas and appropriate ways, also beyond 2020, be appropriate to ensure that objectives are shared and that local governments contribute consistently to achieving them. The breakdown of the target renewable power per region (burden sharing) is being updated in the decree on suitable areas to be released.

In view of the objectives in 2030 and after 2050, it is also necessary to stimulate a more active role for the local authorities closest to the citizen. In particular, through the valorisation and strengthening of the actions that these bodies are carrying out under their Sustainable Energy Action Plans (SEAPs) and Action Plans for Sustainable Energy and Climate (PAESC), operational instruments of the Covenant of Mayors.

The functions of the State call into question, first, the **Ministry of the Environment and Energy Security** (MASE), whose scope is very broad, with all environmental competences within it, as well as some of the key competences in the ecological transition process, mainly related to the energy sector, also understood as security and economy of supplies.

In addition to MASE, other ministries are involved in the process of identifying and implementing the policies and measures necessary to achieve the objectives of the Plan, such as the **Ministry of Economy and Finance** (MEF), the **Ministry of Infrastructure and Transport** (MIT), the **Ministry of Enterprise and Made in Italy** (MIMIT), the **Ministry of Agriculture, Food Sovranity and Forestry** (MASAF), the **Ministry of Universities and Research** (MUR), the **Ministry of Culture** (MiC).

In addition, it should be noted that Decree-Law No 22 of 2021 March 1 established the Interministerial Committee for Ecological Transition (CITE) within the Prime Minister's Office, which stems from the need to provide a first definition of the *governance* of the ecological transition, with the task of coordinating national policies on reducing climate gas emissions, sustainable mobility, combating hydrogeological instability and land consumption, water resources and related infrastructure, air quality and the circular economy.

The CITE is chaired by the Prime Minister or, in his place, the Minister for the Environment and Energy Security, and consists of the other central administrations responsible for the matter (MEF, MIT, MIMIT, MASAF, MLPS). The other Ministers or their delegates having competence in the areas covered by the measures and topics on the agenda shall also participate.

In addition to the central government authorities of the State, national policies linked to the achievement of national objectives are a number of other actors, operating in a framework consistent with European rules. These include the**Competition and Market Authority (AGCM) and the Regulatory Authority for Energy Networks and Environment (ARERA)**: **while**respecting independence from the executive, these bodies have, albeit with different roles, essential tasks of protecting consumers' interests and promoting competition, ensuring the efficiency and deployment of services with appropriate levels of quality, including in the field of energy, and, as regards ARERA, of regulating a large part of the instruments related to national energy policies.

Terna S.p.A. acts as a national transmission system operator (TSO). The tasks of Terna include the operation of the high-voltage and very high voltage network, maintenance of network infrastructure, network development planning and construction, dispatching, i.e. the management of electricity flows on the grid, ensuring a constant balance between electricity demand and supply. These regulated services are carried out under a monopoly on the basis of the government concession, regulated by ARERA.

Snam S.p.A. is the main infrastructure operator for the transport and dispatching, storage and regasification of natural gas. With regard to transport and dispatching, the subsidiary **Snam Rete Gas** is a natural gas transmission system operator under ownership unbundling in accordance with Legislative Decree No 93 of 2011 June 1, which transposed Directives 2009/72/EC and 2009/73/EC concerning common rules for the internal market in electricity and natural gas. The set of rules for access to and use of the transmission service on the network of methane pipelines of Snam Rete Gas, as well as the quality of service levels, are defined in the Network Code approved by ARERA, which also governs the tariff system for the transmission of natural gas by laying down the criteria for determining tariffs for each regulatory period.

Of particular importance for the future, including in the light of a long-term strategy, is the strengthening of cooperation between Terna and Snam, with the aim of coordinating the development of the respective ten-year plans on the basis of scenarios shared and consistent with the INECP and the long-term strategy, in relation to the needs related to penetration of non-programmable renewable sources.

The electricity distribution network in Italy is currently divided into 126 **distribution companies (DSOs)**, operating on the basis of concessions from the Ministry of Environment and Energy Safety and the Provinces of Trento and Bolzano. They are very different in terms of the size of the area served, the size and legal rules of reference (municipalities, municipal companies, types of company). The ministerial concession documents are published on the website of the Ministry of the Environment and Energy Security; in addition, Terna publishes and keeps up to date on its portal the list of distributing undertakings and their identification codes, as well as the historical archive of company changes in relation to those undertakings. The structure of gas distribution concessions is more structured and reorganised.

Of particular importance are the functions of the **Energy Services Manager (GSE)**, a company wholly owned by the Ministry of Economic Affairs and Finance (MEF), operating in accordance with the strategic and operational guidelines defined by the Ministry of Environment and Energy Safety and responsible for managing and monitoring renewable energy support mechanisms – in the electricity, heat and transport sector – and energy efficiency.

The following are members of the GSE group: the **Energy System Research Company (RSE)**, the Energy **Market Operator (GME)** and **the Single Buyer (AU)**.

RSE is a company active in the analysis, study and applied research across the energy sector, with particular reference to national strategic projects of general public interest, financed by the System Research Fund and international funding. The main contents of the ESR projects relate to the evolution of methods and technologies for sustainable energy production, electricity distribution and storage, energy system scenarios in line with national energy policy objectives and guidelines and EU energy programmes.

GME is responsible for the organisation and economic management of the electricity, environmental, natural gas and fuel markets in a neutral, transparent and objective manner, as well as for the operation of the platform for the registration of electricity forward contracts concluded outside the market.

Au has the role of ensuring the supply of electricity to customers in the protected market (as long as this segment of the market is not exceeded) and, on behalf of ARERA, operates the Consumer Desk to provide assistance to final electricity and gas customers and the conciliation service for resolving disputes between customers and operators. Moreover, through the Integrated Information System (ISII), it is at the heart of the information flows on liberalised electricity and gas markets, with a database of collection points and customer identification data. Finally, the company was entrusted with the functions and activities of the Italian Central Storage Body (OCSIT) for the management of emergency oil stocks.

ENEA – **National Agency for New Technologies, Energy and Sustainable Economic Development** is the public research body, supervised by the Ministry of the Environment and Energy Security, aimed at research, technological innovation and the provision of advanced services in the fields of energy, the environment and sustainable economic development to central and local public administration and citizens, in accordance with the guidelines issued by the Ministry. It also performs the functions of the National Energy Efficiency Agency and implements the technology transfer of research results to companies.

The Higher Institute for Environmental Protection and Research (ISPRA) is the public body, under the supervision of the Minister for the Environment and Energy Security (MASE), which carries out research and experimentation, monitoring, monitoring and evaluation, strategic advice, technical and scientific assistance, information, dissemination, education and training in environmental matters, with regard to water protection, the protection of the atmosphere, soil, subsoil, marine and terrestrial biodiversity and their crops.

♦ *MONITORING*

The framework is articulated and therefore suggests that both coordination and monitoring activities should be strengthened, with a view to synergistic action in order to achieve the ambitious 2030 and 2050 targets.

The scenario set out in the INECP is the target scenario which is considered most likely today among all those assessed during planning and which stems from the design of the public policies and measures contained in the INECP itself. In order to monitor the effectiveness of these policies and measures and take corrective action if necessary, it is important to have a function to monitor the state of implementation of the Plan.

Monitoring activities – in line with Articles 17 and 18 of Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action and Eurostat/EU – have a very important role to play in ensuring a thorough identification and verification of the decarbonisation pathway, the degree of achievement of the objectives and implementation of energy and energy policies, both in order to provide timely feedback to public decision makers on the effectiveness of the measures and their possible need for updates (active monitoring) and to provide clear and up-to-date information to all stakeholders. With this in mind, in the areas of shared competences between the State and the Regions, respecting the roles of the sectoral authorities, network operators and market operators and in order to enable the plan to be properly implemented, it is intended to establish a stable technical establishment for active monitoring called the 'PNIEC Observatory'; this Observatory will also take on board the existingRenewable Energy Observatory to verify both the evolution of the emission and energy trends in relation to the objectives and the state of implementation and effectiveness of the climate and energy policies set out in the Plan. The Observatory will be composed of representatives of the MASE, where it is composed of representatives of the other relevant central administrations, a representation of the regions indicated by the Energy and Environment Coordination of the Conference of the State Regions Conference, ANCI, the ESG, RSE, ISPRA and ENEA, as well as energy and climate experts; its aim is to promote greater coordination and to ensure evolving technical comparisons with regard to the implementation of the Plan and the monitoring of its implementation, prior to the official procedures laid down by law at the Conference of State Regions or Unifications, and to share the necessary evolutionary corrections to the INECP when implementing it.

To support the monitoring activities of the PNIEC Observatory, please note the monitoring platform for the integrated national energy and climate plan to be set up by GSE pursuant to Article 48 of Legislative Decree No 199 of 8 November 2021, in line with Regulation (EU) 2018/1999.

This platform will make available information on the level of achievement of the different targets and the effectiveness of policies, the uptake of investments on the ground and the performance of permitting processes, the evolution of technology costs and the economic and employment impact. The collection and processing of this information, from different sources, will also make it possible to prepare the periodic monitoring reports provided for in Regulation (EU) 2018/1999 and to provide input to the INECP's environmental monitoring plan and to provide up-to-date and timely information to citizens and central and local public administrations on the evolution of the energy and emission framework and on the state of implementation of the Plan.

In addition to this platform, it should be noted that the verification of the emission targets stemming from national, European and international rules and agreements is carried out, managed and updated by ISPRA in accordance with national legislation, and through reporting on European obligations(Regulation (EU) 2018/1999 Governance of the Energy Union and Climate Action) and international (United Nations Framework Convention on Climate Change (UNFCCC)), including through the 'National Scheme for Delivering the National Greenhouse Gas Inventory' and the 'National System for Policies and Measures and Procretions'.

Finally, in view of what has been mentioned in Eurostat, namely to enhance energy statistics and to extend their scope to support and support policy decisions, so that Italy can keep up with this evolving scenario, it is envisaged to allocate specific resources to the production of regular statistical surveys to reconstruct the structure and characteristics of energy consumption in the various sectors (residential, tertiary, industrial and transport), with harmonised methods, definitions and methodologies within Eurostat. At the same time, the aim is to make use of the information in the administrative archives of the various bodies and administrations.

1.3 Consultations and involvement of national and Union entities and their outcome

The need for appropriate public consultation on the INECP stems not only from the note of the document, but also from specific provisions of the Governance Regulation, according to which each Member State shall ensure that the public is given real opportunities to participate in drawing up the Plan. In this regard, in order to ensure the "full" implementation of this principle, MASE launched numerous activities in 2023 and 2024, a summary of the consultation and involvement activities planned for the INECP 2024 is set out below.

I. Participation of the National Parliament

In line with the INECP 2019, the proposal to update the plan sent to the European Commission in June/July 2023 was made available to the Presidents of the Senate of the Republic and the Chamber of Deputies. Parliamentary Committees VIII (Environment, Land and Public Works) and X (Production, Trade and Tourism) of the Chamber of Deputies launched a fact-finding inquiry into this proposal in April 2024, carrying out numerous hearings of institutional and non-institutional actors.

II. Involvement of local and regional authorities

Under Italy's constitutional set-up, the regions have a key role to play in achieving energy and climate objectives. The role of local authorities is equally important.

During the preparation of this update proposal, the MASE launched a dialogue with the 9 Italian cities selected under the European Mission "100 neutral cities by 2030" (Bergamo, Bologna, Florence, Milan, Padua, Parma, Prato, Rome, Turin); they were asked to contribute to the identification of the most important policy areas for achieving the national energy and climate targets. This cooperation at this stage has resulted in the preparation by local authorities and, in particular the main Italian cities, of proposals for policies and measures relating to the five dimensions of the Energy Union, especially in areas with the greatest impact on the urban ecosystem: energy efficiency of buildings, sustainable mobility, emission mitigation and climate change adaptation.

Discussions with local and regional authorities were also envisaged when drawing up the final update of the INECP, by sending to the Minister for Regional Affairs and Self-Government the draft plan submitted to the European Commission in June/July 2023.

III. Consultations with stakeholders, including the social partners, and engagement of civil society and the general public

❖ **INVOLVEMENT OF INDUSTRY INSTITUTIONS AND STAKEHOLDERS**

Given the "transversal" nature of the Plan, MASE has involved the relevant central administrations[7] in the process of identifying policies and measures for the pursuit of energy and climate objectives and in the five dimensions of the Energy Union. The main aim of this involvement was to bring forward proposals on policies and measures deemed useful for achieving the increasingly challenging objectives stemming from the new European framework.

- **Stakeholder consultation**

In 2023, a consultation was launched with stakeholders from the productive world, associations and research, with the aim of gathering evidence on specific areas of interest of the Plan. To this end, some fifty associations were particularly representative of certain sectors, including associations in the industrial sector characterised by high energy consumption, transport, gas, agriculture, water services, renewables, energy efficiency and the environment sector.

The associations were asked to draw up a separate sheet for collecting the possible policies and measures to be assessed for the Plan, including an indication of potential, design, constraints and problems, without prejudice to the possibility for associations to express their views on the most relevant aspects and on the various and overall topics covered by the Plan.

The contributions received from the associations allowed confirmation or more details on certain potential and options to overcome any problems linked to the new and more challenging objectives set out in the Plan. The most recurrent topics were the development of renewables and energy efficiency, including in the industrial sectors, the uptake of biomethane, biofuels, hydrogen and e-mobility.

- **Thematic tables**

Between the end of 2023 and the first half of 2024, the MASE organised a number of thematic technical tables in order to involve key institutional stakeholders (ministries, agencies and research bodies, trade unions and trade associations) in preparing strategies and identifying new policies and measures in certain specific areas of the Plan: decarbonisation of the civil and transport sectors and just transition.

- **Table on the civil sector**

The table on the civil sector involved various institutional stakeholders; in addition to MASE, the Ministry of Economy and Finance, the Ministry of Infrastructure and Transport, the Ministry of Culture, ARERA, ENEA, RSE, GSE, the Regions and Anci participated.

Several activities were carried out during these meetings, including:

- an analysis of the national building stock with a view to obtaining information on buildings (public and private), their consumption and energy class, including where possible building and installation equipment. This analysis made it possible to draw up more precise analyses of the size of the National Real Estate Park;
- an evaluation of new proposals for measures or measures reformed (reform of tax deductions, remodulation of electricity excise duties, efficiency of the public administration, etc.), investigating their sources of financing (public finance, CO2 auction revenues, energy tariffs, etc.);

[7] *Ministry of Enterprise and Made in Italy (MIMIT), Ministry of Infrastructure and Transport (MIT), Ministry of Economy and Finance (MEF), Ministry of Universities and Research (MUR), Ministry of Agriculture, Food Sovranity and Forestry (MASAF).*

- an analysis of the possible impacts of the new proposals on their contribution to the achievement of the different objectives (Energy Efficiency Directive, EPBD, effort sharing, etc.).

- **Table on the transport sector**

The table on the transport sector involved, in addition to MASE, the Ministry of Infrastructure and Transport (MIT), GSE, RSE, ISPRA and businesses and trade associations. Ad hoc meetings were held with associations.

The purpose of the meetings was to:

- identify priorities for action and a set of additional measures to pursue the objectives of decarbonisation and reduction of consumption in the transport sector: supporting sustainable mobility, reducing the need for private mobility, developing industrial sectors to increase the supply of green technologies;
- identify priority actions for the development of national and local infrastructure needed to support the demand for sustainable mobility and the reduction of private mobility needs;
- assess the impacts and economic and social sustainability of the measures.

The work carried out identified additional measures which, following a thorough impact and effectiveness assessment, were included among those suitable for achieving the objectives of the Plan.

- **Table on employment and social aspects of the energy transition**

Thematic meetings on employment and social aspects of the energy transition were widely attended. In addition to MASE, other departments took part in the work, including the Ministry of Labour and Social Policy (MILPS), the Ministry of Education and Merit (MIM), the Ministry of Economic Affairs and Finance (MEF), the Ministry of Agriculture, Food Sovranity and Forestry (MASAF), the Ministry of Infrastructure and Transport (MIT).

Anumber of stakeholders also took the floor: Researchinstitutions and bodies, including GSE, RSE, ANCI, ANPAL, INAPP, ISTAT, Unioncamere; Trade associations such as Confindustria, Confindustria Energia and Confcommercio; major Trade Unions: CGIL, CISL, UIL; UGL.

The main objectives of the meetings can be summarised as follows:

- consider enriching the content of the INECP on socio-economic aspects related to the ecological transition (investment, employment impacts, just transition, skills);
- create a permanent forum for discussion between key institutions and stakeholders in order to analyse the benefits, challenges, impacts and potential of a just ecological transition, bearing in mind the requirement that it be economically and socially sustainable, as well as energy and environmental, identifying gaps, measures, and pathways that can accompany decarbonisation;
- establish the basis for dialogue for the preparation of the Social Climate Plan.

Participants provided numerous contributions that were analysed in detail to reveal key messages. Five main themes were identified, around which the interest of the participants focused, namely:

- governance;
- sources of financing and investment;
- economic and employment benefits;
- training and information;
- specialist skills needs.

With regard to the **governance** of the Plan, all participants expressed their willingness to cooperate, always advocating concerted solutions, including facilitated by bodies such as the planned PNIEC Observatory, with others, such as a possible Standing Committee on the Juste Transition. A constant discussion between the government and the social partners is considered essential, in order to define participatory governance arrangements, as well as plans, measures and resources for just transition. We would point out the proposal to put in place a climate framework law that includes policies for a just transition, such as those protecting the rights of workers most affected by the ecological transition and which could be left to it. Examples may include measures to combat relocations, combat energy poverty and transport poverty, support for industrial conversion, income protection, upgrading and certification of skills.

The area of governance is the **monitoring and assessment of the social and employment impact** of the transition over time, which is necessary to make the necessary changes to the policies and measures in place, in a continuous fine-tuning process, in order to ensure positive impacts at system level from a long-term perspective. From this point of view, the planned monitoring platform of the INECP will be useful. It is also necessary to maintain a constant comparison between the central and territorial levels, involving local institutions to ensure employment levels and all services that support an adequate economic and social condition in the territories most affected by the energy transition.

During the meetings, the topics relating to the **financing** of **investments** planned for the green economy, facilitated by the measures envisaged, were also discussed. Across sectors, the positive impact of investments in energy infrastructure and the circular economy, including on employment and social issues, has been highlighted.

As regards the **economic and employment** effects, the analyses shared during the meetings, although heterogeneous in the results, carried out using different methodologies, some historical and not looking at the future, nevertheless show positive and beneficial prospects for the economy arising from the energy transition. To address this major transformation, some stakeholders stressed that the role of the State is indispensable, for example by proposing the establishment of a possible Agency for Sustainable Development and Juste Transition, to guide the ecological and digital transition, with industrial policies in line with the SDGs, steering the industrial and investment plans of large public energy stakeholders towards the energy transition process.

Training and information activities are **strategic** for the transition and require, inter alia, an adequate educational offer, as well as vocational training, while also intercepting the demands of new professionals specialising in the green economy. The promotion of these pathways can also be achieved by enhancing the role of public and private employment agencies, in reducing the gap between labour demand and supply, addressing new skills needs. Other issues discussed related, for example, to the need for increased awareness and information on the ongoing dynamics and medium- to long-term benefits of the ecological and digital transition.

As regards **specialist skills needs**, many participants in the meetings stressed the need to implement measures and policies to enhance digital and green skills, to create professionals able to manage the latest technologies, renewable energy production and energy efficiency measures, and in general new organisational and business models. Some areas have been identified where to focus investments in new skills such as automation of production processes with a view to environmental sustainability, innovation in logistics and safety systems of facilities and workplaces, data processing and analysis, and the design of applications associated with new media and social networks. Insights were also provided on what could be the most suitable profiles to meet the needs of the energy transition. Finally, the need to link resources and investments for job creation and re-employment opportunities, such as lifelong learning programmes, public-private partnerships that concretely promote reskilling and upskilling, training on the job and proper integration of young people into work.

Thematic meetings on the employment and social aspects of the energy transition will not end up with the preparation of the final version of this Plan, but will continue with the aim of steering the decarbonisation process with a view to just transition; the meetings will also be a valid forum for comparison, including with a view to preparing the Social Climate Plan.

❖ **ONLINE PUBLIC CONSULTATIONS**

The preparation of the proposal and the final version of this Plan involved all interested stakeholders (competent authorities, citizens, businesses, workers' associations, trade associations, not-for-profit organisations, professionals in the sector, financial institutions and investment funds, etc.) through two stages of public consultation held in spring 2023 and 2024 on a dedicated online portal accessible to all from the institutional website of the Ministry of Environment and Energy Security. The Ministry, including with the help of GSE, has also adequately disseminated the consultation on the main national information channels.

Both consultations were made available for around 30 days and provided interesting insights that were taken into account both in the drafting of the proposal and the final version of the INECP.

- **Consultation 2023**

A total of 925 respondents responded to the consultation held in spring 2023 (72 % citizens, 22 % businesses and trade associations, 3 % environmental associations, 3 % research institutions and organisations). In this first phase, stakeholders were consulted on the main policy lines to be adopted when preparing the draft plan for each of the five dimensions of the Energy Union.

Renewables were the most relevant area for participants (34 %), followed by energy efficiency (24 %), energy security (13 %), emissions (12 %), research (9 %), market (4 %) and other topics (3 %).

With regard to **renewable energy**, in the electricity sector, the construction of large installations was considered crucial, giving priority to the adoption of innovative technologies in particular for wind power (especially floating foundations), whereas, for photovoltaic, it is considered desirable to give priority to the deployment of industrial and civil buildings to cover, including other solutions to maximise their contribution. In order to facilitate the construction of large installations, many stakeholders stressed the need to continue the process of simplification of permits, including by calling for the reorganisation and rationalisation of procedures through the preparation of a Single Energy Text. They were also considered important tools for the economic support of initiatives, such as two-way contracts and PPA (Power Purchase Agreement); for the latter, it is hoped that public guarantees and actions will be made available to support the aggregation of demand and supply.

As far as smaller installations are concerned, as well as confirming the need for economic incentives for their implementation, many stakeholders are confident that energy communities and collective self-consumption will be fully supported to promote distributed generation. These configurations are also considered essential as a tool to improve the social acceptability of renewable installations.

In the field of **heat**, most interlocutors consider that electrification and the wide deployment of heat pumps, coupled to photovoltaic, are the key levers to promote decarbonisation, while not neglecting the development of other renewable technologies (biomass, biomethane and solar thermal).

In the field of**energy efficiency**, great efforts will be required in the civil sphere; a large number of stakeholders consider it a priority to continue to focus on major economic advantages for retrofitting measures, together with the strengthening of the retrofitting obligation for less performing buildings. Other levers, such as awareness of available technologies, interventions and incentives, are also considered to be important, so that appropriate information and promotion action is considered important. In the industrial sector, priority is given to promoting measures through tax breaks and other instruments, mainly focusing on process innovation and the adoption of certified energy management systems. For the public sector, in addition to economic instruments, both consumption reduction obligations and behavioural measures, training and information on the benefits of efficiency are considered a priority.

The decarbonisation of **transport** is one of the most important challenges for the emission and energy transition objectives. In this context, the interlocutors highlighted as a priority the reduction of transport demand (smart working, digitalisation of services) and the modal shift from private road transport to other means (LPT, rail, etc.). However, a strong improvement in the quality of services and greater integration between them is considered necessary. Equally important is the deployment of innovative technologies, including first and foremost the deployment of e-mobility. In this context, both incentives for the purchase of new electric vehicles and aid for the widespread deployment of charging infrastructure are considered necessary. Support for the purchase of second-hand vehicles and more urban regulation are also considered important to reduce the average age of the fleet. As regards freight transport, the modal shift from road to rail and shipping is considered to be the main area of action, supported by the promotion of alternative fuels such as biomethane and hydrogen, as well as the use of innovative and low-impact solutions for urban freight delivery.

To achieve the necessary **energy security** developments, interlocutors consider both electrification of consumption and diversification of sources to promote renewable gases such as biomethane and hydrogen as a priority. As regards the flexibility of the electricity system, priority is given to the development of renewables in areas with the greatest potential, while developing networks and accumulating to facilitate their integration. Finally, it is considered that CCUS emission abatement technology should primarily be directed to the *hard-to-abate* industry and then to thermoelectric.

With regard to the **market**, most stakeholders consider that further tools are needed to assist with the improvement of those available under current regulation. In order to accompany consumers to the free market, training and information on the choice of the supplier and understanding of bills are considered necessary, although a number of stakeholders have called for the extension of protection schemes. For the most vulnerable consumers, both increasing existing bonuses and efficiency measures to reduce consumption are considered a priority.

For the development of the **hydrogen** carrier, most of the participants consider it a priority to promote its use in hard-to-abate industry and heavy transport.

With regard to **emission reductions**, the replacement of fossil fuels, especially through electrification and the use of hydrogen, is a priority for industry; energy efficiency measures are followed. In the agricultural field, interlocutors favour a mix of solutions, including first and foremost the increased regulation of agricultural practices (in particular for manure management), as well as changes in the type of farm animals and crops. Forest development and active forest fire policies are prioritised over the use of forest raw materials. With regard to citizens, consumer awareness of sustainable choices and behaviour is considered a priority, followed by reducing the amount of waste generated and reducing emissions in transport.

On **research**, stakeholders consider renewable energies, followed by energy efficiency, storage systems and smart grids, to be a priority.

- **Consultation 2024**

A total of 133 stakeholders participated in the consultation held in spring 2024 (71 % businesses and trade associations, 14 % citizens, 8 % research institutions and organisations, 7 % environmental associations). The questions proposed in this second phase focused on issues that emerged as the most challenging for achieving the decarbonisation objectives, also taking into account the Commission's recommendations on the proposal for a plan published in December 2023.

In response to the 21 questions raised, organised on the basis of macro themes and in most cases articulated within them in further questions, the answers were 1.608, of which 20 % concerned decarbonisation in the transport sector, 17 % energy efficiency of buildings, 14 % renewables, 13 % biomethane, hydrogen and CCS, 7 % market, 6 % energy security and the remaining 23 % all other topics (including Just Transition, Research, Innovation and Competitiveness, etc.).

This consultation also included the full text of the draft Plan, which called for an overall assessment with particular reference to the ambition of the objectives, the proposed measures and the technologies and solutions envisaged. Most respondents expressed an overall positive assessment, while pointing to areas of improvement typically linked to the scope of each respondent.

As regards **electricity renewables**, in order to encourage the massive deployment of new large plants, many interlocutors are inclined to continue to focus on the instrument of Contracts for Difference (CFD), albeit with corrective measures such as tariff indexation, geographical coefficients to guide their territorial development and, to a lesser extent, the shift to standard profile contracts; several others are more likely to favour long-term contracts (PPPs), replacing or complementing CFDs, through forms of public guarantee and the development of a demand/supply matching platform. The promotion of accumulations and the uptake of time-shift products are considered to be the priority levers to ensure the effective integration of renewables into the market.

With regard to **simplification of authorisation**, identifying suitable areas (both on land and at sea) and speeding up, with a view to burden sharing objectives, together with the drafting of a single energy text, are the most important stimulus. For photovoltaic, the general liberalisation of building installations and the digitalisation/standardisation of proceedings are also considered necessary. In order to unlock the potential of revamping/repowering, the full implementation of already enacted rules is identified as the main lever, together with incentive schemes that do not penalise new installations.

With regard to the**energy efficiency** dimension, great efforts are required to support the rapid and effective efficiency of the building stock. Most respondents consider that incentives are the main driver for achieving this objective; tax incentives and in particular tax deductions are considered to be the most appropriate form of support. It is stressed that the intensity of tax incentives should be modulated according to the effectiveness in terms of improving the energy performance of buildings and that simplification and stability of the regulatory framework is necessary. It is considered necessary to align the efficiency objectives of the Plan with the new EPBD Directive. The public administration is called upon to play an exemplary role; in the area of public construction, there is a suggestion to use the Public Private Partnerships (PPP) instrument, sharing financial resources and technical expertise. The decarbonisation of the building stock is driven by the energy retrofitting of multi-apartment buildings, which can only be achieved through incentives. The Termico Account and collective self-consumption are frequently mentioned as good practices to be supported and strengthened. The need to accompany support policies with measures to simplify co-ownership decisions is considered essential.

The plan foresees a strong growth **of heat pumps** for heating and cooling and increased electrification of civil consumption. This is a widely shared choice. However, some respondents considered that this strategy should be integrated with a view to technological neutrality, highlighting the challenges of relying on a single solution and the need to diversify sources and technologies to enable the development of sustainable, employment and economic sectors. To support the deployment of heat pumps, it is widely accepted that incentives should be sought, in particular tax incentives, while supporting increased penetration of renewable electricity generation plants, especially photovoltaic combined with storage systems. In addition, grid infrastructure needs to be adapted and preferential tariffs introduced, for example for consumers using high-energy efficient heat pumps.

In order to significantly reduce consumption and emissions in the **transport** sector, most stakeholders consider that a technologically neutral approach is needed to promote the most suitable technologies and energy sources for every use with the aim of choosing the most efficient and cost-effective solution, which must be based on a multitude of solutions combining technological innovations, economic incentives, obligations and investment.

Reducing **transport demand** is a key element for decarbonising the sector and requires collective mobility policies that include the implementation of measures such as smart working accompanied by the development of online services for citizens and community-based services that reduce the length and frequency of travel. Instruments such as the Urban Sustainable Mobility Plans (SUMPs) and the Urban Sustainable Logistics Plans (SUMPs) are important to this end, which should be promoted to a growing range of local administrations.

The deployment of **local public transport** requires infrastructure measures, stable incentives over time to replace the existing fleet and appropriate policies to encourage the use of this mode of transport. At the same time, soft mobility and micro-mobility (cycle paths, bike sharing, scooters, etc.) must be promoted and facilitated by promoting and facilitating an intermodal approach.

Another key element is the implementation of long-term stable fiscal measures and economic incentives that support both the uptake of **electric vehicles** and the deployment of charging infrastructure. This process of progressive growth in e-mobility needs to be accompanied, according to the majority of respondents, by the simultaneous valorisation of fuels such as **biofuels** and LNG and by investing in the development of new technologies to support the deployment of hydrogen.

For long-distance **freight transport**, the interlocutors consider it necessary to invest in rail and maritime transport. For freight transport within urban centres, it is necessary to focus exclusively on the use of electric means integrated with soft mobility for the last mile (cargo bikes, etc.). From a long-term perspective, technology is an essential element to invest in, for example, to develop innovative technological solutions for freight logistics.

With regard to reducing **emissions in agriculture**, the interlocutors favour a mix of solutions showing, first, that promoting the use of anaerobic digestion facilities and in general self-consumption facilities are the most cited solutions. Many interlocutors also propose that measures be taken to reduce pesticides and plant protection products in general; great importance is also attached to reducing the impacts of **intensive livestock farming** and the **livestock chain** in general.

The Plan attaches great importance to promoting the national potential for sustainable **biomethane** production, which, according to respondents to the consultation, should be supported by incentives within a timeframe appropriate to project development, looking beyond the resources of the RRP accessible until 2026. These incentives should also reward the production of agronomic digestate and compost and the recovery of CO_2 biogenic. At the regulatory level, there is a need for a fairer distribution between the network operator and biomethane producer of the installation's connection contribution. Finally, it is common to call for the implementation of legislation allowing the use of **guarantees of origin** in the **ETS**.

With regard to the promotion of the **hydrogen** carrier, a large number of stakeholders consider the implementation of long-term incentives in sectors of greater interest (industry and transport), which is renewable, but without excluding bio, low-carbon variants or even with CO_2 (blue) capture. The adaptation and development of national infrastructure is crucial for international hydrogen trade.

In synergy with hydrogen, **CCS** is considered by companies to be a necessary option for decarbonising thermoelectric, CHP, non-electrifiable production processes (cement, iron and steel), chemistry and refining. However, risk mitigation tools and incentives for the supply chain and the market, as well as for transport/storage infrastructure, are needed to this end. There is no lack of interlocutors against CCS, especially between environmental associations and citizens.

In order to achieve the necessary developments in the field of **energy security**, the interlocutors consider it essential to focus on diversifying supplies in a context of international cooperation with neighbouring countries, especially in the light of geopolitical events in recent years. The upgrading and digitalisation of infrastructure, including the development of new gas storage systems, including in liquid form, and increasing regasification capacity, cannot be ignored, especially if Italy wishes to strengthen its role as an energy hub for the Mediterranean.

Most respondents consider it essential to give a strong boost to the development of RES installations, with a view to diversifying sources, including with regard to the hydroelectric and thermoelectric sector which have the honour to be programmable. The development of new **storage** systems, both electric and thermal, cannot be ignored in order to cope with possible limitations, also due to the numerous extreme weather events in recent years.

In the area of **market**, the use of combined strategies is considered essential for the creation of a more flexible, efficient and sustainable energy system. Therefore, policies and measures, in particular economic incentives, should be implemented to promote innovative technologies, making the best use of synergies between demand side management and the use and development of storage systems. The concept of technological neutrality is a recurring theme in particular in terms of integrating the electricity sector with the gas sector.

Information and training measures are considered important in protecting and promoting the **active role of consumers**. The use of clear and effective consumer protection regulation is a shared need. The regulator (ARERA) is required to simplify both the processes underpinning the market and the documentation made available to the consumer, in particular the energy bill.

Most stakeholders consider that the decarbonisation process goes through **retraining and training of workers. Training**activities must be carried out in synergy between industry and education in order to strengthen the development of new skills and professionalism, accompanied by information activities at all levels (technical offices, local authorities, communities, citizens, etc.) in order to promote greater social awareness.

Priority is given to investing in **research** following a technology neutrality approach, focusing on renewable energy, energy efficiency and storage systems, but not excluding investments in other technologies such as nuclear.

In the area **of environmental damage (SAD)**, there is a strong divergence between respondents, depending on whether environmental associations are considered to be strongly in favour of eliminating SADs or the world of businesses/trade associations, which tend to be opposed to the elimination of SADs or, if they are favourable, are inclined to revisit the criteria underlying the catalogue of current SADs. Associations recommend gradual elimination of SADs, so as not to open up strategic sectors for the maintenance of the national economy. A share of respondents consider that socio-economic distortions should be avoided due to the likely price increases linked to the elimination of SADs, in particular in the fossil fuel sector for the heat and transport sectors. Within the limits of this reference to caution, the transport sector is considered to be a priority to start the progressive reduction of SADs, while the most supported option for using the resources released is the use in R & I for more sustainable and decarbonised supply chains.

The transition process to a low-carbon economy needs to be governed with a view to **Just Transition**. Interlocutors consider that the sectors most affected by the energy transition are those related to fossil fuels as well as buildings and transport. The consultation shows that, in order to alleviate the conditions of those likely to be most affected by the transition, such as vulnerable consumers and/or energy poor consumers, particular attention should be paid to efficiency and decarbonisation measures in buildings through incentives that reduce initial investment costs (invoice discount and credit transfer). Asa measure to protect tenants, it is suggested to impose minimum energy performance standards for rented buildings. Renewable energy communities become an effective tool for sharing environmental, economic and social benefits in local communities, including in geographically disadvantaged communities. Important guidance is the need to accompany support policies with information and assistance measures.

❖ **CONSULTATION IN THE STRATEGIC ENVIRONMENTAL ASSESSMENT**

Directive 2001/42/EC lays down the principle that all plans and programmes likely to have significant effects on the environment must undergo a Strategic Environmental Assessment (SEA) process.

The main objective of theSEA methodology, as laid down in Article 4 of Legislative Decree No 152/2006, as amended, is 'to ensure a high level of environmental protection and to contribute to the integration of environmental considerations when drawing up and adopting plans and programmes in order to promote sustainable development'.

In September 2023, the MASE – ISPRA Joint Working Group was set up to prepare the documentation needed to finalise the SEA: the Environmental Preliminary Report, a list of competent environmental subjects (SCA), Environmental Report (RA) and Non-Technical Summary.

According to the legal framework, the first steps were the drafting of the Environmental Preliminary Report (Scoping Report) 'on the possible significant environmental impacts of the implementation of the plan or programme in order to define the scope and level of detail of the information to be included in the environmental report', as well as the identification of the competent entities in the Environmental Materia (hereinafter 'FAS'), i.e. public administrations and public bodies which, by virtue of their specific environmental competences or responsibilities, may be affected by the environmental impacts of the implementation of the plans and programmes. In identifying the FAs to be involved in approving the plan, the proposing administrations referred to all Ministries and Institutes with environmental competences, the SoprinTrends, all Regions and Autonomous Provinces, Environmental Protection Agencies, Provinces and Metropolitan Cities, the National Association of Italian Municipalities, Idrographics, National and Regional Park Authorities and the Italian Federation of Natural Parks and Riserve.

On 31 January 2 024, the Procedural Authority informed the FAS of the launch of the consultation on the Environmental Preliminary Report. In accordance with Article 13 (1), the FAS were asked to send the contributions within 30 days of the start of the consultation. On 17 March 2024, the scoping phase ended with CTVA's expression of the reasoned opinion. In the context of the preliminary consultation, the comments of 54 parties were collected.

In line with Legislative Decree No 152/06, the analysis of the observations, together with the opinion of the CTVA on the Plan and the RA, has been completed in order to consider and respond to them in the context of the PNIEC document and the Environmental Report. In addition, updates to the analytical base of the INECP (Reference Scenario and Policy Scenario) as well as new policies and measures have been incorporated into the RA in order to assess any environmental impacts.

As stated to the European Commission (DGCLIMA), the Environmental Report will be consulted with the June 2024 version of the INECP. At the end of the procedure, the competent authority will deliver its reasoned opinion within 90 days of the closure of the public consultation. The initiating authority will inform the end of the procedure by publishing on the websites of the authorities concerned the reasoned opinion, a summary statement setting out how environmental considerations have been incorporated into the plan and the measures taken with regard to the monitoring provided for in Article 18 of Legislative Decree No 152/2006 (the so-called Environmental Monitoring Plan).

Environmental monitoring will follow the entire life cycle of the INECP and will make it possible to verify the achievement of the environmental sustainability objectives identified in the SEA pathway and to monitor the significant effects on the environment resulting from the implementation of the plan in order to identify unexpected adverse effects and to take appropriate corrective measures.

The effects that will be monitored are the overall positive environmental effects – reducing climate emissions, improving air quality, reducing population exposure to air pollution and climate change risk factors, improving the quality of life associated with the energy efficiency of buildings – and the negative environmental effects, which may result from the implementation of measures in the different parts of the country, aggregated at plan level.

Environmental monitoring will be carried out through structured cooperation between MASE, Regions and Autonomous Provinces, using the system of environmental agencies and the National Institute for Environmental Protection and Research (SNPA).

Environmental monitoring may contribute to the preparation of the integrated national energy and climate progress reports provided for in Article 17 of Regulation (EU) 2018/1999 Governance, in particular for the purposes of Article 17 (1) (e) of thatRegulation.

IV. Consultations with other Member States

Of course, Italy cooperates with the other Member States on many energy and environmental issues. In addition to EU fora, including the Energy Councils and the relevant meeting opportunities organised by the Commission, Italy and discussed its INECP with other Member States in the context of the events mentioned below.

Slovenia organised two technical and high-level events during the first half of 2024 to facilitate consultation between Member States on the National Energy and Climate Plans.

In February 2024, Slovenia hosted a technical meeting of experts involved in drafting the National Energy and Climate Plans of Italy, Austria, Hungary and Croatia.

During the event, the different representatives of the Member States presented the state and progress in the preparation of the Energy and Climate Plans, contacts were established between experts from neighbouring countries, exchanged views between experts involved in updating the NECP, enhanced existing cooperation and explored new opportunities for regional initiatives and projects related to hydrogen, gas security, strengthening electricity interconnections and market integration.

In May 2024, Slovenia hosted the SEEnergy Ministerial Conference to share the progress of South-East European countries in the field of the green transition also in light of the final update of the INECP. High-level representatives from euro area countries, including Italy, participated in this event.

Italy’s action has valorised the policies implemented at national level in order to achieve the 2030 emission reduction targets, highlighting the main sectoral challenges and technical activities in place with a view to updating the integrated national energy and climate plan. Italy also underlined the existing regional cooperation activities in the energy sector, with particular reference to what was done with Slovenia, Montenegro, Croatia, Albania, aimed at strengthening energy security and sustainable energy transition.

v. Iterative process with the Commission

Italy actively participated in all meetings of the Energy Union Committee and the Joint Working Group on update on NECPs[8], during which a comparison was held with the European Commission (EC) and the other Member States on the individual points of the National Plans. During these meetings, the five dimensions of the Energy Union on which particular attention should be paid to in the proposal to update the plan, also in the light of the amended Community regulatory framework, in particular after the presentation of the Fit for 55 legislative package and the RePower EU plan, as well as the changed geopolitical structures and the COVID-19 pandemic, which place even greater emphasis on issues such as energy security, consumer protection and the fight against energy poverty.

Moreover, the dialogue with the EC remained constant, also on the basis of the communication in March 2023, pursuant to Article 17 of Regulation (EC) No 1999/2018, of the first integrated national energy and climate progress report, in which the state of implementation of the existing INECP was monitored on time, and in the light of the EC assessment and recommendations on the updated draft NECP, sent in June 2023, expressed in 'Commission Recommendation C (2023) 9607[9] final' of 18 December 2023, pursuant to Article 34 of Regulation (EC) No 1999/2018. This process has proved to be very useful to monitor progress towards achieving the objectives, the identification of gaps to be filled and the areas on which more attention was needed in this proposal. As part of the preparation of the interim report, discussions with the EC were ensured by Italy's continued participation in the Working Group NECP Progress Reporting. In addition, during the preparation of this proposal, a bilateral update meeting took place on 7 June 2023, during which the MASE presented the process of drawing up the plan and its timing, as well as the methodological and governance part, all of which were shared by the EC.

[8] *National Energy and Climate Plans*

[9] *https://commission.europa.eu/publications/commission-recommendation-assessment-swd-and-factsheet-draft-updated-national-energy-and-climate-18_en*

1.4 Regional cooperation in preparing the plan

I. Elements subject to joint or coordinated planning with other Member States and non-EU States

The recent energy crisis requires greater regional security coordination with a particular focus on the Mediterranean, infrastructure planning to facilitate different technologies for decarbonisation and to ensure the adequacy of the energy system, as well as on market design issues. Italy supports enhanced regional cooperation, with EU and non-EU countries, as it considers that the regional level is the most appropriate for proper energy infrastructure planning.

Inaddition to what has already been explained in paragraph 1.2 (iii) on issues of cross-border relevance, Italy is stepping up regional cooperation with neighbouring EU and non-EU Member States and in the framework of the Central and South Eastern Europe energy connectivity (CESEC); below is an overview of the regional cooperation initiatives actively carried out by Italy:

- CESEC: the Central and South Eastern Europe energy connectivity initiative was launched in 2015 to coordinate efforts to accelerate the integration of regional markets, initially gas and subsequently also electricity markets. It includes 8 EU Member States (Austria, Bulgaria, Croatia, Greece, Hungary, Italy, Romania, and Slovenia), 8 Energy Community Contracting Parties (Ukraine, Moldova, Serbia, North Macedonia, Albania, Bosnia and Herzegovina, Kosovo and Montenegro) and the European Commission on behalf of the EU. Cooperation is based on two Memoranda of Understanding (MoU) signed in 2015 and 2017 respectively and action plans with concrete priorities. Conclusions and two action plans on gas and electricity and renewable energy were approved during the last Ministerial in Athens in January 2024. The topics covered were: priority electricity interconnection projects and progress in the integration of electricity markets; priority natural gas and hydrogen infrastructure projects, in particular the investments foreseen in the REPowerEU Plan to ensure security of supply and reduce dependence on Russian gas; actions to accommodate an increasing share of biomethane and hydrogen in infrastructure and unifying gas quality requirements. Within CESEC, Italy actively participates in high-level meetings and meetings of the technical groups “electricity and renewable energy” and “gas”.
- SOUTHERN HYDROGEN CORRIDOR: in the REPowerEU Plan of May 2022, the European Commission complements the implementation of the EU Hydrogen Strategy to further increase European ambitions for renewable hydrogen as an important energy carrier to move away from Russia’s fossil fuel imports. The ambition is to produce 10 million tonnes and import 10 million tonnes of renewable hydrogen into the EU by 2030.

  SoutH2 Corridor, of which Italian Hydrogen Backbone is an integral part, applied for PCI in November 2023. Each of the sections of the corridor – Italian, Austrian and German – was individually included in the European Commission’s Sixth Project of Common Interest (PCI) list in April 2024. The PCI project is defined as follows:
  - Internal hydrogen infrastructure in Italy ‘Italian H2 Backbone’ promoted by Snam Rete Gas;
  - Internal hydrogen infrastructure in Austria “H2 Readiness of the TAG pipeline system” promoted by Trans Austria Gasleitung TAG GmbH;
  - Internal hydrogen infrastructure in Austria “H2 Backbone WAG + Penta-West” promoted by Gas Connect Austria GCA GmbH;
  - Internal hydrogen infrastructure in Germany “HyPipe Bavaria – The Hydrogen Hub” promoted by bayernets GmbH.

The project will offer significant transport capacity for renewable hydrogen produced at competitive costs in North Africa and South Italy. The Italian backbone will be approximately 2.300 km long and will mainly use existing infrastructure. The redundancy of gas infrastructure along the routes will allow maintaining security of supply for both the gas and the emerging hydrogen markets. The project will increase the diversification of supplies for Europe by creating a specific route with North African countries in the MED area, in addition to the corridors, the North EU by providing the shortest route to the market for Central Europe.

The project was supported from the beginning at institutional level by the Ministry of Energy of Austria, Germany and Italy, which signed a letter of support for obtaining PCI status in May 2023.

Inaddition, in May 2024, the governments of Italy, Germany and Austria signed a declaration of political intent committing to continue cooperation on SoutH2 Corridor, institutionalising a joint working group between the Parties, in cooperation with the European Commission, leaving open the possibility of extending participation to other countries involved in the project. The governance structure of the Joint Working Group will be defined later. In addition, the Declaration promotes cooperation between their respective network operators, regulatory authorities, any financial institutions and representatives of hydrogen demand and supply. The Parties will discuss the regulatory framework, analyse financing needs, and each Party will analyse and identify future hydrogen production/demand.

Even before the Declaration was signed and following the inclusion of the project in the 6th PCI list, a working group was set up at the level of Directors-General, which also involved the respective TSOs, as well as the regulatory authorities and financial institutions of the State and met regularly both virtually and in their respective countries. A first in-person meeting, organised by Germany, took place in Munich in September 2023. A second in-person meeting, organised by Austria, took place in Vienna in March 2024. A third in-person meeting, organised by Italy, will take place in Rome in July 2024. There is also a meeting at ministerial level likely to be held in Rome on a date to be defined; this group will change the structure pending the recent signature of the Declaration, which provides, as mentioned, for the establishment of a specific "governance" for the work.

- MONTENEGRO: Italy and Montenegro, building on the collaboration established in the development and implementation of the electricity interconnection (MONITA), with the signature of two intergovernmental agreements signed in 2007 and 2010, which led to its operation in 2019, decided to launch a new phase of enhanced cooperation. In May 2024, a kick-off meeting was organised in Rome, in the presence of their respective Ministries, Network Operators, Regulatory Authorities and Electricity *Market Operators, in order to promote Montenegro's transposition of European legislation on the electricity market and, in particular, with the ultimate aim of achieving market coupling* with Italy. On this point, we would point out that there have been several technical meetings which were also promoted by ARERA within the Balkan Energy School (BES), a project launched by the Authority to support the transposition of the acquis communautaire in the Balkan countries.
- ALBANIA: in order to strengthen bilateral relations in the energy sector, the Third Energy Tavolo Italia – Albania met in Rome in October 2023, in the presence of representatives of the respective Ministries, Network Operators, Regulatory Authority, Electricity Market Operators, Energy System Operators and Private Sector Operators. The topics covered were infrastructure development, initiatives for the production and use of low_carbon energy, harmonisation of market rules. Cooperation with Albania is also enriched by the

important contribution of the Balkan Energy School (BES) to support the transposition of the acquis communautaire.

- SUPPORT TO UKRAINE: in the margins of COP28 in December 2 023 in Dubai, a Memorandum of Understanding on Energy was signed between the Italian Ministry of Environment and Energy Security and the Ukrainian Ministry of Energy. The Memorandum of Understanding focuses on the issues of the energy transition and the future perspective of successful cooperation between the two countries for the decarbonisation of the energy sector, with a particular focus on renewables, low-carbon solutions and infrastructure, especially for the post-conflict reconstruction period.

- REGIONAL COOPERATION ON ELECTRICITY INTERCONNECTIONS: several initiatives aim to expand the current interconnection capacity between Italy and neighbouring countries with benefits for managing the growing share of non-programmable production.
  - The ELMED or tunita project (included as a Reciproco Interest Project – PIR – in the sixth list of PCI/RIPs) provides for a submarine interconnection with Tunisia in direct current, which would constitute the first electricity link between Italy and North Africa, which will strengthen and improve the integration of the electricity markets in the EU and North Africa. In addition, the Shanmlach – Somplago interconnection, the Lienz – Veneto interconnection and the SACOI 3 Interconnection between Italy and France (in detail the connection will take place between Corsica, Sardinia and Tuscany) are very important projects to significantly improve the integration of the European market.
  - Other electricity interconnection projects, both with other EU Member States and third countries, are being studied and evaluated, which will enable greater integration of the energy markets of the Member States involved and which will subsequently become part of the future PCI/SME lists. In this regard, it should be noted that the new project selection process will start from autumn 2024, leading to the adoption of the 7 PCI/SME list under Regulation (EU) 2022/869 of the European Parliament and of the Council of 30 May 2022 on guidelines for trans-European energy infrastructure, amending Regulations (EC) No 715/2009, (EU) 2019/942 and (EU) 2019/943 and Directives 2009/73/EC and (EU) 2019/944, and repealing Regulation (EU) No 347/2013.

- REGIONAL COOPERATION ON CCS INFRASTRUCTURE: Italy, France and Greece presented in spring 2023 a plan to support the development of such infrastructure in the Mediterranean Sea basin within the scope of the TEN-E Regulation. This cross-border plan is adaptable and allows for the promotion of further projects in the region, so that other Mediterranean countries could also join in order to strengthen regional cooperation on CCS; also in CCS, the CIP candidate projects covering the Mediterranean region ("Callisto Mediterranean CO_2 Network", "Augusta C2" and "Prinos CO_2 storage") are established in a cross-border context involving Italy at different levels. CALLISTO, Mediterranean CO2 Network and Prinos CO2 Storage were confirmed in the sixth list of Projects of Common Interest (PCI) of the EU at the beginning of 2024.
- REGIONAL COOPERATION ON DIVERSIFICATION OF NATURAL GAS SUPPLY: as regards the objective of diversifying natural gas supplies,Italy is one of the founding countries of the East Mediterranean Gas Forum (EMGF), an initiative launched at the instigation of Egypt, which also brings together Greece, Cyprus, Israel, Jordan and the Palestinian Authority with a view to creating a platform for cooperation, involving the private sector, on common policies for the use of uncovered gas, and to be discovered in the Eastern Mediterranean with a view to promoting a mutually beneficial and secure gas market in the region, with potential spillovers even beyond the region itself. France has been added as a fully-fledged member country to the founding countries of EMGF, while the United States, the European Union and the World Bank are members of it as observers. Inorder to fulfil its mission, the Forum has three statutory bodies: the Executive Board, as a technical body; the Secretariat, hosted

in Cairo; the Ministerial Meeting, which is the strategic steering body. At present, two working groups have also been set up with the aim of finalising thematic studies: 'EMGF Harmonised Carbon Abatement Framework' and 'Developing a Regional Gas Monetisation Plan'.

- REGIONAL COOPERATION ON OFFSHORE RENEWABLES: finally, to facilitate the development of offshore renewable energy, the 2022 TEN-E Regulation requires Member States, within their specific priority offshore grid corridors and taking into account the specificities and development in each region, to conclude a non-binding agreement to cooperate across borders on offshore renewable energy targets to be achieved by 2050, with an indication of the intermediate steps in 2030 and 2040, in line with the national energy and climate plans and the offshore renewable potential of each sea basin. Italy, covering both the eastern and western Mediterranean basin, adopted two such non-binding agreements in January 2023 together with the other Member States concerned (Greece, Spain, France, Malta, Croatia and Slovenia), committing to connect to the Italian national network by 2030 up to 4 GW in the priority offshore grid corridor "South and West Offshore Grids" and 4.5 GW in the priority offshore grid corridor "South and East Offshore Grids".
- MATTEI PLAN: regionalcooperation is supported by the synergy of the Mattei Plan for Africa initiative promoted by the Italian Government. In the energy field, the objective of the initiative is to make Italy a Mediterranean energy hub as a bridge between Africa and Europe, ensuring greater energy security and diversification. The actions will focus on the climate and energy nexus, will aim to strengthen energy efficiency and the use of renewable energies, and to reduce greenhouse gas emissions of carbon dioxide and methane in the energy industry; actions are planned to accelerate the transition of electricity systems, in particular for renewable electricity generation and transmission and distribution infrastructure. The plan also provides for the on-site development of technologies applied to energy, including through the establishment of innovation centres, where Italian companies will be able to select local start-ups and thus support employment and the enhancement of human capital.
- SOLIDARITY AGREEMENTS: as requested in the Commission Recommendations to the INECP, Italy continued its commitment to ratifying bilateral solidarity agreements for security of gas supply with neighbouring countries.

Regulation (EU) 2017/1938 of the European Parliament and of the Council of 25 October 2017 concerning measures to safeguard the security of gas supply provides for measures to strengthen the European Union's energy security, as one of the objectives of the Energy Union Strategy. In particular, in order to ensure that the internal gas system operates even in the event of a shortage of supply or disruption of transport infrastructure, it introduces solidarity and coordination measures between Member States in responding to gas supply crises, both in terms of prevention and response to them, ensuring maximum protection of solidarity-protected customers, as defined in the same Regulation (essentially coinciding with household consumers, hereinafter referred to as 'solidarity customers').

Article 13 of the Regulation expressly provides that Member States are to adopt intergovernmental agreements under which each State may request and provide solidarity in the supply of gas to a Member State which is directly interconnected, or connected through a third country, where a serious emergency situation does not make it possible to ensure the supply of gas to its solidarity customers.

At present, Italy is among the few Member States to conclude such intergovernmental agreements, having concluded the Solidarity Agreement with Slovenia in April 2022 and recently concluded the

Solidarity Agreement with Germany in March 2 024; in view of the fact that the interconnection pipeline between Italy and Germani transited through Switzerland, the two States also signed the trilateral Addendum between Italy, Germany and Switzerland at the same time as the solidarity agreement was signed, in order to ensure transit in the event of a gas supply crisis and demand for solidarity from Germany or Italy and also to take into account Swiss household customers.

Italy had also taken steps to launch discussions on this subject with the Member States Austria, France and Greece.

II. Explanation of how regional cooperation is considered in the plan

In view of the ongoing regional cooperation activities, including those listed in the previous paragraph, Italy intends to implement the regional comparison, including on specific topics whose relevance has recently emerged, such as:

- interconnection infrastructure for energy supply;
- development of the hydrogen strategy;
- offshore RES installations to be developed with bordersti countries.

In addition to these projects, which are also linked to European funding under the REPower EU, the aim is to develop bilateral comparison initiatives in the future, in particular in terms of energy security and diversification of supply sources.

On this point, we would point out that cooperation between the various European countries is now structural in different sectors of the energy system, such as the development of energy infrastructure for which electricity transmission system operators and gas transmission network operators are already engaged in various cooperation activities (through the ENTSO-E and ENTSOG associations), including the definition of energy scenarios (ENTSO-E/ENTSOG Scenario Report), the Ten-Year Network Development Plan and the European Resource Adequacy Assessment, striving to ensure the security of interconnected systems at European level and to promote the development of the internal market.

Cooperation between transmission system operators and distribution system operators is also becoming increasingly structural at European level, as illustrated by the process of writing of the new European network code on demand response, which involves not only ENTSO-E, but also the DSO Entity, the association of distributors. The Network Code on Demand Response (NC DR), becoming an EU Regulation in all respects, will enter into force directly at Member State level immediately after its publication, scheduled for the first quarter of 2025. The NC DR will play a key role in promoting the participation of distributed resources in local and global services markets, through the implementation of a set of measures to simplify and harmonise market participation processes.

2 NATIONAL OBJECTIVES AND TARGETS

2.1 Decarbonisation dimension

2.1.1 Greenhouse gas emissions and removals[10]

I. Elements referred to in Article 4(a) (1)

(1) With respect to greenhouse gas emissions and removals and with a view to contributing to the achievement of the economy wide Union greenhouse gas emission reduction target:

i) the Member State's binding national target for greenhouse gas emissions and the annual binding national limits pursuant to Regulation (EU) 2018/842;

ii) the Member State's commitments pursuant to Regulation (EU) 2018/841;

iii) where applicable to meet the objectives and targets of the Energy Union and the Union's long-term greenhouse gas emissions commitments in accordance with the Paris Agreement, other objectives and targets, including sectoral and adaptation objectives and targets

The European Council of 10-11 December 2 020 adopted the EU's net emissions reduction target of at least 55 % by 2030 compared to 1990. On 29 July 2021, the European Climate Law (Regulation (EU) 2021/1119) entered into force, which makes the EU 2030 target consistent, 'sets the binding objective of climate neutrality in the Union by 2050' and 'establishes a framework for progress towards the overall objective of adaptation'.

The European Union intends to achieve the 2030 domestic reduction target of net greenhouse gas emissions by at least 55 % compared to 1990, which also includes removals and greenhouse gas emissions from the LULUCF sector (land use, land use change and forestry). The package of legislative proposals, known as Fit for 55, consists, inter alia, of proposals to reform the set of directives and regulations setting the ETS (Emission Trading Scheme), ESR (Effort Sharing Regulation), LULUCF, energy efficiency and renewable targets for Member States.

Recent revisions of the relevant legislation included in the *Fit for 55* package foresee a higher reduction for ETS emissions at European collective level from -43 % to -62 % and for ESR emissions from -30 % to -40 % compared to the year 2005.

The *Fit for 55* package also includes provisions that redesign the scope of the ETS (produced by energy industries, aviation energy industries, maritime, transport and buildings – Annexes I and III to Directive 2003/87/EC) a greater reduction at European collective level from -43 % to -62 % and for emissions subject to the ESR Regulation from -30 % to -40 % compared to the year 2005.

The *Fit for 55* package also includes provisions redesigning the scope of the ETS, which will henceforth integrate emissions from shipping and, from 2027, those from building heating and road traffic, which, although regulated with the ETS instrument, will remain included in Effort Sharing. Similarly, emissions from activities included in the ETS for the sole purposes of Articles 14 and 15 of Directive 2003/87/EC remain within the scope of the ESR Regulation.

Inaddition, with regard to the LULUCF sector, Regulation (EU) No 2023/839, which amended the precedent of Regulation (EU) 2018/841, provides for a collective removal target of 310 MtCO 2

[10] *Consistency to be ensured with long-term strategies pursuant to Article 15.*

eq$_{at}$European level by 2030. at national level, the targets of the target area of emission neutrality as of 2025 have been defined, with reference to the accounting period 2021-2025, and a target for 2030 of at least -35.8 Mt$_{CO}$ 2eq, with the definition of the trajectory 2026-2 029 in 2025 and the resulting annual LULUCF targets.

Greenhouse gas (GHG) emissions from energy uses account for 82 % of the national total of around 413 million tonnes of CO_2 equivalent in 2022 [Mt CO_2eq] (national GHG emission inventory, excluding LULUCF emissions and removals). The remaining share of emissions comes from non-energy sources, mainly related to industrial processes, fluorinated gases, agriculture and waste.

The table below provides an overview of the weight of each sector in terms of GHG emissions (Mt CO_2eq) over the period 1990-2022.

Table 6 – Evolution of emissions by sector in 1990-2022 (GHG emissions, Mt CO_2eq) [Source: ISPRA]

	1990	2005	2010	2015	2016	2017	2018	2019	2020	2021	2022
By ENERGY USI, of which:	**426**	**488**	**430**	**360**	**356**	**351**	**346**	**336**	**300**	**332**	**338**
Energy industries	**138**	160	137	106	105	105	96	92	82	86	95
Manufacturing industries and construction	**92**	92	70	56	54	53	54	50	46	55	55
Transport	**102**	128	116	107	106	102	105	106	87	103	110
Civil	**79**	96	96	82	83	83	84	81	79	82	73
Other energy and fugitives	**15**	12	10	9	8	8	8	7	7	6	6
FONTI ALTRE, of which:	**96**	**107**	**92**	**83**	**83**	**81**	**82**	**80**	**79**	**79**	**75**
Industrial processes and F-Gas	**39**	48	37	30	29	29	29	28	25	26	24
Agriculture (livestock and crops)	**38**	35	33	32	34	33	33	32	34	33	31
Waste	**19**	24	22	20	20	20	20	20	20	20	20
TOTAL	**522**	**596**	**522**	**443**	**439**	**432**	**428**	**416**	**379**	**411**	**413**

While for ETS emissions the target is at European level, as the system is applied to all Member States in a harmonised and centralised manner, for emissions subject to the ESR Regulation, the greenhouse gas reduction target is divided between Member States.

The ESR Regulation was recently amended by Regulation (EU) 2023/857, which set an even more ambitious target for Italy, with a reduction of 43.7 % by 2030 compared to 2005 levels. This target will have to be achieved according to a reduction trajectory that will determine an annual cap on emissions (EEA, annual emission allocation).

To achieve the ESR targets, Member States will be able to make use, within certain limits, of flexibility mechanisms to manage the reduction trajectory (banking and intra-period borrowing) and to carry out transfers of emission allowances with other Member States. Additional flexibility is added to these instruments linked to the accounting of removals and greenhouse gas emissions from the LULUCF sector. This operation is allowed only on condition that the commitments under Regulation (EU) 2023/839 (LULUCF Regulation), which sets national targets for the LULUCF sector at 2025 (emission neutrality) and annual targets for the period 2026-2030, with the 2030 removal target of at least – 35,8Mt CO 2$_{eq}$. The LULUCF flexibility sets at 5,75 MtCO 2$_{eq}$the cumulative amount of removals for the period 2021-2025 and 5,75 MtCO 2$_{eq}$for the following period 2026-2030. Finally, the *Effort sharing* Regulation lays down the so-called 'security reserve'. This reserve, consisting of a volume of allowances of 105 Mt, is allocated to countries with a GDP per capita 2013 below the EU average which, by 2020, will have made greater reductions beyond their target (‘*overachievement*’). However, access to the reserve is allowed ‘only’ at the end of the compliance period 2026-2030 as it is still conditional on the ‘achievement’ of the EU 2030 reduction target.

The table below shows the emission reductions resulting from the baseline and the objectives stemming from European legislation.

7 Table – ETS, ESR and LULUCF 2030 baseline and targets

	PNIEC 2024: Reference case	PNIEC 2019: (Objective)	Objectives FF55 REPower EU
ETS emissions *	— 58 %	⎓	— 62 % * *
ESR emissions	— 29.3 %	— 33 %	— 43.7 %
LULUCF emissions and removals	— 28,4 $MtCO_2eq$		— 35,8 $MtCO_2eq$

** excluding national aviation and navigation emissions*
** * European target*

Considering the baseline scenario for 2030 (see Cap 4), it is clear that there is a lower distance from the emission reduction target compared to the aggregate European ETS target.

Much more challenging and challenging is therefore the reduction effort in the light of the update of the Effort Sharing objective: in order to comply with the 2021-2030 emission trajectory (trajectory still being defined for the period 2026-2030), which will have to lead to a 43.7 % reduction compared to 2005 levels, a significant emission reduction of at least 30 % compared to 2022 levels will need to be started immediately, to be achieved mainly in the transport and civil sectors. There is no doubt that the path to achieve the new European target will require a major effort, including in terms of investment, from the whole country system, also in view of the important and profound changes in the economic and geopolitical environment that have taken place.

For the previous period of application of Effort Sharing (2013-2020), Italy achieved higher emission reductions than required to meet the targets. Although the year 2020 was strongly influenced by the effects of closures due to the COVID-19 pandemic, significant emission reductions in all major sectors were already observed in previous years. Several factors contributed to these reductions. The industrial sector has experienced a decline in emissions, which is affected by the progressive efficiency of production processes, the abandonment of the most polluting fuels and higher levels of greenhouse gas emissions, but also from the structural crisis triggered since the global financial crisis in 2008. In the civil sector, the initial reduction in emissions is due, by analogy with industry, to the abandonment of the most polluting fuels and higher levels of greenhouse gas emissions, but also to the gradual, albeit slow, efficiency of the building stock and the equipment used. A key role for the sector’s emissions is the evolution of temperatures and the consequent need for heating. As regards the transport sector, however, policies on the emission and consumption standards of new vehicles have been largely offset by economic dynamics and increasing demand for private transport, including as a change in behaviour following the pandemic. In summary, with regard to sectors that are less affected by the economic situation, such as transport and civil, there are no significant emission reductions since 2013. Therefore, although the reductions required by compliance with the annual allocations for the period 2013 – 2020 have not only been achieved but largely exceeded (a*total*overachievement is calculated for the period in terms of emission reductions of 190 $MtCO_2eq$), the failure to reduce emissions from the transport and civil sectors has led to a progressive approximation of Italian emission levels to the EEA, until they were exceeded for the years 2021 and 2022. These exceedances are 4,6 and 5,5 $MtCO_2eq$ respectively.

Looking at the new target and the weight of individual sectors, the most significant contribution is the transport and civil sectors (particularly residential and tertiary sectors).

In the update of the Plan, it was clear that additional policies and measures are needed to achieve greater energy efficiency in the civil sector (residential and tertiary), as well as to reduce the demand for mobility and to encourage the uptake of low-emission vehicles, and to enhance their infrastructure.

In order to achieve the reduction of emissions in 2030 compared to 2005 and to promote an increase in savings in final energy consumption, measures have been envisaged to accelerate the pace of efficiency of existing buildings, reinforced by an increased uptake of deep retrofitting measures and the application of particularly performant technologies (such as heat pumps and BACS systems).

For the transport sector, emission reductions can be achieved effectively, as well as the gradual and natural replacement of the vehicle fleet, primarily through the development of shared/public mobility and the progressive uptake of biofuels and vehicles with low energy consumption and very low or zero CO_2 emissions.

In addition, looking ahead, a stimulus role for the decarbonisation of the civil and transport sectors will come from the ETS Directive, which provides, inter alia, for the creation of an ad hoc ETS which will also cover these sectors: the cap and trade mechanism will complement national policies and measures as of 2027.

Emissions from fossil fuels from energy uses are added to emissions from non-energy sources, which, however, will make a relatively small contribution to the decarbonisation process.

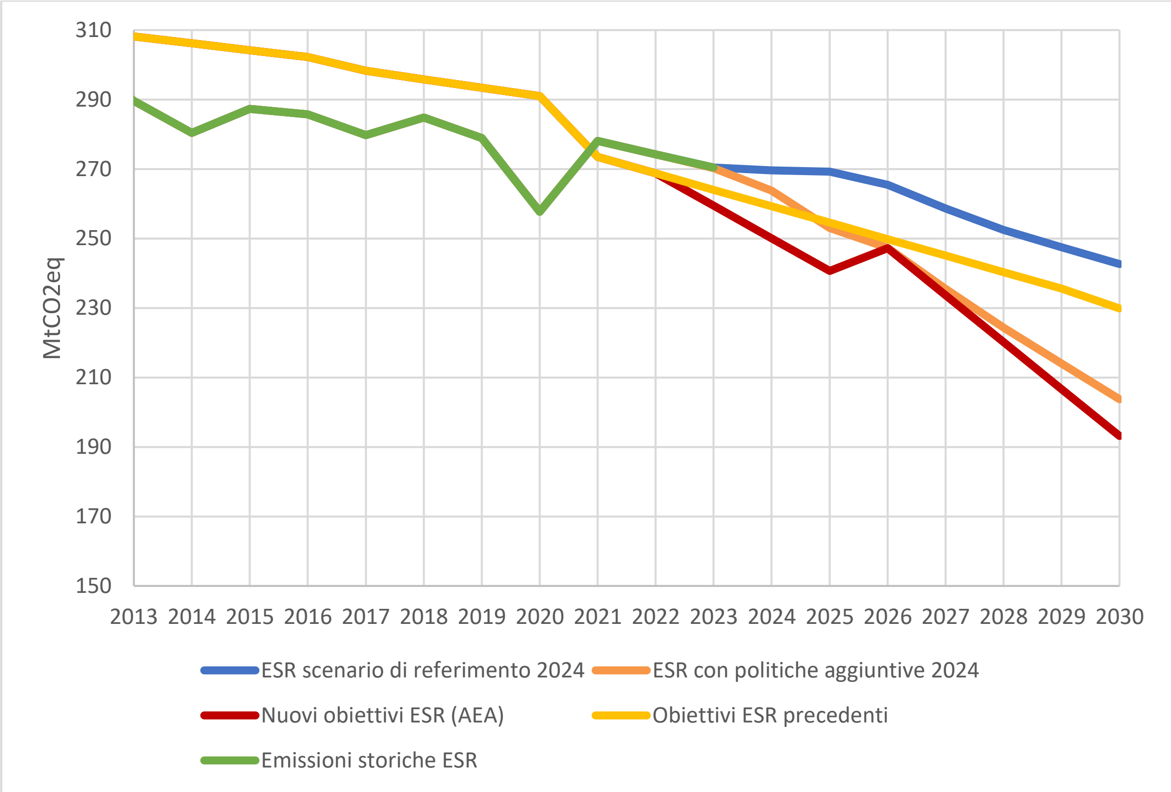
Emissions from industrial processes mainly concern cement, lime and steel production and the use of fluorinated gases. The former are not easy to comprehend as they are directly proportional to the quantities produced. On the other hand, a clear effect on F-gases stems from the implementation of the new Regulation (EU) 2024/573 replacing Regulation No 517/2014, which leads to even stricter control of F-GAS.

It is worth mentioning that, in order to reduce emissions from traditional fuels, the usefulness of secondary solid fuel, which can be used by means of the simplifications introduced by Article 35 of Decree-Law No 77/2021 for cement plants and thermal power plants. For steelworks, as well as for hard-to-abate sectors a similar contribution will be provided by hydrogen and biomethane trials.

In the waste sector, emissions are mainly related to the total quantity produced, the share of biodegradable substances delivered to landfill and the recovery rates of methane from landfill gas. In this case, a relatively significant reduction in emissions is expected to be achieved through the progressive implementation of already approved waste management targets and plans. Indeed, national legislation provides for a very ambitious separate collection target of 60 % in 2030, which is the main driver of waste management policies in Italy. Thanks to this target (not yet uniformly achieved at national level), it has been possible to achieve high recycling rates of municipal waste fully in line with the 2020 Community recycling target of 50 %.

In the agriculture sector, emissions reflect trends in factors such as the number and type of farm animals, the change in the areas under cultivation and the type of crops, and the use of nitrogen containing fertilisers. These variables are sensitive to changes in agricultural practices as outlined in the Common Agricultural Policy and Rural Development Plans. However, this sector has remained relatively stable over the past decade, only marginally influenced by biogas production and the reduction/change in fertiliser use.

Figure 4 - Historical emission trends in the Effort Sharing sectors and future scenarios for additional policies (Mt CO2eq) [Source: ISPRA]



As shown in the figure, despite the policies identified (included in the Cap. (3) there is still some distance from the new Effort sharing objective. These policies, although very ambitious in the civil and transport sectors, allow emissions to be reduced by around 40.5 % by 2030.

In order to "further" accelerate the reduction of emissions in the civil sector, in particular, policies and measures to promote energy efficiency in the residential sector will need to be strengthened by identifying new tools for the involvement of private individuals and the public sector in the upgrading of the existing national building stock. In the transport sector, however, measures to shift user travel from private to public transport through modal shift, reduce demand for private mobility with favourable smart working policies and assess the reduction of working days to equal hours worked should be more strongly encouraged. It will also be necessary to make full use of digitalisation and the consequent reduction of physical travel, as well as the promotion of soft mobility and mobility planning tools.

Greater involvement of non-energy sectors will also be necessary to achieve the objectives.

Finally, with regard to the LULUCF sector, the contribution for compliance with the ESR target is limited to what is provided for in the so-called LULUCF flexibility (5,75 MtCO_2eq for each period 2021-2025 and 2026-2030). However, this flexibility can only be used following the verification of compliance with the specific objectives of the LULUCF sector. In particular, Regulation (EU) 2023/839 (LULUCF Regulation) provides, for the period from 2021 to 2025, for a target of neutrality between emissions and removals for the sector (so-called no *debit rule)*and, for the period 2026-2030, a European target of 310 million tonnes of CO $2_{equivalent}$ of net greenhouse gas removals by 2030, distributed among Member States as annual binding national targets calculated on the basis of a linear trajectory. For Italy, the minimum absorption target at 2030 is 35.8 Mt CO_2eq.

Since 1990, changes in land use in Italy have led to an increase in forest area (+ 25 %), wetlands (+ 12 %) and urban settlements (+ 43 %); there is also a reduction in the area of grassland, pasture and other wooded land (-10 %) and agricultural areas (-17 %) compared to 1990. These dynamics are the basis for the change in removals and emissions from the LULUCF sector, which, overall, shows high variability influenced mainly by the annual areas covered by fires and related greenhouse gas emissions.

The table below shows the removals and greenhouse gas emissions, in $MtCO_2eq$, from the LULUCF sector, estimated on the basis of the IPCC methodology, as reported to the European Commission under the provisions of Regulation (EU) 2018/1999 on the Governance of the Energy Union.

Table 8 – Projections by LULUCF categories (MtCO2eq) [Source: ISPRA]

	1990	1995	2000	2005	2010	2015	2020	2021	2022	2025	2030	2035	2040
Total LULUCF	**—3.6**	**—23.4**	**—20.2**	**—33.7**	**—39.7**	**—41.9**	**—27.5**	**—24.8**	**—21.2**	**—28.0**	**—28.4**	**—24.6**	**—30.8**
Forests	—17.3	—31.0	—26.3	—34.9	—36.4	—40.3	—29.8	—28.4	—26.1	—34.3	—35.4	—35.2	—35.1
Agricultural land	2.1	1.4	1.0	—0.4	0.4	1.7	3.7	2.2	2.3	2.4	2.5	3.0	3.1
Meadows and pastures, other wooded land	4.9	—1.9	—1.4	—5.6	—8.3	—8.3	—6.3	—3.0	—2.0	—1.7	—0.9	2.5	—3.5
Wetlands	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Urban settlements	7.1	8.9	6.9	7.7	4.7	4.7	5.5	4.8	4.8	5.7	5.5	5.2	4.8
Wood Products (HWP)	—0.4	—0.7	—0.5	—0.5	—0.1	0.1	—0.7	—0.4	—0.3	—0.3	—0.2	—0.2	—0.2

II. Where applicable, other national objectives and targets consistent with the Paris Agreement and the existing long-term strategies. Where applicable for the contribution to the overall Union commitment of reducing the GHG emissions, other objectives and targets, including sector targets and adaptation goals, if available

❖ **ADAPTATION**

The national, strategic and planning instruments relating to adaptation are, as indicated in point 3.1.1 of this plan, the National Strategy for Adaptation to Climate Change, adopted in 2015, and the National Climate Adaptation Plan (PNACC).

At the end of a Strategic Environmental Assessment (SEA) procedure, the latter was approved by Decree No 434 of the Minister for the Environment and Energy Security of 21 December 2023, published in Official Gazette of the Italian Republic No 42 of 20 February 2024.

From a systemic point of view, the overall objective of the PNACC is subsumed through four specific objectives:

- define national governance for adaptation, clarifying the need for coordination between the different levels of government of the territory and the different policy areas;

- improve and establish the knowledge framework on the impacts of climate change, vulnerability and risks in Italy;
- define how to include climate change adaptation principles, actions and measures in national, regional and local plans and programmes for the areas of action identified in the NECP, making use of synergies with other National Plans (mainstreaming);
- define sectoral and cross-sectoral modalities and instruments for the implementation of PNACC actions at different levels of government.

A second level of intervention is also intended to exercise a ‘steering function’, in particular towards the regional and local level, by defining a comprehensive framework of possible adaptation options, consisting of sectoral measures, which will be implemented in sectoral and cross-sectoral plans in the ways that will be identified by the governance structure. The “steering function” is complemented in the NECP by two documents for the definition of regional and local climate change adaptation strategies/plans.

Following the approval of the PNACC, as set out in point 3.1.1 of this Plan, activities were launched to implement the first PNACC system action, consisting of the establishment of a dedicated governance structure, the ‘National Climate Change Adaptation Observatory’, with the function of steering and coordinating, as well as analysing and comparing,planning and implementing adaptation actions in the various sectors. The results of this activity will converge into sectoral or cross-sectoral plans, outlining the actions to be implemented.

The Observatory shall consist of:

- a collegiate governing and coordinating body (Committee);
- a technical and administrative support structure (Secretariat);
- a consultative and dissemination body (Forum).

With the aim of making available information and data from the PNACC to all citizens and to support the regions and local authorities in the decision-making process, the “National Climate Change Adaptation Platform” was made available online in October 2022, which will be the reference IT tool for the work of the Forum.

As indicated by the Commission, Member States are invited to strengthen the resilience of the energy system in line with the Climate Law. The National Integrated Plan for Energy and Climate (PNIEC) is mentioned in the National Integrated Plan for Energy and Climate (PNIEC) as one of the national acts relevant to climate change adaptation. A number of areas for the relationship between climate change and energy are also mentioned: first, the increase in cooling demand leading to an increase in electricity consumption in the summer period, directly linked to rising average temperatures. The same phenomenon leads to a lower demand for energy to meet heating demand in the winter period.

In this regard, the PNACC describes the annual climate changes (*ensembles mean*) for some of the climate indicators analysed for the period 2036-2065 (2050s), compared to the reference period 1981-2010, for the scenarios RCP 2.6, RCP 4.5 and RCP8.5. The results of the simulations show a general reduction, particularly in mountainous areas, in heating day degrees (HDDs) and a general increase in cooling day degrees (CDDS) for flat and coastal areas. This trend is also influenced by the increase in the frequency and intensity of heat waves. Indeed, there is a general increase in the danger of hot waves and a general reduction in cold wave events across the country, especially in the SmPC 8.5 scenario.

Moreover, as stated in the Environmental Report drawn up in the context of the SEA process, the higher demand for cooling in the summer period and the resulting increase in the electrical power peak needed to meet it may increase the risk of blackout. This risk must also be considered in the light of the electricity consumption of the various production sectors. In particular, the high electrification of industry makes this sector particularly vulnerable. The increase in droughts leads to a problem directly linked to the availability of water. The use of this key resource in the various sectors could be affected by the need for a quota of uses. There is no production or civil sector that does not use water and there is therefore a need for detailed knowledge of the quantities targeted in agriculture, industry, the electricity sector, the civil sector and other uses.

The NECP includes an overview of the most relevant aspects of climate change impacts and sectoral vulnerabilities in Italy. The sectors covered are those already included in the National Adaptation Strategy, which correspond to the natural systems and socio-economic sectors most vulnerable to climate change in Italy. For this purpose, the results of the climate projections for Italy were taken into account and some of the most well-established impact indicators at national level were selected.

A more detailed picture of the knowledge on the impacts of climate change in Italy, contained in Annex III and produced over the years 2017-2018 by a broad expert community, although not updated to the most recent years, is nevertheless efficient in anticipating the impact of climate change on various environmental, economic and social sectors. In any event, the PNACC contains updated knowledge elements for certain areas, where the necessary information could be found, it being understood that a full update of the impact and vulnerability assessment is foreseen among the system actions defined by the PNACC.

Based on the information contained in the UNACC for the water sector, there was a decrease in rainfall in 2020 compared to the 1971-2000 climate period (CLINO: reference climate standard). In particular, based on ISTAT data from 2022, a total annual precipitation of 661 mm occurred, corresponding to a decrease in precipitation of -132 mm. Total annual rainfall, with reference to CLINO for the various Italian regions, shows significant regional distribution anomalies, in line with the forecasts highlighted in the latest IPCC 2022 report, which are leading to critical and extreme weather anomalies at both global and national levels.

The amount of renewable water resources in Italy corresponds to around 116 billion m^3. Recent data on actually usable water volumes are not available, while the figures estimated by SNAC appear to be around 52 billion m^3. The main user sectors of the resource are agriculture (around 20 billion m^3), drinking water (9.5 billion m^3) and manufacturing (5.5 billion m^3). Cooling of thermoelectric plants uses around 18.4 billion m^3, of which only 11.5 % from inland waters. This shows that more than 30 % of the renewable resources available in our country are used, well above the 20 % threshold set by the Resource Efficient Europe (*Roadmap to a resource efficient Europe* – COM (2011) 571 *final*); *A resource-efficient Europe – Flagship initiative under the Europe 2020 Strategy* – COM (2011) 21). As a result, the Organisation for Economic Co-operation and Development (OECD) has classified Italy as a country under medium to high water stress.

In relation to electricity generation, the trend of increasing the intensity and frequency of extreme precipitation events, if accompanied by a reduction in cumulative precipitation, may directly affect hydropower production. A major factor in this respect is the variability of rainfall and the increase in the frequency of periods of drought, leading to management problems, especially if some reservoirs were to be closed. This impact is directly related to the melting of the glaciers in place and the consequent change in the regime of water courses supplied by them. As pointed out in the Environmental Report, the variation in the rainfall regime, as well as the melting of glaciers, is an issue for hydropower production, which accounts for a significant proportion of electricity production from renewable sources. Therefore, the fall in hydropower production also has a significant impact on the achievement of national targets for renewable electricity production.

The increase in temperature also affects thermoelectric production in relation to the water needs of the sector for cooling installations. The drought in 2 022 showed that water scarcity is also having an impact on the thermoelectric sector. Some production plants on the Po river were forced to shut down due to the lack of water needed to cool them. Water abstraction for thermoelectric production, combined with an increase in the frequency of periods of drought, poses a major problem.

A further impact on electricity transmission and distribution due to the temperature increase is the expected increase in cable resistance and thus in grid losses, resulting in inevitable increased production to meet demand, and more difficult heat dissipation. The risk of energy transmission disruption due to extreme weather events should also be highlighted.

The framework described above highlights several aspects that may negatively affect the achievement of the objectives of the Energy Union. For example, as the need for cooling or heating can increase overall energy consumption, climate vulnerabilities could undermine efforts to improve energy efficiency. At the same time, an increase in overall energy consumption could undermine efforts to achieve greenhouse gas emission reduction targets, if there is no adequate infrastructure for renewable energy generation to support it. Finally, extreme weather events could damage energy infrastructure by affecting the objective of energy security, slowing down the transition to renewable energy sources and undermining the preservation and enhancement of existing ones.

Adaptation policies and measures should support, in line with the objectives and policies of the Energy Union, the resilience of infrastructure to ensure reliable energy supply, the promotion of diversification of energy sources to reduce dependence on resources vulnerable to climate impacts and ensure greater energy security.

For the above, in order to build a resilient energy system that remains reliable through short- and medium-term climate scenarios and capable of developing consistently also in long-term scenarios, a framework of possible adaptation options (Annex IV) is available in the PNACC, which includes, for example, measures to:

- promoting the development of micro grids to encourage self-production of urban communities, while respecting the safety and overall efficiency of the system;
- implementation of demand side management programmes and tools;
- increasing the degree of interconnection of the electricity grid also in order to complement contributions from renewable sources;
- the deployment of interconnected basin networks on a regional or national scale;
- improving interconnection with European networks to compensate for the use of discontinuous renewable sources;
- diversification of energy sources so as to increase security of supply.

In addition, further possible actions proposed by the PNACC (Annex IV) in the field of energy, which correspond to the objectives of the Energy Union, concern measures to safeguard electricity generation capacity and residential energy savings.

The actions identified for the energy sector meet the following objectives:

- Prote and increase better demand response for heating and cooling through: Measures to adapt existing buildings, i.e. *retrofitting* the existing building stock to reduce air-conditioning needs, both for the winter and summer seasons; '*Climate proofing*' of newly built buildings through the strict implementation of the legal provisions on energy efficiency through the planning and planning tools provided for in the current legislation, at national, regional and local level;
- reduce energy losses from transmission and distribution networks;
- increase the use of alternative energy sources;
- promoting renewable sources and energy efficiency;

- increase the resilience of the energy system and reduce the vulnerability of hydropower and thermoelectric production;
- promote and increase better demand response for heating and cooling;
- increasing the resilience of the energy system.

Soilprotection plays an important role in achieving the objectives and targets of the Energy Union. According to the information in the PNACC, soil degradation is a reduction in the biological production capacity of this resource. Often, the process is inextricably linked to biodiversity loss and the impacts of climate change. Degradation is assessed by analysing the change in some indicators, including the main indicators being land cover, its productivity and the organic carbon content. Climate change will be able to exacerbate degradation processes through complex and unprecedented feedback mechanisms for the suolo-vegetation system. Organic matter in agricultural and forestry soils may be reduced due to a change in the thermal and rainfall regime. Changes in organic matter content may, together with other factors, contribute to the abandonment of hilly and mountain areas, combined with overexploitation of soils and water in lowland areas, will increase the risk of desertification and degradation. The gradual abandonment of agricultural activities in hilly and mountainous areas, the consequent expansion of shrub vegetation, the decrease in soil fertility and the increased risk of fire, especially when combined with the increase in the frequency of drough events are concomitant phenomena that greatly contribute to extreme degradation. In parallel with the abandonment of hilly and mountainous areas, the use and urbanisation of lowland areas can be stepped up, leading to soil sealing. Finally, in lowland areas resulting from drainage remediation, the fertility of organic soils will be threatened by the mineralisation of organic carbon due to the unprecedented oxidation state, which will lead to a reduction in resilience capacity and significant CO_2 emissions.
One of the actions included in Annex IV to the NECP to combat desertification and, more generally, soil degradation, is to "integrate risk prevention, management and mitigation between cross-sectoral policies (forests, agriculture, water, energy, etc.)". This action is consistent with the NECP System Action 2, which provides for the identification of the arrangements, instruments and entities responsible for introducing the principles of adaptation measures and actions in national, regional and local plans and programmes.

In order to achieve the objectives and targets of the Energy Union, the forestry sector is also strategic. Forests are a major natural *carbon sink on* Earth and play a crucial role in mitigating climate change by absorbing and storing atmospheric carbon. The protection and restoration of forests are crucial to ensure their capacity to act as long-term carbon reservoirs and to tackle climate change and preserve their importance for biodiversity and human well-being. However, the changes caused by ongoing and future climate change are likely to lead to significant changes in the Italian forest heritage, undermining its functionality and ecosystem services and are set to increase in response to future climate scenarios. Specific adaptation actions are therefore necessary in order to protect the most important functions that our forests are currently called upon to perform, including: biodiversity reservoirs and protection of species and habitats; production function in terms of wood products and bioenergy; water purification and collection, soil protection and protection against hydrogeological instability, including the maintenance of water quality; flood risk containment; carbon removal and fixation in soils and biomass and maintenance of air quality.
Asstated in the PNACC, one of the main threats to the European forest sector, especially in southern Europe, is forest fires, which are indirectly linked to climate change. In Italy, the areas that have historically suffered the most significant damage in terms of areas covered by fires are mainly located in the central and southern part of the peninsula, the main islands and along the Ligurian and Tuscany coast. Fires contribute, inter alia, to the emission of significant amounts of greenhouse gases and pollutants into the atmosphere. Over time, the phenomenon of forest fires in Italy has changed: a critical period took place in the mid-1980s, followed by years in which the incidence of the phenomenon remained generally high. The combination of climate change and abandonment

of rural and forestry areas, if not properly addressed, is exacerbating the problem of fires, leading to an increase in the frequency of fires, increasing the intensity and significance of fires, leading to significant economic, environmental and social losses. The adaptation measures proposed in the UNACC generally aim at sustainable forest management in order to increase the ability of forests to adapt to climate change and improve their stability against extreme weather events, generally favouring their carbon sequestration and hydrogeological defence function.

The effects of climate change will also affect the agriculture sector. As indicated in the PNACC, Italian agriculture, together with that of other Mediterranean countries, is among the most exposed in Europe to the effects of climate change. While climate adaptation is a characteristic feature of the agricultural sector, the speed, uncertainty and magnitude of ongoing and projected climate change require an increase in its adaptive capacity. The PNACC provides information from scientific literature on a large variation in yield forecasts, due to different precipitation representations in climate models and the variable responses of agricultural models to climate impacts. However, there are clear signs of worsening agro-climatic conditions, including increased water stress and a reduction in the growth season in Central and Southern Europe. Agrosystems will be subject to variations in the duration of the phenological cycle, productivity and potential displacement of typical growing areas, with different responses in intensity and signal depending on the species and geographical reference areas. In general, crops will be affected by the temperature increase, reducing the length of the growth cycle leading to lower biomass accumulation and yield reduction. The PNACC provides for several adaptation actions for the agricultural sector, including:

- promoting the uptake of precision farming in order to use more efficiently (specific site) the means of production (e.g. nutrients and water). Optimising crop inputs makes it possible to increase crop productivity and climate change adaptation while respecting mitigation objectives and reducing damage from uncontrolled use of crop inputs (e.g. N pollution in groundwater);
- the development of genetic improvement and crop selection.

Compared to the contribution that adaptation policies can make to emission reduction objectives, the Union is also a water sector, since promoting water efficiency and overall improving the sustainability of water resources contributes not only to resource conservation but also to reducing the energy needed for water treatment and distribution, thereby reducing CO2 emissions associated with these activities. Investing in solutions and practices that improve water efficiency is therefore essential to achieve sustainability and decarbonisation objectives within the Energy Union. As regards water resources, the PNACC in relation to the reduction of water availability provides for actions aimed, inter alia, at:

- improving the efficiency of water infrastructure;
- improve the effectiveness in programming the use of the resource;
- improve the effectiveness of planning;
- promote sustainable farming practices and integrated water management.

The PNACC identifies a number of actions including rationalisation of consumption, improved demand response, reduction of losses in distribution networks and the upgrading of water bodies to ensure the maintenance of vital flows and ecological quality, considering the expected changes in temperature and rainfall regimes.

❖ **CARBON CAPTURE AND STORAGE (CCS): GRADING**

The use of the capture and storage/use of CO_2 is essential to safeguard the objective of limiting global warming mentioned in the first part of this Plan. The use of CCS (*Carbon Capture and Storage*) is necessary as it allows:

- decarbonisation of industrial sectors where CO_2 emissions are unavoidable part of the production process. The International Energy Agency recognises that CCS and CCUS are technologies that can significantly contribute to reducing carbon emissions, especially in hard to abated industries;
- decarbonisation (together with hydrogen and biomethane) of non-electrifiable industrial sectors due to the need to achieve, by combustion, high process temperatures or the need for direct feedstock of the production process;
- decarbonisation of industrial processes that generate emissions not linked to combustion but typical of the production process itself, which are not otherwise avoidable;
- decarbonisation (together with renewables) of the electricity sector, preserving a share of decarbonised, programmable and flexible electricity generation;
- faster development of the hydrogen sector by integrating renewable hydrogen with low carbon hydrogen (i.e. produced by reforming natural gas combined with CCS);
- the removal of CO_2 from the atmosphere through the use of bioenergy associated with CCS (BECCS) and Direct Air Carbon Capture and Storage (DACCS).

To date, the European Union has a number of legislative provisions in place to support carbon capture, use, transport and storage. Note, in particular, the 2009 Directive on the geological storage of carbon dioxide (Directive 2009/31), the EU ETS rules and its implementing regulation (Directive 2023/959; Implementing Regulation 2018/2066) as well as the European Framework on State Aid CEEAG, the TEN-E Regulation and the Renewable Energy Directive. In addition, the EU strategy on industrial carbon management (cd. Industrial Carbon Management Strategy adopted in February 2024), the 2021 Sustainable Carbon Cycles Communication, the Carbon Remotions Regulation (Cd. The Carbon Removals and Carbon Farming Regulation) and the Net Zero Industry Act set out a number of guidelines for future legislative development.

In particular, Directive 2009/31/EC, transposed in Italy by Legislative Decree No 162/2011, laid down a legislative framework to allow CO2 to be stored in suitable geological formations. In the last year, Decree-Law No 181 of 9 December 2023, converted with amendments into Law No 11 of 2 February 2023 ('DL 181/2023') has last amended Legislative Decree No 162/2011 and supplemented the regulatory framework enabling permits for the storage of CO_2.

❖ CARBON CAPTURE AND STORAGE (CCS): POTENTIAL OF NATIONAL GEOLOGICAL STOCCAGIUM AND INJECTION CAPACITY

Onshore and offshoresites where permanent storage of CO_2 is technically possible are distinguished in depleted deposits (in particular gas fields) and saline aquifers.

The depleted deposits have many advantages arising from a thorough knowledge of the characteristics of the storage site, which arose during the years of hydrocarbon development and production. Indeed, the phases of exploration and exploitation of the field have made it possible to characterise the geology of the site, to have knowledge of the dynamics of the field and evidence of the hydraulic resilience of the cover and its characterisation. The presence of hydrocarbons in the deposits also confirms the definition of geological "trap" that may in future contain CO_2, as it has contained gas for millions of years. Finally, depleted or depleted deposits are characterised by the presence of industrial infrastructure at production stages (installations, wells, pipelines), part of which can be reused for new CO2 storage developments, fuelling a virtuous circular economy.

In view of these advantages, an analysis of storage potential has been launched in Italy focusing on depleted or depleted oil & gas deposits at present relating only to the Eni mining rights portfolio.

The results of Eni's analysis alone showed a storage potential for spent offshore and on-shore oil & gas deposits of about 750 Mt delocated as follows:

- Potential offshore geological storage capacity is distributed in two main hubs:
  - Ravenna Hub (515 Mt): it is probably the main known hub for geological storage in the Mediterranean area consisting of several depleted or depleted gas fields that will progressively be dedicated to CO2 storage in close synergy with each other.
  - Jonio Hub (130 Mt): a site for geological storage CO2, which could be indicative from 2040 onwards, in view of the expected production codes and a greater geological complexity than the deposits relating to the 'Ravenna hub'.
- The potential onshore geological storage capacity, considering the areas currently analysed, most relevant and easier to implement, is spread over two sites:
  - 69 MT in the Ravenna area.
  - 35 MT in Sicily.

In addition to spent onshore and offshore hydrocarbon deposits, as mentioned above, permanent storage of CO2 can be carried out in saline aquifers, which, given the increased storage capacity compared to depleted deposits, have less geological knowledge due to lower availability of data and specialist studies. The storage potential of saline aquifers in Italy is not fully known. However, there are several estimates in literature (Buttinelli et al., 2011; Donda et al., 2011, 2013; Civil et al., 2013; Foxes et al., 2015).

In more detail, in the context of studies carried out also through national assessments to identify potential sites for storage of CO_2 in saline aquifers, reference is made to the study work promoted with public funding on system research funds with RSE S.p.A. – Research on the Energy System – in the three-year period 2006-2009 and 2009-2011. The results of this study have led to the investigation of several storage systems in saline aquifers in the areas of Emilia-Romagna, Marche, Abruzzo, on-offshore Alto Adriatic, Medio-Basso Adriatic offshore – Zone B, offshore marchigiano, offshore Calabro, Sulcis coal basin and Malossa onshore (Lombardy). Some of these sites were found to be suitable and a minimum storage capacity of 2.152 million tonnes*of*CO_2 was estimated on these sites. Another public study by the Istituto Nazionale di Oceanography e Geofisica Sperimentale (*donda et al*., 2011) assessed additional storage capacity in saline aquifers considered suitable for an estimated minimum storage capacity (*worst case*) of 2.954 million tonnes of CO_2. Overall, the studies carried out led to the assessment of an overall minimum storage capacity in the aquifer of around 5 billion tonnes of CO_2.

These assessments from scientific literature have not been verified by operators, should be further investigated through dedicated studies and complemented by an exploratory phase aimed at assessing the extent of the aquifer and the characterisation of the storage site.

With reference to the expected timing of injection capacity and the request for further investigation made in this regard by the Commission Recommendations on the proposal to update the INECP, we would point out that the first authorisation was granted in 2023 to carry out an experimental programme called 'CCS Ravenna FPhase 1', the operations of which will start in 2024, with an injection capacity of 25 ktCO2/anno. The emissions captured by the Eni Natural Gas Treatment Plant in Casalborsetti (Ravenna) are channelled to the Porto Corsini Mare West platform and finally injected into the same spent gas field in the offshore ravennate. In the coming years, an Industrial Phase 2 will be launched in the same hub as Ravenna, which will contribute to the decarbonisation of the hard to abate and thermoelectric sectors in Italy and south of Europe. The project development plans provide for its launch in 2027 and the achievement of an injection capacity of 4 MtCO2/anno by 2030. Subsequent expansion phases may allow an injection capacity of 12 MtCO2/anno around 2035 to reach a plateau of around 16 MtCO2/anno over the period 2040-50 in the following years. This development provides for strong synergies between the different fields, progressively integrating new storage sites to reach the mentioned injective targets. This potential for the development of injection capacity is of a programmatic indicative nature and not a binding target.

Injection capacities may be revised upwards in 2030, also taking into account domestic and foreign demand volumes in line with technical constraints.

❖ **CARBON CAPTURE AND STORAGE (CCS): POTENTIAL NATIONAL CO2 CAPTURE NEEDS AND MODE OF TRANSPORT**

Already in the INECP 2019, the possibility to capture and store carbon dioxide in both the energy and industrial sectorsby 2040 was foreseen in order to achieve full decarbonisation of the energy system by 2050. This decarbonisation lever was confirmed in the 'Italian Lungo Strategy for the

Reduction of Greenhouse Gas Emissions'[11]. The document identifies possible pathways to achieve climate neutrality in Italy by 2050. To achieve this goal, CCS has been identified as one of the four key levers to be integrated with energy efficiency. In addition, CCS is considered as an option to address both combustion and process emissions. In particular, the strategy estimated that in Italy 20-40 Mton of CO2 could be avoided by 2050 through the use of CCS.

In response to the Commission's request to quantify the annual CO2 emissions that could be captured per production sector, as well as to provide details of the relevant transport modes, the preliminary results of the study provided for in Decree-Law No 181/23 on mapping the emission clusters and the analysis of the necessary infrastructure highlight the following:

The CO2 emissions in 2022 of the main potential CCUS scope are set out below:

- Hard to Abate Industry: in Italy, 67 MtCO2 can be traced back to the perimeter of the Hard to Abate industries (Steel, Cemento, Ceramico, Chimica, Refinfination, Glass), of which approximately 20 % of the process. These emissions also include those of the processing energy industries (refineries and coke ovens) and those of some large thermoelectric plants integrated into production hubs. Emissions from other industrial sectors amount to 22 MtCO2, of which 4.5 in the Charter sector, which, although national production is substantially free from process emissions, has significant energy needs. Emissions from these sectors as a whole, as shown in Chapter 5, do not appear to be significantly reduced by 2030, although significant changes in production processes are taking place in individual sectors, such as steel where DRI production is expected to be introduced. Drivers that in the hard to abate sector can lead to a higher suitability of some CCS compartments than others are the limits to use alternative technological decarbonisation options to CCS (such as electrification, efficiency, hydrogen and biomethane), the concentration of CO2 in fumes, the volume of emissions of individual industrial hubs and the geographical location in relation to the modes of transport available (mainly by hose and boat to which rail and road transport options are added).

Table 9 – Emissions CO2 industrial sectors Hard to Abate in 2022

	Combustion	Process	Total
Cement and non-metallic minerals	11,4	10,2	21,6
Refining and petrochemical	19,0	0,8	19,9
Steel[12] and other metals	13,9	1,6	15,5
Chemistry and fertilisers	10,1	0,5	10,6
	54,4	**13,1**	**67,5**

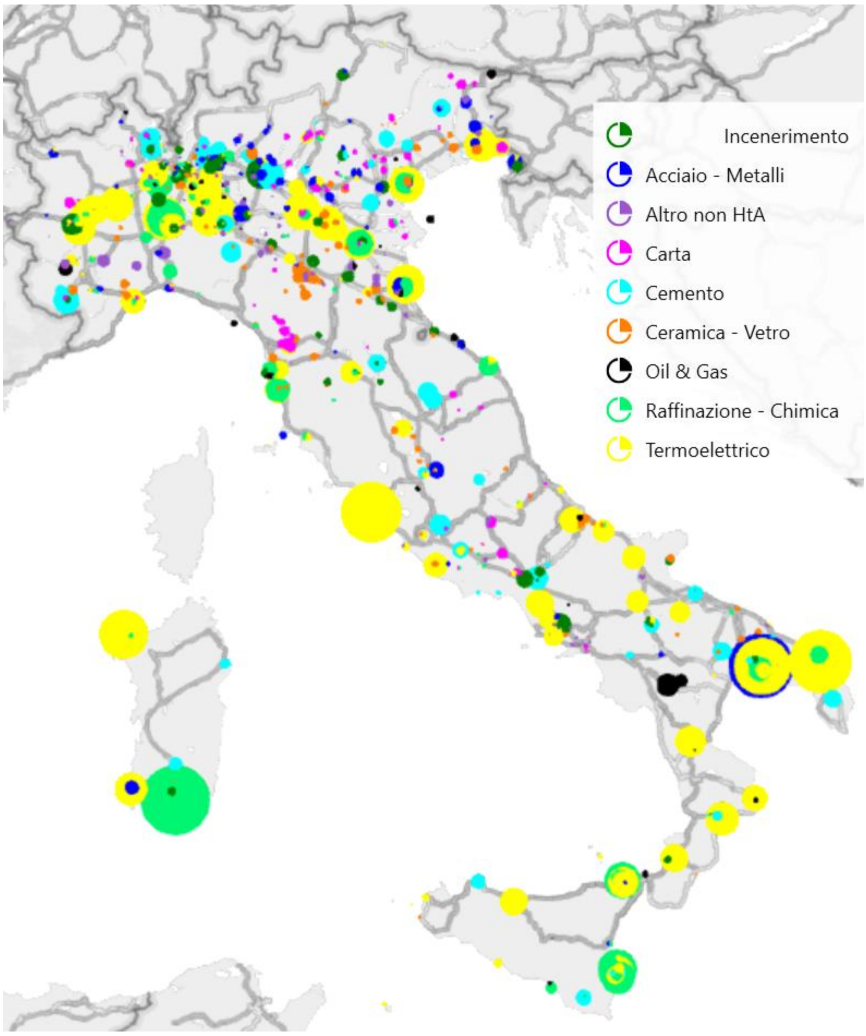
- Incinerators: 36 waste incineration and waste-to-energy plants were operational in 2022 and treat municipal waste and waste resulting from its treatment. The incineration sector produces around 7,5 MtCO2, including those of biogenic origin. The CCUS is the main or only lever of decarbonisation of the sector.
- Blue hydrogen: the production of blue hydrogen (low carbon by capture), complementary to renewable hydrogen (compared to which it has lower production costs), could facilitate faster decarbonisation of industrial sectors in particular those currently using grey hydrogen (e.g. refining, fertilisers) that currently use around 400 kt H2, which are expected

[12] *Including coke production*

to be around 4 $MtCO_2$ counted in the previous Hard to Abate sectors. The use of blue hydrogen is therefore a lever to enable the roll-out of the hydrogen supply chain at lower cost for some user clusters to develop a carrier's market demand to subsequently integrate renewable H_2.

- Thermoelectric: the thermal electricity and heat production sector (IPCC) currently produces 71,4 $MtCO_2$, which is reduced by around half in the scenario with measures until 2030 (due to increased penetration of electricity renewables and phase out of coal). Further work is underway to quantify the electricity system needs in the 2030-40 horizon for decarbonised thermoelectric power generation needed to provide adequacy and safety to the electricity system.
- BECCS, DACCS: estimates of the potential of biogenic CO_2 and captured directly from airpotentially available for Geologic storage are not yet available for these sectors, which are safe for thedevelopment of more forward-looking CCS activities.

Figure 5 – Mapping emissions from industrial sites, incinerators and thermoelectric as part of the activities and clustering of the study referred to in DL 181/23



In order to also test market readiness towards CCS technology, Eni and Snam have launched in recent months a market survey "Survey on the potential market for the transport and storage of CO2 at the Ravenna CCS site" addressed to entities with missile sites on Italian territory and remained active from 7 February to 5 May 2024. The non-binding expressions of interest collected correspond to a potential capture of around 30 Mton/year of CO2 around 2030, confirming the importance attributed to CCS by the Italian industrial fabric, in particular the Hard to Abate, thermoelectric and Waste to Energy sectors. These preliminary market indications, which will complement the further work being carried out in the context of the study referred to in Decree-Law No 181/23, provide a starting point for assessing the technical and economic feasibility of the CCS sector, identifying solutions and optimal solutions from a systemic and market perspective, confirming the timetable for launching and developing the chain for the Ravenna CCS project, in close synergy with the evolution of the regulatory and regulatory framework being developed.

The Italian sites interested in the award are concentrated in Pianura Padana and in some major coastal industrial districts in the south and islands, in line with the distribution of the Italian industrial fabric. The industrial sites in the south and islands, either away from the storage site or located in coastal areas, are more suitable for transport by ship, flexible, modulable and potentially allowing routes and loads to optimise the cost of transport. Transport by ship of CO2 is a crucial transmission mode for decarbonising the heavy industry in Central and South Italy and islands. Over long distances, it offers a flexible, mature connection with a reduced territorial impact, as well as significantly reduced delivery times. It should be noted that the emitters of the industrial hubs of Taranto, Priolo-Augusta and Cagliari, among the main ones in Italy, are located at port infrastructure that will enable them to connect by ship with storage on Ravenna CCS.

The sites located in the Padana Pianura could be connected via the onshore CO2 transport network, the project of which includes a pipeline network connecting the main industrial clusters with the storage infrastructure in Ravenna. A modular development of the network is planned from Ravennate to the rest of the Padana Pianura. The first development phase of the network will connect the areas of Ravenna di Ferrara. Further developments will follow two main lines: one from Ravenna to the north-east and the other from the Padana Pianura to the West. These guidelines will be developed with timeframes, patterns and sizes to be refined in line with the regulatory framework and according to market demands.

In 2030, taking into account current estimates of the temporal profile of injection capacity at the Ravenna storage site, the expected infrastructure developments are estimated to capture 4 Mt CO2 from emitters in the Hard to Abate industrial sectors, waste incineration and gas-fired thermal power generation located in the Po Basin and some large industrial hubs located at the country's port infrastructure.

❖ **NUCLEAR ENERGY: POTENTIAL RUOLO IN THE LONG-TERM STRATEGY TO REACH *NET ZERO* BY 2050**

In the context of the update of the'Italian Strategy of Lungo Terminal on the reduction of greenhouse gas emissions', to be finalised by next year, the recovery in Italian territory of the production of energy from nuclear sources could play an important role, where possible following the necessary amendments to the relevant national legislation.

The electricity sector will play a key role in achieving the 2050 climate neutrality targets, including because electrification of final consumption and hydrogen and e-fuel production *to* decarbonise hard-to-abated sectors will *require* large amounts of electricity, which is in turn decarbonised. International scientific literature agrees that an electricity system fully based on renewable sources, in particular non-programmable sources, **is possible, but not economically efficient**, as there is closer to 100 % renewable share, the more the system costs (e.g. for the development of storage systems and grids) are growing rapidly. There is therefore a need to have a certain share of programmable electricity generation free from climate gas emissions, which could include nuclear power, which can **complement non-programmable renewable sources** to ensure their better integration into the system.

In this context, three specific working groups*,* coordinated by the MASE with RSE and ENEA*,* dealt with:

- assess the availability, development potential, costs and performance of **new fission modular reactors and fusion reactors**, respectively, over a time horizon until 2050;
- based on these parameters, carry out **scenario analyses over the same time horizon** to assess the contribution that these technologies could make to achieving the climate neutrality objectives.

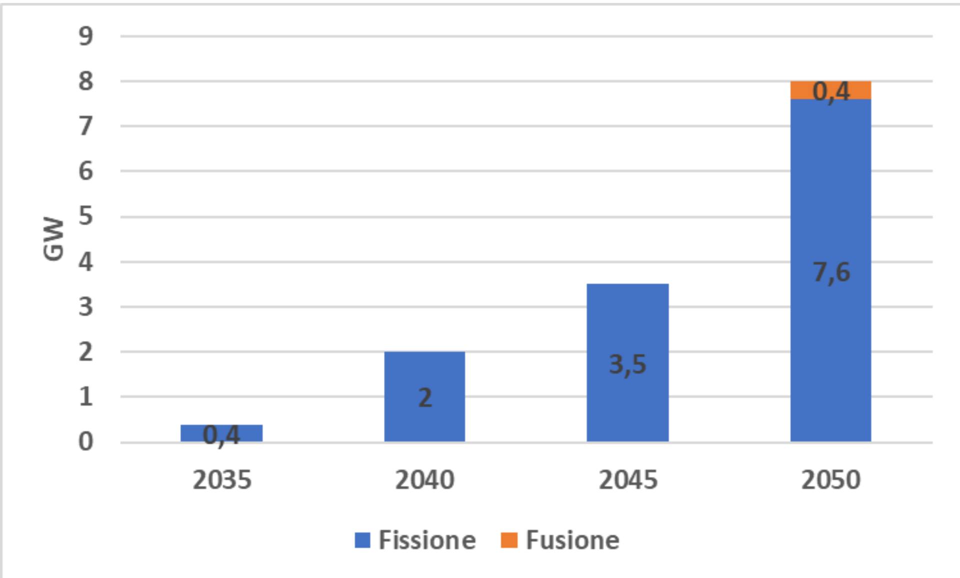
In particular, through the national energy system model 'TIMES_RSE', which is also used to define the scenarios underpinning the INECP, a first exploratory scenario was developed as follows:

- the *same drivers* of demand for energy services (population, GDP, fossil fuel prices, CO2 emission permit$_{prices}$) used for the *policy scenario of the* INECP, defined by the European Commission until 2050;
- energy system configuration as at 2030 corresponding to the *policy scenario of the* INECP;
- net *Zero target* at 2050 for the whole energy system, and in particular also for the electricity system alone;
- the possibility of installing nuclear installations, in the years 2035 to 2050, up to the maximum potential defined *by* the PNNS, depending on the availability of technologies and the industrial and fuel production chain.

The model, given the targets, identifies the **optimal overall minimum cost trajectory of the energy system** to reach them. The result of the downward exercise showed that the estimated development potential of nuclear installations would be fully utilised in all the years considered: this means that **the model considered nuclear technologies both economically and[13] energy-efficient**.

In this way, the usefulness of using nuclear technologies continued, with a more concrete approach, to focus the analysis on a **'conservative' nuclear scenario** characterised by the development of nuclear installations in the order of half of the maximum installed potential, as shown in the following**Figura 6**.

Figure 6 – Development of nuclear generation capacity in the scenario considered, represented by advanced nuclear only (in particular small modular installations: SMR, AMR and microreactors) and, in the years to 2050, a share of fusion energy.



It is interesting to note that, according to the data provided by the PNNS, it is possible to predict a small share of fusion energy close to the year 2050, when the first installations could be available. Fusion energy is therefore expected to develop more globally in the second half of the century, not as an alternative but in synergy with nuclear fission energy and other energy sources.

[13] *The model also identified a specific optimal installation mix of these plants between cogenerative and non-cogenerative versions.*

As mentioned above, for reasons of economic efficiency, it is beneficial to complement non-programmable renewable sources with a share of programmable electricity generation without CO2$_{\text{emissions}}$. In the *'Net Zero'* scenarios by 2050, in the absence of nuclear power, this share is met by hydropower plants in basin and reservoirs, bioenergy generating installations and natural gas generating installations with CO_2 capture and sequestration (CCS). As CCS is not able to capture 100 % of CO2 emitted, to achieve *Net Zero* on the entire power park module, CCS needs to be applied also to part of bioenergy plants, thus generating 'negative' emissions. Moreover, these 'negative' emissions in the electricity sector are also necessary to offset remaining emissions from the industry and transport sectors for the part that cannot be fully decarbonised, with a horizon of 2050.

On the basis of these assumptions, based on the data provided by the PNNS, with specific reference to the technologies of fission SMRs (with installation from 2035 onwards) and fusion reactors (with installation from the second half of the decade 2040-50), the national energy system model 'TIMES_RSE' **is cost-effective,** partly reducing the need to use CCS gas and bioenergy generation[14].

Two scenarios were then compared, the results of which are given in **Figura 7** the following**Figura 8**:

- ***"Nuclear No"*** scenario, which includes all technologies (including renewables and gas/bioenergy with CCS), **without the possibility of using nuclear power**;
- ***"With nuclear"*** scenario, which includes all technologies (including renewables and gas/bioenergy with CCS), **where** it is also possible to include a share of nuclear generation**, which is self-limited to half of the deployable potential** (see above), which would reach 8 GW by[15] 2050.

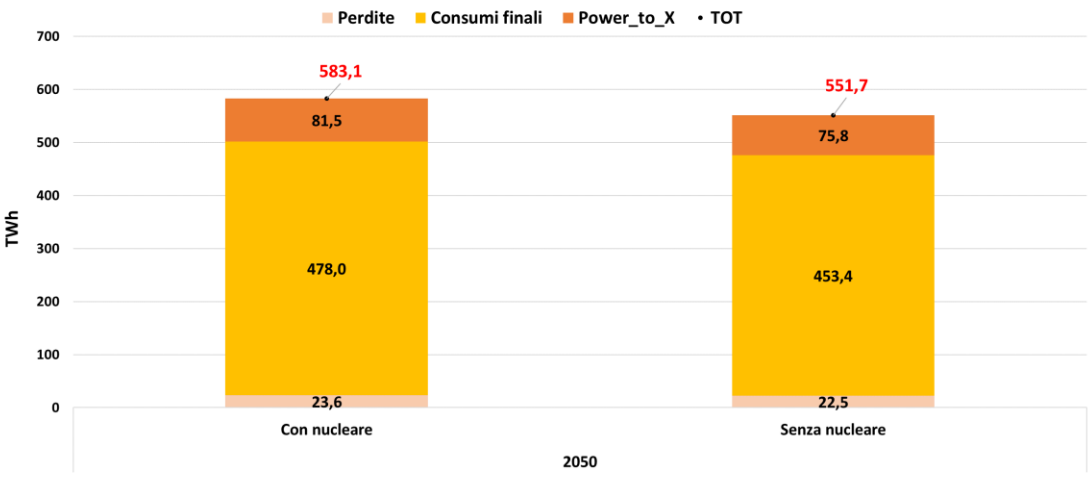
The following shows **Figura 7** the electricity demand at 2 050 in the nuclear-free and non-nuclear scenarios, both of which have a high level of electricity demand, which includes the full potential for the development of renewable sources, in particular photovoltaic and wind. It is noted that this electricity demand is higher in the nuclear scenario: indeed, while the nuclear-free scenario has to compensate for more emissions by using "negative" emissions, the nuclear-based scenario, which can produce electricity at lower cost than conventional CCS installations, decarbonises end-use sectors through increased electrification and production of hydrogen and synthetic fuels[16].

Figure 7 – Electricity request at 2 050 in nuclear and non-nuclear scenarios.

[14] The costs and performance of CCS generating installations used in the model derive from RSE's contribution to the MASE working table 'Study CCUS D.I. Energia'.

*[15] **8 GW is the average value considered**. The reference range is 7,5-8.5 GW. The data provided by the PNNS are derived from analyses carried out within the PNNS and from international literature data.*

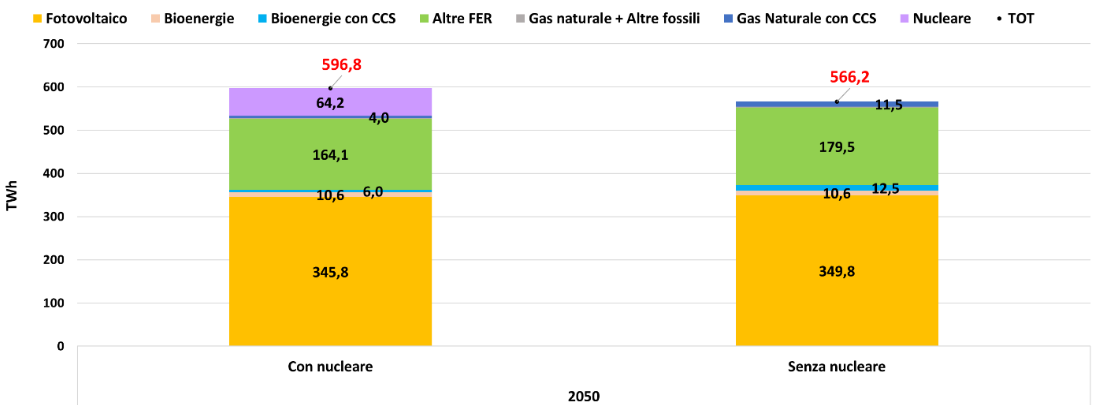
[16] Electricity demand to produce hydrogen and synthetic fuels is shown in the figure with 'Power_to_X'.



On **Figura 8** the other hand, the following shows national electricity production in the scenarios with and without nuclear power[17]. In terms of non-programmable renewable sources, both scenarios in 2 050 are characterised by installed capacity of around 245 GW of photovoltaic and around 51 GW of wind. In both scenarios, a limited amount of imported energy of 17.7 TWh corresponding to the value assumed in the *'EUref2020' scenario is* also considered as a reference for the scenarios underpinning the INECP.

It is noted that in 2050, in the *"With nuclear"* **scenario, nuclear production covers around 11 % of the electricity demand**. In addition to meeting increased demand, nuclear reduces the need for both CCS natural gas generation from 11,5 to 4 TWh and bioenergy production with CCS from 12,5 to 6 TWh.

Figure 8 – National electricity production at 2 050 in nuclear and non-nuclear scenarios.



Of the 8 GW of nuclear generation capacity at 2050, around 1.3 GW operates in cogenerative mode, providing heat to the industrial sector amounting to 16 TWh thermal.

Notes that without the limitation on nuclear capacity to half of the deployable potential, thus considering the development of the full reactor potential from the Platform, **the *"NWith"*scenario would cover around 22 % of the national** electricity demand (around 16 GW of nuclear capacity as at 2050).

[17] *By adding the import/export balance to the national production of Figure 88 and subtracting losses in storage systems, the electricity demand of Figure 77 is obtained.*

The 'TIMES_RSE'model minimises the overall cost of developing the whole energy system over the relevant time horizon, in order to achieve the objectives of the scenario. As can be seen from the different level of demand for electricity in the different scenarios, the different generation costs arising from the presence or non-presence of nuclear power also have an impact on the development of the end-use sectors of energy, and thus on the costs incurred for the installation and use of related consumption technologies. In order to compare scenarios with and without nuclear power from an economic point of view, it is therefore necessary to compare the overall costs of the whole system, not just those incurred in generating electricity. In this respect, the '*TIMES_RSE*' model can provide the total cost of the system incurred over the entire time horizon, updated to date. In addition, the analyses were enriched using an additional model specific to the electricity sector, whereby a simulation of the system focused on the year 2050 was carried out, building on the results of the 'TIMES_RSE'energy model related to electricity demand and supply, again by comparing the *'With Nuclear'* and *'Nuclear Constance'* scenarios. This analysis made it possible to assess:

- the possible presence of *'unsupplied energy'*, i.e. the inability of the system to feed all demand in specific hours;
- the possible presence of *overgeneration,* i.e. excess generation (typically from non-programmable renewable sources) compared to demand in specific hours.

Comparing the cost values for the scenarios considered, therefore, it appears that the Preservation *scenario "with nuclear"* would be able to achieve the *Net Zero objective at* an estimated cost of around EUR 17 billion lower than the cost of the non-nuclear scenario, throughout the relevant time horizon.

Finally, it should be pointed out that:

- the values presented in this paragraph will subsequently be consolidated with a view to updating **the Lungo Period** Strategy, to be finalised by next year;
- the nuclear scenario assumption referred to in this paragraph does **not alter or invalidate in any way the assumptions 2030 underpinning this INECP update and its conclusions**, but merely highlights, following the analyses carried out within the NDP, a potential role of nuclear energy to contribute to *Net Zero* in 2050.

2.1.2 Renewable energy

I. The elements referred to in Article 4(a) (2)

(2) With regard to renewable energy:

In order to achieve the binding EU target of at least 32 % renewable energy in 2030 referred to in Article 3 of Directive (EU) 2018/2001, a contribution in terms of the Member State's share of energy from renewable sources in gross final energy consumption in 2030; from 2021 onwards, this contribution follows an indicative trajectory. By 2022, the indicative trajectory shall reach a reference point of at least 18 % of the total increase in the share of energy from renewable sources between that Member State's binding 2020 national target and its contribution to the 2030 target. By 2025, the indicative trajectory shall reach a reference point of at least 43 % of the total increase in the share of energy from renewable sources between that Member State's binding 2020 national target and its contribution to the 2030 target. By 2027, the indicative trajectory shall reach a reference point of at least 65 % of the total increase in the share of energy from renewable sources between that Member State's binding 2020 national target and its contribution to the 2030 target.

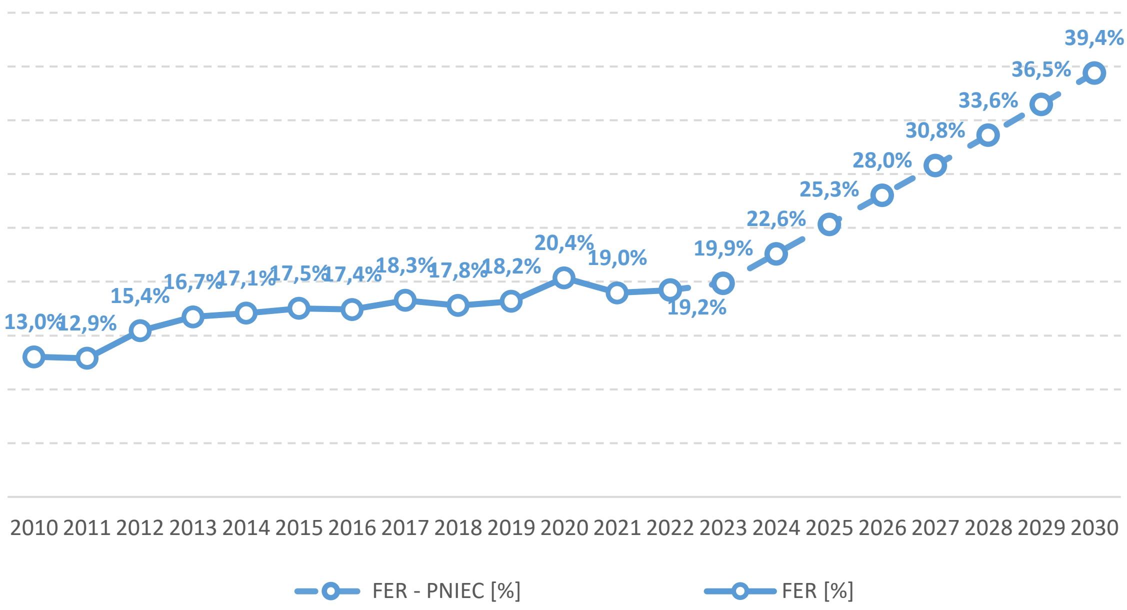
By 2030, the indicative trajectory shall reach at least the Member State's planned contribution. If a Member State expects to surpass its binding 2020 national target, its indicative trajectory may start at the level it is projected to achieve. The Member States' indicative trajectories, taken together, shall add up to the Union reference points in 2022, 2025 and 2027 and to the Union's binding target of at least 32 % renewable energy in 2030. Irrespective of its contribution to the Union target and its indicative trajectory for the purposes of this Regulation, a Member State is free to set more ambitious targets for national policy purposes;

Italy intends to pursue a target of 39.4 % of gross final consumption of energy from renewable sources in 2030[18], setting out an ambitious growth path for these sources with full integration into the national energy system; for 2 030 in particular, gross final energy consumption is estimated at around 110 Mtoe, of which 43 Mtoe from RES.

The evolution of the share covered by renewable sources is in line with the national contribution to the EU target resulting from the application of the formula set out in Annex II to Regulation (EU) No 1999/2018 (38.7 %, so as to reach the EU target of 42.5 %).

[18] For greater certainty, for the years after 2020, the calculation of the item 'share of gross final energy consumption covered by RES' is developed by applying the accounting principles outlined in Directive (EU) 2018/2001 (RED II), as amended by RED III. As the detailed calculation criteria have not yet been disseminated by Eurostat, some of the following values may be amended in the coming months.

Figure 9 - Traiettoria of the overall RES share*(share of gross final consumption of energy covered by renewable sources*) * [Source: GSE, RSE]



** With reference to the data shown in the graph, as well as in the chapter below, the accounting criteria of Directive 2009/28/EC (RED I) apply for the years up to 2020; from 2021 onwards, the accounting standards of Directive (EU) 2018/2001 (RED II), as amended by RED III, apply.*

Table 10 – ERF overall objective at 2030 (ktoe) (Source: RSE, GSE]

ktoe	2021	2022	2025	2030
Numerator – Gross final energy consumption from RES	**22.819**	**22.568**	**29.104**	**43.174**
Gross electricity production from RES	10.207	10.370	13.624	19.585
Final RES consumption for heating and cooling	11.061	10.626	12.490	17.634
Final consumption of RES in transport	1.552	1.573	2.990	5.955
Denominator – Total gross final energy consumption	**120.340**	**117.448**	**114.917**	**109.563**
Total RES share (%)	**19.0 %**	**19.2 %**	**25.3 %**	**39.4 %**

II. Estimated trajectories for the sectoral share of renewable energy in final energy consumption from 2021 to 2 030 in the electricity, heating and cooling, and transport sector

According to the national scenario with policies developed for this Plan, the contribution of renewable sources to meeting national energy consumption in 2030 (39.4 % of total gross final energy consumption) is differentiated between sectors:

- *electricity*: the share of total national consumption of electricity covered by renewable sources of 63.4 %; the aim is also to develop additional capacity from innovative sources of more than 5 GW;
- *thermal sector*: share of total energy consumption for heating and cooling covered by renewable sources of 35.9 %. It should be noted that RED III leads to the identification for Italy of a sectoral target of 29.6 % in 2030, which rises to 39.1 %, taking into account the indicative increases provided for in Annex 1a to that Directive for achieving the target, is intended to make use of the contribution of the recovery of waste heat and the renewable share of electricity consumed for heating, in accordance with the conditions laid down in RED III;
- *transport sector*: share of total energy consumption for transport covered by renewable sources, calculated in accordance with the accounting criteria for the obligation laid down in the revision of RED II as amended by RED III, of 34.2 % compared to a sectoral target of 29 % set by the RED III.

The graphs below show in detail the data on overall and sectoral energy consumption and their share of RES; for the years up to 2022, the statistical data collected are reported, for the following years, scenario calculations.

Figure 10 – Traiettoria of the total RES share [Source: RSE, GSE]

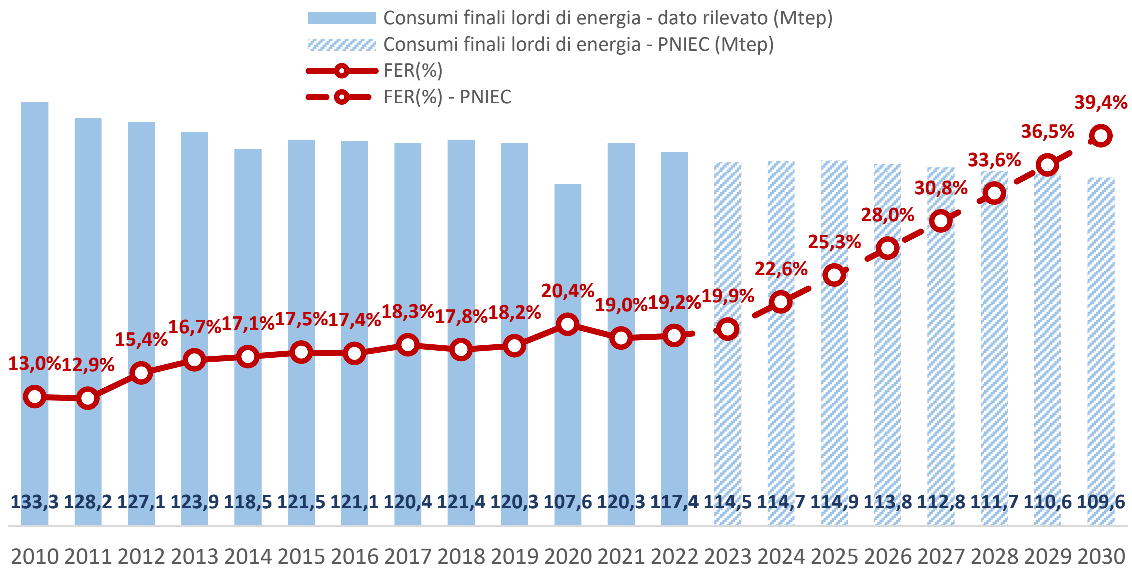


Figure 11 - Traiettoria of the electric RES share [Source: RSE, GSE]

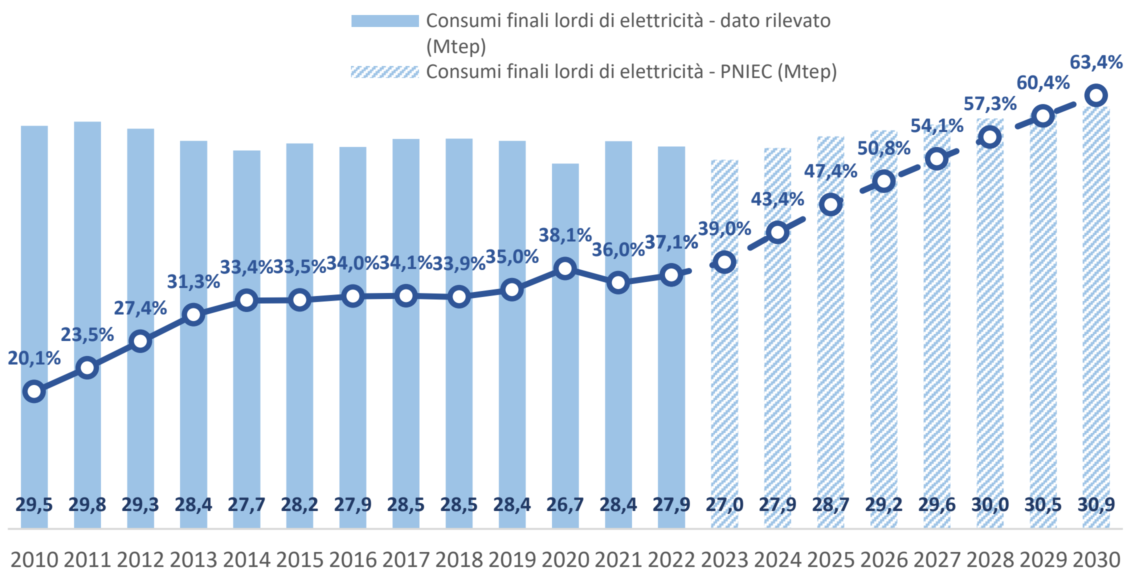


Figure 12 – Traiettoria of the RES share in the heat sector (Source: RSE, GSE]

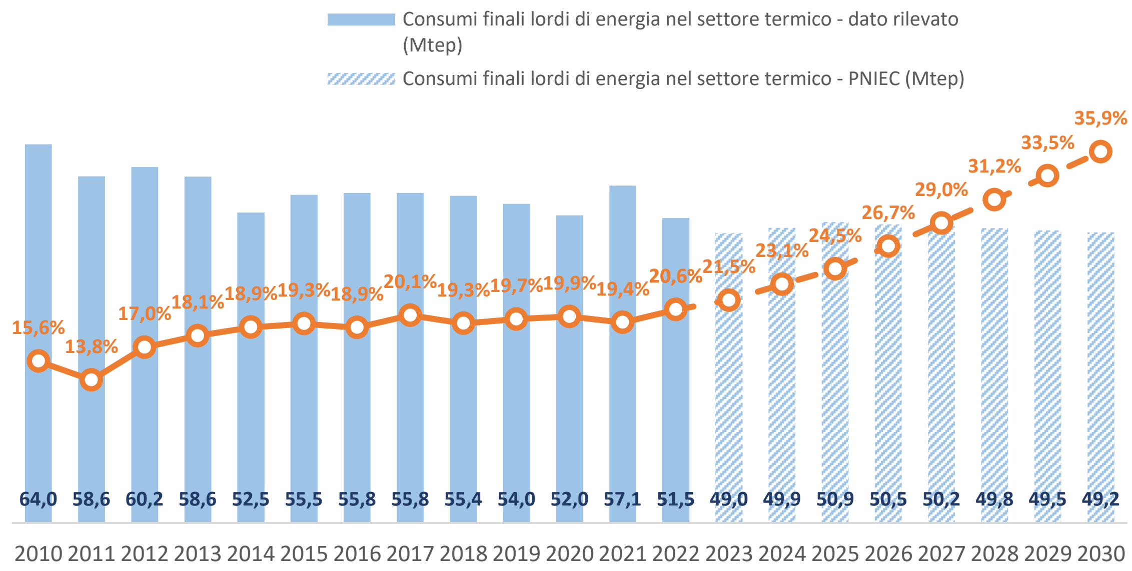
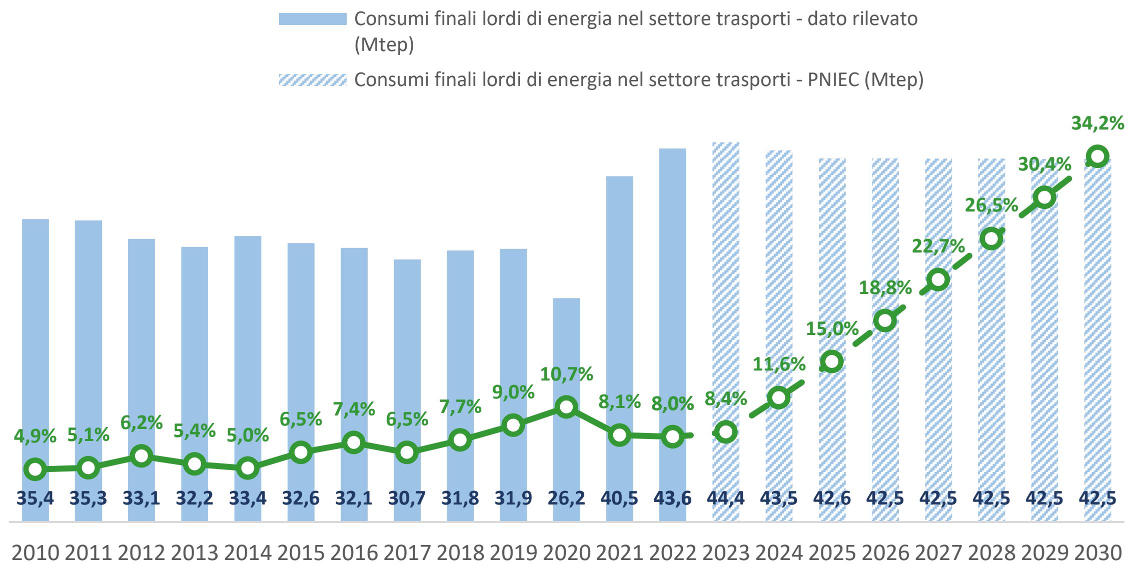


Figure 13 – Traiettoria of the RES share in transport (*) [Source: RSE, GSE]



(*) The variation between the years 2020 and 2 021 in total sectoral consumption in respect of which the share covered by RES is calculated is mainly linked to two phenomena: (1) until 2020, the data shall be calculated by applying the award criteria and multipliers set out in RED I, while from 2021 onwards those set by RED II as revised by RED III, which include all products in the denominator instead of only petrol, diesel, electricity and biofuels; (2) figure 2020 is affected by the effects of the pandemic, which has also affected the transport sector in a particular way.

In this overall context, RED III requires Member States to define certain specific RES penetration targets, which are transversal to the macro-sectors described above. In particular:

- in the district heating and cooling sector, RED III foresees an indicative increase in the renewable share which would lead to a value for Italy close to 48 % by 2030; however, since the energy supplied through district heating and cooling systems was, in 2018, less than 2 % of the national gross final consumption of energy in heating and cooling, in accordance with Article 24 (10) Italy is exempted from this target. For district heating and cooling, it is therefore intended to reach a renewable share equal to that of the heat sector by 2030;

- with regard to the industrial sector, the indicative increases provided for in RED III lead to an RES share of 27 % for Italy in 2030; this is slightly lower than that resulting from the scenario that takes into account all policy effects (28.5 %); it is proposed that this value be achieved through the implementation of the measures described in Chapter 3, using also the contribution that the recovery of waste heat may provide, in accordance with the energy efficiency first principle;
- finally, with regard to buildings, Member States are required to set a target of 49 % RES share at EU level; according to the calculations developed for the policy scenario of this Plan, this share in Italy could amount to 2030, 40.1 %.

III. Estimated trajectories by renewable energy technology that the Member State projects to use to achieve the overall and sectoral trajectories for renewable energy from 2021 to 2030, including expected total gross final energy consumption per technology and sector in Mtoe and total planned installed capacity (divided by new capacity and repowering) per technology and sector in MW

❖ **SECTOR EBEDDING**

According to the objectives of this Plan, the power generating module is undergoing a major transformation through the *phasing out* of coal-fired generation and the promotion of the extensive use of renewable energy sources.

The largest contribution to the growth of renewables will come from the electricity sector. the RES generation will amount to around 237 TWh by 2030, including around 10 TWh for the production of green hydrogen. The strong penetration of renewable electricity generation technologies, mainly onshore photovoltaic and wind, will allow the sector to cover around 63.4 % of gross final electricity consumption with renewable energy, a significant increase from 37.1 % in 2022. Indeed, the significant technical and economically exploitable incremental potential, combined with the reduction in the costs of photovoltaic and wind power plants, suggests an important development of these technologies, the production of which is expected to increase four times and more than triple by 2030 respectively.

In order to achieve the 2030 renewable targets, it will be necessary not only to stimulate new production, but also to preserve existing production and, where possible, to increase it by promoting the revamping and repowering of potentially competitive plants. In particular, the opportunity to encourage investments in revamping and repowering existing wind power with more advanced and efficient machines, taking advantage of the good ventosity of already known and used sites, will also limit the impact on land take.

Such an approach, based on the reduction of land consumption, will be followed in order to steer the deployment of the significant incremental photovoltaic capacity planned for 2030, promoting its installation primarily on buildings, tiles, parking spaces, service areas, etc. However, the deployment of large shore-side photovoltaic plants remains important for achieving the 2030 targets. However, it favours non-productive areas not intended for other uses, such as areas that are not used for agricultural use, including through the process of identifying suitable areas and, in accordance with Directive 2023/2413, in the next two years of the acceleration areas. With this in mind, projects in marginal areas, contaminated sites, landfills and areas along the infrastructure system should be promoted.

Instead of standard shore-side photovoltaic installations will be particularly beneficial for agropolitan installations, aimed at maximising the synergy between electricity production and agricultural activity, in compliance with certain technical and environmental requirements.

Innovative technologieswill support the construction of floating photovoltaic plants, both on inland and offshore waters. Floating photovoltaic installationsrequire the identification of specific technological solutions and safety standards for the particular environmental pressures to which they are subject, especially when in the open sea. Inland water installations, which are present in Italy through a series of experimental and demonstration initiatives, will be able to demonstrate the functionality of these solutions and contribute to the definition of the technical requirements and criteria for their proper inclusion from an environmental and safety point of view. In the short term floating photovoltaic technology can contribute with installations on water bodies of lower environmental value and low hydraulic and structural risk, such as irrigated basins, flooded quarries, industrial basins.

An offshore contribution is also expected from wind, for which the prevailing technology should be floating, as evidenced by the large number of applications for authorisation under way. Floating technology is present in the world only with experimental plants. Pilot plants are being developed in the Mediterranean basin (e.g.: Gulf of Leone plant of 3 MW turbines) where to test possible technological solutions for the different components (floater, anchorages, substations, dynamic cables) that can then be adopted to build large floating installations.

It should also be stressed that the efficient development of offshore floating wind requires the simultaneous development of infrastructure (in particular ports) capable of enabling the deployment and assembly phase of production facilities. At the same time, it is necessary to encourage management of the contractualisation process that takes into account the regional spatial planning and the development of the network envisaged by Terna in order to combine ventosity, impact on the electricity grid, local impact and effects on the regions.

With regard to innovative technologies, including offshore wind (especially floating), as well as floating photovoltaic, agrevoltaic, thermodynamic solar, marine energy and advanced geothermal energy, an additional capacity of more than 5 GW is envisaged.

As far as hydropower is concerned, there is no doubt that this resource is largely already exploited but of major strategic importance in policy in 2030 and in the long term by 2050, and production will need to be preserved and increased.

In this respect, production is expected to grow slightly, partly as a result of increased intrusion volumes, facilitated by the promotion of maintenance of such volumes, for example through actions to reduce the accumulation of material sediment. This increase could be useful in balancing any production declines resulting from severe adverse events.

For bioenergy, it is considered likely to decrease the total power, consistent with a framework for the broad conversion to biomethane of biogas plants, and the use of only installations powered by bioliquids that comply with sustainability requirements and in particular come from national supply chains that ensure their competitiveness. Account should also be taken of the impact of the provisions of Article 40 (1) (c) of Legislative Decree No 199/2021, namely that, from 1 January 2025 at the latest, the share of bioliquids produced from palm oil, empty palm oil fruit bundles and fatty acids resulting from the treatment of palm oil fruits (PFAD) must be zero, unless they are certified at low indirect land-use change risk, in accordance with the criteria laid down in Article 4 of Commission Delegated Regulation (EU) 2019/807.

Table 11 - Renewable power growth targets at 2030 (MW) [Source: RSE, GSE, Terna]

	2021	**2022**	**2025**	**2030**
Water *	19.172	19.265	19.410	19.410
Geothermal * *	817	817	954	1.000
Wind	11.290	11.858	15.823	28.140
— of which off shore	0	0	0	2.100
Bioenergy	4.106	4.050	4.038	3.240
Solar * * *	22.594	25.064	44.173	79.253
— of which at a concentration	0	0	0	80
Total	**57.979**	**61.055**	**84.398**	**131.043**

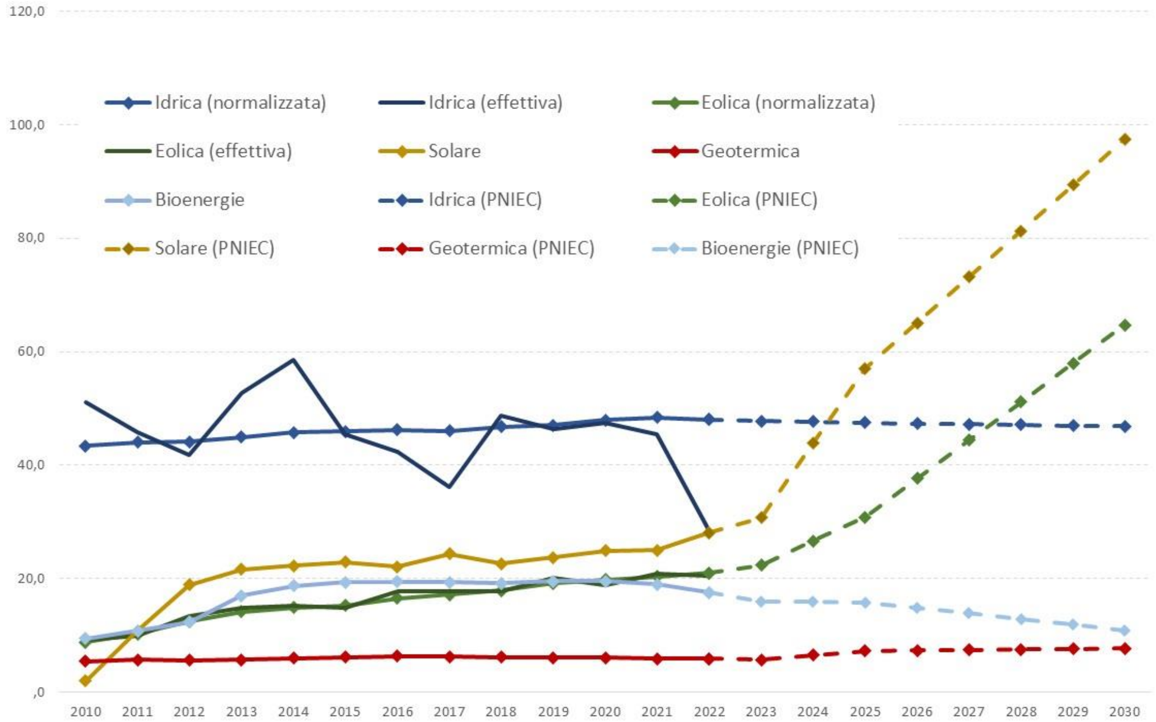
** excludes pure and mixed pumping systems*
* * the *expected geothermal power may be increased if some of the projects under development, in particular on the track cycle, reach a level of maturity compatible with actual implementation, including by means of support tools*
** * * also includes power output for electrolysers*

Table 12 - Growth targets at 2030 of the renewable share in the electricity sector (TWh) [Source: RSE, GSE, Terna]

	2021	2022	2025	2030
Numerator – Production of gross electricity from RES *	**118,7**	**120,6**	**158,4**	**227,8**
Water (actual)	45,4	28,4		
Water (normalised)	48,5	48,1	47,5	46,9
Wind (actual)	20,9	20,5		
Wind (normalised)	20,3	21,0	30,8	64,8
Geothermal	5,9	5,8	7,3	7,5
Bioenergy * *	19,0	17,5	15,8	10,9
Solar * * *	25,0	28,1	57,0	97,6
Denominator – Gross domestic electricity consumption	**329,8**	**325,1**	**334,0**	**359,3**
FER-E share (%)	**36.0 %**	**37.1 %**	**47.4 %**	**63.4 %**

** Electricity production is reported net of uses in electrolysers for hydrogen production, in line with the accounting criteria of RED II as amended by RED III. Considering also the consumption of electrolysers, the gross RES production expected at 2030 would be around 237 TWh.*
** * the contribution of solid biomass, biogas and bioliquids that comply with sustainability requirements shall be reported.*
** * * in this table solar production in 2030 does not include approximately 10 TWh for the operation of electrolysers for the production of green hydrogen.*

Figure 14 - Electricity growth trends from RES at 2030 (TWh) * [Source: GSE, RSE]



** For production from water and wind sources, for the years 2010-2022, both the actual figure (continuous line) and the normalised figure, according to the rules laid down in the RED Directives, are shown. Only the contribution of solid biomass, biogas and bioliquids that comply with sustainability requirements shall be reported.*

❖ **THERMAL TSECTOR**

The thermal sector plays a very important role in achieving renewable targets; a decisive technological change towards solutions that favour the penetration of renewable sources is required. In absolute terms, renewable consumption is projected to reach 17,6 Mtoe in the heating and cooling sector.

The development of the thermal RES sector is influenced by the particulate emissions impacts of existing solid biomass heating systems. Therefore, the installation of new biomass heating systems will need to be guided in such a way as to favour high environmental quality and high-efficiency plants, also considering the possibility of introducing restrictions on ex-novo installations in areas where air quality situations are critical. In order to stimulate the renewal of old installations with efficient and low emission technologies, strict performance requirements for access to incentives for biomass boilers and heat generators will be maintained in the short term.

In this regard, the aim is to encourage the replacement of domestic wood-burning appliances for the benefit of the most efficient and less emitting appliances, which meet the best standards with environmental classification (Ministerial Decree No 186/2017), including the possibility of structuring measures to finance research and technological innovation for this type of plant, in order to further improve their energy and environmental performance.

The aim is also to promote, with a view to the circular economy, the valorisation of agricultural residues, also in order to prevent their burning in the present field and, in accordance with European rules, to promote local biomass by means of a short chain traceability procedure that meets favourable sustainability criteria and overall environmental and social balance.

Heat pumps, given their high performance, will have an increasing weight in the renewable heat mix, further supported by technological progress in the sector, where different performance and characteristics of electric and gas pumps can be compared. It is expected that the increase in the contribution made by heat pumps will be achieved through the installation of new machinery and an increase in the frequency of use of machinery already in operation, as a substitute for fossil fuel consumption. As regards new installations, particular attention will be paid to the development of geothermal applications, in view of high performance.

Heat pumps and summer conditioners will then make a significant contribution also through renewable energy for cooling; the combined effect of the expected increase in cooling needs and the increase in the average performance of machines will lead to a significant increase in this contribution.

In order to help decarbonise the uses of natural gas, the aim is to promote the introduction of biomethane into the network and its destination for the heat sector where the use of approximately 3,2 Mtoe of biomethane (or about 4 billion m^3) is envisaged, with particular reference to the industrial sector.

With the same aim, the process already undertaken to promote the production of hydrogen from renewable sources and its use in hard to abate industrial sectors will continue.

Solar thermal can play a growing role in integrated efficient and renewable heat production systems, such as hybrid systems and integration into district heating installations, including through the promotion of seasonal accumulation.

The increase in the share of total consumption for heating and cooling covered by RES will also be achieved through a widespread upgrading of the existing building stock leading to a greater contribution from heat pumps (ambient heat) and a significant reduction in consumption, in particular fossil fuels.

For district heating from renewable sources and waste heat from different industrial processes, there is scope for development, driven also by specific obligations on operators already laid down in the legislation; in order to exploit this potential, it will be important to exploit synergies between the use of renewable energy sources and high-efficiency cogeneration, taking into account the specific climatic and technical and economic conditions.

Finally, according to the calculations developed for this Plan, the total national production of biogas for thermal and electrical uses and biomethane for combustion and use in transport will amount to approximately 4,6 Mtoe in 2030.

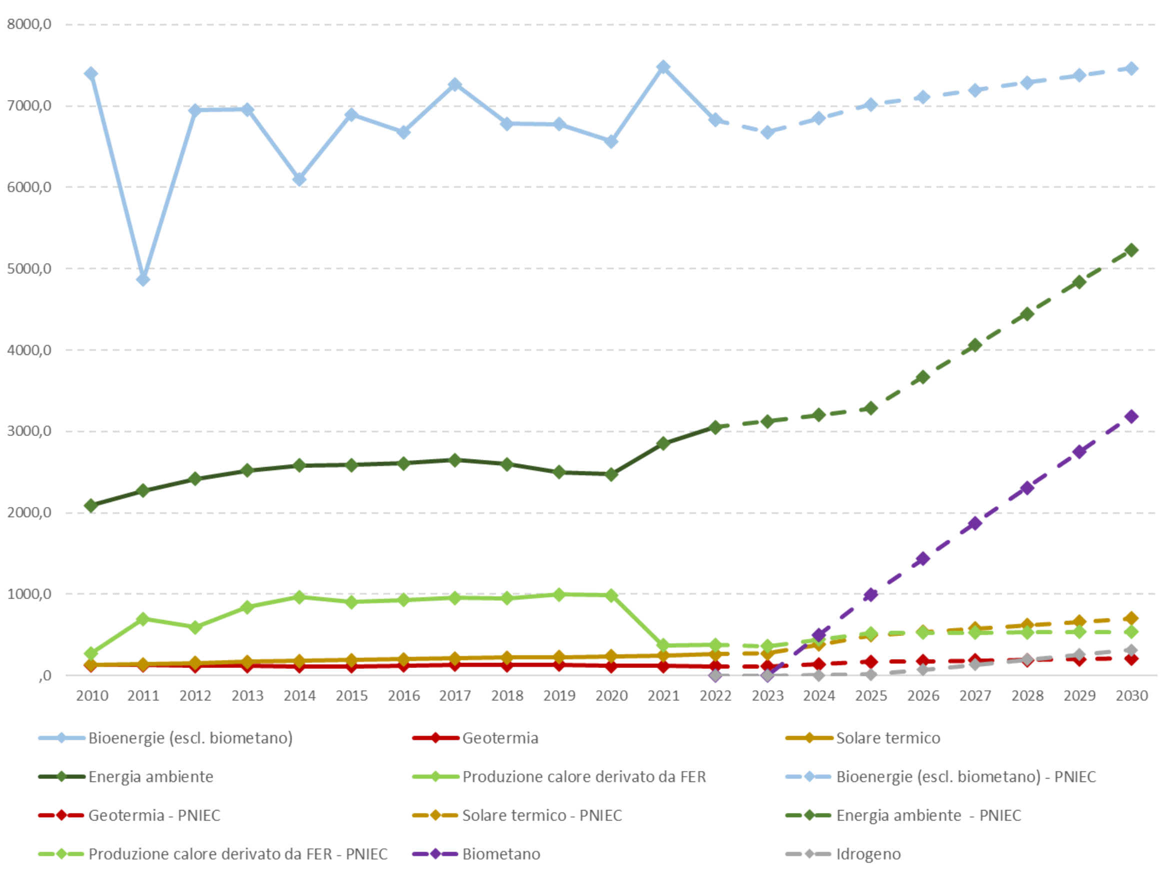
Table 13 - Growth targets at 2030 of the renewable share in the heat sector (ktoe) [Source: GSE, RSE]

	2021	2022	2025	2030
Numerator	**11.061**	**10.626**	**12.490**	**17.634**
Gross production of RES heat	373	373	519	537
Final RES consumption for heating and cooling	10.688	10.252	11.970	17.097
*of which biomethane **	*0*	*0*	*996*	*3.186*
*of which other bioenergy **	*7.477*	*6.827*	*7.018*	*7.464*
of which solar	*247*	*263*	*494*	*699*
of which geothermal	*115*	*110*	*167*	*208*
of which hydrogen	*0*	*0*	*12*	*315*
of which ambient energy	*2.849*	*3.052*	*3.284*	*5.225*
Denominator – Gross final consumption in the thermal sector	*57.068*	*51.538*	*50.884*	*49.159*
FER-C share (%)	*19.4 %*	*20.6 %*	*24.5 %*	*35.9 %*
Possible contribution of waste heat and renewable electricity (flexibility) * *				450
Flexible FER-C share (%)				36.5 %

** Only the contribution of solid biomass, biogas (including biomethane) and bioliquids (including biodiesel and bio-LPG) that comply with sustainability requirements*

** * assumption of the cumulative contribution of annual increases between 2021 and 2030 of renewable electricity used for heating and waste heat recovered through district heating systems*

Figure 15 - Energy growth trends from RES to 2 030 in the thermal sector – ktoe (Source: GSE, RSE]



❖ **TRANSPORT SECTOR**

The RED III Directive further increased the specific transport target to 2030 under RED II (by 14 %) to 29 %. To achieve this objective, the obligation for suppliers should be gradually increased and the use of multiple energy carriers should be promoted at the same time; the combined effect of the measures is projected to reach a 34.2 % renewable share.

It is important to stress that direct electrification of transport and the use of biofuels will play a complementary role in decarbonising the transport sector. While electrification of transport is a solution for new registrations in particular of light-duty vehicles, biofuels will have a key role to play already in the short term as they contribute to the decarbonisation of the existing fleet and not only to that of new registrations. In addition, in the long term, biofuels will play an important role in decarbonising hard-to-electrify sectors, in particular in aviation and shipping, notably through the implementation of Regulation (EU) 2023/1805 on the use of renewable and low-carbon fuels in maritime transport and Regulation (EU) 2023/2405 on ensuring a level playing field for sustainable aviation.

In addition, with a view to technological neutrality, the purchase of light vehicles in the case of low carbon fuels should be facilitated for *freight transport*.

The optimal mix for achieving the target for renewable sources in transport appears from the following guidance from the different types of renewable sources:

- first generation biofuels: for single-counting biofuels, an absolute increase is estimated (from around 98 ktoe in 2022 to 977 ktoe in 2030, equivalent to 2.3 % of total transport consumption). In line with the Directive, however, provision is made for the abandonment of the use of palm biofuels and any other high ILUC (ILUC) risk feedstock;
- advanced biofuel: it is planned to exceed the specific target laid down in RED III of 5.5 % in 2030 (cumulative target with renewable fuels of non-biological origin, of which 1 % is mandatory by the latter), by updating the incentive mechanisms provided for advanced biomethane and other advanced biofuels (by Ministerial Decree of 2 March 2018, Ministerial Decree of 15 September 2022, Ministerial Decree of 16 March 2023 and Ministerial Decree of 20 October 2023) until a target of around 11.6 % is reached;
- biofuels Annex IX Part B: the list of materials, which initially only provided for waste vegetable oils and animal fats, has recently been extended. For this reason, while the Directive imposes a cap of 1.7 %, leaving the possibility for Member States to increase this value, an increase of up to 2.5 % in 2030 had already been proposed in the previous INECP, with a final contribution of up to 5 % (with double counting); this ambition must be achieved in particular with raw materials harvested on national territory, respecting the circular economy principle and discouraging the use of imported products whose sustainability and traceability is less certain. In view of the increase in ambition and the availability of new raw materials in Annex IX Part B, the cap on raw materials set out in Part B of Annex IX is already expected to increase by up to 5 % (with a contribution to the target of up to 10 % taking into account double counting). A formal request to the European Commission to that effect will be submitted after having agreed with the EC on the formal procedure for such a request;
- RES electricity consumed in the road sector: a major contribution from pure electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV) is expected in 2030, which appear to be a solution for private urban mobility contributing to the reduction of final consumption in private transport on equal travel and to support the integration of electricity production. An overall deployment of almost 6.5 million electrically powered vehicles in 2030 of which around 4.3 million pure electric vehicles (BEVs), which together with plug-in hybrid vehicles and Full Hybrid vehicles can contribute to reducing emissions

from the transport sector; the aim is to introduce mandatory electric vehicle quotas specifically for public transport; the RED III will also be implemented by issuing certificates for release for consumption in the case of public renewable electric recharges. Overall, an ERF contribution of 0,6 Mtoe (2,4 Mtoe considering the rewarding coefficient of 4) is expected to contribute by RES on the road;

- RES electricity consumed in rail transport: these consumption will account for around 0,6 Mtoe, multiplied by 1,5 (multiplying factor), accounting for around 2 % of total sectoral consumption. Priority will be given to actions and measures on this segment, which is the most energy-efficient mode, together with shipping, mobility for people and goods;
- renewable non-biological fuels (RFNBO): hydrogen produced by non-organic RES is expected to contribute at least 2 % of the total sectoral consumption, higher than required by RED III (including double counting); this contribution will be provided through use in refinery or direct use in cars, buses, heavy transport and hydrogen trains (for certain non-electrified sections) and, in the medium to long term, in marine and air transport or through the introduction of methane also for transport use. The way hydrogen used in refinery is also counted for biofuel production, as set out in RED III, will be regulated;
- hydrogen of biological origin, produced by biomass gasification or by steam reforming biomethane: this type of fuel is expected to play an increasing role in achieving decarbonisation, but its magnitude is difficult to quantify at present; a process should be undertaken to enable the individual types to be classified in terms of production, environment, technical and regulatory aspects;
- aviation and maritimebiofuels: an important contribution from these sectors, stemming both from the new provisions of the RED III Directive, which provides for the extension of RES use targets to these sectors, and in particular from the provisions laid down in the Specific Regulations (EU) 2023/1805 and 2023/2405mentioned above. Asregards the maritime sector, where the obligations are laid down in terms of emission intensity, the effectiveness of using new sectors, such as methanol from renewable sources, should also be investigated. Finally, specific sectors in the aviation sector should be identified, following the recent update of Annex IX to RED II. At first instance, aviation and navigation biofuels are estimated to be released for consumption at around 235 ktoe by 2030, plus the consumption of RFNBO (36 ktoe) and biomethane (59 ktoe);
- recycled fossil fuels: they are non-renewable fuels produced through carbon recovery, with emission life-cycle savings of at least 70 % (example: separately collected plastics or fuel obtained from recovery of CO_2 from steelworks). This type of fuel will certainly play a role in achieving decarbonisation by enhancing waste recovery, from a circular economy perspective, but its size is difficult to quantify; a process will have to be undertaken to enable the individual types to be classified in terms of production, environment, technical and regulatory aspects.

Table 14 – Contribution from RES in the transport sector foreseen in 2030, according to the calculation criteria set out in RED III for the obligations of fuel and electricity suppliers – by mode of transport (ktoe) *

	coeff. Red III since 2021	2021	2022	2025	2030
Numerator – RES energy		**3.283**	**3.477**	**6.381**	**14.529**

Liquid biofuels		1.415	1.388	2.501	4.687
— of which single counting	**1**	213	98	629	977
of which double counting		1.202	1.291	1.872	3.710
of which by road/iron	**2**	1.202	1.291	1.781	3.475
of which in ships or aircraft	**2,4**	0	0	90	235
Biomethane		137	180	478	877
— of which single counting	**1**	0	5	0	0
of which double counting		136	180	478	877
of which by road/iron	**2**	136	185	467	817
of which in ships or aircraft	**2,4**	0	0	11	59
Renewable electricity		270	287	495	1.332
— of which in road transport	**4**	14	19	121	609
— of which in iron transport	**1,5**	163	178	263	567
— of which in other types of transport	**1**	93	90	111	156
RFNBO		0	0	11	390
of which by road/iron	**2**	0	0	11	356
of which in ships or aircraft	**3**	0	0	0	36
Denominator – Gross final consumption in transport		**40.454**	**43.642**	**42.565**	**42.467**
FER-T share (%)		**8.1 %**	**8.0 %**	**15.0 %**	**34.2 %**

** The contributions of individual components are shown in the table without applying their multiplicative factors. The total numerator, on the other hand, is obtained taking into account multipliers. Denominator values take into account the application of multipliers, in line with current accounting criteria. For more details on the accounting criteria stemming from the RED Directives, see Tables 59 and 60.*

Table 15 – Contribution from RES in the transport sector foreseen in 2030, according to the calculation criteria set out in RED III for the obligations of fuel and electricity suppliers – by type of raw material (ktoe)

with multipliers	**2021**	**2022**	**2025**	**2030**
Numerator – RES energy	**3.283**	**3.477**	**6.381**	**14.529**
Liquid biofuels	2.618	2.679	4.409	8.490
— of which single counting	213	98	629	977
— of which not advanced double counting	1.600	1.715	2.278	4.280
— of which advanced double counting	805	866	1.502	3.233
Biomethane	273	365	961	1.777
— of which single counting	0	5	0	0
— of which not advanced double counting	0	0	0	0
— of which advanced double counting	272	360	961	1.777
Renewable electricity	393	433	989	3.443
RFNBO	0	0	23	819
Denominator – Gross final consumption in transport	**40.454**	**43.642**	**42.565**	**42.467**
FER-T share (%)	**8.1 %**	**8.0 %**	**15.0 %**	**34.2 %**

Figure 16 - Developments in biofuels in the transport sector [Source: GSE, RSE]

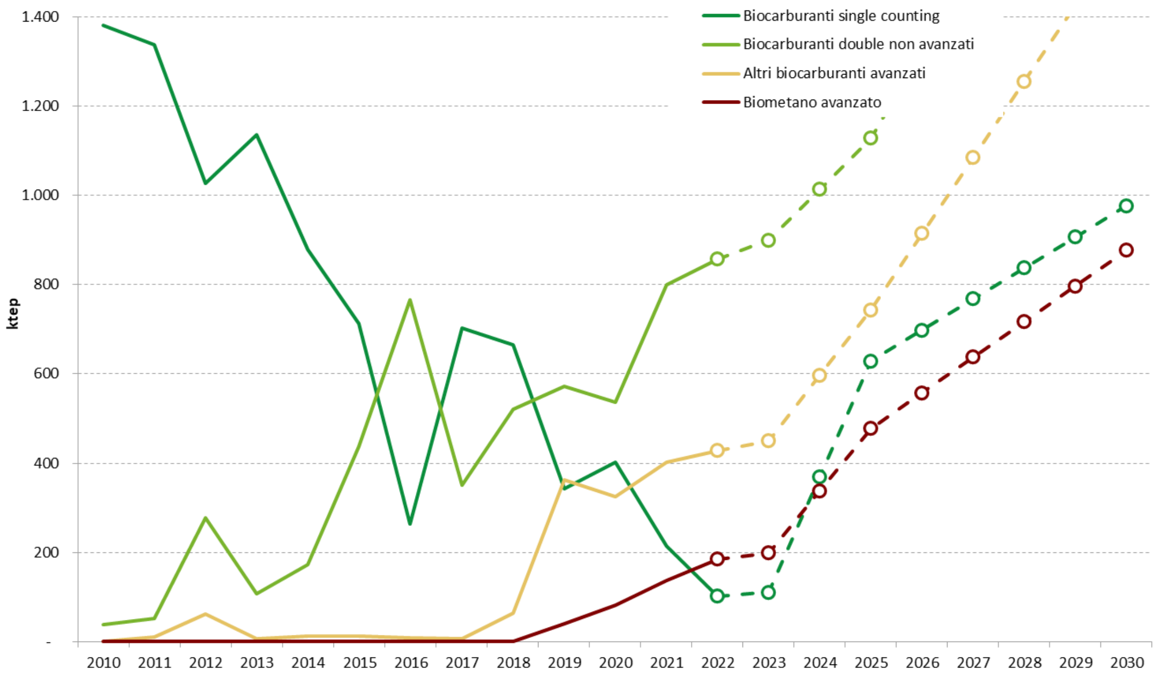
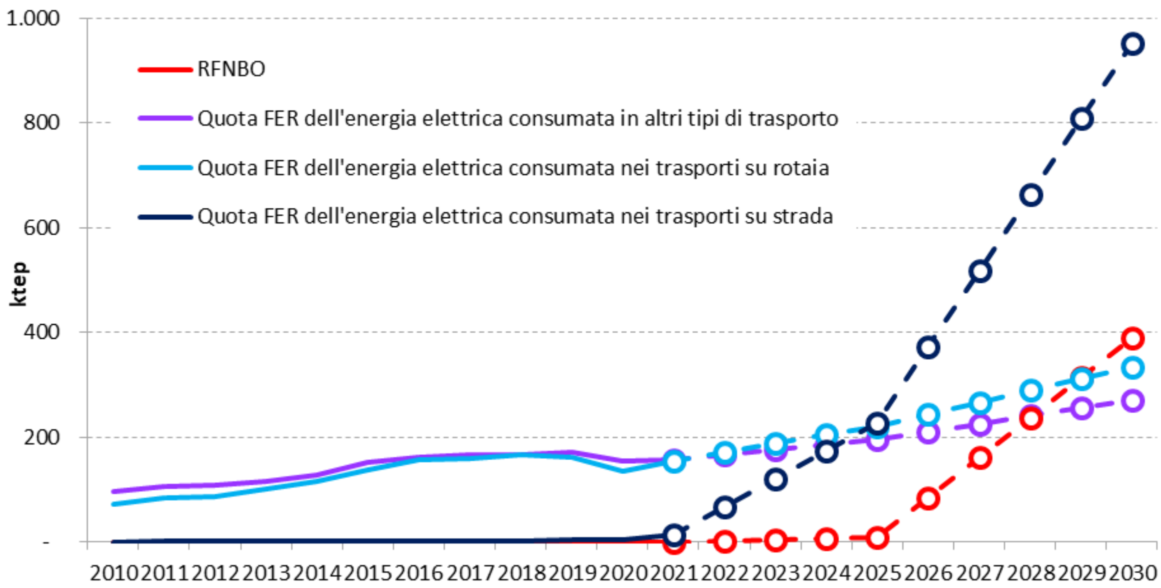


Figure 17 - Developments in RFNBO consumption and RES share of electricity in the transport sector [Source: GSE, RSE]



❖ **HYDROGEN**

RED III, Regulation (EU) 2023/1805 on the use of renewable and low-carbon fuels in maritime transport and Regulation (EU) 2023/2405 on ensuring a level playing field for sustainable aviation have set specific targets on renewable hydrogen and renewable fuels of non-biological origin:

- by 2030, the contribution of renewable fuels of non-biological origin used for final energy and non-energy purposes in industry (excluding refineries) shall be at least 42 % of hydrogen used for final energy and non-energy purposes in industry. By 2035, this contribution should increase to 60 % (RED III);
- by 2030, at least 1 % of the energy supplied to the transport sector must come from renewable fuels of non-biological origin, taking due account of the methodology for calculating double counting provided for in RED III;
- since 2030, at least 1.2 % of aviation fuel (national and international) has to come from renewable fuels of non-biological origin. However, it is possible to achieve this target also through recycled carbon fuels, renewable hydrogen and other low carbon fuels (Regulation (EU) 2023/2405);
- since 2030, States have to ensure that at least 1.2 % of the energy supplied to the maritime sector (domestic and international) comes from renewable fuels of non-biological origin (RED III). Furthermore, from 2025 to 2050, Regulation (EC) No 2023/1805 provides for an increasing obligation to reduce greenhouse gas emissions from the energy consumed, to be pursued by biofuels, biogas, renewable liquid and gaseous fuels of non-biological origin and recycled carbon fuels.

The values for the first target listed above may be reduced by 20 % where the Member State is on track to achieve the renewable energy production target, or the share of hydrogen from fossil fuels consumed does not exceed 23 % in 2030 and 20 % in 2035.

Given that the definition of the specific national obligations will only be quantified following the adoption of the aforementioned Directive and the Regulations mentioned above, we will present an initial assessment of the aforementioned obligations and the definition of the national objectives in this area.

Projections for the use of hydrogen in industry amount to around 330 ktoe of renewable hydrogen reaching a 54 % share of industrial hydrogen consumed by 2030. For transport, an overall consumption of around 390 ktoe of renewable hydrogen (including RFNBOs other than hydrogen) is estimated (for more details see the dedicated paragraph). In addition to the above, it is considered important to assess the need to promote the use of low-carbon hydrogen as a vector to decarbonise the hard-to-abated sectors and transport, in particular shipping and aviation, in combination with the use of CCS.

Overall, the consumption of renewable hydrogen at 2030 would amount to around 0,25 Mton/year. It is estimated that at least 70 % of the application will be produced on the national territory, the remaining quota will be imported. Assuming a 40 % load-factor of electrolysers, a (electrical) capacity of approximately 3 GW of electrolysers would be needed.

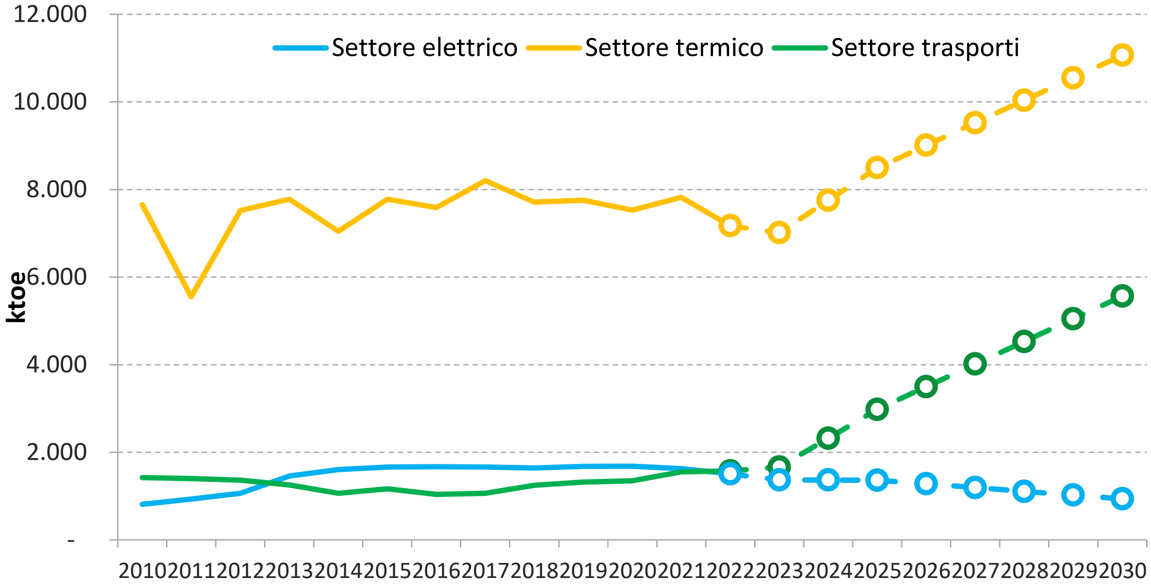
The table below shows a synopsis showing the 2030 minimum hydrogen consumption targets.

16 Table – Estimated hydrogen consumption targets for 2030

Year	Sector	Quantity H_2	
		ktoe	Mton
2030	Industry	330	0,115
	Transport	391	0,137
	of which aviation/navigation	*36*	*0,013*
	TOTAL	**721**	**0,252**

IV. Estimated trajectories on bioenergy demand, disaggregated between heat, electricity and transport, and on biomass supply by feedstocks and origin (distinguishing between domestic production and imports). For forest biomass, an assessment of its source and impact on the LULUCF sink

Figure 18 – Developing trends in the contribution of bioenergy in the different sectors to reach the 2030 RES target [Source: GSE and RSE]



As regards the heat sector, a broadly stable trend in solid biomass consumption and very strong growth in biomethane is expected. While for the former, low variability in the supply mix is expected (currently 80-85 % in energy content from national sources), biomethane will be exclusively national; this will lead to an increase in the share of overall bioenergy consumption covered by domestic production/origin. However, the effects will be accounted, where relevant, in terms of changes in emissions/removals from the LULUCF sector.

In the electricity sector, there is an estimated reduction in total bioenergy production, since – although all sources can and should make an important contribution during the transition period – we expect a sustained trend in upgrading plants from biogas to biomethane production and using only installations powered by bioliquids that comply with the sustainability requirements laid down in Article 42 of Legislative Decree No 199/2021 and, in particular, come from national supply chains that ensure their competitiveness.

In the heat and electricity sectors, sustainability constraints – introduced by RED II and reinforced by RED III – are likely to change the structure, size and type of solid biomass supply chains and biogas; however, at present it is not possible to develop precise quantification of the impacts of these phenomena.

Finally, for the transport sector, a strong increase in the use of biomethane is expected, in this case accompanied by increases in other types of biofuels.

According to the policy scenario, domestic production of liquid biofuels used in agriculture, civil and transport will meet around 70 % of consumption by 2030.

v. Where applicable, other national trajectories and objectives, including those that are long term or sectoral (e.g. share of renewable energy in district heating, renewable energy use in buildings, renewable energy produced by cities, renewable energy communities and renewables self-consumers, energy recovered from the sludge acquired through the treatment of wastewater)

Italy has a great interest in the deployment of renewable sources in all areas, such as – as well as generically in the electricity, thermal and transport sectors – also in specific contexts such as self-generation systems, shared energy configurations (collective self-consumption, energy communities), buildings, district heating and industry. In some of these areas, the new Renewable Directive also sets very ambitious targets (some details are set out in the previous paragraphs).

In order to facilitate the deployment of plants with renewable sources in the area, by Legislative Decree No 199/2021, Italy introduced the category of suitable areas, immediately identifying some of them with national legislation and calling for regional legislation to identify additional areas on the basis of uniform criteria and principles identified at national level. In addition, Directive 2023/2413 (RED3) lays down the obligation for Member States to map the areas needed for national contributions to the overall EU target for 2030. See paragraph 3.1.2 for a detailed description.

It is of course important to accompany the whole process of strong penetration of renewables in all sectors with enhanced simplification and digitalisation of permitting processes. One of the new reforms provided for in the revised RRP at the end of 2024 is the creation of a single text for authorisation procedures for renewable energy, in line with the provisions of Law n.118/2022 (Competition 2021). The RRP itself provides for a comprehensive and comprehensive intervention strategy for the modernisation of the PA, through full digitalisation of internal processes through the re-engineering of administrative procedures as well as the development of new technological infrastructures and digital services. Further facilitation of the process of penetration of renewables will be achieved through the implementation of the so-called Digital Platform for Appropriate Areas (IAP) and the standardisation of regional authorisation models and local authorities through the single digital platform for authorisations for renewable installations.

2.2 Dimension energy efficiency

I. The elements referred to in Article 4(b)

(1) the indicative national energy efficiency contribution required to achieve the Union’s energy efficiency targets of at least 32.5 % in 2030 referred to in Article 1(1) and Article 3(5) of Directive 2012/27/EU, based on primary or final energy consumption, primary or final energy savings, or energy intensity; Member States shall express their contribution in terms of absolute level of primary energy consumption and final energy consumption in 2020, and in terms of absolute level of primary energy consumption and final energy consumption in 2030, with an indicative trajectory for that contribution from 2021 onwards. They shall explain their underlying methodology and the conversion factors used;

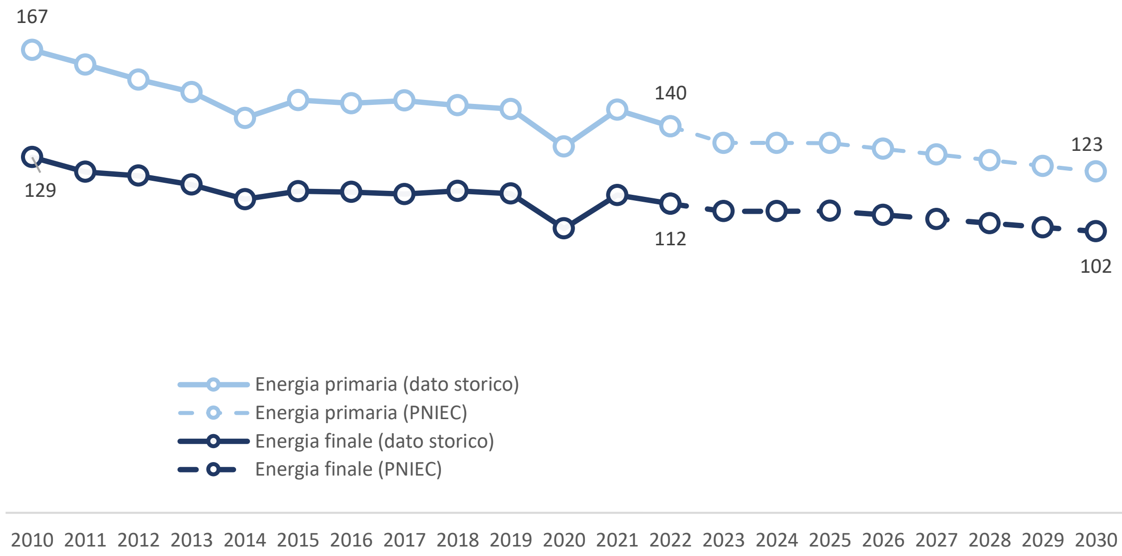
In order to help achieve the European Union’s binding target for final energy consumption (as referred to in Article 4 (1) and Annex I to EED[19] III), according to the calculation formula set out in Annex I to EED III, Italy’s level of consumption should be 92,1 Mtoe of final energy and 112,2 Mtoe of primary energy in 2030. Compared to these consumption levels, the EED III provides for a flexibility of + 2.5 % (Article 4(4)): the application of this flexibility brings the indicative targets for Italy, as set out in the Directive, to 115 Mtoe of primary energy and 94,4 Mtoe of final energy.

The European Commission has verified that the national scenarios for final consumption, indicated by the countries in their draft integrated national energy and climate plans, exceed the binding consumption target at European level. Therefore,as provided for in the Directive, further efforts toreduce consumption were distributed among those countries which had indicated consumption scenarios exceeding the national targets. The distribution of additional efforts concerned only consumption within the limit of the 2.5 % allowance, i.e. Italy’s target of final consumption increased from 94,4 Mtoe to 93,05 Mtoe.

The national policy scenario, which internalises the effect on consumption reduction of implemented and planned measures, estimates final consumption of around 102 Mtoe by 2030. In order to bring this level of consumption to the indicative target described above, further measures in the ESR sectors will be assessed in order to contribute to the emission reduction target at the same time.

[19] *Energy Efficiency Directive.*

Figure 19 - Current of primary and final energy consumption (Mtoe) in the period 2010-2030



(2) the cumulative amount of energy end-use savings to be achieved during the period 2021-2030 pursuant to Article 7(1)(b) on energy efficiency obligation schemes under Directive 2012/27/EU;

In accordance with Article 8(1) EED III, the energy savings target set for each Member State and to be achieved between 1 January 2021 and 31 December 2030 shall be a minimum of:

- 0.8 % per year in the period 2021-2023;
- 1.3 % per year in the period 2024-2025;
- 1.5 % per year in the period 2026-2027;
- by 1.9 % per year in the period 2028-2030.

calculated on the basis of the average final energy consumption over the three-year period 2016-2018.

The first step needed to calculate the savings target is the definition of the amount of final energy consumed in those years at national level. Eurostat statistical data (Online data code: NRG_IND_EFF, Final Energy Consumption Europe 2020-2030).

The table below shows the data on the Italian situation, which is the basis for the calculation.

Table 17 - final distributed energy and average for the three-year period 2016-2018 (data in Mtoe)

[processing of Eurostat data]

	2016	2017	2018
Final energy consumption	115,92	115,19	116,33
Average for the three-year period 2016-2018		115,81	

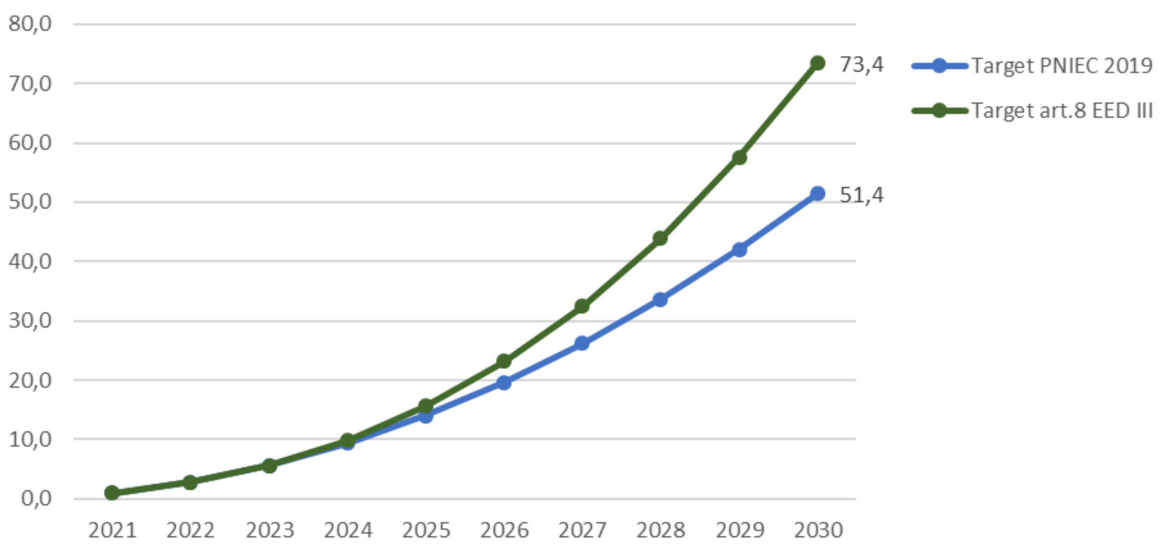
On the basis of the average final energy consumption over the three-year period 2016-2018, it is possible to calculate the annual savings to be achieved in the period 2021-2030; as a result, the cumulative savings to be achieved by 31 December 2030 shall be calculated. These values are shown in the table below.

Table 18 – Savings to be achieved in the period 2021-2030 on the basis of the calculation provided for in Article 8(1) EED III (data in Mtoe)

Year	Annual savings	Annual final energy savings (Mtoe)										Total year (Mtoe)	Cumulative annual total (Mtoe)
		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030		
2021	0.80 %	0,93										0,93	0,93
2022	0.80 %	0,93	0,93									1,85	2,78
2023	0.80 %	0,93	0,93	0,93								2,78	5,56
2024	1.30 %	0,93	0,93	0,93	1,51							4,28	9,84
2025	1.30 %	0,93	0,93	0,93	1,51	1,51						5,79	15,63
2026	1.50 %	0,93	0,93	0,93	1,51	1,51	1,74					7,53	23,16
2027	1.50 %	0,93	0,93	0,93	1,51	1,51	1,74	1,74				9,26	32,43
2028	1.90 %	0,93	0,93	0,93	1,51	1,51	1,74	1,74	2,20			11,47	43,89
2029	1.90 %	0,93	0,93	0,93	1,51	1,51	1,74	1,74	2,20	2,20		13,67	57,56
2030	1.90 %	0,93	0,93	0,93	1,51	1,51	1,74	1,74	2,20	2,20	2,20	**15,87**	**73,42**

In terms of cumulative overall amount, this translates into 73,42 Mtoe of final energy savings to be achieved through active policies in the period 2021-2030, compared with the 51,4 Mtoe projected in 2030 by the previous INECP.

Figure 20 – Energy saving target from energy efficiency measures compared to 2021-2030 (Article 8 EED III and INECP 2019) (Mtoe)



In accordance with Article 8(3) EED III, a share of the above-mentioned cumulative energy savings, which is at least equivalent to the share of households in energy poverty, in accordance with Article

3(3)(d) of Regulation (EU) 2018/1999, will be achieved among households in energy poverty, vulnerable customers and, where applicable, people living in social housing.

Italy has chosen not to make use of the flexibilities provided for in Article 8 (6) to (9) EED[20]III.

In terms of consumption sectors, there is still a need to prioritise energy efficiency interventions in civil and transport, both because of the high scope for reducing these sectors and the synergies needed to achieve the other challenging ESR and renewable emissions targets to be achieved in heating and transport.

In the civil sector, action will be needed in particular on reducing the energy needs of buildings through deep refurbishment, and by increasing the deployment of highly performing technical systems such as heat pumps and BACS systems[21]. The requirements will then have to be met mainly by renewable sources, so it will be important to encourage the integration of thermal and electric renewables into buildings.

In the transport sector, it will be crucial to promote a reduction in the demand for private passenger mobility, towards collective mobility and/or smart mobility and by providing for policies to promote smart working, while freight transport will need to increase road to rail/ship, as well as to continue promoting the replacement of public and private vehicles, following and accelerating the technological advances offered by the market.

(3) indicative milestones of the long-term renovation strategy of the national stock of residential and non-residential, public and private buildings, the roadmap with measurable progress indicators established at national level, an evidence-based estimate of expected energy savings, as well as wider benefits, and contributions to the Union's energy efficiency targets pursuant to Directive 2012/27/EU in accordance with Article 2a of Directive 2010/31/EU;

The civil sector currently accounts for around 44 % of national final energy consumption and 26 % of direct ESR emissions in 2022. These figures show the importance of the energy retrofitting of buildings in this sector to achieve the energy and emission reduction targets outlined in this Plan, while also ensuring economic and social benefits.

In addition, the new EPBD[22], presented as part of the FF55 package and recently adopted, introduces important building renovation targets. Inparticular, in order to achieve the objective of a zero-emission building stock by 2050, Directive (EU) 2024/1275 on the energy performance of buildings (EPBD) requires each Member State to adopt its national trajectory to reduce their average primary energy consumption by 16 % by 2030 and 20-22 % by 2035. With regard to non-residential buildings, it foresees the gradual introduction of minimum energy performance standards, so that 16 % of the worst performing buildings by 2030 and 26 % by 2 033 are renovated.

These savings can be achieved by introducing new materials and technologies into the home, adopting new building standards and end-use devices, upgrading the building envelope, increasing use of thermal renewables and district heating, and more widespread, deep renovation of the existing building stock.

The long-term strategy for the renovation of the building stock, drawn up in accordance with Article 2-bis of Directive 2010/31/EU on the energy performance of buildings, as amended by Directive (EU) 2018/844 and published in 2021, describes an overview of the building stock and,

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[20] These paragraphs allow the calculation to be made taking into account certain flexibilities, which in any case cannot lead to a change in the overall amount of required mandatory savings.
[21] Building & Automation Control System
[22] Energy Performance of Building Directive: Directive (EU) 2024/1275 on Energy Performance of Buildings

subsequently, identifies the energy retrofitting rate of the current and the target building stock, also highlighting the opportunity to carry out energy retrofitting with an integrated approach that improves cost-effectiveness.

It should be noted that the contents of the Strategy, drawn up on the basis of the objectives of the INECP 2020, as well as Directive (EU) 2018/844, will need to be updated to take account of the increased ambition identified in the proposed revision of that Directive, presented as part of the FF55 package, as well as the new objectives set out in this Plan.

However, it was considered crucial, in July 2023 immediately after the submission of the proposal for an INECP, to set up thematic working groups focusing on the most relevant economic sectors, in order to develop concrete and shared proposals to achieve the challenging objectives that the INECP proposes. As regards the civil sector, the activity focused on: consolidate the information available on the building stock and share the identification of the measures needed to safeguard the expected decarbonisation objectives, while assessing its energy, emission and economic impact. This is in particular in order to ensure a balanced energy transition through actions that can optimise the cost/benefit ratio for the community and the state.

As part of this activity, through involvement and cooperation with the public administrations and national agencies in possession of databases on the size of the building stock, with particular reference to ENEA, it was possible to update and deepen the estimate of the size of the 2021 strategy mentioned above.

The updated analysis is therefore set out below.

The table below shows the breakdown into climatic zones of the national territory and the respective number of municipalities.

Table 19 – Number of Italian municipalities by climate zone and “degree day” (ENEA compilation of ISTAT data)

Climate condition area	Degrees Giorno (GG)	Number of municipalities at 1/1/2019	Resident population at 2018	% Resident population
A	DD ≤ 600	2	23.266	0.04 %
B	600 < gg ≤ 900	157	3.217.288	5.33 %
C	900 < gg ≤ 1.400	981	12.826.700	21.25 %
D	1.400 < gg ≤ 2.100	1.572	15.168.668	25.13 %
E	2.100 < gg ≤ 3.000	4.176	27.482.108	45.53 %
F	DD > 3.000	1.026	1.641.892	2.72 %

For the winter air conditioning of existing buildings, national energy consumption can be considered proportional to the product between day and population; therefore, climate zone E, the most populous, is the most important area on consumption, while climate zone B is the smallest area, excluding zone A, where only 0.04 % of the population is located (being only two municipalities).

The consumption structure of final uses in 2021 shows the high share of the civil use sector, 44 % of total final consumption. Of this 44 %, 29 % of the total is taken up by residential and 15 % by the services sector.

❖ **SIZE OF THE NATIONAL BUILDING STOCK**

This chapter contains data on the size of the national building stock. In order to obtain a comprehensive knowledge of the public sector, the Ministry of Economic Affairs (MEF) was assisted by the Department of Economy of the Ministry of Economic Affairs and Finance (MEF), which carries out an annual review of the components of the assets of the public authorities in accordance with Article 2 of Law No 191/2009. Thanks to the data collected through the declarations made by the administrations, the MEF database has made it possible to reconstruct the number of building units and their respective areas for each use purpose. The data used refer to the declarations made by the institutions in 2019 and are the result of processing carried out taking into account the declared use of the buildings.

For public buildings, the data transmitted by the MEF has also been complemented with data from other sources. In particular, for the number of healthcare establishments, reference has been made to the statistical yearbook of the National Health Service; for the number of educational establishments, account has been taken of the information on the Single Data Portal of the Ministry of Education and Merit (MIM); for places of culture (museums and libraries), reference was made to ISTAT 2021 data. For private buildings, it has been chosen to follow the data of the 'Strategy for the Energy Renovation of the National Building Stock' (STREPIN), based on 2018 CRESME surveys, supplemented with data from the Revenue Agency and data provided by ISTAT, both for residential and non-residential buildings.

Overall, according to the ISTAT census of 2011, more than 13 million buildings are present in Italy. There are 1.576.159 buildings and combinations of non-residential buildings, representing around 11 % of the total and dedicated to productive, commercial, directional/tertiary, tourist/hospitality, services and other use.

For the purposes of this analysis, the buildings were divided between private and public service buildings and the different uses were detailed. The number of buildings, the number of buildings, the number of building units, the gross areas and, in the case of public heritage, the areas of buildings without cultural and landscape constraints were identified where possible[23]. The different data sources used are detailed below, referred to in Tabella 1 (buildings for private use) and Tabella 7 (public service buildings).

❖ <u>THE SIZE OF THE NATIONAL BUILDING STOCK: BUILDINGS FOR PRIVATE USE</u>

Tabella 20 The main uses of buildings for private use can be found in the category of buildings for private use. For greater certainty, public residences have also been included in this category. The source used has been specified next to each data element.

Table20. Buildings for private use

Purpose of use	Total number of buildings/facilities	Area of buildings for exclusive or predominant use (m^2)	Total number of real estate units	Total area (m^2)
Total residential	12.420.403 [1]	3.049.806.182 [1]	35.271.829 [3] [24]	3.535.892.926 [3]

[23] *Buildings covered by the following types of protection have been identified: legally protected area – landscape interest (Article 142); declaration of cultural interest (Article 13); declaration of significant public interest (Article 140); indirect protection requirements (Article 45); property with more than 70 years old and no longer living (Article 12); ongoing cultural interest test (Article 12).*

[24] *This also includes dwellings not occupied by residents. The figure shown in the table is quite close to that provided by the Revenue Agency, [2] which, by reference to the real estate stock held by taxpayers on 31 December 2020, indicates 35.265.434 housing units.*

Purpose of use	Total number of buildings/facilities	Area of buildings for exclusive or predominant use (m²)	Total number of real estate units	Total area (m²)
Single-family or two-family residential properties	9.298.410 [1]	1.347.849.624 [1]	—	—
Multi-family residential properties	3.121.993 [1]	1.701.956.558 [1]	—	—
Dwellings E.R.P. [25]	—	—	478.805 [6]	36.145.706 [6]
Other publicly owned dwellings [26]	—	—	161.079 [6]	16.494.743 [6]
Private offices 27	57.129 [1]	35.167.597 [1]	654.761 [2]	89.490.309 [2]
Total trade [28]	259.951 [1]	287.140.200 [1]	—	402.352.100 [1]
Mini-market	—	1.654.028 [1]	—	—
Supermarket	—	10.124.147 [1]	—	—
Hypermarket	—	3.973.374 [1]	—	—
Department store	—	3.578.382 [1]	—	—
Large specialised store	—	5.653.377 [1]	—	—
Other	—	262.156.892 [1]	—	—
Hotels [29]	27.143 [1]	36.550.400 [1]	—	36.550.400 [1]

Source: ENEA processing on various data.

Sources of data

[1] *Ministry of Environment and Energy Security, STREPIN 2021, Cresme and ENEA calculations on 2018 data.*
[2] *Revenue Agency, cadastral statistics 2020.*
[3] *ISTAT, Permanent Population and Housing Census (istat.it). Data 2021.*
[4] *Ministry of Health, Statistical Annual of the National Health Service 2021.*
[5] *Ministry of Education and Merit, School Data Portal. Data year 2019/2020.*
[6] *Ministry of Economy and Finance, database 2019.*
[7] *ISTAT. For museums: Survey on museums and similar institutions: microdata for public use; for libraries: Census of public and private libraries: microdata for public use. Data 2021.*

[25] *For publicly owned residential buildings, data refer only to dwellings (building units) and not to buildings, as at building level ownership is often mixed in nature (some tenants may have purchased their dwelling and subsequently sold it). It is assumed that the majority of publicly owned residential buildings (partial or exclusive) are included in multi-family housing. We would also point out that real estate units owned by the former Autonomous Institutes for Popolar Houses (IACP) converted into public economic bodies which, as such, do not have to report to the MEF, are excluded from the accounts relating to the Public Housing (ERP).*
[26] *This category includes dwellings used directly by governments, dwellings for 'service accommodation', 'forest' and 'student housing', dwellings used outside the public administration perimeter, and temporarily unused dwellings.*
[27] *Only those for exclusive or predominant use are included in the number of private office buildings and their areas.*
[28] *For the category of commerce, the number of buildings includes only those which are predominantly or exclusively intended for commercial use. On the other hand, in the number of building units, account is also taken of those in buildings with a different predominant purpose.*
[29] *The number of hotels, taken from STREPIN's document, includes buildings that are predominantly or exclusively used by hotels.*

Buildings for residential use are 12.42 million, corresponding to an area of more than 3 billion m^2. There are around 35 million dwellings, of which more than 25 million are occupied. More than 60 % of this building stock is more than 45 years old, i.e. before Law 373/1976[30], the first Energy Savings Act. Please find below the situation of the housing stock in the residential sector, broken down by year of construction and climate area. Data on the number of buildings (Tabella 219eTabella 320) are derived from the document of STREPIN (Strategy for Energy Requalification of the National Buildings Park); further data up to 2 021 are reported in Tabella 4 and refer to the total number of dwellings in Italy, including those in buildings with a predominant purpose other than residential ones.

Table 21 - Residential buildings, number and area as at 2018, by time of construction

Building period	Number of buildings	Building period	m^2
until 1919	1.832.503	until 1945	678.743.665
1919-1945	1.327.007		
1946-1960	1.700.834	1946-1976	1.293.138.628
1961-1970	2.050.830		
1971-1980	2.117.649		
1981-1990	1.462.766	1977-1990	600.244.196
1991-2000	871.017	1991-2014	439.536.250
2001-2005	465.092		
2006-2011	359.991		
2011-2018	232.714	post 2014	38.143.445
Total	12.420.403	Total	3.049.806.184

Source: STREPIN

Table 22 - Residential buildings, number and area as at 2018, by climate zone

Climate condition area	Number of buildings	m^2
zone A	5.217	170.118.357
zone B	710.079	
zone C	2.737.222	615.486.151
zone D	2.896.204	734.707.925
zone E	5.340.672	1.383.758.265
zone F	731.009	145.735.486
Total	12.420.403	3.049.806.184

Source: STREPIN

[30] Rules for limiting energy consumption for thermal uses in buildings

Table 23 – Residential real estate units (occupied and not occupied) by climate zone.

Climate condition area	No of municipalities	No of occupied dwellings	No of occupied dwellings	Total number of dwellings	Surface area (m²)
Zone A	2	8.981	6.982	15.963	1.543.622
Zone B	158	1.314.031	680.510	1.994.541	192.872.115
Zone C	983	5.076.799	2.145.548	7.222.347	660.844.751
Zone D	1.578	6.380.581	2.145.908	8.526.489	879.933.665
Zone E	4.171	12.109.127	3.546.672	15.655.799	1.650.121.215
Zone F	1.012	800.538	1.056.152	1.856.690	150.577.559
Total	7.904	25.690.057	9.581.772	35.271.829	3.535.892.926

Source: ENEA processing on ISTAT 2021 data

The growing importance of energy poverty makes a focus on housing in public housing. Thanks to the data provided by the MEF, it has been possible to break down by climate zone and construction period the building units and areas of publicly owned dwellings (excluding those owned by the former Autonomous Institutes for Popolar Houses transformed into public economic bodies which, as such, do not have to report to the MEF), which in Italy are more than 478.000 as shown in the tables below.

Table 24 – E.R.P. Abitations owned by PA, number of u.i. per climate zone

Building period	Zone A No of units	Zone B No of units	Zone C No of units	Zone D No of units	Zone E No of units	Zone F No of units	Total No of units
Before 1919	44	300	777	2.812	16.642	321	20.896
From 1919 until 1945	—	939	2.358	3.685	14.628	130	21.740
From 1946 until 1960	174	12.849	27.283	18.454	29.813	295	88.868
From 1961 until 1970	19	4.077	16.263	12.854	26.213	179	59.605
From 1971 until 1980	231	4.096	21.240	17.858	30.411	624	74.460
From 1981 until 1990	117	9.717	44.439	33.310	40.662	928	129.173
From 1991 until 2000	120	3.394	11.076	9.732	16.840	412	41.574
From 2001 until 2010	—	2.641	3.866	10.038	11.772	212	28.529
After 2010	—	330	1.459	2.025	4.712	171	8.697
ND	—	548	658	696	3.355	6	5.263
Total	**705**	**38.891**	**129.419**	**111.464**	**195.048**	**3.278**	**478.805**

Source: MEF database 2019

Table 25 – E.R.P. Abitations owned by PA, area per climate zone

Building period	Zone A	Zone B	Zone C	Zone D	Zone E	Zone F	Total

	(m²)	(m²)	(m²)	(m²)	(m²)	(m²)	(m²)
Before 1919	248	9.285	51.254	228.552	1.107.673	26.632	1.423.643
From 1919 until 1945	—	59.569	140.696	287.121	916.560	8.927	1.412.873
From 1946 until 1960	8.691	873.444	1.809.377	1.237.621	1.940.671	20.671	5.890.475
From 1961 until 1970	1.465	330.167	1.313.400	961.630	1.822.944	15.241	4.444.846
From 1971 until 1980	22.575	378.375	2.088.653	1.538.597	2.421.676	49.925	6.499.801
From 1981 until 1990	9.250	880.260	3.763.174	2.604.667	2.776.362	70.681	10.104.395
From 1991 until 2000	9.647	270.944	912.122	781.824	1.230.058	29.306	3.233.901
From 2001 until 2010	—	227.108	314.884	728.143	831.243	15.063	2.116.440
After 2010	—	28.242	120.705	154.727	403.123	10.194	716.991
ND	—	33.063	39.866	44.621	184.381	411	302.342
Total	**51.876**	**3.090.457**	**10.554.131**	**8.567.503**	**13.634.689**	**247.050**	**36.145.706**

Source: MEF database 2019

❖ <u>THE SIZE OF THE NATIONAL BUILDING STOCK: THE PUBLIC SERVICES</u>

The table below shows the main uses of public service buildings. For greater certainty, places of culture, healthcare facilities and private educational facilities have also been included in this category. The source used has been specified next to each data element; as regards health facilities, schools and places of culture, the official data available have been complemented with ENEA estimates. Unheated facilities (lights, sea towers, fortifications and their dependencies, cellars, ceilings, remittances, boxes, garages, open/open parking spaces, scientific laboratories, warehouses and storage rooms, covered markets, collective parking areas), buildings for productive activities, religious buildings, sports facilities and spa factories were excluded. In addition, for all use purposes (except for public dwellings), real estate units declared as not used were excluded.

Table 26 – Public service buildings

Purpose of use	Total number of buildings/facilities	Area of buildings for exclusive or predominant use (m²)	Total number of real estate units	Total area (m²)
Public offices [31]	17.229 [1]	27.845.573 [1]	38.375 [6]	38.529.201 [6]

[31] *The number of public office buildings includes only those for exclusive or predominant use, while building units also include those included in buildings where other uses prevail.*

Purpose of use	Total number of buildings/facilities	Area of buildings for exclusive or predominant use (m²)	Total number of real estate units	Total area (m²)
Total health facilities [32]	28.980 [4]	—	—	63.517.469 [33]
SSN health facilities [34]	12.474 [4]	—	—	42.218.809[4], [6] [35]
Accredited private healthcare facilities	16.506 [4]	—	—	21.298.660 [36]
Public non-health collective residential facilities [37]	—	—	533 [6]	1.139.750 [6]
Total schools [38]	54.641 [5]	—	—	114.350.330 [39]
Public schools	41.964 [5]	—	49.125[5], [6]	91.531.730[5], [6] [40]
Private schools	12.677 [5]	—	—	22.818.600 [41]
University	—	—	1.878 [6]	9.362.407 [6]
Barracks	2.489 [1] [42]	—	10.410 [6]	12.668.302 [6]
Penitentiaries	198 [1]	—	304 [6]	4.339.375 [6]
Places of culture: libraries and museums	11.733 [7]	—	—	10.331.519 [43]
Places of public culture	8.700 [7]	—	10.805 [6]	8.208.419 [6]
Places of private culture	3.033 [7]	—	—	2.123.100 [44]
Castelli and Historical Palazzi[45]	—	—	2.303 [6]	3.466.387 [6]
Other goods for public use	—	—	7.532 [6]	6.286.697 [6]

Source: ENEA processing on various data.

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[32] Health facilities, both public and private, include facilities for Hospital Assistance, Special Ambulatorial Assistance, Altra Territorial Assistance, Residential and SemiResidential Assistance.
[33] The surface area of public buildings provided by the MEF was supplemented for private buildings with ENEA estimates based on data from the Ministry of Health.
[34] This includes both publicly owned and privately owned hospitals integrated with the NHS.
[35] The surface area of public buildings provided by the MEF was supplemented for private buildings with ENEA estimates based on data from the Ministry of Health.
[36] Area based on ENEA estimates based on data provided by the Ministry of Health.
[37] It includes: colleges and nurseries, educators, hospitalists, orphanages, ospizi, convents, seminars.
[38] This includes nursery schools, primary and secondary schools in grade I and II.
[39] The MEF data were supplemented by ENEA estimates based on data provided by the Ministry of Education and Merit.
[40] The MEF data were supplemented by ENEA estimates based on data provided by the Ministry of Education and Merit.
[41] Area based on ENEA estimates based on data provided by the Ministry of Education and Merit.
[42] As regards barracks, the number of buildings indicated the number of property fees (including, in fact, more than one building).
[43] The surface area of public buildings provided by the MEF was supplemented for private buildings with ENEA estimates based on ISTAT data.
[44] Area based on ENEA estimates based on ISTAT data.
[45]Buildings of particular historical value have been included in the category of historical buildings communicated by the MEF, which can be used for various purposes. The analysis of the data shows that the predominant purpose of use is that of office or institutional representation activity (declared for 1 353 291 m², around 39 % of the area), but the area covered by this category could be larger as for around 45 % no specific use has been declared.

The number of building units and gross areas broken down by type of use is given, Tabella 8 detailing the impact of cultural and landscape constraints. The total untied gross area potentially affected by energy efficiency is approximately 209 million m^2.

Table 27 – Property owned by PA

Purpose of use	Total number of real estate units	Total gross area (m^2)	Number of unencumbered real estate units	Total gross area (m^2) not encumbered	% UI encumbered	% tied area
Dwellings E.R.P.	478.805	36.145.706	440.448	33.342.275	8.0 %	7.8 %
Other publicly owned dwellings	161.079	16.494.743	132.943	12.955.535	17.5 %	21.5 %
Public offices	38.375	38.529.201	27.412	26.555.937	28.6 %	31.1 %
Publicly owned healthcare facilities (excluding RSA)	5.935	33.033.842	4.555	23.498.275	23.3 %	28.9 %
Public collective residential facilities (including RSA)	3.750	7.030.897	2.928	5.387.296	21.9 %	23.4 %
Public schools	49.125	91.531.730	41.750	79.531.028	15.0 %	13.1 %
University	1.878	9.362.407	1.184	6.469.144	37.0 %	30.9 %
Barracks	10.410	12.668.302	8.613	10.043.321	17.3 %	20.7 %
Penitentiaries	304	4.339.375	237	3.659.360	22.0 %	15.7 %
Places of public culture (libraries and museums)	10.805	8.208.419	5.243	2.870.296	51.5 %	65.0 %
Castelli and Historical Palazzi	2.303	3.466.387	0	0	100.0 %	100.0 %
Other goods for public use	7.532	6.286.697	5.794	4.437.821	23.1 %	29.4 %
Total	**770.301**	**267.097.706**	**671.107**	**208.750.288**	**12.9 %**	**21.8 %**

Source: ENEA processing on various data.

❖ <u>**NZEB**</u>

Since 2021[46], all new buildings or buildings subject to major first-level renovation have to meet the technical and performance requirements imposed by Annex 1 to Ministerial Decree No 26/6/2015 for nearly zero-energy buildings (nZEB). In addition to the overall limit on energy consumption, the minimum nZEB requirements at a national level include requirements relating to thermal performance indicators in comparison with the reference building, to the overall average

[46] *Since 2019 for public administration buildings.*

coefficient of heat transfer by transmission, to the summer equivalent solar area per useful floor area and to the efficiency of heating, air conditioning and hot water production systems.

In all regions of Italy there is an increase in nZEB, the number of which, according to the national database on energy performance certificates SIAPE, is growing rapidly.

Table 28 – Percentage of EPAs with NZEB in SIAPE compared to the total sample per year of issue (source: ENEA)

Year of EPA certification	Percentage of EPAs classified NZEB in the year
2015	0.01 %
2016	0.04 %
2017	0.21 %
2018	0.08 %
2019	0.16 %
2020	0.25 %
2021	0.54 %
2022	0.99 %

The data sample also made it possible to carry out an analysis of the distribution of NZEB EPAs by climate zone and residential and non-residential use. The analysis shows that in absolute terms the number of EPAs classified as residential NZEB is 95.4 % compared to 4.6 % for non-residential EPAs.

Table 29 – Distribution in absolute terms of the NZEB EPAs on SIAPE by use and climate zone (source: ENEA)

Climate condition area	Residential		Non-residential	
A	—	0.0 %	—	0.0 %
B	368	2.2 %	18	2.3 %
C	3.182	19.2 %	94	11.8 %
D	3.577	21.5 %	144	18.1 %
E	9.145	55.0 %	500	63.0 %
F	342	2.1 %	38	4.8 %
TOTAL	**16.614**	**—**	**794**	**—**

❖ **ESTIMATING CONSUMPTION**

The average consumption for the different intended uses was calculated on the basis of the distribution of buildings by climate zone and period of construction, as referred to in this chapter, as well as consumption data taken from statistical surveys on a representative set of buildings. This set was determined using a study that defined the representative sample of buildings for each intended use and the most common building type. KWh/m^2 year, referring to the useful floor area of the building, was used as an indicator of energy consumption. The indicator was harmonised by referencing the climate zone, intended use and building type. The following table contains the average annual final consumption indicators for each intended use.

Table 30 – Destination of use and annual average consumption indicator weighted by climate zone

Intended use	Electric energy consumption (kWh/m² year)	Thermal consumption (kWh/m² year)	Total consumption (kWh/m² year)
Single-family residential properties	38	142	180
Multi-family residential properties	35	125	160
Public administration	50	114	164
Hospitals	211	185	396
Schools	20	130	150
Offices	67	130	197
Hotels	92	139	231
Penitentiaries	50	191	241
Trade:			
Mini-market			535
Supermarket			598
Hypermarket			527
Department store			255
Large specialised store			219
Other			388

Source: ENEA processing on various data.

The analysis developed by ENEA and Assoimmobiliare (National Real Estate Association), on the basis[47] of the data reported in the energy audits carried out on 120 buildings entirely for office use, has become a useful point of comparison for supplementing the information available for estimating the consumption of private offices.

The consumption values for the residential sector and for offices and schools in the tertiary sector show predominantly thermal uses, mainly due to the need to heat rooms in the winter, a service for which electricity is not yet commonly used. However, this difference is less noticeable in relation to hotels, where air conditioning is widely used in the summer.

In terms of energy end-use, national and European studies show that the most widely used energy carrier in the large-scale retail trade is electricity (over 90 %). In particular, the study of energy audits for the food sector shows an average share of almost 95 % of energy taken from the grid and self-generated and self-consumed. The average specific consumption values for the various sub-types of large-scale retail trade and the supermarket and hypermarket values are also taken from the study of energy audits.

The values for hospital specific consumption are derived from the information given in the box below, based on some assumptions concerning m² per reading place at national level. Data collected from the energy audits of a sample of hospitals provided a useful point of comparison in this case too. As far as penal institutions are concerned, some energy analyses carried out by ENEA

[47]*Received by ENEA under the obligation laid down in Article 8 EED II.*

as part of the Energy Retrofitting Programme for Central Government Buildings (PREPAC) have also provided useful supplementary information.

Finally, it should be pointed out that a recent survey conducted by Cresme on a sample of 1.430 public housing shows an overall consumption level of around 4 % higher than the total value of the housing stock estimated by Cresme for 2018. This discrepancy appears to be driven by electricity consumption, which is about 16 % higher, while heating consumption seems more in line (+ 1 %). This should be read taking into account different specificities: lower incidence of households not occupied by residents in public housing, increased use of dwellings (older people and fewer workers), a combination of age of thermal installations and low uptake of energy adaptation works. It should also be noted that, due to the average size of dwellings being smaller, the average consumption per dwelling is lower than that estimated for the total housing stock.

In general terms, users in the non-residential sector, particularly in the case of certain uses, are characterised by very high consumption, thus leaving room for a high potential for energy efficiency.

♦ *THE ENERGY PERFORMANCE CERTIFICATE INFORMATION SYSTEM*

SIAPE (Information System on Energy Performance Certificates) is the national tool for collecting EPAs and monitoring the energy performance of Italian buildings. This system was implemented by ENEA in 2016 and is fed with data from EPAs from the local energy registers of the Regions and Autonomous Provinces, as indicated by Ministerial Decree No 26/06/2015[48], thanks to an XML standard track shared at national level[49].

In November 2020, ENEA published the SIAPE portal online[50], in accordance with Ministerial Decree No 26/06/2015[51], which regulates the possibility of consulting data on the national database by regions, autonomous provinces, municipalities and citizens, as well as the possibility of generating statistics and analysis of the data contained in the EPAs. The regions, autonomous provinces and municipalities are allowed access to disaggregated data on the basis of the geographical area in which they are responsible, following a request for specific credentials, while the remaining users concerned can view analyses and statistics only in aggregated form.

According to the information available in the Annual Report on Energy Certification for Buildings 2023, published by ENEA and CTI (Italian Technical Committee – Energy and Environment[52]), as at 01/04/2023, after the legal deadline for the inclusion of EPAs issued in the previous year, 17 Regions and 2 Autonomous Provinces were linked to SIAPE (Figura 21), collecting almost 5.400.000 EPAs distributed in the period 2015-2023. In this process, ENEA actively participated, supporting 8 regions in implementing the regional energy register.

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[48] Interministerial Decree No 26/06/2015 – 'Adaptation of national guidelines for the energy certification of buildings', Article 5 (4).

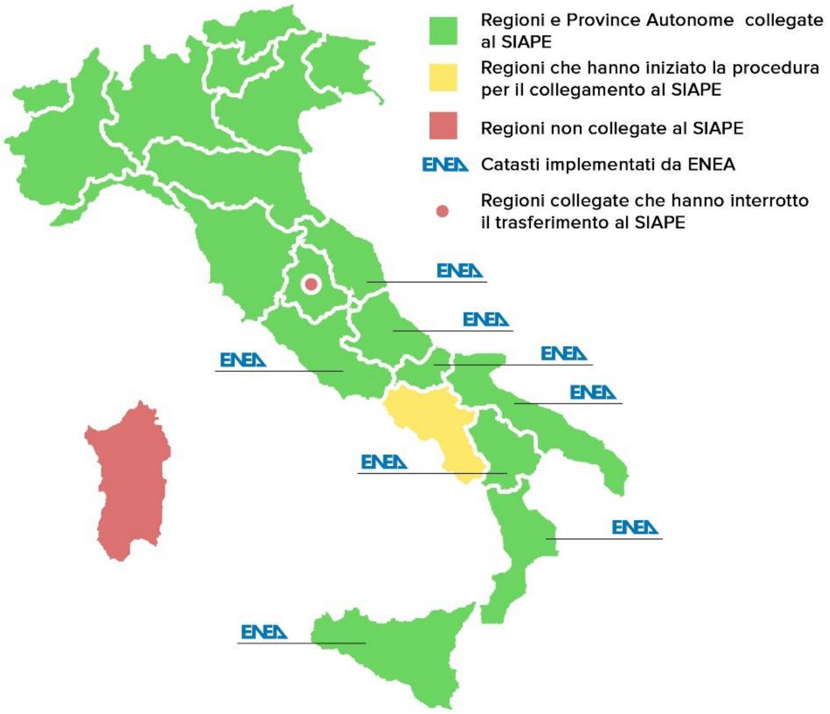
[49] https://www.cti2000.eu/standard-xml/

[50] The SIAPE portal can be accessed at www.siape.enea.it

[51] Inter-ministerial Decree of 26 June 2015 – 'Adaptation of national guidelines for the energy certification of buildings', Article 6 (3).

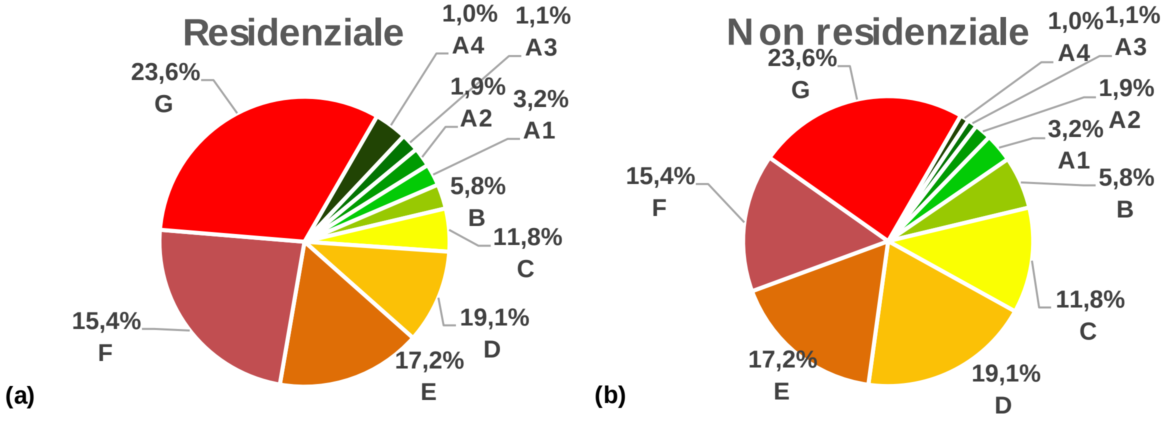
[52] You can consult all editions of the ENEA official channels report: https://www.efficienzaenergetica.enea.it/pubblicazioni/rapporto-annuale-sulla-certificazione-energetica-degli-edifici.html

Figure 21 – National map of regions and autonomous provinces linked to SIAPE as at 01/04/2023



The analysis of the sample in SIAPE[53] provides an overview of the certified building stock on the basis of EPAs issued from the end of 2015 to the end of 2022, showing a split between residential and non-residential use of 85 % and 15 % respectively: the majority of the latter consists of offices, commercial activities and industrial activities. Residential buildings are distributed in increasing order of the deterioration of the energy class, starting with energy class A4: around 55 % of cases fall into the least efficient energy classes (F and G). The non-residential sector, on average, is more efficient, with a total of cases in energy classes E, F and G below 40 % (Figura 22).

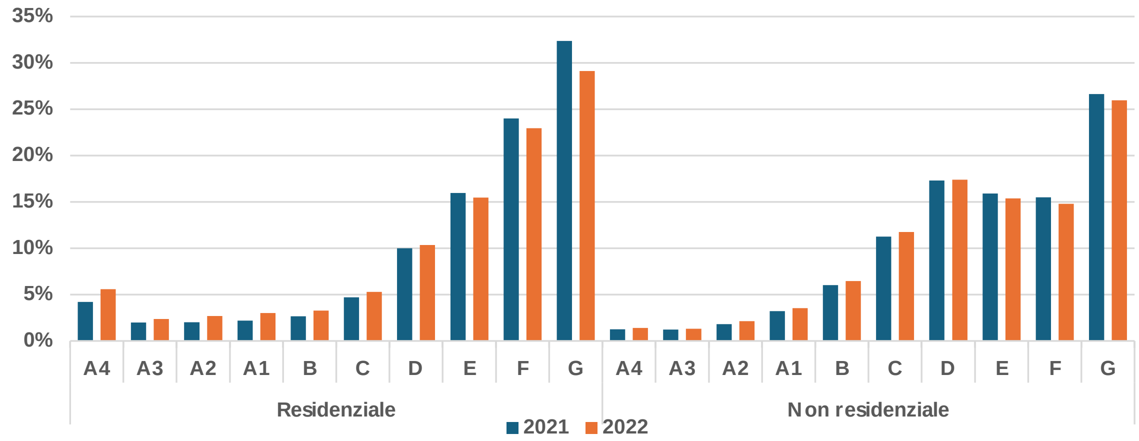
Figure 22 – Percentage distribution of EPAs issued between 2015 and 2022 by energy class for residential (N = 3.594.611) and non-residential sectors (N = 639.273). Source: SIAPE



[53] *Data sample extracted by SIAPE on 30/05/2024 and cleaned from any errors and anomalies. See in this regard the documentation referred to in the letter[52].*

In order to better assess the evolution of energy efficiency in the building stock, it is interesting to deepen the analysis by year of EPAs, focusing on the most recent ones (2021 and 2022). The comparison of EPAs' energy class distributions issued in 2021 and 2022 (Figura 23) shows an improvement in the energy performance of certified buildings in both residential and non-residential sectors, reducing the share in energy classes F and G by more than 4 % in the first case and by around 1.5 % in the latter.

Figure 23 – Percentage distribution of EPAs issued in 2021 and 2022 by energy class for the residential sector (2021 N = 726.482; 2022 N = 862.012) and for non-residential (2021 N = 109.341; 2022 N = 120.115). Source: SIAPE



- ***Focus on publicly owned real estate***

On the basis of the information contained in the EPAs, the ownership of the certified properties appears to be almost 99 % private. The remaining share relates to public ownership[54] for around 0.8 %, while 0.2 % of buildings are indicated as being for public use[55]. However, it should be noted that this information appears to be the most often not available in the EPAs sent to SIAPE, especially the less recent ones. In particular, according to the results available in the Annual Reports on Energy Certification of Buildings, the sample of EPAs with no indication of ownership of the building is around 30 % of the total.

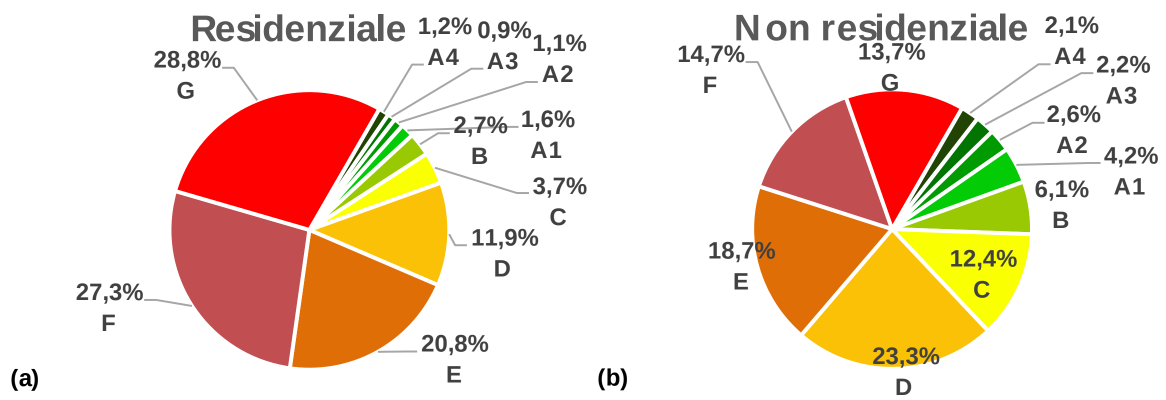
In addition, the current EPA model does not specify the possible public or private ownership of buildings for public use, so since it could not carry out a proper depth, the analyses concerned only EPAs issued between 2015 and 2022[29] relating to public ownership (33.288 EPAs), excluding those relating to public buildings (12.479 EPAs). 58 % of this sample of EPAs belong to the residential sector and 42 % to the non-residential sector; most of the latter consists of school activities, offices and commercial activities.

Residential public buildings certified by EPAs fall under the least efficient energy classes (F-G) and 7.5 % in the most efficient ones (A4-B); as in the overall sample, non-residential public buildings also show better performance, with less than 30 % in energy classes F and G and more than 17 % in A4-B (Figura 24).

[54] *Presidential Decree No 412/1993 defines a publicly owned building as 'a building owned by the State, the Regions, local authorities and other public bodies, including economic bodies, intended both for the performance of the activities of the Authority and for other activities or uses, including private dwelling'.*

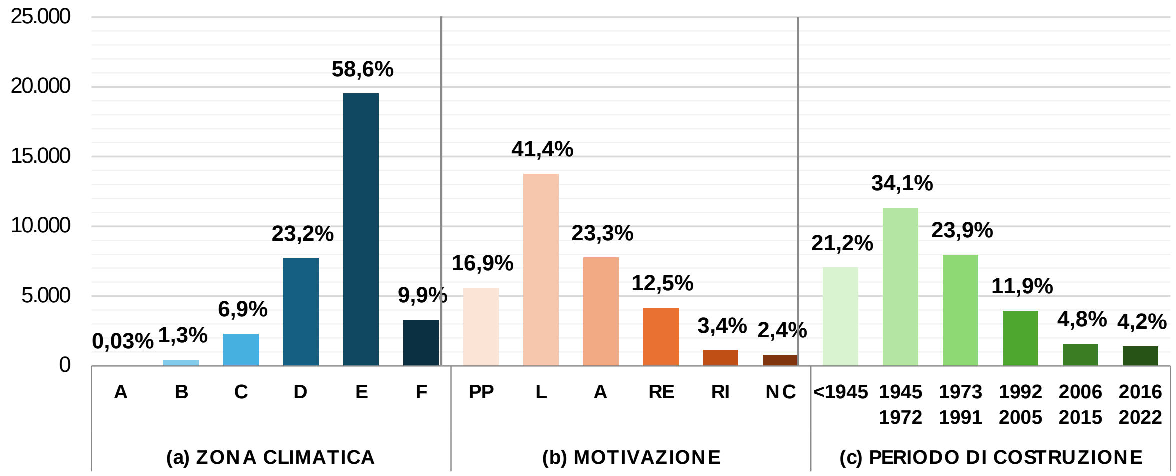
[55] *Presidential Decree No 412/1993 defines a building for public use as 'a building in which all or part of the institutional activity of public bodies is carried out'.*

Figure 24 - Percentage distribution of publicly owned EPAs issued between 2015 and 2022 by energy class for residential (a) (N = 19.339) and non-residential sectors (b) (N = 13.885). Source: SIAPE



Finally, EPAs for publicly owned buildings were analysed according to the climate zone, rationale and construction period (Figura 25). About half of the sample is made up of buildings certified in climate zone E, which are subject to ownership or leases and pre-1972.

Figure 25 - Distribution of public ownership EPAs for (a) climate zone, (b) justification and (c) construction period (N = 33.288) PP: transfer of ownership; L: leasing; A: other; RE: energy requalification; ROP: major restructuring; CN: new construction. (source: SIAPE)



❖ <u>ESTIMATED RATE OF RETRAINING</u>

In order to best plan the actions needed to achieve the 2050 targets and the longer-term 2030 targets, it is necessary to start with the most accurate possible view of the current situation. After reviewing the national building stock, it is therefore of interest to draw up estimates of the rate of energy retrofitting: this will make it possible to quantify the distance of the current situation from the energy savings and decarbonisation target expressed in terms of the retrofitting rate needed to achieve them.

As you know, existing incentive instruments are not limited to promoting deep renovations, but also incentivise individual interventions, such as simple replacement of frames. An indicator called a virtual deep renovation rate was then developed with ENEA, ISPRA and RSE in order to develop a meaningful and measurable indicator of progress in terms of regeneration. Such an indicator is required because it is not possible to consider a building on which a 'simple' intervention has been carried out to have been retrofitted.

The processing carried out – based on the monitoring data of the Ecobonus and Bonus casa – transforms, through the energy savings obtained, the real intervention rate (which takes into account all the buildings on which they have taken place, even in a minimal manner), into a so-called virtual deep renovation rate, the value of which is therefore the rate of retrofitting that would be the case if all the savings obtained were due to building/installation renovations. In this way, the contributions of all measures, whatever their nature, can be brought together.

The virtual deep renovation rate of the building stock is estimated by reference to different types of intervention and technological solutions, based on data on access to tax deductions for energy efficiency interventions.

Taking into account the incentive mechanisms in place at the time of the analysis (Ecobonus and Bonus Casa), the virtual deep renovation rate would therefore be 0.85 %, compared to energy savings of 0,332 Mtoe/year.

For the purpose of deepening the virtual deep renovation rates as at 2030, a dedicated modelling tool has been set up and can be seen below. However, please note that the rate of regeneration will be updated in accordance with the objectives of this plan in its final version.

The following tables show a roadmap for 2030, 2040 and 2 050 in terms of indicative targets on the annual rate of retrofitting for the residential and tertiary sector achieved.

Roadmap 31 – Roadmap of targets in terms of annual rate of regeneration

Indicator	Period 2020-2030	Period 2030-2040	Period 2040-2050
Annual residential sector retrofitting rate	1.9 %	2.7 %	2.7 %
Annual retrofitting rate in the tertiary sector	2.8 %	2.6 %	2.6 %

Source: preparation of ENEA.

Considering the specific savings of residential and tertiary sectors in line with the trends outlined above, the overall annual retrofitting rate would be 2 % in 2030 and 2.6 % in 2050, which is about three times the current virtual retrofitting rate, which best represents the need to increase the efforts involved. The overall retrofitting rate would involve measures being carried out on two-thirds of Italy's national building stock.

It will be necessary to update these objectives in the near future in the light of the adoption of the FF55 directives, so the objective set out here can be considered as a minimum target.

❖ ***UPDATE OF MINIMUM PERFORMANCE REQUIREMENTS FOR BUILDINGS AND NEW NZEB DEFINITION***

Following the publication of the Decree transposing EPBD III (Legislative Decree No 48/2020), work was launched to update the Ministerial Decree on minimum energy performance requirements for buildings (Decree MiSE of 26 June 2015). There are many new developments introduced by the transposition of EPBD III, in particular Article 4. In summary, there are:

- new detailed provisions on technical building systems, aimed at facilitating the installation, where possible, of the most efficient technologies, as well as providing for advanced regulatory and control systems;
- draws attention to the need to promote thermo-hygrometric indoor well-being, fire safety and limit the risks associated with seismic activity, thus laying down elements for the integration of transversal regulations affecting buildings;
- introduction of the framework for the integration of electric vehicle charging infrastructure into buildings, which need to be duly implemented.

In addition to the above points, it is also necessary to provide for an update of the requirements in the light of the new technical and economic analyses carried out (application of the 2018 comparative methodology), as well as a 'reasoned' update based on the experience gained in the application of the standard in recent years.

Please find below a brief discussion of the issues that are being investigated, with the support of ENEA and the collaboration of the CTI, on the basis of which the Decree is currently being updated:

- update of minimum performance requirements for installations and building elements based on the application of the comparative methodology as updated in 2018;
- update of the overall average thermal exchange coefficient (H't);
- updating the framework for thermal bridges to make it more consistent with actual project situations;
- integration of electric vehicle charging infrastructure: on the basis of the information provided by the Legislative Decree and the European Directive, an in-depth analysis has been carried out with the help of RSE, aimed at downgrading the requirements for residential and non-residential buildings, in terms of the number and type of recharging points to be envisaged.

The legislative measure has not yet been adopted as the procedure for issuing an agreement within the Unificata Conference is currently ongoing pursuant to Article 4 (1) of Legislative Decree No 192 of 19 August 2005.

❖ ***UPDATING THE GENERAL CRITERIA FOR THE OPERATION, OPERATION, MONITORING, MAINTENANCE AND INSPECTION OF HEATING SYSTEMS FOR WINTER AND SUMMER AIR CONDITIONING OF BUILDINGS***

Presidential Decree No 74/2013 sets out the general criteria for the operation, maintenance and inspection of thermal installations, as well as the professional requirements of experts and bodies to be entrusted with their inspection tasks by introducing, among other measures, the specific mandatory energy efficiency control requirement for winter air-conditioning installations with a power of more than 10 kW, or 12 kW for summer air-conditioning systems, according to specific time frequencies. In addition, the measure defines the operating limits for heating systems for winter air conditioning, laying down the periods and methods for switching them off and switching off.

The aforementioned Decree is currently being updated, as provided for in Article 6 (1) of Legislative Decree No 48 of 10 June 2020 transposing Directive (EU) 2018/844 on the energy performance of buildings. The draft decree updates the general criteria laid down in Presidential Decree No 74/2013, with a view to minimising the administrative burden on building owners and tenants, ensuring optimal environmental, energy and safety performance of small thermal installations, simplifying administrative procedures.

In summary, the draft decree in preparation proposes the introduction of new provisions in relation to Presidential Decree No 74/2013, with particular reference to the following issues included in articles of the Decree:

- *Criteria for the operation of installations:* operating time limits are stable, reducing ignition periods and updating derogations for particular climatic situations, in order to preserve and ensure thermohygrometric well-being;
- *Installation book:* it is mandatory to draw up a booklet for plants with a capacity of more than 10 kW (reduced to 5 kW for solid fuel plants – *i.e.* biomass), and the electronic plant manual is planned to be implemented as an integral part of the land register of thermal installations;
- *Monitoring energy efficiency:* periodic checks are planned for installations with a power of more than 20 kW (reduced to 10 kW for solid fuel *installations – i.e.* biomass), amending the control thresholds to ensure greater coverage of the relevant installations, and a dedicated 'Energy Efficiency Control Report' model for biomass installations is introduced;
- *Regional competences:* optimise the cost/benefit ratio by standardising the way in which energy efficiency ratios are transmitted;
- *Information activities:* a national information system and an annual report on the state of heat installations is introduced;
- *Guidance on the management of thermal installations:* a guide will be drawn up by ENEA and CTI, with a section dedicated to the management of summer air-conditioning installations.

These amendments aim, inter alia, at improving energy efficiency by ensuring greater uniformity in enforcement across the national territory. Theadoption process involves the acquisition of the understanding by the Unified Conference, the opinion of the Council of State and the deliberation of the Council of Ministers.

*(*4) the total useful floor area to be renovated or the equivalent annual energy savings to be achieved between 2021 and 2 030 in accordance with Article 5 of Directive 2012/27/EU on the exemplary role of public bodies' buildings*;*

❖ <u>OBLIGATION TO RENOVATE CENTRAL GOVERNMENT BUILDINGS</u>

With regard to the objective of energy upgrading the floor area of central public authorities referred to in Article 5 of Directive 2012/27/EU, the INECP 2019 had calculated that, taking into account the total area of buildings subject to the provisions in Italy of 15,2 mln^{m} 2, for 4.102 occupations, it was expected that 2030 mln m 3,2 would be subject to energy retrofitting in the^{period} 2021-2.

Looking at the final results of the 2014-2022 period, we would first point out that further refinements of the inventory of buildings brought the total surface area to 16.1 million square metres. It can also be noted that the area for which regeneration was planned and financed in 2022 (thanks to the approval of specific projects) is 3.3 million square metres[56], compared with the 3,9 planned roadmap. This is in particular due to a slowdown in the rate of submission of projects by public administrations, due to their technical capacities and the need to speed up the implementation phase of approved projects. The possibility of introducing a further reform of the

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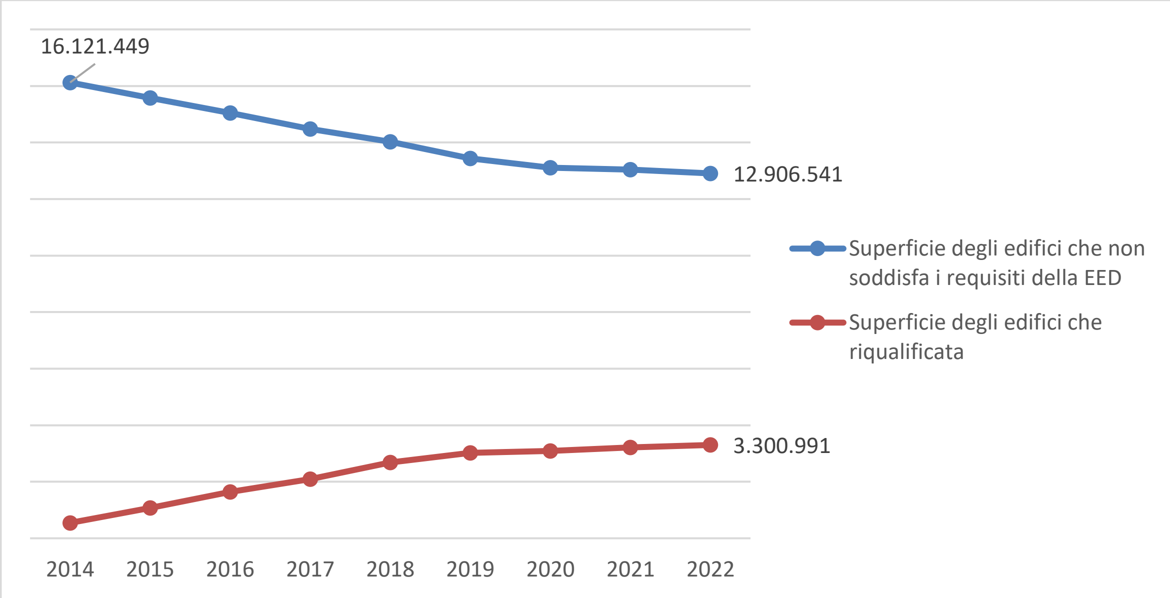
[56] *Data 2021 and 2022 below are related to the PREPAC programme only, while the 2014-2020 data include the effect of other policies to incentivise the renovation of central PA buildings; therefore, further work is ongoing to update these data in line with the effect of all active measures on the target.*

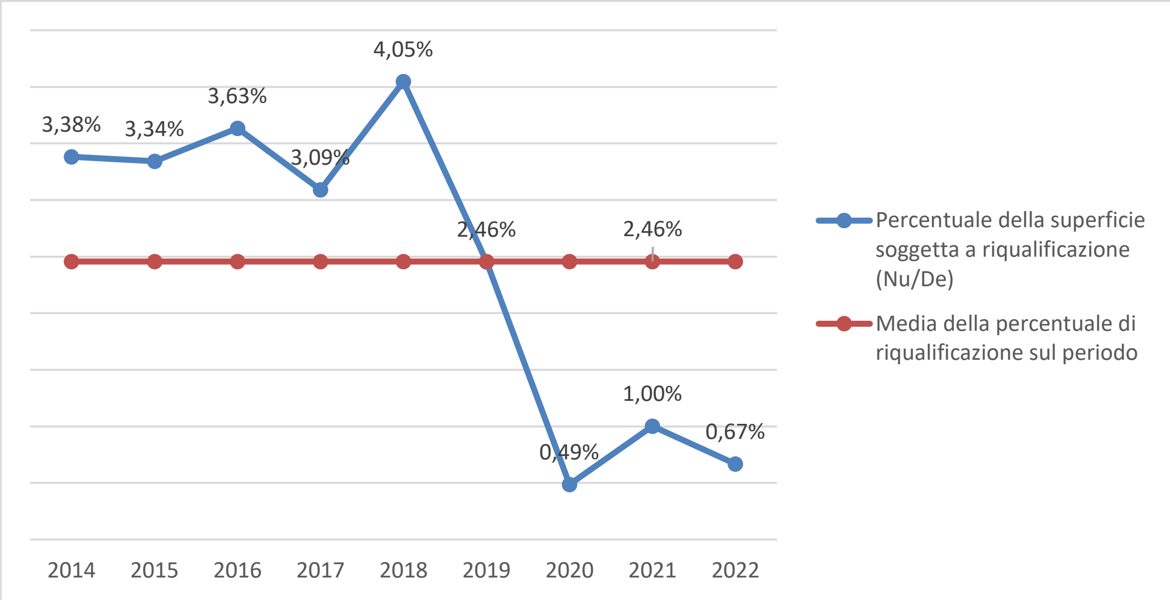
functioning model of the mechanism, in addition to that already carried out under the NRRP, is under consideration.

Figure 26 – Trend of upgrading the central PA's building stock in the final accounts for the period 2014-2022 (m²)



In terms of the annual and average rate, the graph below shows the above-mentioned negative increase in the area planned for regeneration from 2019 onwards, as a result of the decrease in approved projects. Nevertheless, in the period 2014-2022, there is an average regeneration rate of 2.46 % of the area subject to the obligation laid down in Article 5 of Directive 2012/27/EU.

Figure 27 - Rehabilitation rate of the central PA's building stock in the final accounts for the period 2014-2022 (%)



❖ **EXTENSION OF THE OBJECTIVE TO LOCAL PUBLIC ADMINISTRATION**

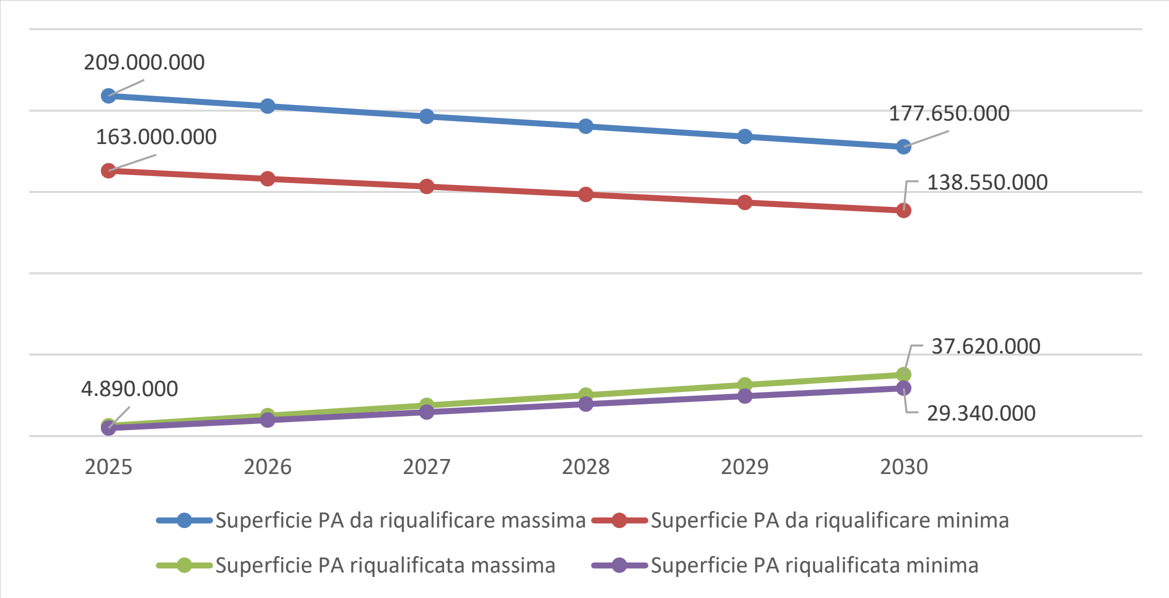
Article 6 EED III requires that 3 % of the air-conditioned area owned by the public administration be requalified annually, reaching the requirements of at least a nearly zero-energy building.

In fact, this obligation extends that already provided for in Article 5 of Directive 2012/27/EU discussed above, including local government and public housing.

According to the latest estimates of the size of the building stock shown above, the total assets of the national public administration amount to approximately 209 million square metres, of which 163 million square metres are not subject to architectural constraints (see Table 8), before buildings with a surface area of more than 250 square metres.

The annual regeneration trend from 2025 to 2030 is assumed below, which should be supported in order to comply with the obligation, taking into account a forged range between the above values of total area and not bound.

However, we would point out that these values will have to be confirmed when transposing the EED III Directive, due to the possibility of applying the derogations provided for therein (Article 6(2) of the Directive), as well as the possibility of excluding buildings with a surface area of less than 250 square metres.



❖ **<u>OBLIGATION TO REDUCE ANNUAL CONSUMPTION BY THE GENERAL GOVERNMENT</u>**

Article 5 EED III provides that public administration consumption is to be reduced by 1.9 % per year, compared to consumption in year X-2, with X the year of entry into force of the Directive.

Member States may exclude consumption of public transport and armed forces from this obligation.

RSE carried out in 2023 an update of the 2014 study entitled 'Energy consumption by public authorities – estimate of consumption and energy retrofitting scenarios', the findings of which can be found in this paragraph. At the same time, for statistical purposes, Terna, with the cooperation of GSE, analysed the data used to compile the 'Energy consumption in Services' template sent to Eurostat, estimating the consumption component attributable to the public administration. The calculations carried out show annual consumption of the PA between 3 and 4 Mtoe.

Given that the final values and calculation criteria to be adopted are not yet certain, caution is to calculate the objective referred to in Article 5 of the EED III from the highest consumption value pending further analysis in the coming years. The annual savings target is therefore 76 ktoe, which may be reduced with the exclusion of the consumption of the armed forces, and with the derogations granted by the EED III Directive.

Indeed, it is important to add that EED III provides that:

- during the transitional period ending on 11 October 2027, the target will be indicative. During the transitional period, data on estimated consumption may be used and then the target will have to be adjusted to actual consumption;
- the obligation does not include, until 31 December 2026, energy consumption by public authorities in local administrative units with less than 50.000 inhabitants and, until 31 December 2029, the energy consumption of public bodies in local administrative units with less than 5.000 inhabitants.

To take into account in particular the second of these aspects, further work is underway to break down consumption by municipality.

II. the indicative milestones set out in 2030, 2040 and 2050, indicators of progress developed at national level, a reliable estimate of expected energy savings and wider benefits, and their contributions to the achievement of Union energy efficiency targets as set out in the roadmaps set out in the long-term renovation strategies for the national stock of residential and non-residential, public and private buildings, in accordance with Article 2a of Directive 2010/31/EU

Please refer to point i above.

III. If applicable, other national objectives, including long-term targets or strategies and sectorial targets, and national objectives in areas such as energy efficiency in the transport sector and with regard to heating and cooling

The achievement of the energy targets, as described above, is strategically linked to the renewal of the building stock, both by the public administration and the private sector, with priority being given to energy efficiency and the use of renewable energy.

Achieving the targets requires the use of technologies that can ensure low heating, cooling and domestic hot water (ACS) needs, to be met with high energy efficiency and the use of renewable sources. It is also necessary to consider the increased demand for comfort in homes, in particular linked tothe need for cooling.

Among the available solutions, heat pumps (pdc), both electric and gas-fired, enabling the provision of the heating, air-conditioning and production services of ACS with a single appliance, making the pdc a device of safe interest in the air-conditioning of a large part of the civil buildings located in the national territory.

In addition, Italy will continue to promote the expansion of the use of efficient district heating and cooling, exploiting the residual economic potential in a manner consistent with other energy and environmental policy objectives, such as reducing waste waste-to-energy needs and limiting the use of biomass for emission reduction reasons.

In particular, according to the assessment report on the national potential for applying Cogeneration ad Alto Rendimento and efficient district heating provided for in Article 14 of the EED Directive, drawn up by GSE in 2015 and updated in 2021, the economically viable potential to increase energy from district heating is around 20.9 TWh of heat delivered annually (compared to 9.8 TWh in 2018), for an extension of district heating and cooling networks at national level of approximately 3.700 km (+ 77 % compared to 2018) and new volumes connected of 340 million cubic metres.

The above assessment of the incremental potential of district heating has been carried out in conjunction with the analysis of the incremental potential of Cogeneration ad Upper Rendimento and has now focused on the main sources for both purposes (DH and CAR), i.e. natural gas, biomass and waste. It may be interesting to carry out a wide-ranging in-depth analysis of the integration with district heating networks of certain technologies, which are currently marginal in the area of DH but potentially promising in high-density urban fabric, such as solar thermal, centralised heat pumps or the recovery of waste heat.

According to the scenario with active policies, reflecting the effects in 2030 of the measures planned and planned to date, heat supplied to customers through district heating networks could reach around 11 TWh, while heat produced in Cogeneration in Upper Rendimento would amount to around 25 TWh.

2.3 Dimension energy security

The security dimension concerns the energy system as a whole and requires the security of energy supply to consumers at sustainable prices capable of maintaining the competitiveness of the industrial and manufacturing sector. This dimension must be taken into account in a context, such as the Italian one, where energy supply is mainly provided from renewable sources and gas, with an increasingly marginal role of coal, in line with the phase-out objective. Security of energy supply will be fostered by greater diversification of natural gas supply routes and the development of electricity and gas production from renewable sources, as well as further improvements in energy efficiency.

According to the Commission's recommendation, both energy security and energy affordability need to be increased in order to ensure "a more resilient Energy Union". In this regard, the Commission recommended that Member States in updating their NECPs*"increase preparedness and strengthen measures in the EU to promote collective energy security*".

In 2021, domestic production of energy sources decreased overall by 1.1 % compared to the previous year, from 37.480 ktoe to 37.078 ktoe. There were declines in the production of oil and petroleum products, ranging from 5.856 ktoe to 5.228 ktoe (-10.7 %), natural gas, 3.287 ktoe to 2.608 ktoe (-20.7 %), and non-renewable waste, from 1.190 ktoe to 1.161 ktoe (-2.4 %), while production in renewable energy and bioliquids increased slightly from 27.146 ktoe to 28.081 ktoe (+ 3.4 %).

As regards the national upstream oil and gas sector, research permits and cultivation concessions have decreased, thus restricting the areas concerned: for research permits, the decrease was 1.115 km^2, rising from 24.500 km^2 in 2020 to 23.345 km^2 in 2021, while for areas covered by cultivation concessions, it increased from 14.113 km^2 in 2020 to 12.410 Km^2 in 2021, a decrease of 1.703 Km^2. No new exploratory wells were perforated in 2021 and only one development well was perforated, with national natural gas production continuing on the basis of the natural decline of the fields in production.

By contrast, biomethane mains its growth trend, reaching 300 million cubic metres in 2023. At the end of 2023, there are 75 installations connected to the Snam network Gas, while 29 are connected to distribution networks to other transmission networks. Particularly interesting is the production of biomethane from municipal bio-waste (FORSU), which makes it possible to enhance the organic fraction of waste by obtaining a form of renewable energy on the one hand and on the other hand to use CO_2 produced by the purification of biogas for industrial purposes, for example in the food industry (which is now forced to import it). It is also worth mentioning the production of biomethane from the agricultural sector, which, by exploiting agricultural waste and livestock waste, makes it possible to reduce emissions from the agricultural sector, which are difficult to reduce.

Net energy imports have increased: they increased from 105.799 ktoe in 2020 to 114.850 ktoe in 2021 (+ 8.6 %). In particular, there has been a sharp increase in net electricity imports (+ 33 %) and solid fuels (+ 13.4 %). Smaller increases were recorded in net imports of natural gas (+ 8.1 %) and petroleum products (+ 7.4 %). Net imports of renewable energy and bioliquids (-0.4 %) decreased slightly.

The share of net imports in gross energy availability, an indicator of the country's dependence on foreign countries, decreased slightly from 73.5 % in 2020 to 73.3 % in 2021.

Since February 2022, the severe war situation between Russia and Ukraine has created major challenges in terms of security of supply for Europe as a whole, given that the current energy dependency on fossil fuels from Russia is 34 % for oil (4.5 million barrels per day) and 46 % for natural gas (155 bcm/y). The economic sanctions imposed on Russia in response to the invasion of

Ukraine have called for a drastic strategic rethinking of supply sources in Italy and open up opportunities for accelerating the energy transition towards a more efficient and sustainable system and ensuring greater energy independence.

The only marginal deterioration in the security conditions of the Italian system due to the conflict is due to the fact that the gas consumption containment plan and record energy prices have contracted gas and electricity demand and ensured acceptable capacity margins both in the gas system, despite the fact that no 1/4 of the 2021 imports and the electricity system came to an end. In the period August 2022 to February 2023, the reference period of the National Consumption Control Plan, gas consumption was 19 % lower than the average of the last five years, while the peak daily demand stood at an exceptionally low value (slightly above 300m of^3 m, almost 1/5 below the potentially critical threshold of 400 million m^3).

Measures to curb consumption and very high energy prices – which policy decisions have only partially mitigated – have led to adaptation strategies and behavioural changes leading to a significant drop in gas (especially) and electricity consumption; on the supply side, policies for accelerated filling of gas storage, maximisation of LNG imports and the use of coal and fuel oil in electricity generation ensured the availability of natural gas throughout the winter.

Chart 29 - The ratio of monthly gas and electricity consumption in the euro area compared to the average over the past 5 years

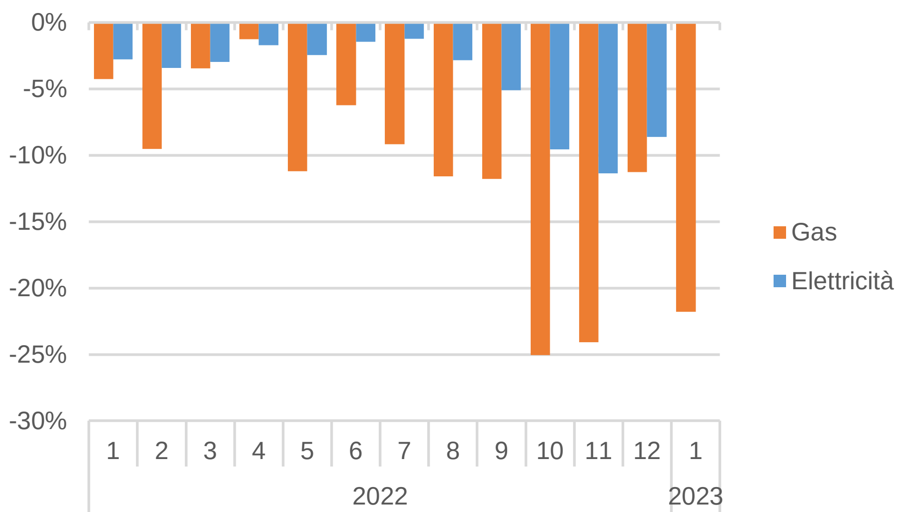
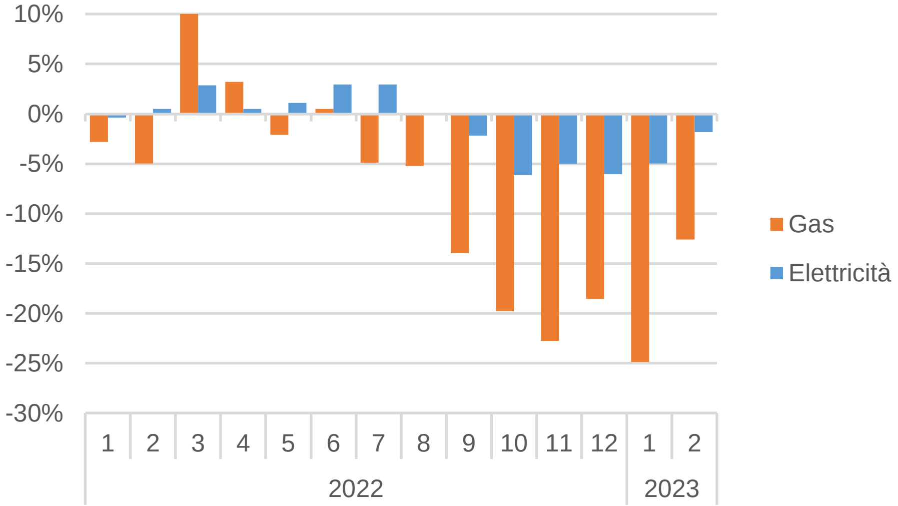


Figure 30 – Determination of monthly Italian gas and electricity consumption compared to the average of



the last 5 years

In this context, at European level, with Communication COM (2022) 108 of 8 March 2022 '*REPowerEU: Joint European Action for more affordable, secure and sustainable energy*', the European Commission has set a path towards the progressive replacement of imports from Russia to strengthen and accelerate the measures of the Fit-for-55 package.

The measures set out in the REPowerEU Communication can be summarised in the following main points:

- diversification of gas supply sources through agreements with different countries: the Commission recommends strengthening gas transmission infrastructure, including at continental level, making it compatible with hydrogen transport;
- doubling the availability of biomethane compared to the growth rate foreseen in the Fit-for-55 package;
- evolution of the energy mix by increasing the penetration of renewables much faster than the Fit-for-55 targets (in particular onshore and offshore wind and photovoltaic wind), including an increase of 20 %, including through the simplification of planning and permitting, the identification of suitable areas and acceleration areas and the implementation of regulatory sandboxes;
- doubling of the target for heat pumps to reach 10 million pieces installed within 5 years in the EU;
- accelerating actions to support the use of hydrogen, with particular reference to the implementation of a European (internal and import) market for this energy carrier;
- transformation of processes in energy-intensive industries, with particular reference to conversion to hydrogen and the integration of renewables.

In this sense, Italy's security of energy supply will be strengthened by stepping up efforts already undertaken to diversify natural gas supply sources, including to reduce dependence on Russian gas imports, continuing the action taken in the course of 2022 following the Ukrainian Russian war. This requires optimising the use of existing infrastructure (including storage facilities and regasification facilities), increasing the capacity of existing infrastructure (such as TAP), new regasification capacity and capacity extension of existing regasification equipment capacity, removal of gas bottle packages. Finally, Italy intends to further develop national biogas production and optimise natural gas production.

I. The elements referred to in Article 4(c)

(1) national targets:

1.Increase diversification of energy sources from third countries, with a view to reducing dependence on energy imports;

2. increase the flexibility of the national energy system;

3. addressing supply constraints or disruptions to an energy source, with a view to increasing the resilience of regional and national energy systems, including a timetable for the achievement of the targets;

❖ **GAS SECTOR**

Gas will continue to play a key role for the national energy system during the energy transition period and will complement the increasing volumes of synthetic renewable gases (biomethane, bioLPG, bioLNG, renewable dimethylether, hydrogen and synthetic methane) ~~and~~ contribute to the deployment of alternative fuels and fuels in the energy sectors, including the transport sector.

Gas demand amounted to around 62 billion cubic metres in 2023, a reduction of 6.8 billion cubic metres (-10 %) compared to the previous year. The reduction relates in particular to the thermoelectric and residential sectors.

In 2023, 5 % of gas demand (including exports) was covered by domestic production and 95 % by import. National production, around 3 billion cubic metres, was down by 10 % compared to 2022, while imports, around 61 billion, fell by 16 % compared to 2022; finally, there was a net balance of storage deposits of around 0.3 billion cubic metres.

National production also includes biomethane, from 99 million cubic metres in 2020 to 300 million cubic metres in 2023. Pipeline imports in 2023, amounting to around 45 billion cubic metres, representing around 73 % of total imports, recorded a reduction of 13 billion cubic metres compared to 2022. In particular, imports from Northern Europe (the Netherlands and Norway) decreased to around 6.6 billion cubic metres from Libya (around EUR 2.5 billion), while imports from Algeria (around 23.0 billion cubic metres) have been increasing. As regards Russia's entry, the value has fallen sharply due to the Russian-Ukrainian conflict (around 2.8 billion cubic metres). Gas from Azerbaijan, via TAP (input to Melendugno), with import flows starting in the last days of December 2020, was around 10 billion cubic metres in 2023, contributing to the security and diversification of supply sources for Italy and Europe.

In 2 023, the LNG input amounted to around 16.6 billion cubic metres, 27 % of total imports, an increase of 17 % compared to the previous year, corresponding in absolute terms to around 2.4 billion cubic metres. In particular, there are the following LNG arrivals at the three national terminals: LNG Adriatic (Cavarzere) 8.8 billion cubic metres; LNG Italy (Panigaglia) 2.6 billion cubic metres; Olt (Livorno) 3.8 billion cubic metres and FSRU Piombino 1.2 billion cubic metres.

The civil sector increased from 27,6 to 29.2 billion cubic metres in 2021, an increase of 1.6 billion cubic metres (+ 5.8 %) divided into the two Residential and Tertiary components. The increase is driven both by a colder climate of 2021 compared to 2020 and a recovery in the tertiary sector and after the reduction in 2020 due to Covid recovered pre-pandemic turnover and consumption levels.

In 2023, the civil sector increased from around 25 to 23 billion cubic metres, a reduction of around 2 billion cubic metres (-8 %) divided into the two Residential and Tertiary components. The reduction was mainly due to milder temperatures overall than in 2022.

For the thermoelectric sector and combined generation of electricity and heat from natural gas, consumption increased by around 2 billion cubic metres (+ 5.8 %) in absolute terms, corresponding to a higher gas generation of around 10 TWh (+ 7.8 %) driven by the recovery in electricity demand to 320 TWh, an increase of around 19 TWh (+ 6.2 %) compared to 2020. The increase in thermal power generation from gas was partly limited by the increase in gas prices, which in particular in the second part of the year made coal-fired generation cheaper than in 2020 by 7.4 %. For the thermoelectric sector and combined generation of electricity and heat from natural gas, consumption decreased by around 4 billion cubic metres (15 %) in 2023 as a result of the increase in electricity imports resulting from the resumption of French nuclear power, increased renewable production (in particular hydropower) and the reduction in electricity demand also as a result of the slow recovery of the industrial sector.

Gas demand for direct industrial uses in 2021 recorded a consumption of 10,8 bcm, an increase of around 1 billion m^3 (+ 9.7 %). All sectors recovered after the fall of 2020 due to the pandemic. Gas demand for direct industrial uses (including consumption in the Industry, Agriculture and Fisheries sectors, Chimica Synthesis and Autotration) recorded consumption of 11 bcm in 2023. This is lower than in 2022 by about -0.5 billion cubic metres, due to a fall in industrial production.

The table below shows the consumption of the main industrial sectors directly interconnected to the Snam Rete Gas network. Since 2015, gas removals have totalled around 13 billion cubic metres on an annual basis; these quantities also include consumption for cogeneration and energy system consumption. In particular, in the latter sector representative of gas consumption in petrochemical poles and refineries, gas is mainly used in desulphurisation and hydrogen production processes by Steam Reforming of natural gas, with an average consumption of around 1.3 billion m^3.

Table 32 – Consumption of the main industrial sectors directly interconnected to the Snam Rete Gas network

Direct industrial (Mm3/a PCS 10.58 kWh/m³)	**2017**	**2018**	**2019**	**2020**	**2021**
Chemistry	2.116	2.138	2.060	2.222	2.238
Glass and ceramic	2.131	2.243	2.263	2.118	2.456
Paper	1.975	1.983	1.959	1.800	1.983
Iron and steel	1.753	1.780	1.706	1.477	1.719
Grocery	1.191	1.175	1.217	1.238	1.254
Others	4.395	4.187	4.057	3.840	3.841
Total	**13.560**	**13.507**	**13.262**	**12.696**	**13.491**

Given the particular interest in natural gas for transport as an alternative to oil fuels, the transport sector deserves specific attention in recent years. The table below shows the gas consumption for transport. As noted, the sector is dominated by the use of gas in the form of compressed gas (CNG), with the use of LNG in recent years as fuel for heavy transport. It can be noted in the table that part of the LNG is not used as liquid fuel but is regassified on-site at distributors and used as CNG (L-CNG).

Table 33 - Gas consumption for transport

Transport	**2017 [MSm3]**	**2018 [MSm3]**	**2019 [MSm3]**	**2020 [MSm3]**	**2021 [MSm3]**
CNG from Distributors connected to the SRG network	775	748	723	546	591

CNG from Distributors connected to other networks or/L-CNG	287	277	314	271	303
Total CNG	**1.052**	**1.048**	**1.037**	**817**	**894**
LNG for Stradali transport	25	47	135	165	224
of which L-CNG	13	20	33	39	52
Total CNG + LNG	**1.077**	**1.094**	**1.172**	**943**	**1.066**

The Italian gas system has historically been characterised by a higher level of gas trading prices than the main European hubs, in particular compared to the Dutch TTF market. This spread is due to the fact that the Italian system, due to the gradual decline in domestic production, has over the years shown an increasing dependence on foreign sources of supply, particularly during the winter period, when prices depended on imports from northern Europe. Imports from Northern Europe, in addition to the increased liquidity of the TTF market, also lacked incomplete integration of the Italian market with the northern European markets, given the connection via the Swiss Transitgas pipeline characterised by short-term transport capacity management not in line with European rules, which did not allow prices to be balanced daily between the two markets. This situation had worsened in 2017 as one of the two pipelines constituting the TENP transmission system in Germany, linking the Transitgas pipeline to northern Europe, was out of operation. However, the supply situation has improved compared to the situation analysed in the last edition of the INECP and the 2017 Preventive Action Plan (PAP), in particular as from December 2020, with the entry into operation of the TAP gas import pipeline from Azerbaijan, which, with an annual capacity of up to approximately 9 billion cubic metres per year, enabled access to a new supply resource at competitive costs. Already in 2021, thanks to the contribution of this new source of supply, conditions for aligning prices with the hubs in Northern Europe have led to a progressive increase in exports from the Italian system to Central and Northern Europe (around 4.7 billion cubic metres in 2022 and around 2.6 billion cubic metres in 2023). Before the events linked to Russia's invasion of Ukraine, the Italian gas system had virtually aligned with European price systems.

The Italian gas system remains in the current situation one of the most interconnected systems on the European continent, thanks also to its privileged position and its branched infrastructure, with access to gas resources from North Africa (Algeria and Libya) and Azerbaijan through TAP's transmission system, as well as LNG which can be regaxified at the four existing Panigaglia, offshore Adriatic, OLT and Piombino plants, which entered into operation in 2023 as a result of the urgent measures decided by the Government to deal with the crisis resulting from the Russian-Ukrainian war and with regasification capacity of 5 billion cubic metres per year.

The differentiation of the supply of the Italian gas system is also supported by one of the most developed and flexible storage systems in Europe, which provides the country with a key resource in the winter season during which the highest consumption is recorded, consisting of a strategic storage volume (owned by storage companies and payable in the event of an emergency), and a volume of modulation storage that is stored in the summer period by gas market operators and delivered during the winter period.

Following the crisis resulting from the Russian-Ukrainian conflict, the possibility of accessing alternative sources of supply to gas from Russia and the possibility of using gas in Italian storage has created important opportunities for the Italian gas system, improving its competitiveness and highlighting the supporting role for the European internal market, especially for countries highly dependent on gas from Russia and which are poorly interconnected with alternative sources of supply. This is confirmed by the increase in the frequency and volumes exported to Austria both through the Tarvisio exit point (and thus potentially to other countries interconnected through the

Baumgarten hub) and to Switzerland (and thus potentially to Germany and France via the exit point of Passo Gries) in 2022 and 2023.

Below is the outline of possible new sources of supply aimed at eliminating the dependence of the Italian system on Russian gas by 2025.

Table 34 – Contributions for reducing dependence on Russian gas, incremental bcm compared to 2021

	2.S 2022	2023	2024	2025	
Pipe gas and national production					
Algeria by tube	1,2	6,0	9,0	9,0	Agreement initialled on 12 April
TAP	0,8	1,5	1,5	1,5	
National production			1,4	1,4	From the end of 2023/inizio 2024
Total incremental gas via tube	**2,0**	**7,5**	**11,9**	**11,9**	
LNG imports					
Egypt LNG	0,7	3,5	3,5	3,5	Agreement initialled on 13 April
Congo LNG		1,1	2,1	4,6	
Qatar LNG	0,5	1,4	1,4	1,4	
Angola LNG	0,2	1,0	1,0	1,0	
Other LNG	0,1	0,9	1,5	2,2	Nigeria, Indonesia, Mozambique, Libya, Others
Total incremental gas via LNG	**1,5**	**7,9**	**9,5**	**12,7**	
Saving gas consumption					
Savings from electricity renewables	0,4	2,4	4,9	7,3	Scenario 8 GW/incremental year. Hypothesis 1° of domestic saving temperature first 2 years, equivalent efficiency below
Savings from thermal and electrical consumption containment	1,0	2,0	2,0	2,0	
Biogas and biofuels development savings	0,1	0,6	1,1	1,6	
Savings for provisional production of coal thermal electricity (max. 2 years)	1,1	2,3			more 10/12 TWh in 2023 than in 2021
Total saving gas consumption	**2,6**	**7,3**	**7,9**	**10,9**	
Total potential reduction of Russian gas import	**6,1**	**22,7**	**29,3**	**35,5**	

Italy's commitment to support the internal and European market has been broken down by measures aimed at increasing the production of renewable gases (exploiting the sustainable agricultural and biomass potential of the country), traditional gas production and the conclusion of international agreements ensuring an increase in both LNG imports and pipeline imports from North African countries and Azerbaijan. Infrastructure development must also take account, in the long term, of the possible development of hydrogen production from renewable sources, both in the south of the country, where the largest production of non-programmable renewable sources is concentrated, and in the North African countries already interconnected to the Italian gas system, a resource which will become essential for achieving the decarbonisation objectives of the country together with the use of carbon dioxide capture and storage technologies.

In the gas sector, therefore, the main objective is to ensure an overall safer, more flexible and resilient system capable of facing a more uncertain and volatile market environment and supporting the strong development of both renewable electricity sources and green gas production, ensuring that energy demand is covered both in Italy and in interconnected European countries, especially in relation to peak demand coinciding with low levels of renewable energy production.

In addition to the above objectives, attention should be paid, in particular, to LPG supply depots (located on maritime land and inland areas), with a view to preserving the infrastructure network already in place and ready to accommodate mixtures of LPG with bio (bioLPG) and renewable (rDME) products.

❖ PETROLEUM PRODUCTS SECTOR

While oil products are characterised by a contraction demand in 2030, they will still account for a significant share of total national energy needs, particularly in the transport and petrochemical sectors. In the first path outlined by the Green Deal and then by the Repower EU, which is geared towards the strong use of renewable sources in 2030 and carbon neutrality by 2050, the refining sector will be able to make a major contribution to the transition to a lower carbon economy, with a high degree of specialisation, state-of-the-art production processes and continued strong research and development efforts to transform production processes for the production of increasingly climate-neutral fuels.

However, petroleum products still account for more than 80 % of the energy demand of the transport sector, with a peak close to 100 % in heavy road transport, maritime and aviation. Demand for these products in these sectors is set to decrease in perspective 2030, but maintaining the competitiveness of the domestic refining sector is crucial to continue ensuring security of energy supply. Petroleum products are also an essential raw material for green chemistry and for the production of plastics, synthetic fibres and rubber, detergents and other widely used products. Oil products have covered around 90 % of petrochemical raw material needs in recent years, followed by gases and solids only marginally. The most important supplies from abroad are oil and refined products. However, as national refining capacity is higher than domestic demand for petroleum products, Italy is not only self-sufficient in terms of finished products but is also a country exporting significant quantities of finished products.

Supplies also come from countries with high geopolitical risk profiles; the recent Russian-Ukrainian war has highlighted this risk, although the energy crisis has been managed without any problems by the national refining system due to the strong diversification of suppliers, which started in historical times (Algeria, Libya, Iran, Russia) and continued actively until now (e.g. Azerbajan, Qatar, USA, Canada). The recent energy crisis was mainly caused by a widespread freeze on investment in traditional forms of energy, which has led to a strong imbalance in demand and supply on the back of consumption. Therefore, in line with Community environmental objectives, the transformation of the energy system towards renewable and carbon-neutral production should be planned in full coherence with security of supply, avoiding the prohibition of traditional energy sources before the renewable alternative is fully available. The processing of refineries into the production of carbon neutral fuels must therefore be carried out precisely in accordance with that principle.

In 2 021, gross domestic consumption of oil and petroleum products grew by 13.5 % compared with the previous year, an increase of around 6.079 ktoe, mainly due to a post-pandemic recovery. Consumption of transport fuels was 30.322 ktoe, an increase of 21.6 % (5.392 ktoe) compared to 2020. Petrol grew by 21 %, diesel by 22.2 %. Gas oil, also used by heavy duty vehicles, recovered part of the 2020 decline, returning to pre-pandemic levels.

National production and changes in inventories accounted for almost 16 % of gross energy availability of 53.508 ktoe, while net imports accounted for more than 84 % of demand.

Italian imports of crude oil, semi-finished products and petroleum products, amounting to 71.977 ktoe, increased overall by 9.5 % compared to 2020. Crude oil imports (57.025 ktoe) increased by 13.2 %, while imports of semi-finished products and petroleum products (15.159 ktoe) decreased slightly by 3 %.

The increase affected imports from Africa (+ 61 %, from 13.511 ktoe in 2020 to 21.736 ktoe in 2021), Europe (+ 8 %, 16.431 to 17794), Asia (+ 3 %, 14.736 to 15.248). Only negative changes were recorded in purchases from the Middle East (-15 %, 17.466 to 14.815) and America (-34 % from 3.845 to 2.531).

Total exports of crude oil, semi-finished products and petroleum products (26.856 ktoe) increased by 13.2 % compared to 2020.

To the recent crisis in the Suez Canal area, the Italian refining system reacted promptly and in 2023 the import flocks across the Persian Gulf, Red Sea and Suez Canal area were around 17 % of the total crude imported (10,3 Mton out of 61,2). These quantities in the first months of 2024 were in many cases replaced by sources from other areas, given that the lengthening of the routes made these supplies less competitive.

On the other hand, the impact on imported finished products was more significant. Following the embargo with Russia, alternative purchases moved to the Middle and Far East (India, Abu Dhabi, Saudi Arabia and the Arab Emirates) from which **around 60 % of imported gas oil (2,9 Mton out of 4,8) and significant shares of other products in 2023**: 50 % of Jet fuel (mainly from the Arab Peninsula); 40 % of semi-finished products (from Iraq in particular), as well as 50 % of biofuel feedstocks (from Indonesia and Malaysia). However, the final effect on the country has always remained limited, with imports accounting for less than 18 % of the products available on the domestic market, while the rest is met by national refineries. Beyond the direct effect on our country, the conditions of global instability have nevertheless led to tensions and higher costs at international level in supplies and freight, which have also indirectly borne the national supply system.

Following Italy’s transposition of Directive 2009/119/EC of the European Community byLegislative Decree No 249 of 31 December 2012 ‘Implementation of Directive 2009/119/EC laying down an obligation for EU Member States to maintain a minimum level of stocks of crude oil and/or petroleum products’, the Italian system of oil security stocks provides for the presence of the Central Storage Body (OCSIT), the functions of which have been assigned to Acquirente Unico S.p.A., as well as the establishment of an information exchange platform, set up by MASE in cooperation with OCSIT, for the electronic exchange of all information flows on stock levels and location, both in Italy and abroad.

Stocks are held in order to cope with possible crises in the supply of crude oil or petroleum products (they were recently used during the Russian-Ukrainian war and past damage to the US refining system due to hurricane Katrina and during the blockade of crude oil imports from Libya during the armed conflict). Stocks to be held are 90 days of net imports of crude oil and petroleum products.

The refining crisis has led to the conversion of five major refineries in Italy: Mantova, Rome and Cremona were converted into logistics hubs, while Marghera and Gela were converted into biorefineries. The conversion of the two biorefineries ensures the current production of more than 750.000 tonnes of biofuels, which will reach 1.1 million tonnes in the future, especially advanced biofuels. In this sector, Italy has significant technological leadership at international level and will build on this basis the future transformations of Italian refineries. The pathway undertaken to safeguard the efficiency of refineries, by promoting the progressive decarbonisation of processes and products, concerns the gradual conversion of industrial facilities for the production of decarbonised fuels, including in particular biofuels, and will ensure, throughout the transition, the continuity of energy supplies in full security and under competitive conditions.

❖ ELECTRICAL SECTOR

In the field of electricity, the energy security objectives are now part of objectives aimed at increasing energy security under the various expected conditions, while the management objectives have been consolidated in relation to the INECP 2019, aimed at implementing the legislation necessary to remove the obstacles and constraints that slow down the implementation of the above measures.

The national electricity transmission grid is interconnected abroad through 30 interconnection lines:

- 9 lines with France, of which:
  - 4 HVDC lines: two at 320 kV (Piossasco-Grand'Ile) and two 200 kV with Corsica (SACOI);
  - 1 direct current line 150 kV between Sardinia and Corsica (Sarco);
- 4 lines in CA: one 220 kV in a single tank; one 380 kV in a single tank and one at 380 kV in double tank;
- 12 lines with Switzerland;
- 4 lines with Austria;
- 2 lines with Slovenia;
- an HVDC 500 kV Italy-Montenegro line (MONITA);
- an HVDC 500 kV Italy-Greece (GRITA) line;
- and a 220 kV connection to Malta.

Please find below the import and export data from the various countries with which Italy is interconnected:

Table 35 – Import and export data from the various countries with which Italy is interconnected

GWh	France	Switzerland	Austria	Slovenia	Greece	Malta	Montenegro
Import 2021	15.153	19.468	1.258	5.450	1.857	34	3.353
Export 2021	1.185	1.256	12	74	518	547	190
Import 2022	14.397	20.286	1.499	6.214	1.741	6	3.248
Export 2022	1.210	1.041	9,06	23	1.054	646	422
Import 2023	19.318	21.201	1.328	6.513	1.989	26	4.197
Export 2023	958	980	10	28	644	648	52

(Source: Terna)

The contribution of imports from the various countries with which Italy is interconnected is driven by 2 key factors: the hourly energy price differential between Italy and the interconnected country, and cross-border interconnection capacity.

Interconnections towards these borders will be further enhanced through medium- and long-term projects identified by the national electricity system operator, which will allow for an increase in external interconnection capacity, mainly located at the northern and southern borders of the country. In the medium term (2030), the total estimated increase is around 1.000 MW, due to the planned entry into operation of the HDVC interconnection project with Tunisia “tunita” (NTC increase on the border of 600 MW), and the reduction of capacity limitations with Slovenia (with NTC increase on the border of 400 MW). In the long term (2040), an overall increase of more than 2.000 MW is expected due to the development of the second HDVC interconnection with Greece “GRITA 2” (NTC increase on the border from 500 to 1 000 MW[57]), the interconnection with Valtellina – Valchiavenna Switzerland and two additional interconnections with Austria.

In addition, there are several private merchant lines, some of which are already authorised.

Internally, the new generation system will be increasingly characterised by strong growth of non-programmable renewables, with increasing management complexity for the grid and increasing demand for flexibility for balancing. Even considering the possibility of gradually changing the infrastructure structures and the same market design, the scenarios for strong growth in renewable production are now technically viable safely, provided that the network development works (new pipelines and upgrading existing sections) already provided for in the Terna plans are carried out at the same time, so as to manage the phenomena caused by the change in the production mix, including the coal phase-out process, and to increase cross-zonal transit capacity.

In order to address the new challenges of the energy transition, a series of interventions on the RTN have therefore been put in place with the ambitious aim of reducing the negative impacts on the safety of the electricity system produced by RES generation, such as zonal congestion between North and South (caused by RES production that is mostly located in the south and thus far away from consumption units), the reduction of the system adequacy margin caused by the load peaks characterising RES production, the phenomenon of reverse flow from primary Cabine to RTN and the instability of the medium-voltage and low-voltage electricity distribution network caused by connection to RES.

In order to implement the PNIEC 2019 objectives, the Terna Development Plan has already introduced RTN development measures necessary to achieve the decarbonisation and energy

[57] *Joint activities and studies with the Greek TSO IPTO, in view of the evolution of renewable generation in the policy scenario planned in the south of the country, showed efficiencies and synergies resulting from the implementation of a new 1.000 MW bipolar connection.*

security objectives, including the known Tyrrhenian link (HVDC link Campania-Sicilia-Sardinia), the Adriatic link (Central Central North Centre HVDC link), the renewal and upgrading of SACOI (the Tuscany – Sardinia – Corsica HVDC connection), the 380 kV cable pipeline Bolano – Annunziata.

In addition to the development measures mentioned above, which are characterised by complex infrastructure measures on RTN's backbone, there are many measures put in place, both for RES integration and for the resilience of the electricity system, which did not require complex authorisation steps, as they have benefited from simplified authorisation procedures provided for in the simplification rules adopted in the last 2 years. These include the installation of synchronous compensators, all extraordinary maintenance activities for RTN's resilience to violent weather phenomena, reconstructions of existing overhead lines and all operations leading to the improvement of the operational performance of existing lines or allowing the operation of existing direct current lines, which are used to transport renewable energy.

In this complex and composite landscape, the central objective of maintaining system adequacy conditions also in the medium to long term remains in the update of the INECP, especially in a scenario of strong change in the national and European generation mix and the range of resources possible. For this reason, in the latest development plan submitted by the operator (Annual Year 2023), the development projects already planned to implement the INECP objectives are supplemented, even more challenging, with the aim of fermenting the national transmission network towards the energy transition, by modernising existing electricity pipelines on the eastern and western backbone of the country to the southern regions and islands, using direct current transmission technology (HVDC), together with the development of new 500 kV submarine connections. This will make it possible to improve and increase the performance of electricity pipelines, allowing the transfer of increasingly power generated by renewables in southern Italy to the northern loading areas.

This fierce project, known as 'Hypergrid', therefore provides for the upgrade of existing 220 kV or 380 kV power lines, with interventions on existing lines built on or adjacent to the same route, with improved operational performance or to enable them to operate on a direct current basis.

The objective of the work carried out by the operator with other European and national stakeholders to strengthen and improve RTN is to improve the country's energy security standards, reducing dependence on foreign sources and making energy supply stable in relation to the country's needs.

A second vital objective will be to increase the resilience of the system to consider the impacts of climate change that are causing increasingly significant disservices linked to extreme events. This objective requires that the planning and operation aspects of the system be taken into account in an integrated and coordinated manner by means of appropriate methodologies enabling overall action plans to be drawn up to minimise the extent of disservices.

II. National objectives with regard to increasing: the diversification of energy sources and supply from third countries for the purpose of increasing the resilience of regional and national energy systems

III. Where appropriate, national targets for reducing dependence on energy imports from third countries, with a view to increasing the resilience of regional and national energy systems.

IV. National targets to increase the flexibility of the national energy system, in particular through the development of domestic energy sources, demand response and storage

❖ GAS SECTOR

Given that gas will continue to play, in the short to medium term, an essential function, in synergy with renewable sources, for industrial and household uses (as well as for transport) and for electricity generation, special attention should continue to be paid to the diversification of supply sources and the flexibility of the national energy system.

Diversification of supply sources can be pursued both through the conclusion of new agreements and by upgrading the necessary infrastructure. As Russian gas supplies no longer exist, Italy, due to its geographical position, can strengthen its role in supporting the European gas market.

To this end, the following objectives shall be pursued:

- create the conditions for upgrading the Southern Corridor through TAP (Trans Adriatic Pipeline), favouring an additional capacity increase of 10 billion m^3 per year from Azerbaijan;
- increase the transport capacity from the entry points of southern Italy through the implementation of the "Linea Adriatica", which is essential in order to increase flows to northern Europe, as a result of the increase in gas imports from Algeria, resulting from the reduction in Russian gas flows from Austria;
- optimise the use of LNG import capacity in existing terminals and develop new liquid-form regasification and storage capacity (SSLNG deposits), of strategic importance for Italy's participation in the Mediterranean and global LNG market in competition with Northern Europe terminals;
- strengthen the storage system, allowing for a more flexible and resilient system;
- update the Preventive Action Plans and Emergency Plans, bearing in mind that, with zero gas supplies from Russia, the role of the largest gas infrastructure for the calculation of N-1 conditions under Regulation UE/201771938 is now the Transmed Interconnection Pipeline with Algeria, and their relationship with the plans of the other Member States interconnected with Italy;
- support the development of new renewable gas plants, in particular biomethane;
- make the savings measures adopted in winter 2022-2023 stable for the domestic heating sector, on the basis of Regulation (EC) No UE/2022/1369. The administrative measures, to be adopted by MASE decrees, will be aimed at reducing consumption by modifying the annual ignition periods, reducing the daily activation time of the plants and the maximum internal temperature allowed for the environment, and revising the values of so-called 'degree days' based on outdated meteoclimatic averages[58];
- support the development of a gas transmission system that can also be suitable for developing a multive-vector network capable of transporting both natural gas and hydrogen when this energy source is available at competitive prices. The development of the transport network may also include the creation of infrastructure suitable for the transport of carbon dioxide (CO_2) with the aim of connecting the large emitters that will install capture facilities with the CO2 storage facilities under$_{study}$ in the high Adriatic;
- complete the assessments in relation to the EastMed-Poseidon gas interconnection project that could allow for further diversification of current routes, sourcing from promising offshore gas fields in the Eastern Mediterranean. However, for the Eastmed section, there are still some insights to be carried out mainly in relation to the geopolitical situation, as its

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[58] Theresult of the administrative measures can be achieved through a combination of the reduction of the winter heating period of 15 days, reducing the internal temperature of 1 °C (from 20 °C to 19 °C) and a one-hour reduction of the plant by one hour per day, with a total value of approximately 2.7 billion cubic metres of saved gas (of which 1.65 billion for the reduction of 1 °C and 550 million m^3 for one hour reduction only). These measures do not substantially reduce the comfort of the environment, which can also be adopted with a view to decarbonising energy consumption.

route concerns areas of the submarine continental shelf that are still the subject of international disputes over their delimitation.

It also seems useful to promote the production of renewable gases for all end uses, even if not connected to the network of methane pipelines, contributing to their progressive decarbonisation.

The objective of diversification of supply must also include the development of renewable gas production chains (such as biomethane, bioLPG, renewable dimethylether and hydrogen), which can contribute to the decarbonisation of all end uses, fostering the development of synergies of industrial sectors from a circular economy perspective.

With reference to the increase in energy security, it should be noted that the development of national bio- and renewable gas supply chains must be combined with solutions that can be channelled into the grid (biomethane, synthetic methane and hydrogen) and complementary solutions (such as LPG and LNG, bioLPG, bio-LNG and renewable dimethylether, resulting from both bio-based and recycled carbon processes) and, with distribution infrastructure already spread across the national territory, can immediately contribute to the decarbonisation of users not connected to the network of methane pipelines (residential, industrial and agricultural). both jobs in the transport sector (light and heavy road, as well as maritime).

In this regard, we would point out that, in order to enhance the existing infrastructure already ready and available (storage stores, fuel outlets and installations already installed in utilities), industry is planning significant investments for the decarbonisation of LPG, with the aim of releasing for consumption, in the medium term (horizon 2030), a blend consisting of 40 % of bio and renewable products (bioLPG and renewable dimethyl ether) and 60 % conventional LPG.

From 2030 onwards, against the background of these investments, Italy is estimated to have a potential annual availability of 750.000 tonnes of rDME and about 700.000 tonnes of bioLPG per year (the latter, to date, already available in the two national biorefineries currently producing around 40.000 tonnes of bioLPG per year), which could be released for consumption for transport or combustion, mainly in the civil sector.

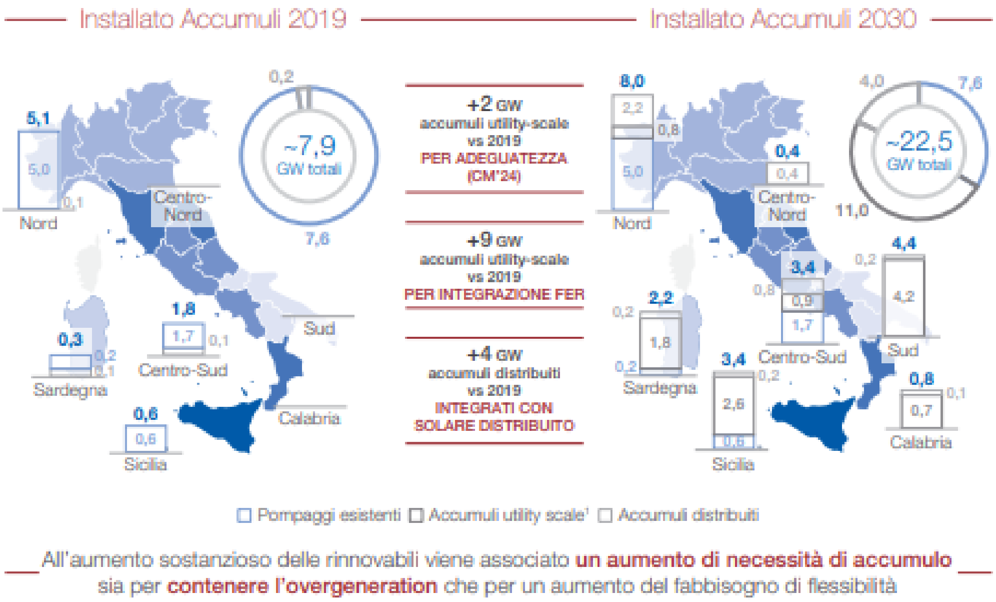
❖ **ELECTRICAL SECTOR**

In updating the INECP energy security targets, it is necessary to continue the development of measures that can support renewable energy production, in order to achieve the challenging Eurounit targets of generation mix by 2030.

The main objective is therefore to be able to safely manage the growth of non-programmable renewable generation up to the level set by the European legislator, with the subsequent objective of full decarbonisation in 2050, also ensuring the abandonment of coal in 2025 (with the exception of installations located in Sardinia). To this end, the development of new electric storage capacities of both utility *scale and distributed types of* electricity should be encouraged.

The table below shows the forecast figure for accumulations drawn up by Terna in the 2023 Development Plan:

Figure 31 – Buildings 2019 and 2030 (GW)



The increasing penetration of non-programmable renewable generation capacity with almost zero variable costs has, among other things, exacerbated the risk factors typical of private investment in electricity generation and storage capacity, making it extremely complex for the individual private investor to predict, on the basis of price signals from spot markets alone, the profitability associated with its investment choices. In the absence of sufficiently developed forward markets, the expected revenues from participation in *spot* markets are characterised by a considerable degree of uncertainty due to their dependence on exogenous factors that are increasingly difficult to predict by the investor, such as: the growth of renewables, the development of storage, the evolution of demand, network developments and the system operator's behaviour in the ancillary services market.

It is therefore necessary to continue the adoption of market mechanisms such as *the capacity market* to ensure the availability of the capacity necessary for system adequacy in the medium long term.

An additional objective is to increase electricity storage capacity to ensure the integration of renewables into the electricity market, efficiently manage overgeneration and respond to system flexibility needs. In that regard, in implementation of Article 18 of Legislative Decree 210/2021, followed by ARERA Resolution 247/2023, a new centralised supply mechanism dedicated to this type of resources was introduced into the system.

Among the storage technologies, pumping facilities are still an important resource for the adequacy of the system, as well as for the security and flexibility of the system, being able to provide the maximum available capacity during the hours of the highest load, ensured by filling the upstream reservoirs, following the pumping of these facilities at times of low load.

Another objective to ensure the security of the energy system is the development of a resilient network against weather events induced by climate change, which, increasingly extreme in terms of intensity, extent and frequency, increase risks to the electricity system, leading to disruption and breakdown of components with impacts on entire areas of the national electricity system.

The objective of increasing the resilience of the electricity system, which has already been addressed in the INECP 2019, requires to date the implementation of passive and active solutions to mitigate the effects on transmission and distribution networks by optimising the coordination mechanisms between the various relevant institutional actors.

This objective will cover the implementation of mitigation measures at all stages of electricity system management, from planning to operation, so that extreme events can be managed more efficiently and effectively. It will therefore be necessary to improve the system's resilience to stress events, the effectiveness of emergency intervention and restoration of service in the event of interruption and the safety of all actors involved in various ways. The objectives in this area must necessarily take into account the transnational dimension of security risks, given the increasing interconnection of transmission networks, and the consequent need for greater coordination between European countries, including in the definition of national plans.

Compared to the resilience plans already drawn up by distribution concessionaires and Terna at the direction of the then MISE, integrated and coordinated resilience building plans based on both passive (grid reinforcement planning) and active (protection, automation and defence) solutions will need to be developed in the medium term, including by improving restoration plans in order to reduce the duration and impacts of disservices, reducing LOLE (Loss of Load Expectation) and EENS (Expected Energy Not served). In addition, the plans will have to consider both reducing the probability of failure and reducing the risk of discharging, with the aim of improving stress resilience and reliability of the system in the face of extreme events.

2.4 Dimension Internal energy market

2.4.1 Electricity interconnectivity

I. The level of electricity interconnectivity that the Member State aims for in 2 030 in consideration of the electricity interconnection target for 2030 of at least 15 %, with a strategy with the level from 2021 onwards defined in close cooperation with affected Member States, taking into account the 2020 interconnection target of 10 % and the following indicators of the urgency of action:

1) *wholesale price differential above an indicative threshold of EUR 2/MWh between Member States, regions or bidding zones;*

2) *nominal transmission capacity of interconnections less than 30 % of the peak load;*

3) *nominal transmission capacity of interconnections of less than 30 % of installed renewable energy generation capacity.*

Any new interconnection shall be subject to a socio-economic and environmental cost-benefit analysis and shall only be implemented if the potential benefits outweigh the costs.

At national level, the development of cross-border power lines mainly concerns projects of new public networks included in the Terna development plans, which are complemented by new interconnections financed in whole or in part by third parties within the meaning of Regulation (EC) No 2019/943 (so-called merchant initiatives).

Terna is required, by virtue of its mandate as TSO and the concession granted by MASE, to manage and develop interconnection capacity with the electricity systems of other countries in order to ensure greater security and reduce electricity supply costs.

The Terna Development Plan for 2023, in line with previous plans, maintains the reinforcement of the transmission network to develop interconnection capacity with the electricity systems of neighbouring countries in order to ensure greater security through the possibility of mutual assistance between interconnected systems. In this respect, in line with previous Terna Development Plans, the aim is to develop Italy's interconnection capacity, in particular with Corsica, Tunisia, Greece, Slovenia, Austria, Switzerland and Malta.

The development of interconnection capacity with North Africa is of strategic importance for the entire Mediterranean electricity system and will provide an additional tool to optimise the use of energy resources between Europe and North Africa. The Italy-Tunisia interconnection (tunita) will in fact contribute to increasing the benefits not only for the Italian electricity system but overall for the whole European system, particularly in terms of sustainability, market integration and diversification of supply of resources.

In this context, the development of interconnectors financed by third parties – and in particular by energy-intensive customers – can also contribute to a significant increase in the overall available transport capacity. The Concession Convention requires the TSO to take these projects into account in the definition of development lines, with particular reference to the identification of the needs for the upgrading of the interconnection network with foreign borders. In order to improve long-term planning capacity, it is also useful to note that in Italy the so-called merchant line (ML) initiatives, which are still in place, are particularly numerous in terms of authorisations granted.

The electricity interconnection target of 15 % by 2030 is currently assessed as the ratio between Net Transfer Capacity (NTC) and installed generation capacity. The significant growth in installed generation capacity expected due to new solar and wind power in 2030 (+ 74 GW in the Policy scenario, maintaining fossil capacity with an integration, flexibility and reserve function) makes it even more challenging for Italy to meet the interconnection target on time. The expected significant development of non-programmable renewable sources will lead to the need for regulatory tools in order to ensure the necessary reserve margins for the safe operation of the system.

More details on interconnection planning will be dealt with in paragraph 3.4.1

In any event, as stated by the Expert Group and shared by the Commission, a *sine qua non* for the creation of a new interconnection is that it is subject to socio-economic and environmental cost-benefit analysis that ensures that the benefits outweigh the costs.

As regards indicator 1), we would point out that it is currently impossible to estimate it, in the absence of detailed information on the configuration of the electro-energy systems of the other States recruited for 2030, which will become available only after the publication of their National Integrated Climate Energy Plans. It should also be pointed out that a small cross border price differential would discourage the development of merchant initiatives, which are precisely justified by this differential.

As regards indicator (2), the estimated value at 2 030 in the Terna PdS scenario is 33 to 40 % considering all interconnection projects planned to date by the TSO and private promoters with entry into operation by the 2030 horizon. The value of this indicator would be 19 to 22 %, taking into account only the projects developed by Terna, which highlights the need to develop additional interconnections already planned beyond the horizon that can contribute to achieving the targets.

As regards indicator (3), the estimated value at 2 030 in the Terna PdS scenario is 19 to 25 %, which would be 11 to 14 % considering only the projects developed by the TSO, which highlights the need for the development of additional interconnections already planned beyond the horizon that can contribute to achieving the targets. As mentioned above, however, this value, while showing a gap from the 30 % threshold, is reduced by the significant share of installed renewable sources (123 GW) foreseen in this Plan in 2030.

2.4.2 Energy transmission infrastructure

I. Key electricity and gas transmission infrastructure projects, and, where relevant, modernisation projects, that are necessary for the achievement of objectives and targets under the five dimensions of the Energy Union Strategy

❖ **ELECTRICAL SECTOR**

With regard to the National Transmission Electricity Network (RTN), decarbonisation targets pose new challenges for grid development and operation. In particular, requests to connect to RTN indicate that market participants are concentrating the development of new RES mainly in the south and islands, i.e. areas with high availability of primary energy resources. In order to enable the growth of RES needed to achieve the European objectives, it will be crucial to develop new, efficient infrastructure that can connect the areas with increased RES production – in the south and on the islands – with consumption centres, mainly located in the north of the country.

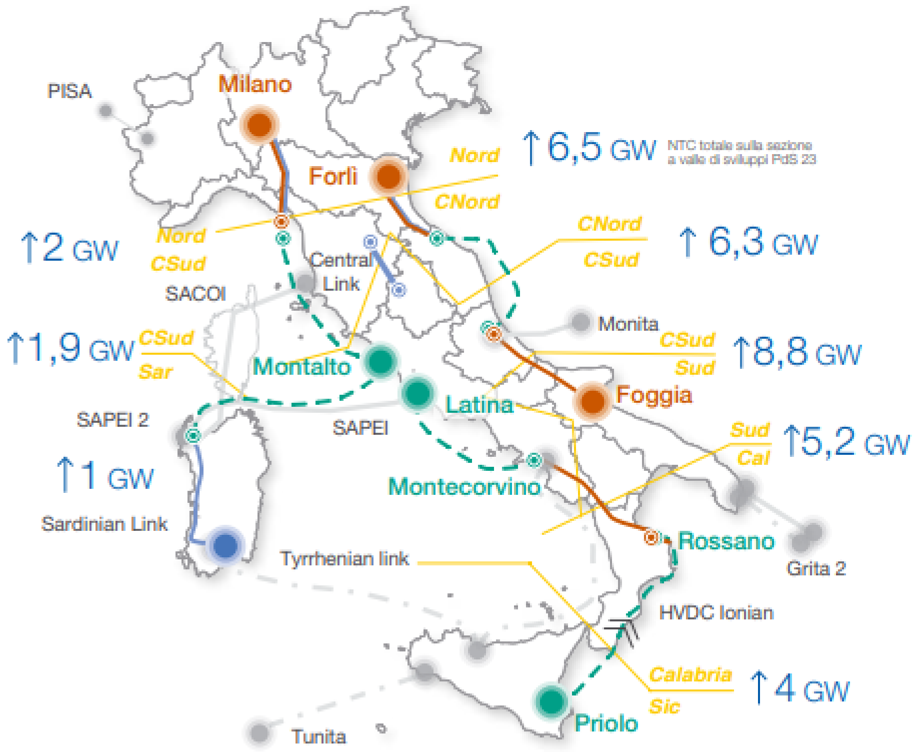
In this context, in the new Development Plan presented in March 2023, Terna provided for infrastructure development and new tools to achieve the ecological transition objectives in the most efficient way.

The objectives of the Development Plan include:

- integrating RES;
- increase transport capacity between market areas and resolve the congestion of the electricity system;
- developing interconnections with foreign countries;
- improve the levels of safety, quality and resilience of the electricity system, in order to ensure continuous coverage of electricity demand as well as continuity of service;
- ensure the robustness of the network and dampen low-frequency inter-systemic oscillations.

One of the main expected benefits of the interventions foreseen in the 2023 Development Plan will be the increase in inter-zone trading capacity, i.e. doubling the current trading capacity between market areas from around 16 GW at present to over 30 GW. In this context, the modernisation of electricity pipelines with interventions on existing lines, carried out on or adjacent to the same route, with improved operational performance, to enable direct current (DC) operation, in addition to the use of underground/submarine cable technology and innovative AC solutions, will allow a significant increase in transport capacity; this will allow the implementation of a layer in DC (Hypergrid), which will enable an active and highly stabilising network to be built. The new Hypergrid development interventions will allow for a doubling of the current trading capacity between market areas and, in a synergical manner with the actions planned in the previous plans, will contribute to reducing and resolving future congestion of the National Transmission Network.

Figure 32 Terna Development Plan 2023: Overview of new interventions and increases in transport capacity (GW)



DORSALI HYPERGRID

		E.E.	MLN €
HVDC Milano-Montalto	>>	2030/2032	2.675
Central Link	>>	2030	280
SAPEI 2 & Sardinian Link	>>	2040	1.422
HVDC Ionian	>>	2035	1.410
HVDC Rossano-Latina	>>	2035	2.724
HVDC Foggia - Forlì	>>	2032/2036	2.355

All the measures provided for in the Terna Development Plan are described in paragraph 4.5.2.

In parallel with the flexibility infrastructure, it is also important that the network is equipped with devices to increase the controllability and stability of RTN such as reactors, synchronous compensators and FACTS – Flexible AC transmission systems, capable of providing voltage regulation and cargo control services to ensure high standards of service quality and system safety.

Additional investments in distribution networks, which are increasingly affected by the deployment of small and medium-sized installations, should be added to the above mentioned interventions. In the distribution networks, it is extremely complex to estimate the overall scale of the modernisation measures needed to achieve the objectives, given the diverse geographical location of distributed generation (mainly photovoltaic conversion) and electrification of end uses. For the latter, in particular, the largest effects are expected in areas with high housing density, while the effect of distributed generation is reasonably more likely to be felt in low-load rural areas. In any event, the spatial consistency between generation and load does not guarantee the coincidence in time between production and levies, as injections not consumed locally (in individual users or with nearby users) may have increased to the higher levels of the network.

❖ **GAS SECTOR**

The contribution of the TAP import pipeline, connected to the national transport network in the course of 2020, was instrumental in supporting the national energy system in the course of 2021 and especially after the outbreak of the conflict in Ukraine. The new source of supply of Azerbaijani gas, through a new TAP route, has in fact increased the diversification, security of supply and resilience of the gas system, making the Italian system also able to support the supply of neighbouring countries, mainly Austria and Slovenia.

The adjustment of the transport network also continues in relation to solutions aimed at overcoming the difficulties in carrying out maintenance on sections of the network that pass through highly urbanised areas. It is therefore necessary to follow the intervention plans on the network in order to ensure continuity of service for final customers, given the progressive ageing of natural gas transmission infrastructure, both national and European, which are part of a network which has developed more than 40 years ago, and to provide, in the future, for the rearrangement of the network as a result of the activation of new interconnections or new supply routes. The storage system also continues with a plan to adapt existing installations with the aim of updating plant solutions, improving efficiency and ensuring that performance is maintained in the medium to long term.

The gas system will also be able to rely on two new FSRU regasification terminals authorised during 2022, which will increase the independence of the Italian system from a single supplier and, in particular, from imports from Russia. The first FSRU terminal, which entered into operation in 2023, was located in the port of Piombino and the second terminal will be located off the coast of Ravenna and is scheduled to enter into operation in 2025. Further initiatives will also be considered for the construction of new regasification terminals located in southern Italy and for the methanisation of Sardinia.

Construction work is also ongoing for a new natural gas production plant located near Gela and its connection to the national gas network, which is expected to enter into operation in 2024.

In the gas sector, several small-scale coastal deposition (SSLNG) projects are being authorised and evaluated at MASE for the discharge of LNG from small methane vessels, storage and subsequent loading on bettoline vessels (bunkering) for the supply of household and industrial customers and fuel refuelling stations. In particular, solutions have been put forward in Sardinia involving the loading of LNG into bettolins at existing regasification plants (Panigaglia and Livorno in particular) to provide small storage/regasification facilities located on the island and connected to the future gas network in Sardinia.

2.4.3 Market integration

I. National objectives related to other aspects of the internal energy market such as increasing system flexibility, in particular related to the promotion of competitively determined electricity prices in line with relevant sectoral law, market integration and coupling, aimed at increasing the tradeable capacity of existing interconnectors, smart grids, aggregation, demand response, storage, distributed generation, mechanisms for dispatching, re-dispatching and curtailment, and real-time price signals, including a timeframe for when the objectives shall be met

The electricity market was originally designed with the aim of pursuing, through the promotion of competition in the *spot* markets, both short- and long-term objectives of production efficiency and allocation. More recently, the challenging objective of decarbonising the electricity system has been added to these traditional objectives. The need to pursue, in an effective and efficient manner, the latter key objective has highlighted the need to reform market design.

The original market design – focused on spot markets has clear limitations in ensuring the investments needed to pursue the challenging decarbonisation objectives, while ensuring that the necessary resources are available to preserve the adequacy and safety of the electricity system.

In order to ensure effectiveness and efficiency in the transition process towards the decarbonisation of the electricity system, it is therefore considered to be a priority to strengthen the role of forward markets with the aim of promoting investments in renewable generation capacity necessary *to* meet decarbonisation targets, while ensuring:

- an efficient distribution of these resources between different market areas and due to the expected different production profiles; overcoming the concept of cost minimisation to also take into account the value generated for the system due also to the evolution of other relevant elements (networks and accumulations);
- full integration of renewables into the markets, without exposing producers to unjustified risks;
- the availability of a minimum amount of resources to maintain the security and adequacy of the system.

This requires not only the introduction of new segments of centralised forward markets, such as the supply of utility stairway storage resources referred to in Article 18 of Legislative Decree 210/2021, and to innovate existing ones, such as the system's forward contractualisation mechanisms for renewable production (with two-way contracts), but also to:

- promoting *merchant* initiatives for the development of renewable energy and storage, for example through *Power Purchase Agreements* or PPA;
- ensure efficient coordination between the various fixed-term contracting mechanisms and *merchant* initiatives, in order to maximise their synergies and ensure that the *mix* of resources in the electricity system is optimised;
- ensure full integration of the resources procured in the *spot* markets in the future, so that these markets can continue to express correct signals with respect to the actual value of electricity produced and consumed in real time, thereby maximising short-term efficiency.

In parallel with the above-mentioned strengthening of forward markets, we intend to continue the process already undertaken to promote greater integration of the Italian market with other European markets and to improve the functioning of the retail and *spot* wholesale *markets*.

❖ **THE DEVELOPMENT OF FORWARD ELECTRICITY TRADING INSTRUMENTS**

The energy crisis has made even more pressing the need to make structural, alongside short-term markets that are functional to the efficient dispatching of resources over the short or very short time horizon, trading tools for the long-term supply of the resources needed to:

- pursue decarbonisation objectives (PPPs and two-way contracts with the system);
- ensure the security of the electricity system and the efficient integration of renewable sources into the electricity market (supply mechanism for utility scale storage resources referred to in Legislative Decree No 210/2021);
- ensuring the adequacy of the electricity system (capacity market).

♦ ***Power Purchase Agreements and Two-way Difference Contracts***

With regard to fixed-term contracts for renewable capacity, it is considered necessary to encourage *merchant* initiatives, for example through the *Power Purchase Agreements* or PPA, and above all to innovate the system's contractualisation mechanisms such as two-way or CfD contracts.

PPPs are useful tools to promote new investments in renewable generation capacities and, in particular, to help decarbonise the energy consumption of large industrial consumers. This medium to long-term contractualisation instrument allows, in relation to the electricity covered by the contract, to stabilise the price over time, providing the producer with stable revenue flows over the medium to long term (necessary to ensure the bankability of the project) and the consumer against price volatility in *spot* markets.

However, access to this type of instrument is particularly burdensome for operators due to the multiple risks associated with the conclusion of contracts with very long time horizons. This burden makes PPPs unsuited to the needs, in particular, of small consumers.

The main actions that can be taken to resolve the above-mentioned problems and to promote fixed-term contracts for renewable production through PPAS are:

- standardisation of contractual parameters;
- counterparty risk management through the establishment of a forward market with a CCP;
- the possibility to provide for public guarantee schemes to support operators.

In this regard, the REpower chapter under the NRRP, as updated following the decision of the Council of the EU in December 2023, provided for a specific reform to mitigate counterparty risk with the aim of promoting access to this type of contract, through the introduction of a centralised guarantee system with the identification of an entity with the function of last resort operator.

CfDs, understood as a contractualisation tool with the renewable generation capacity system, are a crucial tool to ensure the pursuit of decarbonisation objectives at a low cost and in line with network developments and the necessary investments in accumulation systems.

The CfD tool can provide significant benefits in terms of price stabilisation over time, providing the producer from renewable sources with certainty of revenue flows in the medium to long term and consumer protection against price volatility in *spot* markets. In addition, the conclusion of fixed-term contracts such as CfDs allows the scheme to benefit both from the lower costs associated with the reduction of the risks faced by producers and from the increased competition characterising fixed-term supply.

In order to improve the effectiveness and efficiency of this instrument, some developments in the design of the CfDs are being assessed, with particular reference to the mechanism for defining the needs to be supplied in auctions and the contractual structure.

The definition of needs must, in particular, take into account, in an integrated optimisation approach, the need to pursue decarbonisation objectives at the lowest cost to consumers and without compromising the safety of the electricity system. In that regard, it must be borne in mind that minimising costs for the system requires consideration, first, of the different market value associated with the expected production profiles of different renewable technologies; market value which, in turn, is closely linked to network developments and storage capacity.

The structure of the contract, in terms of rights and obligations for assignees, will have to evolve with the dual objective of efficiently allocating risks and responsibilities between the system and private investors and of integrating renewable capacity more closely into the dynamics of *spot markets. In*particular, the following*will be considered:*

- the introduction of automatic tariff adjustment mechanisms to address rising costs and risks related to inflation;
- the possibility of recognising the fee payable on the basis of different profiles from the actual input of the installation in order to promote efficient investment and resource management solutions, as well as a better allocation of risks among the different actors in the system. As a first step, for example, the fee payable could be recognised on the basis of the potential inputs of the installation instead of the actual net input at times of cuts to renewable production due to local constraints and/or overgeneration *situations*. In the future, as soon as the electricity system has a minimum amount of *utility scale* storage resources and the related *time shift products provided for* in Legislative Decree No 210/2021, the tariff to be charged could be recognised on the basis of *standard* profiles consistent with the needs of the electricity system (e.g. *baseload* and/or peakload*)*, providing for an obligation to place renewable energy on an annual basis equal to a share of the contracted profile, this type of contract structure would leave private investors responsibility for the optimal *mix* of renewable technologies to be deployed.

♦ ***FORWARD SUPPLY MECHANISM OF UTILITY STAIRWAY STORAGE RESOURCES***

With regard to fixed-term contract instruments designed to ensure the safety of the electricity system and the efficient integration of renewable sources into the electricity market, the detailed rules on the measure provided for in Article 18 of Legislative Decree No 210/2021 will be approved by 2024, with the aim of carrying out the first capacity supply procedures quickly and introducing the related *time shift* products on the market. In particular:

- the new forward supply segment of *utility scale* storage capacity will promote the development of new storage capacity, on the basis of a development programme prepared by Terna according to a time progression in order to effectively integrate renewable sources into the electricity system, so as to reduce overgeneration*in* line with grid developments and according to the network operator's regulatory needs. Adequate storage capacity (both widespread and concentrated) is important in view of the significant growth of non-programmable renewable sources and the resulting increased need for flexibility required by the system, also due to the progressive decommissioning of thermoelectric capacity. Hydroelectric and electrochemical storage systems are today the most mature option of storage technologies;
- the new market segment for *time shift* products will promote the efficient use of contracted storage capacity, as well as greater integration of renewable sources into the markets. Terna downstream of the supply of the storage capacity will issue the aforementioned *time shift products*, built using the *pool* of previously contracted physical resources. These products, characterised by different timeframes (e.g. multiannual, annual, daily), will be made available, through competitive auctions, to third party market participants on a platform operated by the EMG. Market participants holding time shift products will *be able* to have virtual storage units to be used in energy markets to shift energy from hours with

low prices to hours with the highest price. The availability of these products will allow operators wishing to invest in non-programmable renewable capacity to manage more efficiently the typical risk of long-term sales contracts with predefined profiles (e.g. PPA or CfD with a *standard* contractual profile other than actual inputs), thus ensuring greater integration of renewable sources into *spot* market dynamics.

♦ ***CAPACITY MARKET***

Italy has long been equipped with a capacity remuneration mechanism, as provided for in Legislative Decree No 379/2003, among the most sophisticated at European level (the 'capacity market'). The capacity market will continue to play a structural role in the design of the Italian electricity market to ensure the adequacy of the electricity system, including in the transition towards full decarbonisation.

The capacity market is open to all the technologies capable of providing adequacy and the ' *reliability options*' has the advantage of incentivising the maximum availability of contracted capacity, mitigating the phenomena of market power typically affecting electricity markets in situations of scarcity.

In order to ensure efficient coordination between the various forward contracting mechanisms, the capacity needs to be procured within the capacity market will have to fulfil the contribution to adequacy provided by:

- the storage capacity available, including that supplied by means of the mechanism provided for in Legislative Decree No 210/2021;
- available renewable generation capacity, including the capacity contracted forward through PPA and CfD.

Capacity market auctions shall be conducted on the basis of multi-annual adequacy assessments carried out by Terna, in accordance with the conditions and methodologies set out in Regulation (EU) 943/2019. In view of the analyses carried out for the coming years showing that there are still risks to the adequacy of the electricity system, auctions for the delivery periods 2025, 2026, 2027 and 2 028 are planned in accordance with the Ministerial Decree of 9 May 2024. Given the increased frequency of drought conditions, the capacity market will also aim to promote investments to ensure availability in times of increased stress.

❖ **<u>STRENGTHENING THE PROCESS OF MARKET INTEGRATION</u>**

In recent years, the EU's push for the harmonisation of national rules governing the functioning of electricity markets for an integrated electricity market has intensified. The European network codes adopted between 2015 and 2017 and, in particular, those on capacity allocation and congestion management (Regulation (EU) No 1222/2015) and on balancing (Regulation 2195/2017) set out a clear market model, both for electricity trading and for the supply of dispatching services. Specifically:

- as regards the day-ahead market (MGP), Italy is already integrated with France, Austria, Slovenia and Greece through the *market coupling,* which will eventually also start on the Swiss border (subject to the completion of negotiations between Switzerland and the EU on energy markets);
- for the intraday market (MI), the European Cross Border intraday (XBID) project, promoted by network operators and market operators from several Member States, including Terna and GME, has been launched since September 2021. Continuous trading close to real time

will promote greater integration of renewables and active demand into the market, while allowing compliance with efficiency criteria to ensure system security;

- with regard to the integration of balancing markets, Regulation (EU) 943/2019 on the internal market for electricity aims to develop common platforms for the exchange of flexibility services and resources between network operators from EU countries; this will facilitate cross-border imbalance compensation, the purchase of capacity and energy in another market area and, more generally, common methodologies for the coordinated calculation of national reserve needs will be adopted. The process of harmonisation of balancing rules seems more delicate, as it affects the operation of network operators on deadlines close to real time, and thus on system security in the short term. In this context, since January 2020, Terna has been participating in the IGCC platform for clearing at the European level of unbalanced imbalances by the different TSOs, and since January 2021 has participated in the Terre platform for the exchange of replacement balancing energy at European level. Furthermore, as of July 2023, Terna is part of the European Picasso platform for the exchange of balancing energy from secondary reserve. Operational participation is currently suspended with a view to updating the algorithm. In addition, the Mari platform for the exchange of balancing energy from rotating tertiary reserve is expected in the coming months.

❖ **PROMOTING THE ACTIVE ROLE OF DEMAND**

The role of the consumer is changing from a taxable person to an active person, i.e. able to change his consumption in response to price changes on the market and, under certain conditions, to self-produce and offer network services.

The active role of the consumer can mainly take place at three levels:

- choice of supplier and proper evaluation of commercial offers and related services;
- self-production and use of storage and efficient consumption management systems;
- change of load due to demand response.

On the first point, in the first few months of 2024, the process of overstepping the regulated retail price system in energy markets has been completed, extending it to domestic customers, in accordance with the provisions of the so-called ‘competition’ law, Law No 124 of 2017 and in accordance with the reform programme of the NRRP for the liberalisation of the sector approved by the European Commission (M2-C1-7).

In parallel, with particular regard to domestic customers, initiatives, including communication, have been strengthened to ensure greater awareness among final consumers.

On this subject, reference should be made to the new provisions on minimum qualification requirements for retail market operators in terms of reliability and punctuality in contractual obligations and compliance with the competition rules and the sectoral rules in force, which define indispensable steps for the proper exercise of consumer sovereignty in a free market context.

The development of widespread self-production can be expressed through various individual and collective configurations, industrial/commercial or as an expression of citizens’ initiatives, including for social and environmental purposes. The uptake of self-consumption, including through public energy pricing policies within the various possible self-consumption configurations, including renewable energy communities, will of course be fostered by technological developments, such as the potential of new *smart meters in* terms of the functions available to consumers, the deployment of digital technologies together with the*Internet of Things and* the increased accessibility of small medium size production and storage systems, especially renewable and cogenerative sources in Alto Rendimento, with lower costs for users. This is a phenomenon to be supported, through enabling public policies based on efficiency criteria, enabling market players to organise themselves.

The development of the *demand response* also requires changes in market rules that can make consumers aware of the benefits of flexibility in consumption. In this regard, with the entry into force of the new regulatory framework on dispatching from 2025, new rules will also be put in place for the participation of demand response in the provision of ancillary services, through a revision of the technical requirements for participation, such as reducing the minimum size of the power commitment and promoting aggregation, the structure of the services required and the procurement procedures.

For the gas market, it is necessary to increase the diversification of supplies and to develop a market and infrastructure environment capable of attracting LNG with the aim of positive downward price competition and for the same diversification of source sources.

II. Where applicable, national objectives related to the non-discriminatory participation of renewable energy, demand response and storage, including via aggregation, in all energy markets, including a timeframe for when the objectives are to be met

As of January 2025, the new regulation on electricity dispatching adopted by ARERA in Resolution 345 of 23 July 2023, which will promote, in line with the European Balancing Code (Commission Regulation 2017/2195), the conditions for a more active participation of renewable energy, including distributed renewable generation of demand response and other flexibility resources (including storage systems), including through aggregation, in accordance with the principles of technological neutrality and cost minimisation. This objective builds on the awareness of the expected significant growth of facilities connected to distribution networks and the need to further open up energy markets to new actors, including by involving distribution system operators in the definition of local ancillary services and related procurement procedures.

In this regard, we would point out the pilot projects launched by ARERA, pursuant to Legislative Decree No 210/21, by Decision 350/2021, for the testing of regulatory solutions for the supply of services by distributors and their remuneration.

ARERA has also launched regulatory initiatives, including with regard to tariff regulation, to further develop the deployment of integration technologies between electric vehicles and the electricity grid, in line with the Ministerial Decree of 20 November 2020, as well as to promote the integration and interoperability of charging infrastructure that can participate, including with the evolution of second generation smart meters, in the provision of flexibility services and in particular pilot projects for local services serving distribution networks.

The regulatory reform process will therefore, in addition to promoting greater integration with other European markets, serve to achieve the objectives of:

- sustainability, as the increasing opening up of MSD allows for more effective integration into the market and the electricity system of renewable sources, also for the purposes of Directive 2001/2018 and in particular Article 20a for the integration of small systems and electric vehicles;
- competitiveness, as the increased availability of resources and technologies capable of delivering the required service strengthens competitive conditions among operators, with potential positive effects on service cost dynamics and the risk of abuse of dominant position.

Moreover, as regards increased demand participation, one of the objectives is to complete the process of making electricity collection and consumption data available to final customers and third parties designated by the customer, which relies on the deployment of smart meters at an advanced stage. By Decision ARERA 158 of 24 April 2024, in implementation of the provisions of the Competition Law of 30 December 2023, which supplemented the relevant regulatory framework provided for by Legislative Decree 102/2014, in line with Directive 944/2019 on the integrated electricity market and Implementing Regulation 1162/2023 on requirements for data interoperability, the regulatory framework was launched, which will be completed in the course of 2024, for access to the data of authorised third parties, in compliance with consumer rights and privacy rules.

III. Where applicable, national objectives with regard to ensuring that consumers participate in the energy system and benefit from self-generation and new technologies, including smart meters;

See paragraphs 3.1.2 i and 3.4.3 ii for a detailed description of the intentions on promoting self-consumption and developing and supporting renewable energy communities, mainly through regulatory tools and consumer information and assistance.

IV. National objectives with regard to ensuring electricity system adequacy, as well as for the flexibility of the energy system with regard to renewable energy production, including a timeframe for when the objectives are to be met

The adequacy of the electricity system is a central objective of energy policy and is why Italy, which has been experiencing a situation of gradual reduction in conventional capacity for years, introduced in 2019 a tool to ensure the adequacy of the electricity system through the conclusion of long-term (*capacity market*) and open to generation capacity (subject to emission constraints), as well as storage systems and *demand response*.

The adequacy is regularly analysed and *reviewed* by Terna, both in the medium to long term and in the short term, with a particular focus on times of increased seasonal demand and particular exogenous problems. In the light of the findings of the latest Italian Adequacy Report (RAI), published in December 2023, the Minister for the Environment and Energy Security recently approved the new rules governing the system of remuneration for the availability of electricity production capacity for the years 2024 to 2028 (further details in Section 3.3.

With regard to the flexibility of the electricity system, with a view to the expected significant growth of non-programmable renewable sources and the consequent increased need to shift the energy produced over time, it is necessary to develop new storage capacity, both centralised and distributed, so as to enable a more efficient management of overgeneration *phenomena*.

The flexibility objective is distinct from the adequacy objective and both, as necessary, require dedicated instruments as part of a comprehensive market design covering the objectives of sustainability, competitiveness, adequacy and flexibility while ensuring the security of the electricity system. The New Storage Capacity Supply Mechanism (MACSE), as described in Section 3.3, will be necessary to ensure the development of storage capacity necessary for the electricity system.

In addition, other possible storage solutions involving the use of alternative carriers such as hydrogen will be assessed *in* the light of the need for flexibility and in the light of the Cross-sectoral energy aspects, in coordination with the aim of promoting a market and infrastructure environment suitable for the development of this resource.

v. Where applicable, national objectives to protect energy consumers and improve the competitiveness of the retail energy sector

In general, for the electricity sector, the price *gap* compared to the European average, albeit gradually decreasing, remains at present. The main cause of this *gap* is to be found in a higher wholesale energy price, which in turn depends on a number of factors, including a gas price (the main and marginal source for Italy) which is still higher than the European average, and that the energy mix is still heavily shifted to combined gas plants which, although more efficient, have variable costs higher than, for example, nuclear power plants, which are still significantly present in European energy mixes.

The objective of increasing renewable energy sources is therefore also confirmed for the purpose of price containment, so as to protect the purchasing power of consumers and the competitiveness of SMEs and energy-intensive industrial sectors, preventing the risks of relocation and protecting employment.

The promotion of the active role of consumers is closely linked to improving the transparency and competitiveness of the retail market. In this regard, it is essential that this result be achieved in coordination with the aforementioned completion of the process of liberalisation of the retail market until the price regulation system has been definitively exceeded (see: More protection) operational since 1 July 2024, which now affects more than 30 % domestic consumers, and with the above mentioned measures to increase consumers' awareness of their market choices and the reliability of sellers.

2.4.4 Energy poverty

If applicable, national objectives with regard to energy poverty including a timeframe for when the objectives shall be met

For several years, the phenomenon of energy poverty (EP) has gained a prominent role in the European context, both in terms of analysis/evaluation and the identification of law enforcement policies; the economic crisis linked to the pandemic and international tensions has further called for attention and responses from the EU and thus many countries.

In Italy, the INECP adopted in 2019 already identified the fight against the EP as an important energy policy choice, recognising that the transition path towards a sustainable energy system requires special attention to be paid to the most vulnerable final customers[59].

Over the last few years, household energy expenditure has increased[60], and also in forward-looking terms, the expected evolution of economic variables affecting the EP is an additional element of attention, for example, to the trend increases in fossil fuel prices in European scenarios.

In order to ensure institutional coordination of the analysis and fight against the EP, and following the provisions of the INECP 2019, Decree No 131 of 29 March 2022 established in Italy*the National Energy Poverty Observatory (ONPE)*, an interinstitutional body promoted and led by the Ministry of the Environment and Energy Security, which has among its tasks the monitoring of the EP phenomenon and the development of a law enforcement strategy. A more detailed description of the role of the ONPE and its composition is provided in paragraph 3.4.4.

At the time this plan is drawn up, a legislative definition of the EP has not yet been introduced in Italy; this definition is planned to be formalised in the national decree transposing the new Energy Efficiency Directive (EU) 2023/1791 of 13 September 2023. The EP definition will certainly take into account the indications of the European legislative and policy framework; this refers in particular to:

- the new Energy Efficiency Directive, which, in addition to introducing priority objectives for consumers in EP conditions, defines the EP (Art. 2 (52)) as "impossible for a household to access essential energy services providing basic levels of living and health, including adequate provision of heating, hot water, cooling, lighting and energy to power appliances, in their national context, existing social policy at national level and other relevant national policies, due to a combination of factors, including at least affordability, insufficient disposable income, high energy expenditure and poor energy efficiency of homes";
- recommendation (EU) 2023/2407 of 20 October 2023 supplementing the previous Commission Recommendation 2020/1563 of 14 October 2020 (referring, however, to the definition of the EP introduced by the new Energy Efficiency Directive) and its working document SWD (2023) 647 final, which refers to 11 monitoring indicators, in line with Recommendation 2020/1563;
- Regulation (EU) 2023/955 of 10 May 2023 establishing the Social Climate Fund to finance measures to address energy poverty and transport poverty, also in light of the effects on

[59] By Legislative Decree No 210 of 8 November 2021 (Article 11 (1)) transposing the Electricity Market Directive (EU 2019/944), Italy introduced the following definition of 'vulnerable customers':

- *persons in co0nnditions which are economically disadvantaged or who are in serious health conditions, requiring the use of life-saving medical and therapeutic equipment powered by electricity;*
- *persons with disabilities;*
- *entities whose utilities are located on non-interconnected smaller islands;*
- *entities whose utilities are located in emergency housing following catastrophic events;*
- *persons over 75 years of age.*

[60] For a historical series analysis of developments in household energy expenditure in Italy, see also paragraph 4.6.iii

the energy costs of household consumers and small enterprises, resulting from the extension of the emissions trading system to the buildings and transport sectors, as provided for in Directive (EU) 2023/959 (ETS II).

We fully agree with the vision of energy poverty as a complex and multidimensional phenomenon and the explicit reference in the EP definition introduced by the new EED to the joint consideration of at least three main factors, such as: insufficient disposable income, high expenditure on energy compared to the household budget, poor energy efficiency of homes and installations. These may be accompanied by more specific secondary factors, such as, for example, household characteristics, health situations and vulnerabilities, geographical and climatic conditions, specific energy needs, etc.

As regards the EP's measurement, until the introduction into national law of an official definition of energy poverty when transposing the new EED, it is not considered appropriate, when this version of this plan is drawn up, to formally adopt composite or innovative indicators compared to what has already been suggested in the recommendations of the European Commission. This choice is made in view of the need to have an official definition of the EP at national level, so that it can identify indicators that are fully consistent with it and thus be capable of realising hopefully all the multidimensional characteristics, including the three mentioned above.

The results of the activities of the National Energy Poverty Observatory (ONPE) will, of course, be taken into account in the process of identifying the most appropriate and possibly complex indicators. Moreover, in full coherence with the activities and objectives of the ONPE, Italy launched in 2 023 a statistico-methodological project, financed by Eurostat, called Energy Poverty Indicators Calculation (*EPIC project*), which aims to improve and expand the current indicators, including through new data sources and methodologies, suggesting reliable and replicable practices at European level for the collection of the EP, contributing to the process of harmonising the monitoring of the phenomenon. Of course, in the process of identifying the most appropriate indicators, account may be taken both of the discussion on this subject with the European institutions and other countries (including some European initiatives such as the work of the Energy Poverty and Vulnerable Consumers Coordination Group and other initiatives), as well as discussions with researchers and experts at national and international level[61].

In the meantime, as a preliminary point, until the introduction into national law of a definition of energy poverty and related indicators, with a view to identifying in this version of this plan, until it is updated, quantitative targets to combat energy poverty, it is considered possible to carry out an analysis on the basis of the indicators referred to in the European recommendations. In this regard, in document SWD (2023) 647 final related to Recommendation (EU) 2023/2407, as mentioned above, the EC suggests a set of 11 indicators for EP monitoring, to which each Member State can refer using the one best suited to the situation in its own country. These indicators are obtained by compiling the data collected from surveys which the Member States are required to carry out on a regular basis as part of the obligations for Eurostat[62], and are therefore replicable and comparable across countries. The 11 indicators describe individual characteristics or specific conditions of the household or dwelling, which are different and not necessarily interrelated: it follows that, if we assume that each indicator could provide an indication of the number of households in energy poverty, we will have mixed results, since, when the indicator changes, both the absolute number

[61] *Such as, for example, in Italy, OIPE researchers*

[62] *In particular:*

- *the EU SILC – Statistics on income and living conditions, which provides both transversal data over a given period with variables on income, poverty, social exclusion and other living conditions, as well as longitudinal data on individual changes over time, observed regularly over a period of 4 years*
- *The HBS – Household Budget Survey, which provides both data on the household as a whole and variables concerning household members.*

of households that would be in EP conditions and their relative incidence on total resident households vary significantly. The table below shows, for example, the values taken in Italy over the last three years by 6 indicators that can be calculated from the processing of EU-SILC or HBS data. Depending on the indicator considered, the hypothetical absolute number of households in EP status in 2022 would vary from around 1.1 million, if the indicator on late payment of bills (4.3 % of total resident households) were taken into account, to around 4.7 million if the indicator related to the impact of energy expenditure on total household income were taken into account (18 % of the total).

Table: Some indicators for monitoring energy poverty recalled by SWD 647 related to Recommendation (EU) 2023/2407 [source: GSE processing on ISTAT data]

Rif. SWD 647	Indicatori	Indagine	Percentuale di famiglie che risulterebbero in povertà energetica secondo l'indicatore rispetto alle famiglie residenti totali			Ipotetico numero assoluto di famiglie che risulterebbero in condizioni di povertà energetica secondo l'indicatore		
			2020	2021	2022	2020	2021	2022
1.	Inability to keep home adequately warm	**EU-SILC**	8,8%	8,6%	9,9%	2.273.190	2.198.881	2.587.981
2.	Arrears on utility bills	**EU-SILC**	5,3%	5,6%	4,3%	1.368.152	1.427.353	1.126.214
3.	High share of energy expenditure in income	**EU-SILC**	n.d	17,5%	17,9%	n.d	4.480.978	4.681.942
4.	Low absolute energy expenditure	**EU-SILC**	n.d	11,2%	11,5%	n.d	2.881.310	3.011.435
5.	Share of individuals living in households which spend more than 10% of their budget on residential energy electricity, natural gas, liquid fuels for heating like heating oil, solid fuels for heating like coal or wood, and district heating	**HBS**	14,6%	13,6%	n.d	3.809.178	3.545.895	n.d
10.	Share of population with leak, damp or rot in their dwelling – total population	**EU-SILC**	19,6%	17,8%	17,1%	5046127	4579778	4459033
A.	At-risk-of-poverty rate	**EU-SILC**	20,0%	20,1%	20,1%	5040130	n.d	5235723

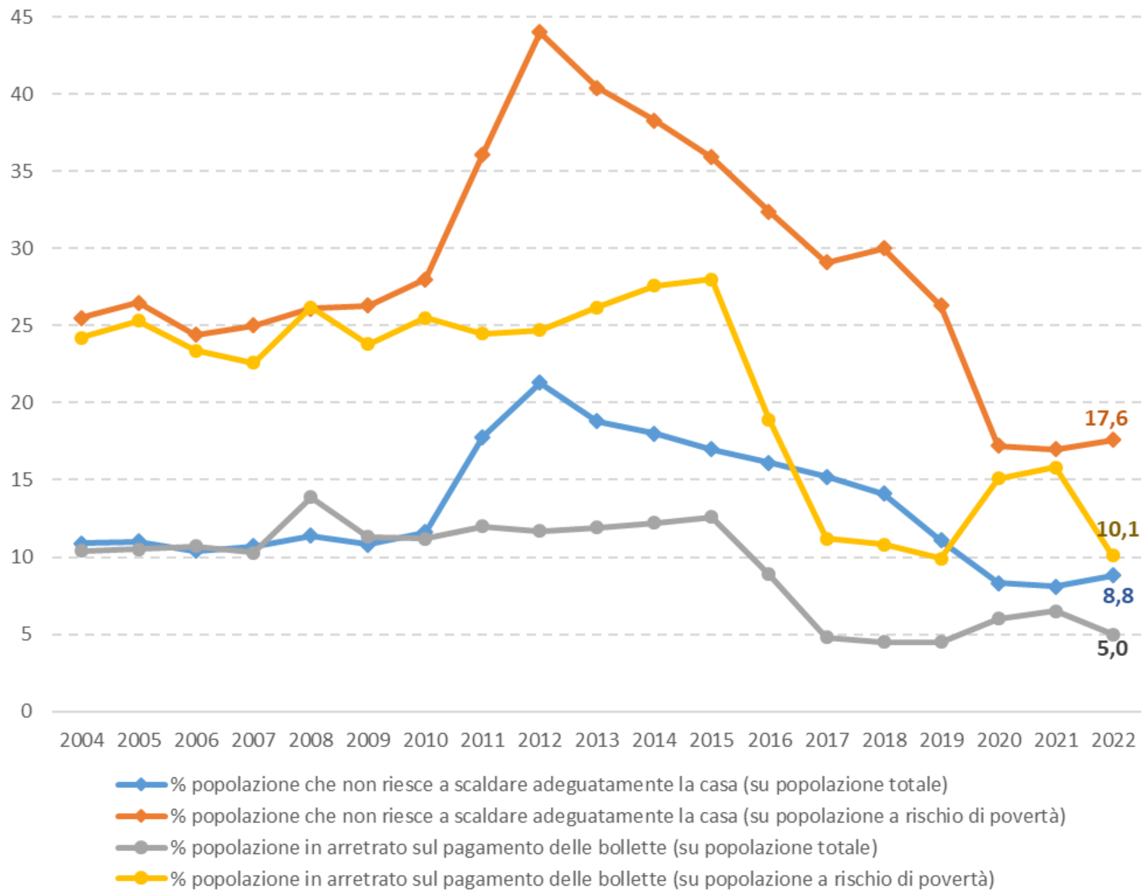
The indicator 'at-risk-of-poverty rate', corresponding to the share of people at risk of poverty with equivalised disposable income (net of social transfers) below the at-risk-of-poverty threshold, set at 60 % of the national median equivalised disposable income net of social transfers, was also reported in the table. This additional indicator is mentioned in Commission Recommendation (EU) 2024/1590 of 28 May 2024[63], point 4.4.1.2, together with indicators 1, 2 and 5; in the latter recommendation, the average of these four indicators (or their minor variants) is identified as a possible option, as an alternative to the share of households in EP conditions considered in the European National Energy and Climate Plans, for the purpose of determining the 'share of end-use energy savings among target groups of specific measures' (people affected by energy poverty, vulnerable customers, from low-income households and living in social housing). Although this combination of indicators is mentioned only for the specific purposes of the above-mentioned Recommendation, it is considered that any extension to energy poverty monitoring indicators would produce a weak indicator to describe the EP condition.

For all the analyses and reasons highlighted, it is clear that, in the absence of a legislative definition of energy poverty in national law, and as it does not consider it appropriate to anticipate the adoption of complex indicators in relation to this definition, the use of one of the indicators mentioned to express a target for reducing the number of households in energy poverty is nevertheless at risk of incompleteness. However, as a preliminary point, until the definition of energy poverty and related indicators is adopted, an EP reduction target is provisionally expressed by reference to one of the indicators mentioned in the European recommendations. The graph below shows the historical trend of four indicators based on the responses provided in the Survey on Income and Living Conditions (EU-SILC) conducted annually by ISTAT:

- share of the population at risk of poverty (i.e. with income below 60 % of the national median equivalised disposable income) that is unable to keep their home adequately warm on the basis of the answers to the question "can your family afford to keep your home adequately warm?";
- the share of the total population that is unable to adequately warm his dwelling on the basis of the answers to the question referred to in the previous paragraph;
- share of population at risk of poverty (below 60 % of national median equivalised disposable income) in arrears with payment of bills;
- share of the population in arrears with the payment of bills.

[63] *Recommendation (EU) 2024/1590 on the transposition of Articles 8, 9 and 10 containing the provisions on the energy savings obligation of Directive (EU) 2023/1791 of the European Parliament and of the Council on energy efficiency.*

Figure 33 – Evolution of four indicators proposed by Recommendation (EU) 2023/2407 [Source: Eurostat]



Pending the identification of a national definition of energy poverty and the selection of appropriate monitoring indicators, it is considered to refer to the indicator "Total population share that is unable to heat your home adequately". Apart from its relevance to the phenomenon proposed to be measured, it should be noted that this indicator is based on the data that all EU Member States are required to collect annually and provide Eurostat (the reference survey, in particular, is the above-mentioned EU-SILC). It is therefore constantly the subject of control and validation measures typical of official statistics, available and monitored on the Eurostat website, and harmonised and comparable across all EU Member States. Moreover, this indicator is also used for the monitoring of the Sustainable Development Goals, with particular reference to Goal 7 'Affordable and clean energy'.

As indicated in the name of the indicator ('share of the total population that is unable to heat your home adequately'), the percentage data reported in the graph refer to the individuals who are part of the population that meet the requirement. Using the micro-data of the EU-Silc survey properly, it is also possible to trace the number of Italian families falling within the perimeter drawn by the indicator; in particular, in 2022, there were just under 2.6 million Italian households unable to keep their homes adequately warm, representing 9.9 % of all resident households (see table above). With reference to the objectives of the Plan in terms of combating the EP, it is assumed that, with the measures identified in paragraph 3.4.4, the absolute number of households in energy poverty decreased by at least 1 % per year between 2030 and 2022. In this case, the number of households unable to keep their home adequately warm is expected to be around 2.4 million units in 2030.

However, as argued, with the adoption of a national definition of energy poverty and the appropriate multi-dimensional monitoring indicators, this target will be updated.

2.5 Dimension Research, innovation and competitiveness

I. National objectives and funding targets for public and, where available, private research and innovation relating to the Energy Union, including, where appropriate, a timeframe for when the objectives are to be met

The aim of this Plan is to define a medium- and long-term strategy (at least until 2030 with a 2050 perspective) setting out, for research, innovation and competitiveness, objectives and priorities as well as the measures needed to achieve them.

The identification of national R & S & I targets on energy technologies is a priority to accelerate the market introduction of those technologies necessary to meet the objectives set out in the Green Deal and at the same time to strengthen the competitiveness of national industry. With this in mind, the R & I objectives therefore identify those clusters of energy technologies that can be expected to:

- achieving the decarbonisation objectives, both by 2030 and 2050, both because of their penetration potential and their role in making the transition technically feasible;
- maintain and strengthen the competitiveness of Italian industry.

The aim is also to create the conditions for the participation of Italian industry and public and private research centres in future research programmes under the SET Plan/Horizon Europe and Mission Innovation to be broader and less fragmented and more focused on common and shared objectives.

❖ **EUROPEAN CONTEXT**

In December 2019, the European Commission presented its Communication on the European Green Deal (COM (2019) 640 final), which confirms and updates its commitment to tackling climate change and environmental challenges and launching a decisive transition of the energy system, with the aim of achieving climate neutrality by 2050.

With the new European Hydrogen Strategy (‘*A hydrogen strategy for a climate neutral Europe*’), the Commission set out in July 2020 the Union’s path to promote the use of hydrogen, in view of the decarbonisation objectives of the Green Deal.

In July 2021, the Commission published the*Fit for 55*package, containing legislative proposals to implement the Green Deal’s interim targets of achieving a 55 % reduction in net GHG emissions by 2030 compared to 1990 levels and to make the EU’s decarbonisation path in line with 2050 climate neutrality.

With the Communication “*REPowerEU: Joint European Action for more affordable, secure and sustainable energy’* COM (2022) 108 of 8 March 2022, the Commission set a path towards a progressive reduction in fossil fuel imports, which, while also focusing on energy efficiency and reducing consumption, reinforces and accelerates the measures of the Fit-for-55 package.

In this context, the contribution of research to the development of innovative technologies, which are currently the main beneficiaries of European support instruments, such as: the Strategic Energy Technology Plan (SET-Plan) and the European Framework Programme for Research and Innovation 2021-2027 Horizon Europe.

❖ **THE SET-PLAN**

The SET-Plan was set up by the European Commission in conjunction with the "20-20-20 Package" as a "technology push" tool in energy and climate policies and as a "*strategic pillar of the EU to foster the development of innovative technologies in energy sectors by establishing joint partnerships between research, industry, the European Commission and the Member States*". Following the establishment of the Energy Union, this programme was divided into ten 'key actions', representing the priority technological sectors of European energy research, which in turn resulted in the creation of fourteen Implementation Working Group (IWG) to define the priority research lines for each technology area and the forecasts of financial needs. Italy supervises each of the IWG with industry experts from research organisations and universities, which have set up permanent consultation groups with national companies and research organisations, working together with other Member States which have often resulted in joint participation in Horizon projects (CETP, DUT, CHP in particular).

Italy continues to consider the SET Plan as a key tool to address the new challenges posed by decarbonisation and shares the guidelines proposed by the Commission for its "revamping" under discussion in the Steering Group, in the light of the new EU energy and climate objectives. Italy will continue to progressively align the objectives and priorities of public investment in energy research and innovation with those of the SET Plan. Italy has also ensured from the outset its accession to the new IWG on hydrogen in the process of being set up.

❖ **HORIZON EUROPE PROGRAMME**

Horizon Europe is the programme of the integrated funding system for research activities of the European Commission for the period 2021-2027. The overall objective of Horizon Europe is to generate scientific, technological, economic and social impact through EU investment in research and innovation, so as to:

- strengthen the scientific and technological bases in order to promote competitiveness in the Member States;
- implement the Union's strategic priorities and contribute to the delivery of European policies, as set out in the Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda and the Paris Climate Agreement;
- strengthening the European Research Area;
- Research and innovation activities funded by Horizon Europe should focus exclusively on civil applications.

❖ **INNOVATION FUND**

The Innovation Fund is one of the major global funding programmes for commercial demonstration of innovative low-carbon technologies. The Fund has a financial availability linked to the auctioning mechanism of around 530 million EU ETS allowances for the period 2020-2030, the value of which depends on the average market price of the tonne of CO_2. The JTF aims to support highly innovative clean technological solutions that can be implemented quickly so as to contribute as soon as possible to the Union's transition to climate neutrality. The areas that may participate in calls for proposals from the Fund are:

- energy-intensive industrial sectors, including the Carbon Capture and Utilisation (CCU) sector and the substitute for carbon-intensive products;
- projects for the capture and geological storage of CO_2 (CCS);
- innovative renewable energy generation technologies;
- energy storage technologies.

The recent revision of the EU ETS Directive provided for the widening of the scope of funding from the Innovation Fund, both in terms of sectors (which now also include maritime transport, aviation, buildings and road transport) and in terms of the level of innovation, which has been extended to include technologies with higher maturity.

❖ **ITALIAN PUBLIC RESEARCH IN THE ENERGY SECTOR**

Italian public research in the energy sector is implemented through the following main programmes:

- ‘*Electrical System*Research’ (RdS), supporting technological innovation of general interest in the electricity sector, structured on a three-year basis;
- “*Italian Mission Innovation Programme*”;
- “*NRRP hydrogen research*” from the National Recovery and Resilience Plan.

The extension of these programmes has allowed for a new organisation of investment in Italian energy research through enhanced coherence between financial resources, objectives and technology readiness of results (expressed in terms of TRL-Technology Readiness Level).

R & S is expected to contribute both to the reduction of GHG emissions and to support the competitiveness of the economic system by accelerating the market introduction of new innovative technologies, products and services.

A further objective is to direct the participation of Italian industry and public and private research centres in future research programmes under the SET Plan/Horizon Europe, enabling a stronger role in the sector to be achieved.

Looking at the next decade, three key criteria will have to guide action on energy research and innovation in the next decade:

- the finalisation of resources and activities towards (i) the development of processes, products and knowledge that have an outlet in open markets, (ii) support for the use of renewable technologies, energy efficiency and networks;
- synergistic integration between systems and technologies.

safeguard 2030 as an intermediate step in the so-called “deep decarbonisation”, to which Italy committed itself in line with the 2050 long-term strategy.

To this end, Italy’s objective is to maintain its COP21 financial commitment for Mission Innovation, together with 24 other countries including the European Union, to double investment in R & D from EUR 222 million per year (for 2013) to EUR 444 million. To date, the total allocated resources have reached a value of more than EUR 320 million by 2027, taking into account the following:

- Ministerial Decree No 386 of 16 November 2023 implementing Mission Innovation 2.0 makes available an allocation of EUR 502 million over the three-year period 2023-2026 for research and development of zero-carbon clean tech;
- investment 3.5 of M2C2 of the NRRP provides EUR 160 million for the period 2022-2026 for research and development projects in the hydrogen sector. This amount is further increased with an additional EUR 140 million allocated under the RepowrEU;
- the three-year National Electrical System Research Plan 2025-2027 focuses on fundamental research for a wide range of technologies, supported by funding of more than EUR 240 million.

Italy’s objective is therefore to safeguard the value of EUR 444 million per year in 2030, while keeping the financial flows constant until at least 2040 and increasing them until 2050, with a share of at least EUR 500 million.

In addition, with a view to speeding up the simplification of R & D activities, the MASE, with the publication of Ministerial Decree No 139 of 12 April 2024 reforming the electricity system research, as the main national instrument for promoting R & D in the energy sector, changed the methods and timing of the investigation phases of the approval of the three-year plan, thus ensuring faster implementation of the initiatives.

Particular attention will be paid to the issue of training, in line with what has already been proposed under the RRP, where funded R & D projects (Investment 3.5 of M2C2 and the entire Mission 4 "Education and Research") include policies and measures to foster skills development, through the acquisition of staff not already structured and the financing of Doatory and Research Assignments. In addition, the same financial support, together with other measures, such as Mission Innovation and Research in the Electrical System, supports the organisation of initiatives aimed at training professionals in the future, such as the organisation of training seminars, workshops and schools on specific topics relating to clean technologies (Summer School Idrogen, which is being held in the third edition of the Autumn School on Bioenergy and Sustainable Mobility by ENEA). Finally, training and information activities may be launched for public administration, businesses, schools and citizens, with comprehensive and structured planning, which will lead technological innovation to achieve decarbonisation objectives.

♦ ***PRIORITY TECHNOLOGY AREAS FOR THE ITALIAN RESEARCH SYSTEM***

The 2030 programming is intended to provide continuity to national energy research, in order to consolidate results and promote progress in the technology readiness level of funded projects, to seize the opportunities of further development areas and to steer all in line with the proposal for a regulation on Net Zero Industry Act, which identifies a set of net-zero technologies, which are considered strategic for achieving the 2030 GHG reduction and climate neutrality targets by 2050.

Italy therefore considers it a priority to develop the following technological areas and lines of action by 2030:

- electricity storage (innovative accumulators);
- renewable sources (solar, geothermal, other onshore and offshore renewables)
- hydrogen;
- renewable fuels other than hydrogen;
- nuclear;
- capture, utilisation and storage of CO_2 (CCUS);
- network technologies and digitalisation;
- critical raw materials and advanced materials for the energy transition and their national supply chains.

The main lines of activity for the above mentioned technology areas identified as priorities are described below.

In their development, it will also be important for the country system to provide for a strengthening of the relevant national and European supply chains, in line with what has already been done in Batterie (Battery 1 and Battery 2 – EuBatIn), hydrogen (Hy2Tech, Hy2Use, Hy2Intra, Hy2Move) and IPCEI Cloud Infrastructure and Services.

In addition, particular attention will be paid to their application, especially in hard-to-abate sectors.

▪ ***Electricity storage (innovative accumulators)***

Research and development of next generation batteries (Gen 3b – Advanced lithium ion, to Gen 4 – solid state batteries to Gen 5 – post-lithium batteries) have some priority objectives: (I) diversification and flexibility of possible solutions depending on the specific application, (ii) increased performance with a focus on energy density, security and duration; (III) greater economic and environmental sustainability. The latter is crucial to boost Europe's competitiveness in the global battery market and to avoid that, by continuing to use critical raw materials (CRMs), Europe is highly externally dependent on the supply of key materials or manufactured products for the energy economy. Another priority theme is the reuse, recycling and recovery of spent batteries to bring key raw materials back into circulation, as provided for in the new European Batteries Regulation. Italy will therefore aim for the development of batteries with a high level of sustainability, with a low carbon footprint and an optimised approach to the circular economy at all stages of the value chain. Research activities will therefore focus, in addition to the technological advancement of batteries, on the capacity to supply, extract and process raw materials (primary and secondary).

To respond to the upcoming short-term needs of the battery industry, research into generation 3 (optimised lithium-ion), generation 4a (solid state lithium ion) and 4b (solid state lithium metal), is supported by several measures to ensure that new European technologies are entering the market as early as 2025.

A cross-cutting enabling role will be played by digitalisation, providing opportunities for acceleration across the battery sector, from discovery of materials to the optimised cross-sector use of battery systems to support the energy grid. Digital twin and big data analysis will be crucial for the progress of BMS; traceability of battery materials, production, second-life applications and recycling will also play an essential role for mobile and stationary applications.

Research in the field of electrochemical accumulation is supported by the three-year programmes of Elettrico System Research, and the Important Projects of Common European Interest (IPCEI) initiative, which provided for Italian involvement in the first two IPCEI Batterie ('IPCEI on Batteries' and 'IPCEI European Battery Innovation EuBatIn').

- ***Renewable sources (solar, geothermal, other onshore and offshore renewables)***

Solar photovoltaic (PV) is intended to increase its role as an absolute player in the development of a decarbonised electricity system. To this end, it is essential to implement strategic research actions on (i) increasing generation efficiency (photovoltaic cells and modules), (ii) land take for the needs of new installations and (iii) revitalising Italian companies engaged in various segments of the PV value chain (process scale-ups, product innovation, pre-industrialisation).

It is necessary to focus the research effort on improving the performance of photovoltaic devices already on the market and of interest to the Italian industry (silicon heterojunction cells or concentration cells). In parallel, further innovation needs to be created through research in the field of innovative materials and technologies for new generation photovoltaic cells and modules, with a focus on the greening of cell and module production and flexibility of applications.

Rapid and sustainable expansion of photovoltaic capacity also requires actions for (i) the development and testing of innovative photovoltaic systems integrated into the built environment (BIPV), (ii) the development of floating photovoltaic and (iii) the development of "agvolutional" systems, where agricultural production and photovoltaic generation complement without impacting on land consumption. In particular, it is necessary to continue the actions provided for in the RRP to support the aggitaque and to create the conditions for the creation of a specific market, through a thorough and reliable assessment of the country's aggitac potential. To this end, it is useful to feed research into innovative, space-explicit methodologies (i.e. GIS-MCDA/AHP) to draw up maps of agrotacular potential on a regional scale and national coverage. High specialisation methodologies that identify the suitability of areas on the basis of a set of multidimensional criteria, geared towards optimising the production of the agvoltaic system (land use minimisation, energy yield, agricultural production).

The need to regain competitiveness for a national sector sector requires an effort to diversify industrial operators to ensure optimal coverage of the most significant segments of the PV value chain. Research and innovation on manufacturing processes is essential to support the 'high' part of the supply chain and to provide fertile ground for the activation of new production facilities (gigafactories), in addition to those already planned. At the same time, the need for innovation in other high-impact segments needs to be supported: the management of photovoltaic installations (O & M) with technical progress on monitoring and detection of plant failures and anomalies; prediction of energy production in the short and medium/long term, using artificial intelligence techniques; the use of methodologies and tools for mapping photovoltaic potential (solar cadastre) in cities and, in general, on national territory.

In the wind sector, national research aims at two macro-objectives: (1) development of floating offshore wind and (2) consolidation and improvement of onshore wind farms. In particular, with regard to offshore wind, efforts will be made to develop reliable technological solutions with a low environmental impact, so as to enable environmentally compatible and energy-efficient application, taking into account the typical conditions of the Mediterranean as well as the capacities of the Italian industry value chain in the sector. As regards onshore wind, however, we will focus on the development of turbines in terms of optimisation of performance, materials used and adaptability to the national context and the development of a national industry for reblading.

As regards geothermal, Italy is among the European leaders with a rated power of more than 900 MW and an annual electricity production of around 6 TWh. Thanks to the historical presence of geothermal in Italy, there is advanced industrial and scientific expertise in both geological and energy conversion. Research in this field involves major research organisations and universities, with recognised scientific results in the international community and links with industry and local actors. It is also important, in the European context, to involve Italy in the industrial ETIP of the sector and in the association for the promotion of the EGEC sector. Technological development objectives can be identified in the following research lines, in line with the main international trends:

- extension of energy conversion to geothermal resources that are poorly valued or difficult to access (low enthalpy, superhot/supercritical deep fluids);
- development of closed-loop systems, well exchangers including heat recovery from oil wells and spent gases, underground heat storage as energy storage system;
- performance improvement of electrical or thermal production plants and technologies, including low enthalpy geothermal installations with heat pumps and development combined with other RES,
- testing the extraction of critical raw materials from geothermal fluids;
- innovation on plant components, well drilling and well construction systems, geothermal prospection methods for research and characterisation of the geothermal resource.

The marine energy resource (marine energy) has great potential for both the amount of power available globally and its power density, estimated at more than 20 times that of the wind resource and its increased predictability. In Europe, the availability of marine energy resources is greater along the Atlantic coast (Ireland and Scotland). However, the Mediterranean Sea also offers interesting opportunities for both energy production and technology development. ENEA evaluations have shown that the areas with the highest wave energy potential are the western coasts of Sardinia and the Strait of Sicily, where the average energy flow ranges between 10 and 13 kW/m. Strengthening the role of energy from the sea in the Mediterranean now seems to be more necessary than a choice, as evidenced by the growing interest of local authorities (e.g.: ANCIM Italia – National Association of Minors Islands). In addition to industrial use, offshore energy devices can cover the needs of local and isolated markets, with respect to which they are already more competitive (e.g. offshore energy devices are more competitive than diesel generators used for a desalination plant or fish farm). Therefore, a great effort is being made by the national scientific community to develop wave conversion devices into electricity, following shared methodologies for the assessment of their Technology Readiness (TRL) and converging towards a limited number of optimal solutions that avoid the dispersion of funding and skills, taking into account different conditions of use and specific needs.

Research and development activities are supported by funding instruments operating on two levels: (I) basic research for innovative technologies and (ii) the development of pilot and demonstration projects.

The objectives of national research and development activities are in line with those set by the Ocean Energy Working Group of the European Strategic Energy Technology Plan (SET-Plan). In this context, Italy, represented by ENEA, chairs the collaborations between Member States interested in energy from the sea. R & S activities are also in line with those proposed by the Joint Research Program Ocean Energy of the European Energy Research Alliance (EERA).

- ***Hydrogen***

In Italy, following the issuance of the National Guidelines for a hydrogen strategy, R & D activities on hydrogen have been launched in a structured way, through various support/funding instruments operating at different levels: from basic research on innovative technologies to be applied in the medium to long term (TRL 2-5), the development of pilot and demonstration projects, to the first applications on a real scale, with the aim of supporting the entire industrial supply chain.

Under the RRP, R & D activities are implemented on enabling technologies, covering the whole hydrogen value chain, such as:

- renewable and low-carbon hydrogen production technologies;
- innovative technologies for the storage and transport of hydrogen and its transformation into derivatives and e-fuels;
- fuel Cells for stationary and mobility application
- digitalisation and integration of electricity/gas networks to improve the resilience and reliability of hydrogen based infrastructure.

Further R & S activities, with a particular focus on the power to gas approach, concern the development of technologies and systems to support the integration of the electricity grid with the natural gas grid, with grid balancing function, such as long-term storage and long distance hydrogen transmission and distribution infrastructure. These activities are carried out in the context of research into the Electrical System through the 'Integrated Hydrogen Technology Project'.

Higher TRL R & S activities (≥ 6) are conducted as part of Mission Innovation, through the construction of two 'Hydrogen demo Valleys', i.e. multi-functional platforms to test and validate hydrogen supply chain technologies in an integrated manner and on a pre-commercial scale. The two Hydrogen Valleys will take place at the ENEA Research Centre in Casaccia (Rome) and at the CNR in Cape D'Orlando respectively.

The objectives of national R & S activities are aligned with the European objectives defined by the Joint Research Programme on Fuel Cells and Hydrogen technologies of EERA and Hydrogen Europe Research (HER), with reference to the 'Strategic Research and Innovation Agenda 2021-2027', which defines the Key Performance Indicators (KPIs) for research and development.

Technological innovation is accompanied by a path aimed at increasing the skills and new jobs needed for the introduction of hydrogen into the production system.

- ***Renewable fuels other than hydrogen***

Biofuels are produced from biomass or organic organic material. Advanced biofuels produced from waste, residues, non-food cellulosic material and ligno-cellulosic material, as detailed in Annex IX to Directive 2009/28/EC, are of particular interest in sustainability aspects. The main technological sectors, with regard to the transport sector, include:

- liquid biofuels through fermentation processes (e.g. bioethanol, microbial oils), pyrolytic conversion (e.g. bio-oils and bio-crude for refining), or gasification thermochemical processes (e.g. methanol, ethanol);
- gaseous biofuels from biological processes (e.g. biomethane) and thermochemical processes (e.g. dimethyl hetere-DME, bio-SNG).

Some of these biofuels can already be used directly in existing engines and are therefore called drop-in.

The degree of maturity of the various sectors is different. Research focuses on analysing their sustainability and neutrality, optimising processes, reducing costs and not least expanding the usable matrices.

E-fuels (renewable liquid and gaseous fuels of non-biological origin – RFNBO – referred to in RED II) are obtained by chemically combining ‘renewable’ hydrogen and carbon dioxide. Methane, synthesis products such as diesel and kerosenes and other fuels/chemicals such as methanol and ammonia are part of e-fuels. Green hydrogen can also be coupled with gasification processes for the treatment of synthetic gas and the production of biofuels.

In addition, RED II also contains another category of fuels, ‘*recycled carbon fuels’*, i.e. liquid and gaseous fuels produced from liquid or solid waste of non-renewable origin (such as the non-organic fraction of municipal waste, non-recyclable plastics).

In general, R &Don will be aimed at:

- develop technologies and processes with greater flexibility in terms of food, for example capable of transforming raw materials containing biomass of different kinds but also other sustainable carbon sources such as plastics, waste, sewage sludge;
- high performance catalytic processes (efficient, durable and affordable catalysts);
- biocatalysts (enzymes and micro-organisms) capable of maintaining adequate performance in converting substrates from by-products or waste;
- performing processes to produce green hydrogen and CO_2 capture.

▪ ***Nuclear***

Together with renewable energy resources, new generation nuclear technologies will play an important role in the energy transition towards climate neutrality. There is also great potential for Italy to help revitalise nuclear energy, including at national level, as set out in Chapter 2.1.1.

Should the Government and Parliament decide to make use of new nuclear technologies, with appropriate and necessary amendments to national legislation in this field, from legislation and *governance* to the updating of technical legislation in the field of nuclear energy, the country’s commitment to nuclear energy could therefore reduce the research dimension also with a view to the possible use of nuclear sources on national territory. In line with this potential, Italian participation in international and European programmes and initiatives should be progressively promoted (but not limited to the recent *SMR Industrial Alliance initiative,* in which MASE participates together with several dozens of national operators, including businesses, utilities*,* research organisations and academies, and the EUROfusion programme, for which ENEA is the *national Program Manager*).

The EU has included certain types of nuclear installations in the list of European Taxonomy of economic activities considered sustainable in support of the Green Deal. In order for advanced nuclear technologies to make a substantial contribution to decarbonisation objectives, their deployment will have to take place in the next decade, putting the market close to the year 2035, in order to maximise potential in the next 15 years, until 2050. The capacity of the 'new nuclear' of (i) replacing certain types of high-climate gas-producing thermal power plants, (ii) providing industrial cogeneration (industrial heat), district heating and hydrogen and e-fuel *production* are an added value to foster their penetration into future hybrid energy systems.

Economic competitiveness is presented as one of the strengths of the *third-generation Small Modular Reactor* (SMR) and Generation IV *Advanced Modular Reactor* (AMR), as well as microreactors (< 30 MWe per module) by developers/designers and industry experts. The guiding factors to compensate for the lack of economy of scale would be: (I) reducing the time and cost of building the site, which in turn would also reduce interest expenditure during construction (one of the most significant costs for recent large installations); (II) standardisation and factory construction which, together with the reduced size of the investment for each modular unit, would achieve the full benefit of the learning curve faster and with lower overall expenditure.

In addition, fusion energy, in the long term (beyond 2050), may be able to further ensure sustainability without $CO2_{production}$, not necessarily as an alternative but in synergy with nuclear fission energy and other energy sources. It can therefore be used to meet the rapid growth in global energy demand, which is expected to more than double by 2050 due to the combined effect of population increases and energy needs in developing countries.

- ***Capture, utilisation and storage of CO_2 (CCUS)***

Over the last 4-5 years, following decarbonisation policies, mainly the hard-to-abate sectors promoted by the European Union, there has been renewed interest in CCUS technologies in Italy. This has led to some important investments in the development of CO2 separation and confinement technologies for industrial applications and numerous projects to develop carbon dioxide technologies to produce fuels and products for the chemical industry. In particular, numerous initiatives have been launched on CO2 use technologies (CCU), mainly aimed at power-to-fuels applications for chemical storage of renewable energy and the production of synthetic fuels (e-fuels), as an alternative to fossil fuels.

We would also point out that ENI S.p.A. was granted the first authorisation in Italy to carry out an experimental programme – called 'CCS Ravenna Fase 1' – for the capture, transport and geological storage of carbon dioxide from the ENI power plant in Casalborsetti (RA), in the storage complex identified within an offshore gas hydrocarbon production area with an objective of 4 Mton/year with a possible upside of up to 16-20 Mton/year. The implementation of the 'Ravenna project' could be a first step in replicating similar initiatives in depleted fields.

In this perspective, as explained in detail in paragraph 1.2 on cross-border cooperation, Italy shared with France and Greece its willingness to promote cross-border cooperation on CO2 capture, transport and storage, through the development of joint projects and the development of joint plans for joint cross-border management of CCS. Requests for cooperation were received from companies in the sector, operating in Italy, France and Greece, with projects included in the Union list of Projects of Common Interest (PCI), pursuant to Regulation TEN-E 2022/869, in the thematic area of cross-border carbon dioxide transport and storage networks (CO_2). Italy's potential in this sector is considerable, with a large network of gas fields depleted or close to depletion, especially in the Adriatic offshore, which could be converted to CO2 $storage_{using}$ most of the existing infrastructure (production platforms, sealines and sinks), allowing for a significant reduction in geological storage costs.

- ***Network technologies and digitalisation***

Electricity transmission and distribution infrastructure is an enabler for the energy transition, as it will have to be able to operate a generation system radically different from the past and distributed energy flows from multiple installations. Achieving the ambitious decarbonisation targets requires, in addition to a high degree of reliability, security and flexibility of the national energy system, but also a substantial integration of the national energy system with digital technologies, so as to ensure both optimised management of renewable energy production and the enabling towards greater electrification of consumption.

As highlighted in Terna Development Plan 2023, cooperation between AC infrastructure and DC layer requires new planning standards and the development of innovative technologies to ensure full interoperability and synergy between the HVAC network and the various HVDC Hypergrid projects. From a technological point of view, this will be possible by using multi-terminal configurations thanks to the use of high voltage DC circuit breakers, which are currently not available on the market. Such switches may, unlike traditional switches, isolate a fault on an HVDC line without interrupting the power flow. New insulation technologies are also being developed to withstand higher voltages and currents, supporting the deployment of HVDC systems with higher rated power. In addition, broadband HVDC control systems can better regulate the flow of energy into an HVDC system, improving the stability of the electricity grid.

- ***Critical raw materials and advanced materials for the energy transition;***

The large-scale deployment of clean energy technologies has led to a sharp increase in the need for critical raw materials and materials. These include Critical Raw Materials (CRM) those of high strategic importance, characterised by high supply risk. The list of CRMs currently includes 30 raw materials (source COM (2020) 474 final) and is subject to regular update. In this context, the promotion of technological innovations, not only in mining, but also from a circular economy perspective, aimed at strengthening the resilience and sustainability of CRM supply, as identified at Community level by the European Critical Raw Materials Act, is of central importance.

At the same time, experimentation in the field of materials science for energy uses can offer innovative solutions that are complementary to the use of CRMs, replacing and/or reducing their intensity of use in the various technological devices.

At national level, research and development activities in the field of energy materials are funded by different instruments, diversified on the basis of the TRL. Indeed, the 2022-2024 three-year plan for electricity system research (low TRL) provides for an experimental research line dedicated to the development of frontier materials for energy use. Instead, under the Mission Innovation (TRL) initiative, the Italian Energy Materials Acceleration Platform (IEMAP) was funded, whose activities are divided along three strands:

- battery materials: screening of possible new materials with lower CRM intensity; recovery of materials (lithium, cobalt, nickel, copper) from end-of-life accumulation systems (so-called urban mining);
- electrolyser materials: summary of new electrode materials that ensure better performance and lower costs;

photovoltaic materials: development of alternative materials to those currently in use.

II. Where available, national 2050 objectives related to the promotion of clean energy technologies and, where appropriate, national objectives, including long-term targets (2050) for deployment of low-carbon technologies, including for decarbonising energy and carbon-intensive industrial sectors and, where applicable, for related carbon transport and storage infrastructure

In the context of the Italian long-term strategy for 2050, drawn up by the Italian Government in January 2021, on the basis of the assessments carried out, photovoltaic and wind, the main options to be used to increase renewable electricity production were identified. However, development values are emerging that pose sustainability issues, in terms of land take and environmental impacts. There is therefore a need to promote at European level the search for technological and operational solutions enabling these issues to be managed. In addition to objectives of substantially increasing the efficiency of renewable primary sources to electricity, a priority action line should be considered to be the efficient use of available renewable sources at sea and the enhancement of geothermal energy.

In other respects, it will be appropriate to investigate the possibilities for the use, including in third countries, of areas that are dry and not usable for other purposes. Other innovative technological options have been considered and, for each one, the actual technical and economic feasibility will have to be assessed.

The Italian participation in Mission Innovation, the famous initiative aimed at accelerating innovation in technologies for the energy transition, is an opportunity for the Italian energy material industry to participate in highly innovative pre-competitive research projects for the coming decades; this will pave the way for a significant global strengthening of domestic companies in the sector.

Other research and development of particular interest, especially in the medium to long term perspective, relates to technologies for the integration of electricity and gas systems through the development of pilot projects power to gas, power to hydrogen. A gas integration that supports the development and deployment of renewable gases by exploiting an increasing amount of intermittent renewable electricity sources, and – through conversions of the electricity carrier into gas and vice versa – a pillar of integrated energy infrastructure, enabling the full potential of renewable sources to be exploited, including ensuring energy storage in the medium to long term.

Particular attention should be paid in this context to the development of hydrogen carrier technologies, in particular those produced using electricity from renewable sources: research in the coming years will need to be directed towards improving the performance and costs of electrolysers, as well as controlled injection of increasing amounts of hydrogen into gas networks, making them more sustainable. In addition to the possibility of setting up dedicated hydrogen transport infrastructure, we can use existing infrastructure to add increasing amounts of hydrogen blended to natural gas. As regards hydrogen, there is also a need to invest in research and development in refuelling infrastructure. In the rail sector, hydrogen could be a viable alternative where electrified infrastructure is not present and is cheaper than electrification, to replace diesel locomotives. Also for the use of hydrogen in the shipping sector, there are ongoing studies and research involving Italy with major national manufacturers, but the development time and scale of investment is high.

It will become essential to establish a clear and certain regulatory and regulatory framework in order to facilitate the introduction of hydrogen into existing gas infrastructure, as an additional energy source in blended with natural gas (inter alia by implementing the application of selective hydrogen unbundling systems, such as membranes), to deepen the implications of its entry into the storage and end-use system and to provide for possible incentive measures on the different technological options to develop hydrogen production from renewable sources in synergy with the electricity and bioenergy sector, or from zero emissions such as methane cracking. It is necessary that potential investors in power to gas installations have clear rules on how to calculate the renewable component of hydrogen produced.

From a research perspective, it will also be important to investigate syngas and sector coupling in order to achieve greater integration between electricity and gas, optimising existing synergies in the generation, transport and distribution of the two sectors, with the ultimate goal of achieving a hybrid and decarbonised European energy system.

In order to achieve the expected results in the various areas, given the need for extensive investment, it is essential to build broad alliances of a European and even non-European dimension, bringing together all stakeholders (institutions, universities and research centres, businesses) to support R & D activities in the sector and facilitate the introduction of new technologies into the market, including by developing measures to address the regulatory and regulatory framework, with the aim of removing market entry barriers and supporting the attractiveness of financing and the return of investment. In this regard, synergies in the university triangle, research bodies and enterprises need to be improved and optimised, distinguishing between long-term public research and innovative industrial research that best meets the needs of national industrial policy, characterised by different TRL (Technology Readiness Level).

Another important theme is the decarbonisation of sectors where the direct use of the electricity carrier is not easily feasible. The approach used is Power to X, which identifies technologies that transform electricity into other energy carriers and offers different opportunities: (I) reuse of waste CO_2; (II) balancing of networks through the absorption of overgeneration from ERF; (III) seasonal storage of electricity produced by RES.

The development of smart grids will also be a dominant theme for the coming decades, which will facilitate small producers, large companies and individual citizens. The availability of a network in which all devices communicate with each other can enable software, equipped with artificial intelligence, to manage large amounts of information and data that will adequately predict energy demand, with a positive impact on the stability of the transmission and distribution network. However, the increasing use of these technologies raises a number of legal questions that could be an obstacle to the full and full exploitation of their potential.

The risks associated with digitalisation will increase. A field, cyber security, where great spaces and opportunities for development are opened. Therefore, the electricity cyber research plan in Italy will also have to address energy infrastructure innovation in the coming years from a long-term perspective through modelling and simulation activities, experimental work to verify preventive and reactive security measures used in electricity communication systems.

III. Where applicable, national objectives with regard to competitiveness

The latest data on investment in research and innovation in the manufacturing sector show that the overall technological intensity of the Italian production fabric is still below the European average, despite the good recovery in recent years, with a share of business R & D expenditure as a GDP ratio of just over 0.9 % in 2021, compared to 1.4 % in the EU as a whole. In view of this situation, there is a strong limitation on the innovation capacity of the Italian industry, which may not contribute adequately to the decarbonisation of the economy. This could lead to the need to increase imports from abroad, putting a burden on the foreign deficit for a long time, putting at risk the country's development. Given the energy and climate policy strategies at national level, in line with the European decarbonisation path, investment in research and innovation for the development of innovative technologies plays a key role and therefore requires a step change.

The first pillar, for target setting, is therefore the Net-Zero Industry Act (NZIA), which aims to increase the EU's production capacity, in particular some strategic technologies for the Net Zero transition: solar photovoltaic and thermal energy, onshore and offshore renewable wind energy, batteries/storage, heat pumps and geothermal energy technologies, electrolysers and fuel cells, sustainable biogas/biomethane, carbon capture and storage, grid technologies. Italy's current innovation framework for low carbon technologies points to a situation of substantial industrial despecialisation (technology specialisation index based on patent activity below unit) for most of the technology clusters for which data are available (photovoltaic, wind, batteries/storage, hydrogen technologies, nuclear, CCS), with the exception of solar thermal, geothermal and wave energy. Technological despecialisation is also reflected in the emergence of growing trade liabilities in all low-carbon technologies. This situation gives priority to the need to rebalance Italian specialisation in strategic decarbonisation technologies so as to overcome the current situation over the medium term and, in the long run, to achieve a relative specialisation situation in at least some of them. Such developments could over time also lead to a rebalancing of the trade balance of strategic technologies.

The competitiveness challenge facing Italy is the development of an integrated system for research and industry, with greater contact and coordination between research and production that can accelerate the market introduction of new technologies and products. Appropriate instruments must therefore be put in place to increase investment in R & D and promote the Italian production chain for clean energy plants, so as to also have a positive economic and employment impact.

The increase in research and development appropriations foreseen by the accession to Mission Innovation, the refinancing of the Electricity System Research Funds and for actions and measures for technological and industrial development, the funds of the National Recovery and Resilience Plan (NRRP) – Mission M2C2 Investment 5.1 ‘Renewables and batteries’ – will have a significant impact on the country, increasing the level of technological innovation in the production system.

This is illustrated by the project “TANGO” (italAN Giga factOry), one of the seven initiatives funded by the EU Commission – for EUR 118 million – under the first Innovation Fund call for major projects, which by 2025 is expected to achieve a PV module production capacity of 3 GW/year (the largest in Europe), using innovative technologies (solar cells with perovskite/silicon tandem technology) on which the Italian R & S activity, funded by the Electricity System Research programme, is highly competitive globally.

R & S activities in Italy are then aimed at finding new technological solutions to support RES integration into the energy system, supporting the production chain of digital storage and architectures and automation systems linked to network services, given the increasing interrelation with the renewable supply chain, strengthening cooperation at Community level in initiatives such as the EBA, to evaluate gigafactory industrial cooperation projects for storage systems and electrolysers for hydrogen production. From this point of view, it is noteworthy that the other three Italian projects financed by the Innovation Fund concern intraday storage and hydrogen. Italy also participates in the project “European Battery Innovation (EuBatIn)”, funded by EUR 2.9 million under the second IPCEI, which aims to create a European battery industry. Coordination between research activities and industrial production is ensured by the participation of ENEA and the Bruno Kessler Institute, on the research side, and 12 companies on the industry side.

Digitalisation of the energy sector is closely linked to this work stream and requires technological standardisation in order to be adequately fostered. The generation of data by the energy system, the increase in the data transmission capacity of telecommunications networks (broadband) and the accessibility to a huge amount of data generated outside the energy system (e.g. IoT – Internet of Things), but also relevant for the sector, require operators to equip themselves with computing and analytics (big data) capacities both to improve their operations and to offer new services.

The other main sectors to which Italy intends to aim, including with a view to developing on foreign markets, are the entire circular economy sector, geothermal energy and plant equipment linked to the production and use of hydrogen and renewable gases in general. As regards nuclear energy, see Chapter 2.1.1.

The second pillar for defining competitiveness objectives is the Critical Raw Materials Act (CRMA), which points to the need for the acceleration of the transition not to go hand in hand with a worsening of European dependency on critical materials, and therefore a secure and sustainable supply of critical raw materials for European industry is a priority. Ananalysis of the Italian situation of dependence on foreign borders for many strategic technologies shows that none of the top ten critical raw materials imported into Italy are part of the list of materials which, according to the IEA, are 'critical' for clean energy technologies, namely copper, lithium, nickel, cobalt, neodymium and polycrystalline silicon. The strategy to strengthen Italian industrial specialisation in priority energy technologies for the transition could pose a risk of having a negative impact on the current low levels of Italian imports of critical materials. It is therefore necessary for the strengthening of domestic production of clean energy technologies to go hand in hand with the strategy to improve European independence on critical materials.

As part of Mission Innovation, Italy has long launched a research programme with the main public research bodies to develop an integrated computational and experimental platform for research into innovative energy materials. The aim is to achieve a significant reduction in the number of summaries carried out in the laboratory, accelerating the selection of new materials for energy applications that meet the sustainability (economic and environmental) criteria.

In general, all the measures Italy intends to take with the aim of fostering the competitiveness of its industrial sectors, taking advantage of the opportunities offered by the energy transition, in particular in terms of research and development of new technologies, will be subject to close monitoring and analysis of costs and benefits. In this way, also following a discussion with the main production chains involved in the transition, with the citizens and territories concerned, the measures will be updated to take advantage of the opportunity offered by the energy transition as a driver of sustainable growth, following the Green New Deal logic.

3 POLICIES AND MEASURES

3.1 Decarbonisation dimension

3.1.1 Greenhouse gas emissions and removals

I. Policies and measures to achieve the target set under Regulation (EU) 2018/842 as referred in point 2.1.1 and policies and measures to comply with Regulation (EU) 2018/841, covering all key emitting sectors and sectors for the enhancement of removals, with an outlook to the long-term vision and goal to become a low emission economy and achieving a balance between emissions and removals in accordance with the Paris Agreement

Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 provided for a national reduction target of -33 % compared to 2005. Recently, with Regulation (EU) 2023/857,[64]this target is more ambitious and much more challenging as it has been increased to -43.7 %. To achieve the target, Italy uses several measures already in place, as well as new and additional policies that will be introduced over time and which will require a major effort for the country system. Regulation (EU) 2018/842 was amended and updated by Regulation (EU) 2023/839,as part of the Fit for 55, setting the national LULUCF targets: emission neutrality for the period 2021-2025 and 2030 target of at least -35.8 Mt CO2eq net absorption. In addition, the final trajectory 2026-2029, and consequently the LULUCF targets, will be defined in 2025, following the revision of the reported greenhouse gas emissions inventory data in the same year.

The sectors responsible for greenhouse gas emissions and removals falling within the scope of the ESR Regulation are: transport, residential, tertiary, industrial activities not covered by Annex 1 to Directive 2003/87/EC, waste and agriculture. Some of the emissions from the transport, residential, industrial and maritime sectors have recently been regulated in the context of the revision of the ETS Directive, within which they have been regulated. The national policies and measures identified for these sectors will therefore go hand in hand with the cap and trade mechanism provided for under the new ETS Directive[65].

For details of national measures relating to the decarbonisation of transport and energy efficiency of residential, tertiary and industrial activities not covered by Annex I to Directive 2003/87/EC, please refer to the following relevant sections of this Plan (paragraphs 3.1.2, 3.1.3, 3.2)

The following are the main policies and measures that specifically affect the circular economy and waste sectors, agriculture and the LULUCF and fluorinated gases sectors in order to achieve the 2030 greenhouse gas emissions reduction target. Finally, policies on methane emissions have led to a reduction in methane emissions as a result of interventions in the waste, agriculture, livestock and energy sectors.

[64] Regulation (EU) 2023/857 of the European Parliament and of the Council of 19 April 2023 amending Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement, as well as Regulation (EU) 2018/1999.

[65] Directive (EU) 2023/959 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Union and Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme.

❖ **CIRCULAR ECONOMY AND WASTE**

In 2023, only 7.2 % of the world economy is circular, five years ago, 9,1[66]%. Consumption of the global economy amounts to 100 billion tonnes of materials per year. Quantities estimated to increase to double by 2050 compared to 2015 levels.

In this worrying context, accelerating the transition to the circular economy would greatly contribute to improving the world's conditions. In particular, the extraction of virgin material could decrease by more than a third (-34 %) and greenhouse gas emissions could be reduced, helping to limit the global temperature increase to 2 °C. It is therefore increasingly important to promote the circularity of our economies. This is further accentuated by the difficult international context, which requires Europe and Italy to accelerate the transition not only for environmental and economic reasons but also geopolitical reasons.

In general, climate change mitigation policies have so far focused on energy efficiency rather than material efficiency as the main driver of improving technical performance. Given the highly cross-cutting nature of the circular economy, it is necessary to develop an overarching policy framework that identifies the specific policy areas and areas of greatest impact, while ensuring coherence and synergy with the programming of other policies.

This overarching strategic framework must therefore extend the traditional role of the circular economy linked to the vision of the integrated waste cycle towards a sustainable system that is more responsive to the efficient use of material resources, creating a significant synergy between the circular economy and all strategic and financial sustainable development instruments and, given the specificities of our country, paying particular attention to the manufacturing, food, textile, construction and mobility sectors.

Recent international studies (https://www.resourcepanel.org/) are specifically deepening the issue of the efficient use of materials and their potential contribution to the reduction of greenhouse gases. In particular, some studies identify the following specific strategies that can be adopted to improve this efficiency:

- extension of the useful life of products;
- re-repair;
- choice of materials less Carbon-Intensive at the production stage;
- material reduction and choice of lighter materials;
- improved yield in the production process;
- asset sharing;
- industrial symbiosis;
- recycling and end-of-waste status.

The circular economy, understood as a new production and consumption model aimed at the efficient use of resources and the circular maintenance of their flows in the country, is a historic challenge for the eco-design of durable and repairable products to prevent waste generation and maximise its recovery, reuse and recycling, for the creation of new supply chains for second raw materials, replacing virgin raw materials.

The success of the ecological transition therefore depends, on the one hand, on the capacity of public administration, businesses and not-for-profit, to work in line with simpler, faster and more efficient rules, on the other hand, on a general increase in awareness and participation among citizens (especially young people and consumers in general), including through a national information, communication and education effort towards achieving full sustainable development.

[66] *5 report on the circular economy in Italy – 2023. Summary, CEN*

For a country that is poor in raw materials and geographically marginal to the major markets in central Europe, such as our, the full transition to the circular economy is therefore a strategic objective to address the major transformations that are investing in the global economy.

The national strategy for the Circular Economy, the policy document adopted by Italy in June 2022, which identifies the actions, objectives and measures to be pursued in the definition of institutional policies aimed at ensuring a genuine transition to a circular economy, includes among its priorities the contribution to achieving climate neutrality objectives, setting out a roadmap for measurable actions and targets by 2035.

The strategic themes for the circular economy, also defined on the basis of discussions with the European Commission, are: eco-design, reuse and reparability of products and process innovation that are part of upstream production processes; there are also waste management, the implementation of the minimum environmental criteria (CAM), the financial instruments to support the circular economy and the*end of waste*. Among the issues of particular concern are: critical raw materials, the development of a second raw materials market and industrial symbiosis.

The Strategy also outlines the overall framework of the objectives to be pursued until 2035, which are:

- creating the conditions for a second raw material market to replace traditional raw materials;
- consolidating and strengthening the principle of extended producer responsibility;
- the development of taxation conducive to the transition to the circular economy;
- strengthening actions aimed at the upstream of circularity (ecodesign, extension of product durability, reparability and reuse);
- the development and dissemination of methods and models for product life cycle assessment and waste management systems in order to be able to identify by scientific technical method the activities we are going to develop and their overall effects;
- improving the traceability of the waste stream;
- education and the creation of public and private skills in the circular economy as a driver for the development of youth employment (men and women).

TheNational Strategy was supplemented in September 2022 by a timetable approved by Ministerial Decree No 342 of 19.9.2022, which the European Commission requested in order to identify the measures that could be implemented immediately from 2022 to 2026.

The implementing measures can be grouped into the following macro-categories:

- the governance of the strategy requiring the establishment of a National Observatory (set up DD 180 of 30 September 2022) and the publication of an annual report on the progress of the implementation of the Circular Economy Strategy (starting in 2023);
- the implementation of the new waste traceability system, adopted by Decree of 14 April 2023;
- tax incentives to support recycling and use of secondary raw materials;
- the revision of the system of environmental taxation on waste in order to make recycling more affordable than landfilling and incineration on national territory;
- the right to reuse and repair (please note the adoption of the Regulation under Article 214-ter (2) of Legislative Decree No 152 of 2006, which is intended to encourage re-use and repair, pending publication in the Official Journal);
- reform of the Extended Producer Responsibility (EPR) system;
- the establishment of the national register of producers provided for in Article 178b;
- support for existing regulatory instruments: waste legislation (national and regional) and minimum environmental criteria (CAM) in the area of green public procurement. In particular, we would point out:

  - Ministerial Decree No 254 of 23 June 2022 on CAM – supply, rental service and service extending the useful life of interior furniture;
  - Ministerial Decree No 255 of 23 June 2022 on CAM – entrusting the service for the collection and transport of municipal waste, the cleaning and sweeping service, the supply of the associated vehicles and containers and bags for the collection of municipal waste;
  - Ministerial Decree No 256 of 23 June 2022 on CAM – award of planning services and the award of construction works;
  - Ministerial Decree No 152 of 27 September 2022 laying down the end-of-waste regulation pursuant to Article 184-ter of Legislative Decree No 152/2006 on construction and demolition waste;
  - Ministerial Decree of 19 October 2022 with CAM – award of the service of organising and implementing events referred to in 'Reform 3.1 – Adoption of minimum environmental criteria for cultural events' in the National Recovery and Culture Mission 4.0 of the NRRP;
  - Ministerial Decree of 7 February 2023 on CAM – entrustment of the supply and hire of textile products and the restyling and finishing service of textile products;
  - Ministerial Decree of 7 February 2023 on CAM – award of the service for the design of playgrounds and the provision, installation and maintenance of outdoor furniture and urban furniture products.

- support for industrial symbiosis projects through regulatory and financial instruments;
- measures for sustainable land use with a view to the circular economy;
- measures for the sustainable use of water resources from a circular economy perspective.

The National Waste Management Programme was also adopted in June 2022, with a six-month horizon (2022-2028).

It sets out the macro-objectives, macro-actions and targets, criteria and strategic lines to be followed by the Regions and Autonomous Provinces when drawing up waste management plans and provides a national survey of the plant, addressing disparities between regions.

In relation to the separate collection rate, the reduction in the number of irregular landfills and the decrease in the landfilling rate of municipal waste, it sets the target below 10 % in 2035.

The Programme also indicates the need to adopt regional planning based on the quantification of waste streams and identifies the LCA methodology to compare management scenarios, taking into account all environmental impacts.

The waste sector contributes 4.9 % to total greenhouse gas emissions in Italy and is responsible for 20,1 $MtCO_2$ eq. in 2022, mainly due to landfill management (78 %) and waste water treatment (19 %).[67]

To date, around 29 % of the waste generated is going to landfill (in 2022, 5 173 000 tonnes of municipal solid waste, 2 469 000 tonnes of similar industrial waste and around 96.000 tonnes of sludge were disposed of in landfill in 1990), while in 91 % of the waste was disposed of in landfill.

Due to changes in waste legislation and the introduction of new forms of waste management, the amount of waste treated in mechanical-biological and composting plants, as well as anaerobic digesters, has grown significantly.

[67] *Ispra (2024), "*Technical Report on Gas Serra Emissions in the National Inventory of Emissions and in the Emissile Reference Scenario developed for the purposes of monitoring Previsto by Regulation (EU) 2018/1999 and subsequently updated as part of ISPRA's work to support the update of the Integrated National Energy and Climate Plan"*, § 3.7, p. 46-49.*

Based on ISPRA data, there is a clear reduction in greenhouse gas emissions from waste incineration without energy recovery. In particular, these decreased by 84 % in around three decades, from 531 $ktCO_2$ eq. in 1990 to 113 $ktCO_2$ eq_{in} 2022. These emissions include the treatment of municipal, industrial, health, waste oils and sludge in incinerators without energy recovery; it also includes emissions from co-incineration of waste in industrial plants, the cremation of the deceased, the combustion of agricultural waste, and from the waste waste waste waste waste waste waste waste waste waste wastage.

Emissions of CH_4 and N_2O from urban and industrial waste water treatment show a decrease over the period 1990-2022, as in the last thirty years there has been a gradual increase in sewerage coverage and as a result of the share of refluo sent for purification, which in 2022 covers 91 % of the population.

Table 36 – Greenhouse gas emissions from waste sector categories, 1990-2022

	1990	1995	2000	2005	2010	2015	2020	2021	2022
	MT CO_2 equivalent								
Landfilling solid waste	13,7	16,9	19,3	19,0	17,4	15,7	16,0	15,7	15,6
Biological treatment of waste	0,0	0,1	0,2	0,5	0,6	0,6	0,6	0,6	0,5
Waste incineration	0,6	0,6	0,3	0,3	0,3	0,2	0,2	0,2	0,2
Waste water treatment	4,7	4,5	4,3	4,2	4,1	3,8	3,8	3,8	3,8
Total waste sector	**19,0**	**22,0**	**24,1**	**24,1**	**22,4**	**20,3**	**20,5**	**20,2**	**20,1**

source: ISPRA, 2024

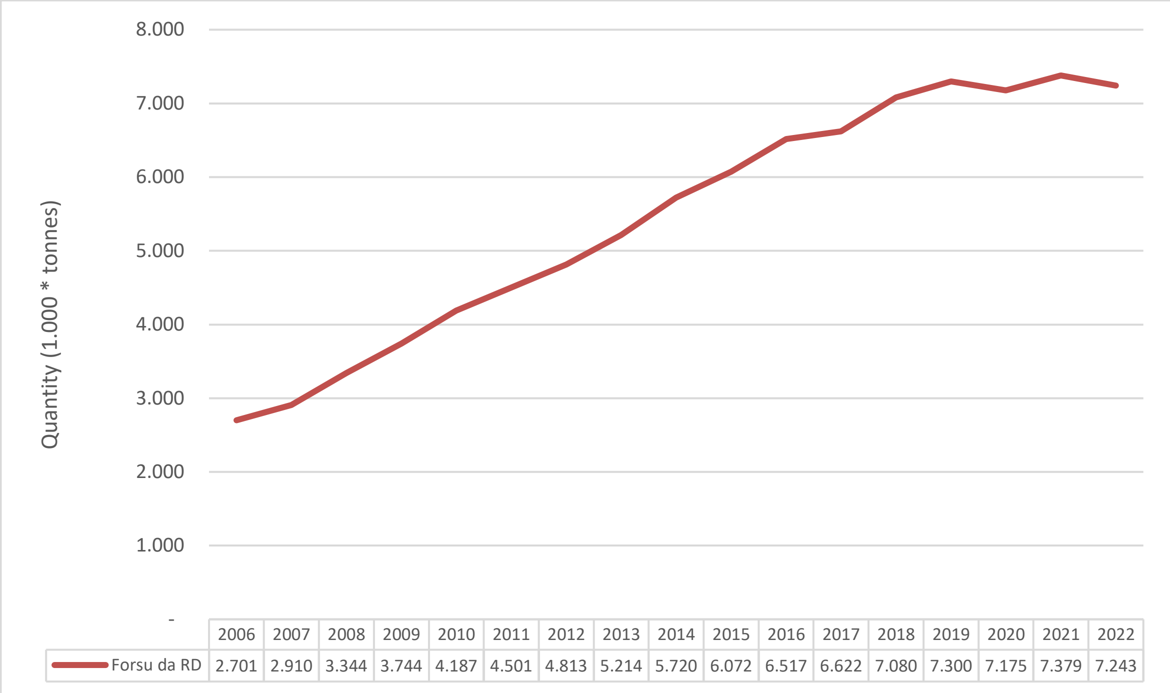
This inevitably leads, in the case of civil waste, to an increase in methane production, but compensated for by increased biogas collection efficiency that has been undertaken for energy recovery.

For industrial waste, however, emissions are linked to the amount of waste produced, which in turn depends on industrial production itself: technological progress and industry's growing commitment to environmental issues has over the years led to a reduction in the amount of processing water, and thus of waste water produced in certain sectors, resulting in a lower concentration of COD (chemical oxygen demand) to discharge and thus lower methane production.

The reduction of emissions in the waste sector is mainly linked to the increase in separate collection and the resulting recycling of separately collected fractions. The materials obtained from the collection and processing of waste into new resources make it possible to save emissions significantly compared to the use of virgin raw materials. The net gain is dependent on the type of material (higher for aluminium and metals) and the quantities collected.

As regards the biodegradable organic fraction of separate collection, the subsequent aerobic/anaerobic treatment for compost production makes it possible to transform waste that would otherwise be landfilled into a soil improver rich in organic matter. It should also be borne in mind that these treatment systems make it possible to limit methane emissions to the atmosphere, as opposed to landfilling. In quantitative terms, the treatment of the biodegradable organic fraction of municipal waste from separate collection increased from 2.7 Mt in 2006 to 7.4 Mt in 2021.

Figure 34 – Trend in the separate collection of FORSU in Italy



source*: National Waste Catasto Section, Ispra*

In the future, there is provision for an increase in the separate collection quotas for bio-waste, also in view of the new Community obligation to collect this fraction, resulting in recycling of that fraction for the production of soil improvers. The development of proximity bio-waste treatment systems will also further contribute to reducing emissions by reducing the transport of waste over long distances to centralised installations.

In this context, in quantitative terms, in compliance with the legislation in force, there is a gradual increase in treatment plants for the organic biodegradable fraction of waste, the implementation of which has also been supported by specific funding from the NRRP.

The treatment of residual fractions of waste sent to sorting and stabilisation facilities further contributes to reducing emissions to air. Compared to 2003 (when the decree transposing Directive 1999/31/EC on the landfill of waste was issued), Italy has implemented a capacity to treat residual fractions to cover national requirements in full. In this way, the residual waste is biostaised before being landfilled by reducing biogas emissions from landfill.

The improvement of the overall waste management in relation to the composition (increase in differentiation) and the amount of waste disposed of in landfills, following the transposition of Directive 1999/31/EC on landfill sites, by Legislative Decree No 13/1/2003 No 36, has led to a reduction in the impacts related to the waste sector. As mentioned above, this dynamic can be encouraged by new measures to encourage the recycling of organic and non-organic waste, as well as by increasing the use of existing regulatory instruments: *END of waste* (national and regional), Minimum Environmental Criteria (CAM) in the field of green public procurement, reform of the*Extended Producer Responsibility*(EPR) system and consortia

As regards the future, there remains a need to further increase national waste collection and recycling performance, while reducing landfilled quantities.

In order to increase the efficiency and effectiveness of separate collection from a circular economy perspective, as required at European level, both by the current directives and by the European regulation under negotiation, the MASE, by Ministerial Decree No 360 of 28 September 2 022, adopted the 'Technical Guidelines for the Environmental Labelling of Packaging'. The guidelines, adopted pursuant to Article 219 (5) of Legislative Decree No n.152/2006, entered into force on 1 January 2023 and, in the future, may be updated periodically, on the basis of new legislative measures and technological developments. The technical indications were provided with the aim of helping Italian companies to provide the environmental characteristics of their packaging in a clear and correct manner, while increasing consumer awareness of the final fate of waste. More specifically, the guidelines are the result of the work of the technical group launched by CONAI, Consorzio Nazionale Imballaggi, which, for more than one year, in agreement with the Ministry, has collected the needs of all production sectors and provided support for the implementation of legislation whose primary objective is to improve the quality of the separate collection of packaging and increase consumer awareness of the final fate of such waste. The guidelines transpose the European Commission's guidelines on strengthening the use of digitalisation of labels with the aim of facilitating the updating of indications and avoiding barriers to the internal market. It is a unique technical support tool in the European landscape and can be presented as a virtuous example, for the method used and for technical content.

In order to boost the differentiated collections of PET bottles while at the same time ensuring that this flow can be exploited for the production of new bottles, the Ministry promoted the Mangiaplastica Sperimentale Programme (by Ministerial Decree No 360 of 2 September 2021). The measure provided for a total budget of EUR 27 million, increased by EUR 6 million for 2023 and EUR 8 million for 2024. The Programme provides for the grant and payment to the municipalities of non-repayable aid for the purchase and installation of eco-compaters for the separate collection of PET beverage bottles, which are able to selectively recognise PET bottles and reduce their volume by encouraging their recycling. Around 1500 eligible applications were accepted. A monitoring action is foreseen for the measure for at least three years after the eco-compator is activated and will start in early 2023.

With regard to the system of implementing the decree, we would also point out the following measures adopted in 2022 and 2023 on the circular economy.

- Ministerial Decree of 15 June 2022 implementing Article 18 (7) of Legislative Decree No 49/2014 to encourage the adoption of certified environmental management systems in companies recycling waste from electrical and electronic equipment, WEEE;
- Ministerial Decree No 307 of 10 August 2022 approving the statutes submitted by WEEE consortia pursuant to Legislative Decree No 49 of 14 March 2014;
- Ministerial Decree No 19 of 17 January 2023 implementing Delegated Directives of the European Commission (EU) 2022/1631 and (EU) 2022/1632 of 12 May 2022 of the European Parliament and of the Council amending Annex IV to Decree No 27 of 4 March 2014 on the restriction of certain hazardous substances in electrical and electronic equipment (ROHS II);
- Prime Ministerial Decree of 3 February 2023 approving the single environmental statement template for the year 2023;
- Ministerial Decree No 40 of 20 February 2023 on the updating of the clusters of waste from electrical and electronic equipment listed in Annex 1 to Decree No 185 of 25 September 2007;
- Ministerial Decree No 122 of 3 April 2023 implementing the corrigendum to European Commission Delegated Directive (EU) 2020/363 amending Annex II to Directive 2000/53/EC of the European Parliament and of the Council on end-of-life vehicles.

❖ **AGRICULTURE**

Agriculture and livestock are important sources of greenhouse gas production and air pollutants, mainly methane, nitrous oxide and ammonia.

Methane emissions are caused by enteric fermentation of rations in the digestive system of livestock, in particular ruminants, and decomposition of manure during storage, treatment and grazing, rice crops and combustion of agricultural residues.

Nitrification and denitrification reactions of nitrogen in manure, during the storage and treatment of livestock waste, and nitrogen present in soils, are caused by the use of synthetic and organic fertilisers, the spreading of livestock waste, grazing, sewage sludge, the incorporation of agricultural management residues into the soil and the cultivation of organic soils. Nitrous oxide emissions are also caused by the combustion of agricultural residues.

Ammonia emissions are mainly determined by the management of animal manure and fertiliser use.

At sectoral level, in the case of the livestock sector, manure management, which includes emissions from stalls, storage, spreading and grazing, of the bovine, porcine and poultry categories generates 57 % of the total agricultural ammonia emissions. More specifically, in animal husbandry, ammonia emissions are generated by microbial fermentation on nitrogen in manure (faeces and urine) and take place at all management stages, from excretion, during hospitalisation to field distribution. For the agricultural sector, ammonia emissions are generated by the use of synthetic and organic fertilisers.

As regards the agricultural and livestock sectors, the following actions have been identified:

♦ ***NATIONAL INDICATIVE CODE OF GOOD AGRICULTURAL PRACTICE FOR THE CONTROL OF AMMONIA EMISSIONS***

The code, which has been included in the National Control Programme for Atmospheric Pollution (PNCIA), takes into account the following aspects for reducing ammonia emissions:

- nitrogen management, taking into account the whole [...] nitrogen cycle;
- livestock feeding strategies;
- manure storage and spreading techniques leading to reduced emissions;
- low-emission animal housing systems;
- possibilities for limiting ammonia emissions from the use of mineral fertilisers.

The Code therefore provides for mandatory measures for ammonia mitigation and abatement by: different use of fertilisers and spreading techniques for manure and storage. Optional mitigation measures can be financed through European funds from rural development policies or through the use of the EUR 2.3 billion fund established by Law No 234 of 2021 (Article 1 (498)) for the implementation of the national air pollution control programme.

♦ ***MEMORANDUM OF UNDERSTANDING ESTABLISHING THE 'AIR QUALITY ACTION PLAN'***

The Protocol, adopted in Turin on 4 June 2019 by the President of the Council and all the Ministries with competence in the fields of emissions, as well as by the MEF, provides for a number of national measures to improve air quality. The measures provided for in the Protocol cover all sectors that contribute most to emissions to the atmosphere, such as transport, domestic (biomass combustion), energy and agriculture.

With regard to the latter sector in particular, the Protocol provided for the adoption of a rule to limit the killing of plant residues in the open air, while creating supply chains aimed at the recovery and energy valorisation of these residues.

The dual aim pursued by the provision, which is to progressively limit the practice of the extraction of vegetable residues and, where possible, to favour the recovery and valorisation of such residues, is in fact consistent with the objective of implementing the ecological transition in the sense of making certain established behaviour less harmful to the environment (in this case, the practice of reducing agricultural residues) and at the same time to recover and exploit agricultural residues by creating a chain for the collection and processing of agricultural residues into a product (pellets or fuel for district heating, for example) with market value.

Again, the measure will be financed through the use of the Fund established by Article 1 (234) of Law No 2021 of 498 for the implementation of the national air pollution control programme.

♦ ***PRACTICAL LIMITATION OF GROUPING AND KILLING OF PLANT MATERIALS AT THE PLACE OF PRODUCTION***

The aim of the measure is to introduce rules on the combustion of plant materials, whether agricultural or forestry, at the place of production and at the same time to promote the recovery and valorisation of such materials through the creation of a chain of collection and processing of such materials into a product (pellets or fuel for district heating, for example) with market value. The practice of outdoor harvesting of agricultural residues, which is widely spread across the territory and without control systems, is a significant source of emissions of both climate gases and air quality pollutants into the atmosphere.

The measure will be implemented through the prior adoption of a national rule which will provide for the combustion of plant materials, whether agricultural or forestry, at the place of production (limiting their practice in particular in areas most critical to air quality), and through subsequent funding for the creation of local supply chains for the collection of residues and their exploitation.

The measure will be launched in the most critical regions on air quality from winter 2023 and will have effects from 2024 onwards. There is no deadline for the intervention, since it is of a regulatory nature, but during the year the restrictions on grabbing will only cover a few months.

♦ ***COMMON AGRICULTURAL POLICY (CAP) 2021-2027***

The measures set out in the national code referred to above find a financial and enforcement response in the instruments of the Common Agricultural Policy (CAP), which, compared to the 2014-2020 CAP, is more geared towards improving the environment. These measures will be feasible in the period 2021-2027 and include:

- the reinforcement of conditionality with direct payments subject to stricter environmental requirements;
- an obligation for Member States to introduce eco-schemes that have a positive impact on the climate and the environment, but whose use is optional for individual farms, in the first pillar (direct income support for farmers and market measures);
- payments for environmental, climate and other management commitments, in the second pillar (rural development).

❖ **LULUCF (LAND USE, LAND USE CHANGE AND FORESTRY SECTOR)**

As regards *Land Use, Land Use Change and Forestry*, the following actions have been identified:

♦ ***NATIONAL FORESTRY ACCOUNTING PLAN***

Under Regulation (EU) No 841/2018, Italy submitted the National Forest Accounting Plan, which includes the reference level for accounting for forest management, based on the continuation of sustainable forest management practices, considering the future impact of the dynamic characteristics of forests linked to age, so as not to limit the intensity of forest management. This element is considered crucial for the development of sustainable forest management practices and thus for the maintenance or strengthening of long-term carbon removals.

- ***NATIONAL FOREST STRATEGY FOR THE FORESTRY SECTOR AND ITS SECTORS" (SFN)***

The mission of the NSF will be to bring the country to extensive and resilient, biodiversity-rich forests that can contribute to mitigating and adapting to the climate crisis, providing ecological, social and economic benefits for rural and mountainous communities. The SFN stems from a European commitment, the European Union Forest Strategy of 16 July 2021, and was published in the Official Journal on 9 February 2022, valid for 20 years.

- ***PUBLIC REGISTER OF VOLUNTARY CARBON CREDITS FROM THE AGRO-FORESTRY SECTOR***

Article 45.2-quater of Law No 41/2023 established the public register of carbon credits generated on a voluntary basis by the national agro-forestry sector at the Council for Agricultural Research and Analysis of the Agricultural Economy (CREA), in order to enhance sustainable agricultural and forestry management practices that can improve atmospheric carbon removal capacities and additional to those required by European and national legislation on the management of agricultural and forestry areas. The legislation provides that credits are to be used within a voluntary national market, in line with previous provisions with the establishment of the National Register of Agro-Forestry Carbon Tanks (Register), in the competent Directorate General of MASE. The establishment of the public register of carbon credits generated on a voluntary basis by the national agro-forestry sector also defines the use of the relevant credits; in particular, credits cannot be used in the EU-ETS market referred to in Legislative Decree 47/2020, and in the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) market. In addition, while the credits contribute to the achievement of national greenhouse gas emission removal targets accounted for by ISPRA under international obligations, they are only relevant for voluntary use for the additional sustainable management practices implemented. CREA is also expected to allow carbon credits generated and certified in accordance with the paragraph to be entered in the Register at the request of the owners or managers of agroforestry land, which carry out afforestation, reforestation and sustainable agricultural and forestry management activities, in addition to those provided for in existing European and national legislation in the sector, in line with IPCC guidelines. Guidelines should be adopted by MASAF-MASE inter-ministerial decree to identify the criteria for implementation and to define the procedures for certifying claims and managing the register within the National Agricultural Information System (SIAN), in line with the territorial and production information contained in the farm files listed in the system. Only afterwards will the procedures for registering, updating and checking registered claims be defined.

- ***THE EU CARBON REMOTE CERTIFICATION FRAMEWORK REGULATION***

On 11 March 2024, the European Regulation establishing a Union certification framework for carbon removals (CRCF) was approved to establish an EU certification scheme for permanent carbon storage, carbon farming and carbon storage in products. The Regulation is an important voluntary instrument to promote carbon removals and land emission reductions, which are instrumental in moving towards the European climate neutrality objective by 2050. The framework aims to ensure the high quality of carbon removals in the EU and establish a governance system for

EU certifications, through the establishment of minimum requirements, methodology and standards for the measurement and trading of carbon removals. The Regulation defines carbon removals, in line with the reports of the United Nations Intergovernmental Panel on Climate Change (IPCC), and includes atmospheric or biogenic carbon removals, including the following carbon removal and emission reduction activities:

- permanent carbon removal (atmospheric or biogenic carbon storage for several centuries);
- temporary carbon storage in long term products (such as wood-based construction products), lasting at least 35 years and which can be monitored on-site throughout the monitoring period;
- temporary carbon storage through carbon farming (e.g. restoration of forests and soils, wetland management, underwater grassland);
- reduction of emissions to soil (due to carbon farming), which includes reductions in carbon and nitrous oxide from soil management and activities that overall need to reduce soil carbon emissions or increase carbon removals from biological materials (examples of activities are wetland management, absence of tillage and crop cover practices, reduction of fertiliser use in combination with soil management practices, etc.).

The Regulation requires carbon removal activities to meet four general criteria to be certified: quantification, additionality, long-term storage and sustainability. On the basis of these criteria, the Commission, supported by an expert group, will develop certification methodologies specific to different types of carbon removal activities, in order to ensure a correct, harmonised and cost-efficient implementation of the carbon removal criteria. Certified carbon removal and land emissions reduction activities will generate the corresponding units (where one unit is one tonne of CO2 equivalent benefit in terms of certified net removals generated by one of the carbon removal or land emissions reduction activities). These certified units can only be used for EU climate objectives and Nationally Determined Contribution (NDCs) and must not contribute to third country NDCs and international compliance schemes. The Regulation sets out clear monitoring obligations and liability rules for operators. Within four years after the entry into force of the Regulation, the Commission will establish a common and transparent electronic register at EU level in order to make public and accessible information on certification and units, including certificates of conformity and summaries of certification audit reports. Until then, the certification systems under the framework must provide public registers based on automated and interoperable systems.

❖ **CROSS-CUTTING INSTRUMENTS AND OTHER MEASURES**

In addition to what is foreseen at sectoral level, further policies and measures contributing to the Effort Sharing objectives are set out below.

♦ ***IMPLEMENTATION OF THE FLUORINATED GAS REGULATION***

Emissions of fluorinated gases (HFCs) account for 2.4 % of total GHG in CO_2eq. in 2022 and show an increase of 192 % between 1990 and 2022. This increase is the result of different factors for different gases. For example, HFCs increased considerably from 1990 to 2020, from 0,4 to 9.1 Mt in CO_2eq. Overall emissions actually peaked in 2013 with 13.6 Mt in CO2eq and then gradually declined (although remaining at much higher levels in 1990) as a result of the implementation of the F-gas Regulations that have taken place over the years and have led to the progressive reduction and/or replacement of gases with higher climate power with less or no greenhouse substances. The sectors most responsible for these emissions fall under the so-called ‘use of substances in place of ODS’. These are the refrigeration, conditioning (stationary and mobile A/C) sectors, fire fighting, foams and aerosols where HFCs started to be used around the early 90s to replace ozone depleting substances (ODS). In particular, refrigeration and stationary conditioning accounted for 63.9 % of total ODS emissions with 2022 $MtCO_2$eq in 5,8. In the stationary conditioning and vehicle conditioning sectors, the increase in emissions over the years is due to a higher uptake of air-conditioning equipment and as a result of an increase in the quantity of refrigerant installed, while quantities recovered at the end of life are still insignificant.

Italy has taken immediate action to reduce HFCs, in line with the objectives of the Kigali amendment, by adopting in 2014 Regulation (EU) No 517/2014 on fluorinated greenhouse gases, transposed by Presidential Decree No 146 of 16 November 2018. Furthermore, Legislative Decree No 199 of 8 November 2021 implementing Directive (EU) No 2001 (RED II) lays down important provisions on energy from renewable sources and defined the instruments, mechanisms, incentives and institutional, financial and legal framework necessary to achieve the objectives of increasing the share of energy from renewable sources up to 2030.

In addition, Regulation (EU) 2024/573 on fluorinated greenhouse gases, amending Directive (EU) 2019/1937 and repealing Regulation (EU) No 517/2014 was published in the Official Journal of the European Union on 20 February 2024. The new Regulation (EU) 2024/573 entered into force on 11 March 2024 and aims to phase out the use of fluorinated gases with a climate impact by incentivising the use of natural and low climate friendly refrigerant gases.

In this regard, in order to improve energy efficiency from renewable sources, the Italian Government, in line with European legislation, has planned the 2024 Termico Account. This is an update of the current Termico Account. Specifically, the 2024 Termico Account provides incentives to promote the use of latest generation technologies for small installations and is targeted at public administrations, businesses and private entities, in order to enable the retrofitting of buildings with a significant reduction in energy consumption.

Finally, in order to effectively monitor, with consistent and quality data, emissions of fluorinated greenhouse gases and to verify progress towards the emission reduction targets, the F GAS database is operational, which collects and stores information on the sales of fluorinated gases (and certain equipment containing them) and on the installation, maintenance, repair and dismantling of equipment.

♦ ***METHANE EMISSIONS***

The issue of reducing methane emissions has become increasingly important in recent years, both in view of the challenging European and global climate neutrality objectives, and with a view to increasing resilience of the European energy system and increased security of supply, which have become central themes in the current international context.

The measures to be implemented for the energy sector are already known and focus on four key points: (a) enhance the measurement and reporting of emissions across the chain; (b) eliminate leaks through detection and repair at an appropriate frequency; (c) end widespread venting and flaring practices by promoting the capture of volumes otherwise dispersed into the atmosphere; (D) limit the emission footprint of methane in imports: these measures, in order to be effective, must also be applied in fossil fuel exporting countries. In general, today there are technologies that also use artificial intelligence for these purposes, which also include drones and satellites. Advanced technologies capable of detecting emissile hotspots and conducting component or installation surveys, including better management of natural gas flows in networks.

The EU Strategy for Energy, published by the EU Commission in parallel with the REPowerEU plan, shows that action on security of energy supply can be combined with decarbonisation objectives. In particular, the EU's external strategy foresees that the EU's efforts to achieve greater diversification of gas and LNG supplies from suppliers other than Russia should be accompanied by targeted actions to tackle methane losses across the gas supply chain, in particular*flaring*and*venting*, creating further liquidity on global markets while ensuring significant climate benefits.

The International Energy Agency estimates that at least 46 billion cubic metres of natural gas are lost each year as a result of flaring and venting into the atmosphere in the producing countries from which imports will increase or which could be new suppliers to the EU with a view to greater diversification. Most of this methane can be captured sustainably and economically.

In REPowerEU, the "You Collect/We Buy" initiative was also launched by the EU Commission, with the aim of promoting methane capture in producer countries with lower safety and environmental standards.

At COP27 in Egypt, the European Union signed a joint declaration between exporting and importing countries of natural gas to reduce greenhouse gas emissions from fossil fuels. The Declaration, also signed by the United States, Japan, Canada, Norway, Singapore and the United Kingdom, promotes an international fossil energy market that minimises *flaring*, methane and CO_2 emissions along the value chain, to the greatest extent possible. It also supports the development of frameworks or standards for fossil energy suppliers to provide customers with accurate, transparent and reliable information on methane and CO_2 emissions associated with their value chains.

Italy, as the main importer of natural gas, is very careful and active in this consignment; it is between the first countries that joined and launched together with the US and the EU the Global Methane Pledge initiative and many of the Italian companies, in the various segments of the sector, voluntarily adhered to the international industry standards provided for in OGMP 2.0 (Oil and Gas Methane Partnership).

Implementing the objectives of the Global Methane Pledge, the Regulation on methane emissions reduction in the energy sector has been adopted at EU level, which sets out targets for measuring, monitoring and reporting emissions across the gas chain and for methane leakage detection and repair activities; in addition, the Regulation provides that natural gas and LNG importers in Europe shall introduce in future supply contracts clauses requiring the exporting State to comply with standards for measuring and monitoring, detecting and repairing methane leaks equivalent to European methane leaks, as well as a methane intensity index below a threshold to be identified by the Commission.

At national level, operators in the gas supply chain, in accordance with the sectoral legislation and the regulation of ARERA, as well as adhering to voluntary international initiatives, have for years already adopted safety standards that have led to a reduction in methane leakage, with recovery of raw material.

The implementation of the measures provided for in the Regulation – with the establishment of sectoral governance, with the regulatory measures necessary to recognise the costs incurred by operators, as well as proper information and communication to the public – will enable Italy to comply with the GMP objective with regard to the energy sector.

Moreover, the overall weight of methane emissions from the energy sector (combustion/production and fugitive) in total methane emissions in the ESR sectors is 2.3 %, compared to 6.7 % in the waste sector and 7.6 % in agriculture.

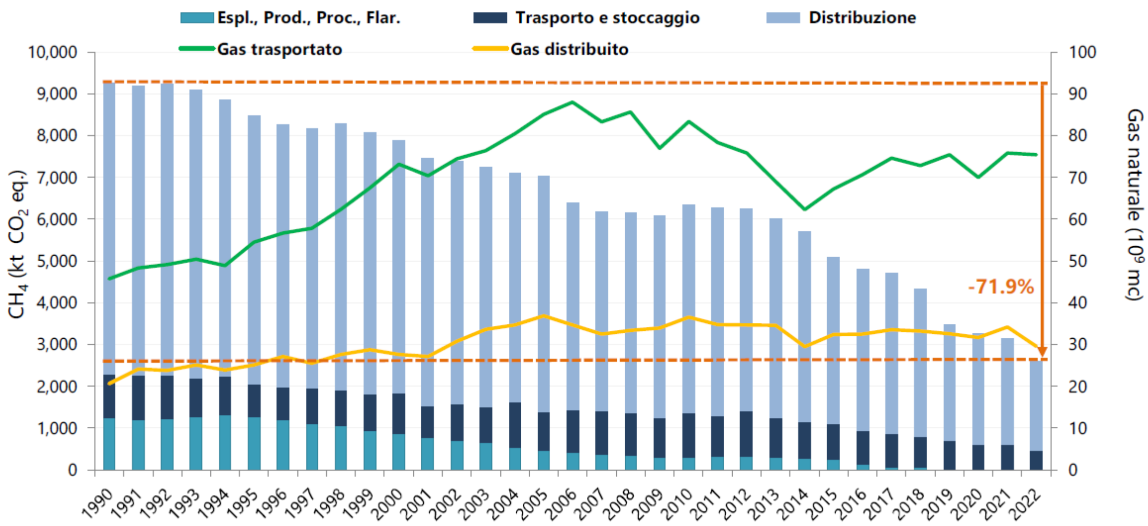
Below are some data showing the commitment of the Italian gas industry along all activities in the supply chain.

Methane emissions from the gas supply chain accounted for 5.7 % of national methane emissions in 2022 and 80.1 % of fugitive emissions, which have been significantly reduced since 1990 as a result of numerous actions to improve the transport and distribution network.

Overall, although the development of transmission and distribution infrastructure has increased considerably since 1990, as well as the flow of gas injected into the grid – 65 % more from 1990 to 2022 – methane emissions from the natural gas supply chain in Italy decreased by 71.9 % over the same period, from 259 kt of CH4 (9.251 ktCO_2eq) to 72.8 kt of CH4 (approximately 2.599 ktCO_2eq) in 2022.

Around 81.9 % of the natural gas supply chain emissions result from distribution, in view of the extent and coverage of networks; 17.6 % come from transport and storage activities (and LNG regasification terminals); 0.3 % come from domestic natural gas production and 0.2 % from the processing of the extracted gas.

Figure 35- CH4 emissions (kt CO2 eq.) in natural gas supply chain sources, gas injected into the network (transport) and distributed



Source: ISPRA report 399/2024 "Greenhouse gas emissions in Italy. 2030 reduction targets"

Starting from the distribution sector, it is important to note that, from the 90s to the present day, the replacement of equipment in the distribution network characterised by high emission factors (grey iron with hemp and lead joints) has been continued with materials characterised by lower leaks. In addition, the steel network with effective cathode protection to prevent the corrosion of ducts is increasingly extended. Fugitive methane emissions from the operation of natural gas distribution networks from 1990 to 2022 showed a 69.4 % reduction: from 249 kt of CH4 (6.962 ktCO_2eq) in 1990 to 76 kt CH4 (2.128 ktCO_2eq) in 2022.

In the natural gas transport and storage sector (including regasification terminal activities), the reduction of methane emissions over the period considered is 56.6 %, from 38 kt (1.052 ktCO_2eq) in 1990 to 16 kt CH4 (456 ktCO_2eq) in 2022.

Finally, in the upstream sector for natural gas research activities in Italy, methane emissions have very low values that can be considered irrelevant; natural gas production activities, methane emissions between 1990 and 2022 decreased dramatically compared to the initial value, which in 1990 was 30 kt CH4 (836 ktCO_2eq) and in 2022 was about 0.3 kt of CH_4 (8,1 ktCO_2eq); during the same period, fugitive methane emissions from processing activities decreased from 13.4 kt of CH4 (374 ktCO_2eq) to 0.1 kt of CH4 (3,6 ktCO_2eq) in 2022.

As can be seen from the data, the commitment of the Italian gas industry has certainly led to significant reductions in methane emissions over the years; however, the strong impact of methane emissions related to imported gas remains to be considered.

On this point, as mentioned above, Italy, both at EU and global level, is taking part in many initiatives to bring these exporting countries into higher safety and environmental standards.

In particular, in November 2023, Italy signed together with the European Commission and twelve other states, including France, Germany and the United States, a Public Announcement in the GMP framework for the development of voluntary regulatory frameworks for the measurement, monitoring, reporting and verification of methane emissions along the natural gas supply chain, so that the data are as accurate, transparent, comparable and reliable.

II. Where relevant, regional cooperation in this area

With the countries with which Italy has initiated the regional cooperation process, the discussion will be based mainly on the exchange of best practices on policies adopted or planned.

III. Without prejudice to the applicability of State aid rules, financing measures, including Union support and the use of Union funds, in this area at national level, where applicable

3.1.2 Renewable energy

I. Policies and measures to achieve the national contribution to the achievement of the binding EU 2030 target for renewable energy and trajectories, as referred to in Article 4(a) (2), where applicable or available, the elements referred to in point 2.1.2 of this Annex, including sector-specific and technology-specific measures[68]

The list of main measures to achieve the renewable energy targets, split between the electricity, heat and transport sectors, is set out below.

❖ **ELECTRICAL SECTOR**

Measures for the electricity sector will be aimed at supporting the deployment of new installations and the safeguarding and upgrading of the stock of existing installations that are still potentially competitive and sustainable. Measures of an economic, regulatory, planning, information and administrative nature are calibrated on the basis of the type of intervention (new construction or reconstruction), the size of the installations and the state of development of the technologies.

In general, long-term incentive mechanisms are an efficient tool to promote the deployment of new installations. In the absence of such forward mechanisms, spot markets alone would not ensure the realisation of the renewable capacity needed to achieve the decarbonisation targets. The regulatory framework adopted in recent years already clearly indicates how such mechanisms should be structural and integrated with spot markets. In particular, Legislative Decree 199/2021 provides for auctions for fixed-term contracts for new renewables, also making explicit reference to the definition of quotas per area, as requested on several occasions by ARERA in some alerts/opinions (both in its opinion of 20 November 2018 on the draft RES Decree 1 – adopted by the Ministerial Decree of 5 July 2019 – and in the opinion of 3 August 2022 on the draft ERF Decree 2, in which ARERA proposed the establishment of quotas differentiated by source and geographical areas).

Currently in the national context, offshore wind, thermodynamic solar, geothermal thermal energy, geothermal thermal energy with low environmental impact and ocean energy, as well as some types of photovoltaic, such as floating and agestral outputs, are considered to be technologies with significant innovation potential; they are considered to be more mature onshore wind, solar photovoltaic, hydroelectric, sewage treatment plant gas and biomass and biogas, but still suffer from high production costs, mainly due to raw material costs. Furthermore, the considerations set out in Chapter 2 on objectives apply to biomass.

♦ ***SMALL INSTALLATIONS (TYPICALLY LESS THAN 1 MW): REGULATORY AND ECONOMIC MEASURES***

- ***Regulation of incentives for small installations***

Legislative Decree No 199/2021 transposing Directive (EU) 2018/2001 lays down detailed rules for the implementation of incentive schemes for installations with generation costs that are closer to market competitiveness, in compliance with specific guiding criteria, including encouraging self-consumption and combining installations with non-programmable renewable sources with storage systems, so as to enable greater programmability of sources.

- ***Renewable Energy Community, Collective Self-Consumption and Remote Self-Consumption***

[68] *When planning such measures, Member States shall take into account the end-of-life of existing installations and the potential for redevelopment.*

Following the intentions of the first version of the INECP and in accordance with the guidelines of Directive (EU) 2018/2001, support for collective self-consumption configurations and energy communities has been launched in Italy. In particular, Decree-Law 162/19 (Article 42a) and its implementing measures, such as Decision 318/2020/R/eel of the ARERA and the Ministerial Decree of 16 September 2020 of the Ministry of Economic Development (MiSE), set out the modalities and conditions for activating self-consumption from renewable sources and creating renewable energy communities by setting up a transitional framework to encourage these configurations, which allows for the 'sharing' of local electricity produced by new plants powered by small and medium-size renewable sources (production facilities of up to 200 kW in sharing with utilities underlying the same secondary cab). The mechanism provides for the allocation of a premium energy tariff shared by the participants in the configuration, together with the return of some components of network services following local energy sharing. A virtual self-consumption model has been adopted, making it possible to exploit the widespread actual self-consumption without having to make new connections (except for production facilities), new electrical connections or the installation of new measuring equipment, applying the regulation in force, for all final customers and producers in collective configurations.

Legislative Decree No 199/2021 provided for the updating of the transitional rules, already identifying significant areas of extension, such as increasing the renewable power limit to 1 MW and extending the perimeter of participants to the primary cab. By Decision 727/2022/R/eel, ARERA has already adopted the provisions governing the methods for exploiting the widespread self-consumption for the configurations provided for in Legislative Decrees 199/21 and 210/21.

Decree No 414 of the Minister for the Environment and Energy Security of 7 December 2023 transposing the new provisions introduced by Legislative Decree No 199/2021 and covering all self-consumption configurations using the distribution electricity network to share the energy produced entered into force on 24 January 2024. The measure identifies two ways of promoting the development of self-consumption configurations: a non-repayable contribution of up to 40 % of the eligible costs, financed by the NRRP (measure M2C2 – Investment 1.2, EUR 2.2 million), targeting collective self-consumption configurations and renewable energy communities whose installations are built in municipalities below five thousand inhabitants, which will support the development of at least 2 GW of installations in total, and an incentive tariff for produced and shared renewable energy intended for remote collective and individual self-consumption configurations and renewable energy communities located across the national territory. The entry into force of the provision leads to a significant boost to the uptake of self-consumption and renewable energy communities, which could be expected to be achieved by 2027 at around 5 GW.

In order to avoid inefficiencies in grid development, self-consumption configurations are promoted as a matter of priority by enhancing the existing electricity grid and will also be a tool to support the economies of small municipalities and to provide opportunities for local production and consumption of renewable energy even in those contexts where self-consumption is technically difficult. In this respect, renewable energy communities will also be able to play an important role in terms of local consent for the authorisation and deployment of installations and infrastructure.

An additional tool for the development of these configurations is the NRRP investment M2C2 1.2, which provides for specific resources (EUR 2.2 million) to finance renewable energy plants, coupled with storage systems, embedded in collective self-consumption configurations and renewable energy communities, in particular in municipalities with less than 5.000 inhabitants with a total capacity of at least 2 GW. The measure was implemented by means of Ministerial Decree No 414 of 7 December 2023 laying down the incentive arrangements to support electricity produced from renewable installations included in self-consumption configurations for the sharing of renewable energy and lays down criteria and modalities for granting aid. In February 2024, by D.D. 22 of 23 February 2024, the MASE approved the GSE document governing the modalities and timing of access to the economic benefits provided for by the measure in question and in April 2024 the gateway was opened for the submission of requests for assistance.

In other respects, the promotion of renewable energy communities will be pursued through information tools on locally available resources (including by using the pathway for identifying suitable areas and acceleration areas) and the opportunities offered by support instruments. The development of standard tools for the establishment and management of communities and the valorisation of energy production will also be considered. In view of the fact that first local experiences have already been launched in Italy, at the initiative of some regions and municipalities, within the framework of the INECP Observatory, a review of these experiences will be carried out to verify the possibility of developing facilitation and support measures also on the basis of monitoring and reconnaissance of these experiences. In local contexts where it will be possible and convenient, communities will also promote the valorisation of renewable thermal energy.

Particular attention will be paid to the interlinkages between renewable energy communities and citizen energy communities, which offers the possibility – in addition to producing, storing and consuming energy from renewable sources – to provide energy efficiency, charging services for electric vehicles and other energy services.

The latter will also be explored to explore the possibility of promoting forms of aggregation and cooperation for renewable energy production and consumption, as well as for the provision of energy services, including in production districts.

Communities can also be an additional tool to support households in energy poverty, especially where direct interventions (e.g. self-consumption facilities) are not technically possible.

- ***Installations for single self-consumption: regulatory and economic measures***

The guidelines for the collection of general system charges from electricity tariffs, introduced in 2018 as part of the adjustment plan provided for in the Community guidelines on State aid for energy and the environment, constitute, in themselves, general rules which favour instantaneous self-consumption.

In addition, Legislative Decree No 199/2021 provided for the gradual evolution of the on-spot exchange mechanism (which allows the network to be used as storage), which will no longer be accessible for new installations, as it is progressively replaced by instruments that are better designed to promote self-consumption, the installation of storage systems and the provision of services for the safety of the electricity system on the medium and low voltage networks.

On the substance, Decree-Law No 181 of 9 December 2023, converted, with amendments, into Law No 11 of 2 February 2024 ('DL Energia') introduces a specific provision which empowers ARERA to regulate the arrangements for the gradual exit from the service of the exchange on the spot from 31 December 2024, identifying specific guiding principles.

In all cases, the promotion of individual self-consumption will be directed mainly at distributed installations for which, moreover, the simplicity and automaticity of support mechanisms seems preferable to other instruments, the management of which is more complex and costly.

Additional instruments to support self-consumption, both individual and collective, will be:

- upgrading obligations for the minimum share of renewable sources in new buildings or buildings undergoing major renovation, in line with the nearly zero emission building targets; in this regard, Legislative Decree No 199/2021 increased the share of the obligation to cover energy consumption from renewable sources to 60 % (compared with the previous 50 %). This is a valid percentage for private buildings, while for public buildings the share was raised to 65 %;

- progressive and gradual extension of the minimum share requirement of renewable sources (which, as mentioned above, is currently only for new buildings or buildings undergoing major renovation) to existing buildings, starting with certain categories such as production halls and tertiary buildings. As an alternative to the construction of the plant, arrangements will be made for the transfer of the right to the roof to third parties, with the renewable installation serving the building.

The latter two points are, moreover, linked to similar measures relating to thermal renewable energy, referred to in the specific paragraph.

As a preliminary point, it is considered that the promotion of self-consumption through these measures could lead to an increase in renewable energy consumption of more than 1 TWh each year.

- ***Other measures for small installations***

In addition to the promotion of self-consumption in the terms set out above, which in itself constitutes an important boost to the construction of small installations, further measures will be introduced, both to facilitate self-consumption where possible, and to encourage the construction of small installations that feed production into the electricity grid as self-consumption is not technically and economically feasible, and finally to facilitate the simultaneous achievement of other objectives deemed relevant. In particular, the following definitions shall apply:

- promote the installation of photovoltaic installations on existing agricultural structures not covered by the definition of a building, including through the introduction of the concept of rural building for access to support measures; see also in this respect the measure ‘Parco Agrisolare’, as described below;
- setting specific incentive tariffs for cases where self-consumption is not feasible, and provided that there is an accessible potential of some meaning and prospects for limiting costs and incentives. The combined production of electricity and heat from waste and residues in the agro-industrial sector is of interest, in particular through installations forming part of the production cycle of undertakings, thus allowing, in accordance with the principles of the circular economy, to valorise the waste and optimise production cycles, with a minority share of second harvest raw materials (in the case of biogas plants, moreover, advantages can also be obtained in terms of the use of digestate, which is important in areas vulnerable to nitrates). In this regard, Law No 145/2018 (subsequently updated by Law No 21/2021) extended the possibility of access to incentives, in accordance with the procedures and tariffs laid down in Ministerial Decree No 23/06/2016, to plants producing electricity using biogas, with an electrical capacity not exceeding 300 kW and forming part of the production cycle of an agricultural and livestock farm, made by farmers, including in consortium form, whose feed is derived for at least 80 per cent from waste and materials derived from agricultural holdings and for the remaining 20 % from their second harvest crops and with on-site self-consumption of the heat produced, for the purposes of farm processes;
- introduce premiums for the construction of photovoltaic installations whose modules are installed as a substitute for asbestos-containing covers.

In this direction, the first operational instrument for encouraging (including) small installations is the Decree of 4 July 2019, which laid down specific procedures for small photovoltaic installations on cover with asbestos/eternit replacement. A large part of the plants found to be in a useful position on the reserve lists will enter into operation in the coming years. It is planned to replicate this approach in future support schemes dedicated to mature sources and technologies introduced by Legislative Decree No 199/2021, which, as a further simplification, provide for direct access to the mechanism for such initiatives below MW.

- ***LARGE INSTALLATIONS (TYPICALLY NOT LESS THAN 1 MW): REGULATORY AND ECONOMIC MEASURES***

- ***Contracts for difference to be concluded as a result of competitive downwards tender procedures***

Legislative Decree No 199/2021 provided for the continued use of the already tested competitive bidding mechanisms. In particular, work is ongoing on the draft 'FERX Decree' dedicated to mature sources and technologies close to market competitiveness and based on a centralised *asset-based* model in which the system assumes responsibility and the associated risks – to define the quantity, location and type of sources to be achieved in order to ensure that decarbonisation objectives are pursued at the least cost/benefit for the system.

The draft decree also provides for the evolution of conventional two-way contracts (CfD) in order to overcome the problems and potential inefficiencies that become particularly burdensome for the system as the more the penetration from renewable sources contracted in this area increases and that occur both in the investment and in the operation phase.

The problems relating to the investment phase of conventional CfDs would be mitigated by defining and regularly updating the needs for renewable resources to be contracted as a result of a centralised optimisation process aimed at maximising the value for the system of the production mix of resources present on the market; optimisation process determined taking into account a specific set of features characterising the system and its expected evolution.

In order to provide appropriate logistic signals, the design of the competition procedures also provides for the development of a selection algorithm to enhance – through the application of appropriate coefficients to the tenders submitted by operators – the positive or negative externalities – in terms of network developments and expected production profile – relating to location in different market areas.

Compared to the current design, it is also considered appropriate for the system to bear the risk of inflationary dynamics, which have been particularly accentuated over the last year, so as to make the fees recognised more appropriate to the cost structure and its evolution, thereby reducing the risks of operators.

Finally, in order to mitigate problems relating to the operation of conventional CfDs, the structure of payments under the contract was redesigned with the aim of discouraging the provision of contracted capacity at prices below its marginal costs and at the same time reducing the volume risk borne by the holders of the same capacity. In particular, for installations capable of providing dispatching services, unlike previous support schemes, provision is made for regulation also on the basis of the electricity that can be produced instead of the net input, particularly in cases which are not dependent on producers' will.

The proposed solution aims at improving the efficiency of CfDs as, in addition to removing the incentive for producers to offer on the day-ahead market below their marginal costs, it ensures that the final decision of the producer whether or not to feed energy into the grid is linked to the actual state of overgeneration *of* the system in real time.

This measure will be accompanied by another support mechanism introduced by Article 4-septies of Decree-Law No 181 of 9 December 2023, converted with amendments into Law No 11 of 2 February 2024 and will be fully effective when the electricity system has a minimum amount *of utility* scale storage resources and the *associated time* shifting products provided for in Legislative Decree No 210 of 8 November 2021. This new mechanism provides for the regulation of charges on the basis of *standard* profiles consistent with the needs of the electricity system (e.g. *baseload* and/or p eakload*)*and provides for an obligation to place renewable energy into the grid on an annual basis equal to a share of the contracted profile while leaving to private investors responsibility for the optimal *mix* of renewable technologies to be deployed, promoting efficient investment and resource management solutions, as well as a better allocation of risks among the different actors in the system.

This mechanism seems appropriate for the pursuit of the objectives in that it makes it possible to plan the implementation of pre-established powers, providing certainty to operators, especially with a view to the five-year programming of quotas.

These mechanisms will be the main instrument to support the construction of newly built installations, but also to support full reconstructions and upgrades of existing installations, should long-term contracts and administrative simplifications prove insufficient.

Competitive mechanisms have already been implemented in Ministerial Decree No 4/7/2019, which made it possible, through auctions, to allocate around 4.2 GW, mainly related to wind and photovoltaic installations, which are part of the same technology group; in addition to this capacity, 1.3 GW of installations of less than 1 MW are largely photovoltaic, allocated through registries. Whereas in auctions for installations with a capacity of 1 MW or more the criterion is only economic, for registry installations, preference is given to high environmental value solutions, such as a specific PV quota on asbestos substituted hedges or installation in areas of low environmental value, such as closed and restored landfills. In addition, installations coupled with charging stations are encouraged, thus aiming to further boost electric mobility and smart and vehicle to grid charging technologies. Where self-consumed energy exceeds 40 % of production, a specific premium is foreseen, which may also be a boost to the deployment of storage systems. In addition, the aggregation of installations is encouraged by a specific priority criterion. Finally, all-inclusive tariffs of up to 250 kW can be chosen.

- ***Long-term contracts (PPA)***

Italy intends to promote widely the use of this instrument, in addition to contracts for difference, with rules favouring investors to conclude Power Purchase Agreement (PPA) contracts with stakeholders interested in purchasing the energy that the installation will produce over a sufficiently long period to ensure the amortisation of the investment needed to build a new production facility, or to rebuild or upgrade an existing plant.

Updating the provisions of the Ministerial Decree of 4 July 2019, Legislative Decree No 199/2021 provided that GME is to set up a computer card with the aim of promoting meetings between the parties potentially interested in the conclusion of such contracts, ensuring a gradual start of long-term renewable energy contracts. The bulletin was carried out in 2022 and, in compliance with the legislation on the protection of personal data, provides for the obligation to record data on contracts that are necessary to ensure maximum dissemination of results and monitoring.

In order to give further impetus to PPPs, Legislative Decree No 199/2021 also provided for the development of an organised market platform, with voluntary participation, for the long-term negotiation of energy from renewable sources. The PPA Platform will bring together sellers and buyers in order to provide the consumer with standard profiles with green energy and to remedy the main 'counterparty risk' barrier. The PPA Platform will be managed by a central counterparty (e.g. GME) and provides for the exchange of physical or financial RES energy products with multi-annual delivery (e.g. 10-15 years for new RES plants, 5 years for existing RES installations), on standard profiles itagrees between demand (retailers and final consumers, including energy communities and qualified aggregators) and supply (qualified RES producers). In addition to facilitating the matching of supply and demand, the PPA Platform will provide for the greatest possible standardisation of contracts (in order to reduce contractual complexity), which will include a system of penalties to be paid in the event of failure by one of the counterparties to comply with drawdown or entry obligations, and introduce appropriate tools to manage counterparty risk (e.g. by providing for a buyer of last resort in the event of default of the counterparty, a system of guarantees, both private and public, and credit risk sharing among different entities on the basis of precise criteria). The EU Repower also envisaged the introduction of a specific reform by 31 December 2024 to establish a system of guarantees to mitigate the financial risk associated with the conclusion of PPPs from renewable sources lasting at least three years.

Inaddition, Legislative Decree No 199/2021 provided that, in order to give afirst boost to the use of this type of contract, Consip, with the support of GSE, is to define tendering instruments for the supply of energy from renewable sources to the public authorities through draft long-term power purchase agreements. This task was also completed in the course of 2022.

Using the tools put in place by Consip, a progressive obligation to supply renewable electricity to the public authorities through long-term PPPs will be defined, reaching 100 % coverage within five years.

As a preliminary point, it is estimated that around 18 GW of incremental power, mainly from photovoltaic and wind, will be achieved by 2030 without direct use of incentive measures; a significant part of this contribution could be facilitated by the conclusion of PPPs.

♦ ***COMMON MEASURES FOR LARGE AND SMALL INSTALLATIONS***

The size of renewables targets, together with the fact that increases in electricity production are mainly expected from photovoltaic and wind, implies the need for surfaces to install such installations. This leads to the need for a strong involvement of the regions, for example by taking advantage of the public debate, which has already been introduced for major investments, including energy investments. This tool, together with renewable energy communities, will allow for a greater awareness of the local communities involved, to be achieved by informing and involving citizens and local authorities well ahead of final territorial choices. In addition to information, crowdfunding mechanisms, as well as environmental compensation measures, may contribute to the acceptance of crowdfunding mechanisms. In any case, support mechanisms should guide localisation choices, favouring installations with a low environmental impact such as those on buildings and areas not suitable for other uses.

It is of course necessary to ensure the uniformity and certainty of the timing of the authorisation process, together with a simplification thereof, and to promote greater coordination between the Member States and regions, including through the adoption of a single model for issuing authorisations at national level, equating time, procedures and procedures. A significant contribution to the coordination between the various projects involved in the process of developing new installations will be provided by the 'TE.R.A.' digital portal, in more detail in Section 3.4.2.

In particular, for large wind power plants, operators will be encouraged to carry out careful preliminary assessments with local communities and economies, while giving adequate priority to upgrading and renovating obsolete installations.

These requirements also suggest the following measures:

- ***Sharing of objectives with the regions and identifying suitable areas for the installation***

The achievement of renewable energy targets naturally requires full involvement of the regions. One of the forms in which such involvement takes place is also the identification of objectives to be achieved at regional level.

In the 2020 policy cycle, this approach took the form of a burden sharing in terms of regional targets for consumption from renewable sources.

In the 2 030 policy cycle, the identification of regional objectives may also take different forms. One of these forms is the allocation of contributions in terms of identifying suitable areas (and over the next 2 years of acceleration areas) for the installation of installations, in particular photovoltaic and wind.

Article 20 of Legislative Decree No 199/2021 provided that, by decrees of the Minister for the Environment and Energy Security, in agreement with the Minister for Culture, and the Minister for Agriculture, following agreement at the Unified Conference, uniform principles and criteria for identifying areas and areas suitable and not suitable for the installation of renewable installations with an overall power at least equal to that identified by the INECP to achieve the objectives of developing renewable sources. In this regard, an agreement was reached between the State and the Regions in early June 2024 on the draft Ministerial Decree laying down rules for the identification by the Regions of areas and areas suitable for the installation of renewable installations within six months of the publication of the Decree. This Decree defines the criteria for minimising the environmental impact of new installations, defining the maximum amount of land that can be used per unit of surface area from installations already installed and new installations, and identifying the areas technically available, giving priority to built-up areas, brownfield sites, abandoned and marginal areas suitable for the installation of renewable installations.

A further push to speed up the mapping of the areas that will host RES installations needed to achieve the 2030 targets comes from Directive 2023/2413 (RED III), which obliges Member States, by February 2026, to identify areas on land, sea or inland waters that are particularly suitable for the installation of RES installations (also called acceleration), where the construction of such installations is not expected to have significant environmental impacts, thereby facilitating harmonic spatial planning and a significant reduction in the timing of permitting.

In order to ensure an adequate support service for the Regions and Autonomous Provinces in the process of identifying the suitable areas and monitoring activities associated with it, Article 21 of Legislative Decree No 199/2021 also provided for the establishment of a digital platform (Idonee Aree Platform – PAI), carried out at the GSE, with the aim of including all the information and tools needed by the Regions and Autonomous Provinces to connect and process data for the characterisation of the area (including in relation to the infrastructure already implemented, those authorised and under authorisation), the estimation of the potential and the classification of areas and areas.

For maritime areas covered by offshore wind installations, pending the transposition of Directive (EU) 2014/89 on maritime spatial planning, the aim is to consider launching tenders for areas already pre-identified, in order to allow for a more comprehensive development of initiatives, while simplifying the permitting process of projects and reducing development costs.

- ***Simplification of procedures***

Italy has long embarked on a process of simplifying authorisation procedures, which are proportionate and differentiated according to the type and size of the installations and areas in which they are installed. Ways to achieve this improvement include, for example, standardisation of models and procedures, broadening thresholds for certain simplified authorisation schemes, digitalisation and exploitation of interoperability of information systems.

In fact, uniform simplified procedures for the construction, commissioning and operation of installations have been progressively introduced, including by extending the scope of the single model, a mechanism allowing, through a single procedure, to deal with permitting aspects, network connection and access to support mechanisms. The threshold for applying the single model, starting from 20 kW, was extended to 50 kW by Legislative Decree No 199/2021 and thus to 200 kW by Ministerial Decree No 297 of 2 August 2022. These procedures, aimed at both new RES installations and the reconstruction of existing plants, may also be extended to small storage systems, as well as to installations connected to existing POD with a greater capacity than the power of the plant.

Inaddition, the cases of use of the PAS (Simplified Attorney Procedure) have been extended. The numerous legislative simplification decrees (e.g. DL 17/2022, DL 13/2023), adopted after the entry into force of Legislative Decree No 199/2021, extended the scope of the PAS to 10 MW for agrotary installations with rotating modules raised from the ground, not more than 3 km away from areas for industrial, artisanal or commercial purposes; floating installations, on the mirror of water in reservoirs and reservoirs, including water reservoirs in disused quarries or those installed to cover irrigation channels; photovoltaic installations in suitable areas.

Article 9 of Law No 11 of 2 February 2 024 extended until 30 June 2025 the simplifications provided for in Article 47 (1-bis) of Decree-Law No n.13/2023 (Decreto PNRR 3), which exempt certain types of plants from renewable sources and storage in suitable areas covered by plans subject to an EIA (paragraph 9-quinquies); from 20 MW to 25 MW and from 10 to 12 MW the excess power thresholds for which photovoltaic installations located in suitable areas or other areas are to be subject to EIA or EIA screening (paragraph 9-sexies); the power threshold below which photovoltaic installations are subject to PAS instead of AU is raised from 10 to 12 MW (paragraph 9-septies).

Article 19of Legislative Decree No 199/2021 established a single digital platform for the submission of applications for single authorisation (SUER), using a standard authorisation model for all regions, implemented and managed by GSE. The platform provides guidance and assistance along all stages of the administrative procedure and ensures interoperability and respect for the once only principle with IT tools for the submission of applications already operational at national, regional, provincial or municipal level, in line with the guidelines of the Simplification Agenda intended in particular for the NRRP.

Law No 118 of 5 August 2 022 provided that, in order to reorganise, simplify and digitally reengineer administrative procedures, the Government is empowered to adopt one or more legislative decrees for the purposes of reviewing, simplifying and identifying the activities subject to a certified notification procedure of commencement of activity or silence, as well as those for which the express title is required or prior notification is sufficient. The need for no longer to be delayed and urgent legislative provisions was further reiterated by the provisions of Reform 1 Mission 7 of the NRRP revised at the end of 2023 and which led to the circulation at the end of May 2024 of a first draft Consolidated Text on Energy by the Ministry of Reform and Simplification, with a view to possible adoption by the end of 2024, containing the following priorities:

- establish principles for simplifying and harmonising authorisation procedures at sub-national level for RES (Free Activities, Single Authorisation and Simplified Authorisation Procedure), with limit rules for the Regions in order to avoid issuing authorisation rules that are stricter than those laid down in national legislation;
- identify renewables acceleration areas, in line with the Red III Directive and maritime spatial plans to accelerate the deployment of offshore wind energy;
- ensure the creation and operation of a single digital gateway to obtain all authorisations at national and regional level, starting with the SUER already provided for in Legislative Decree No 199/2021.

- ***Ad hoc tools for new installations based on innovative technologies***

For technologies that are still far from economic competitiveness in the Italian context or with significant innovation potential, procedures tailored to their specificities will be put in place. The use of tariff instruments will be assessed in the light of the state of development, the capacity to reduce costs, the potential for exploitation, the possible contribution to the achievement of the target, the compatibility with cost containment on bills, the improvement of environmental performance and the concomitance of other objectives. In this context, the support mechanism (known as FER-2), on which the European Commission decided, on 4 June 2024, not to raise objections to the aid measure referred to in this Decree, in so far as it is compatible with the internal market within the meaning of Article 107(3)(c) of the Treaty on the Functioning of the European Union, will soon be implemented. The mechanism shall cover in particular technologies such as: off shore wind, thermodynamic solar, geothermal energy with low environmental impact, marine energy exploitation technologies, as well as some types of photovoltaic, such as *floating outputs,* onboth inland and offshore waters. Limited quotas are also foreseen for technologies with high operating costs such as biogas and biomass installations that meet the sustainability criteria of RED II.

This provision provides for competitive procedures for allocating available quotas, totalling around 4.5 GW. Of these, the largest is foreseen for offshore wind, which is considered to make a significant contribution to decarbonisation objectives, while minimising environmental and landscape impacts, especially in the case of floating solutions. For the latter types, as stated in paragraph 2.1.2, it is necessary to proceed in parallel with the development of energy and non-energy infrastructure capable of enabling large-scale projects to be carried out in coordination with regions and TSOs.

This is in line with the provisions of Article 8 of Legislative Decree No 181 of 9 December 2023 on 'Measures for the development of the sector relating to floating offshore wind turbines'. In accordance with this forecast, on 18 April 2024, the MASE published a notice for the collection of expressions of interest for 'the identification of State-owned maritime areas with associated aquatic mirrors outside the forage defences, to be used for the development of appropriate infrastructure to ensure the development of shipbuilding investments in the production, assembly and launch of floating platforms and electrical infrastructure for the development of shipbuilding for offshore wind power generation'.

With regard to geothermal technologies, it is also considered appropriate to provide for the inclusion in the national regulatory framework of a special guarantee fund for geothermal technologies, in line with what has already been adopted in France, in order to reduce the risk faced by operators while maintaining an adequate incentive for operators to operate in accordance with the principles of efficiency and effectiveness.

One of the innovative solutions to be addressed is also aggitac, i.e. the establishment of systems that maximise the synergy between photovoltaic production and agricultural activity.

The NRRP provided for a specific investment measure (M2C2.1) for the development of aggitac, which includes: (I) the implementation of hybrid agricultural and energy production systems which do not jeopardise the use of land dedicated to agriculture but contribute to the environmental and economic sustainability of the holdings concerned; (II) monitoring outputs and their effectiveness, with data collection on both photovoltaic plants and underlying agricultural production and activity, in order to assess microclimate, water savings, recovery of soil fertility, resilience to climate change and agricultural productivity for different types of crops. The objective of the investment isto set up a production capacity from 1.04 GW, which would produce around 1.300 GWh per year.

Legislative Decree No 199/2021 provided for an implementing decree for the granting of the benefits of the NRRP measures and, in more detail, to establish criteria and methods for encouraging the construction of agestral installations by granting loans or grants which, through the implementation of hybrid agricultural and energy production systems, do not jeopardise the use of land dedicated to agriculture. This measure, which entered into force on 14 February 2024 by Decree No 436 of the Minister for the Environment and Energy Security of 22 December 2023, lays down the detailed rules for allocating NRRP resources, in the form of a capital contribution of up to 40 % of the investment costs, coupled with a specific tariff support for the energy injected into the grid allocated through competitive auction and registry procedures.

With regard to the synergy between photovoltaic and agricultural sectors, the NRRP M2C1 2.2 "Parco Agrisolare" aims to support investments in the construction of solar photovoltaic power plants in the agricultural and agro-industrial sectors, excluding land use. In particular, the measure provides for the selection and financing of interventions consisting of the purchase and installation of photovoltaic panels on the roofs of buildings used for the activities of the beneficiary undertakings. Together with this activity, one or more complementary measures may be carried out to upgrade buildings with a view to improving the energy efficiency of the facilities, such as the removal and disposal of asbestos from roofs, the construction of thermal insulation of roofs and the establishment of an ventilation system. Together with the deployment of the photovoltaic system, a contribution may be requested for the installation of electric energy storage systems and/or electric charging devices for sustainable mobility. The 'Parco Agrisolare' project has four specific targets, namely that the resources allocated should be at least 30 % by 2022, at least 50 % by 2023 and 100 % by 2024, and that the funded projects include the installation of at least 375 MW of new photovoltaic plants. As of 31/12/2022, both the first and the fourth targets were reached following the call for proposals and the publication of the relevant projects accepted. As a result of the high participation, the measure was updated by means of the Ministerial Decree of 19 April 2023, which provided for a second call for tenders, with additional resources being allocated by 2024, up to an overall limit of almost EUR 2.4 million. The Decree also revised the maximum eligible costs, allowing participation in associated companies, including in shared self-consumption configurations.

- ***Enhancement of guarantees of origin***

The aim is to strengthen the Guarantee of Origin (GOs) instrument by promoting greater value for PPPs, and assessing their recognition of all the energy produced. In this sense, Legislative Decree No 199/2021 provides that the procedures for issuing the GOs are updated and the purpose, the information given, the validity, the method of issue, the economic value, including through the exchange platform and the direct release to the purchaser, are to be defined. The role of GSE will also be defined. Implementing DecreeNo 24 of 14 July 2023 was published on the website of the Ministry of the Environment and Energy Security on 17 July 2023.

♦ ***SPECIFIC MEASURES TO SAFEGUARD AND UPGRADE EXISTING INSTALLATIONS***

Achieving renewable targets requires the establishment of new installations but also the maintenance and, if possible, the increase in renewable production, of existing installations, for which support is mainly provided through simplification and clarification of the regulatory framework, with the use of economic support instruments only where such measures are not sufficient. Similarly, mechanisms will be introduced to safeguard the production of installations that are bankrupt or seized by the judicial authorities.

In particular, we intend to act as explained below.

- ***Revamping, repowering, reversions, role of existing productions***

Without prejudice to the following paragraph with regard to hydroelectric concessions, specific non-economic measures for revamping and repowering existing plants provide for simplified permitting procedures, laying down criteria for carrying out operations with an extension of the PAS and the exclusion or simplification of EIA/environmental screening; in particular, environmental assessments are intended to promote an approach that only assesses the impact of variations compared to the situation before revamping or repowering.

In that sense, Decree-Law No 77/2021 provided that the measures to be carried out on photovoltaic and hydroelectric installations which do not involve changes in size, area and related works may be classified as non-substantial changes and notified to the municipality, even if they consist of altering the technological solution used and irrespective of the electrical power resulting from the intervention. In addition, the measures to be carried out on wind projects and wind turbines, as well as related works, which, irrespective of the rated capacity resulting from the modifications, are carried out on the same site as the wind farm and which result in a minimum reduction in the number of wind turbines compared to those already existing or authorised, are not considered to be substantial.

Decree-Law No 17/2022 provided for the use of municipal DILA (Initial Works Declaration), in relation to the execution of related works, in the event of non-substantial alterations leading to an increase in installed power and the need for additional related works without any increase in the occupied area. Decree-Law No 13/2023 provided for an exemption from the EIA, until 30 June 2024 (extended until 30 June 2025 by Law No 11 of 2 February 2024) for a number of electricity installations and infrastructure, provided that they are in suitable areas for projects to rebuild, upgrade or rebuild existing photovoltaic installations, possibly including storage systems, which do not provide for a change in the area occupied and with overall power, as a result of the interventions, of less than 50 MW, and for repowering projects of existing wind turbines which do not provide for a change in the area occupied and with overall power, as a result of the intervention, of less than 50 MW.

There is also better information on the performance of the installations transported by GSE on the basis of the stock of data acquired as part of the management of incentive mechanisms. This action will, inter alia, enable:

- support the deployment of innovative performance monitoring technologies;
- identify, within homogeneous categories of installations, possible actions to improve performance and extend their useful life;
- promote the development of a supply chain associated with the restoration of production performance and the extraordinary maintenance of installations that are subject to decay;
- to raise awareness among operators of actions to optimise the performance of the installations.

It is also intended to promote the conversion of certain types of plant which, at the end of the incentive period, should not be competitive on the market, in favour of plants that are more suited to system requirements in the energy transition pathway. These include, for example, the conversion of biogas plants to biomethane. To this end, the PNRR measure M2C2 1.4 "Development of biomethane, according to criteria to promote the circular economy" supports investments in the construction of new biomethane production plants and for the conversion, in whole or in part, of existing biogas plants. In line with the Ministerial Decree of 2 March 2018, the purpose of the Ministerial Decree of 15 September 2 022 is to promote the encouragement of biomethane entering the natural gas network by means of capital support (up to 40 % of the expenditure incurred, through resources provided for in the NRRP) and an energy incentive (incentive tariff applied to net biomethane production). This option, which is open to large installations, is more complex for smaller plants, for which efficient forms of support compatible with the Community rules on state aid will also be promoted, particularly in the agricultural sector, in order to safeguard production. The biogas plants in question must also serve the efficient use of livestock waste, in accordance with the principles of the circular economy, and the enhancement of the organic fraction of municipal solid waste (FORSU).

With this in mind, Legislative Decree No 199/2021 provided for measures to supplement the revenues resulting from participation in the electricity market, in favour of renewable installations that continue and be operated at the end of the period of entitlement to the incentives, with particular regard to renewable installations with generation costs linked to fuel supply costs, taking into account the need to limit costs in accordance with efficiency principles and in any event in compliance with a circular economy principle and the State aid rules.

The role of bioenergy plants can also be understood, during the transition period, as also serving the very high level of development of non-programmable renewable energies. For this purpose, the existing production capacity of bioliquids is also a useful transitional source of support to ensure support for maintaining decarbonisation trajectories. The current situation of the biomass production stock is characterised by a capacity of around 4.100 MW of installations in operation in 2021, of which around 1.000 MW from sustainable bioliquids. Given the number of potential operating hours of the capacity to bioliquids above 4000h/a, it could act as back-up and compensate for any deviation from the installation trajectory of at least 3 GW of new photovoltaic installations. This back-up is an insurance tool that also makes it possible to compensate for a failure to implement timely storage systems designed for non-programmable renewables, as its programmability provides a built-in accumulation function; it is also a fully renewable, programmable instrument with high production reliability, which can easily be included in the existing mechanisms for maintaining the adequacy of the electricity system (see capacity market authorised by the European Commission until the plan horizon). However, as a critical factor for these products, it is necessary to point out both the high costs of kWh produced by bioliquids compared to the average which call into question their competitiveness, and the need to use only installations powered by bioliquids that comply with the sustainability requirements laid down in Article 42 of Legislative Decree No 199/2021 and which in particular come from national supply chains. The impact of the provisions of Article 40 (1) (c) of Legislative Decree No 199/2021, namely that, from 1 January 2024, the share of bioliquids produced from palm oil, empty palm oil fruit bundles and fatty acids resulting from the treatment of palm oil fruits (PFAD) should be considered as critical for the sector, unless they are certified as low indirect land-use change risk, in accordance with the criteria laid down in Article 4 of Commission Delegated Regulation (EU) 2019/807.

- ***Minimum price guarantees for bioenergy***

In order to address the exceptional instability in energy prices resulting from the Russian-Ukrainian war and safeguard the energy production of the existing bioenergy plant stock, measures have been taken to maximise electricity production with a view to the planned reduction of natural gas consumption for the 2022-2023 thermal year.
Therefore, Decree-Law No n.57/2023, converted with amendments into Law No 95 of 26 July 2023, established the value of the minimum guaranteed price to be awarded to net electricity production, paid to cover operating costs and differentiated according to the power of the installation in order to ensure its continued operation and efficient operation. The revenue supplements resulting from participation in the electricity market shall apply to the production of biogas and biomass plants in operation on the date of entry into force of that DL and beneficiaries of incentives expiring by 31 December 2027 or renounce them by that date.
The DL requires minimum prices to be updated annually, taking into account the cost values of raw materials and the need to promote the progressive cost efficiency of installations.

Minimum guaranteed prices ensure a minimum remuneration, irrespective of the tensions that may occur in the electricity market and help keep a number of installations in operation under efficient conditions. In early 2024, minimum guaranteed prices for biogas and solid biomass plants were defined by ARERA. For installations using sustainable bioliquids, a similar provision is also laid down, as indicated in Decree-Law No 181 of 9 December 2023, which introduces a mechanism for contracting the production capacity of existing installations using sustainable bioliquids, which are mostly close to the end of the incentive period. The measure aims to maintain production capacity in efficient operating conditions in the coming years also to address the growing needs of backup and modulation of the electricity system, in particular when the availability of other RES sources is not fully sufficient to cover electricity demand.

- ***Hydroelectric concessions***

Law No 12 of 11 February 2019 converting Decree-Law No 135 of 14 December 2018 confers powers on the Regions in respect of existing large concessions. The Law provides, inter alia, that where the Regions do not consider that there is an overriding public interest in a different use of water which is incompatible with the maintenance of hydroelectric use, they may award concessions for large hydroelectric derivations to qualified operators on the basis of certain criteria, including: (a) the definition of the minimum improvements in terms of energy, generation power and producibility to be achieved in the entirety of water and electricity generation, processing and connection works with reference to national policy objectives on energy security and renewable energy sources, including the possibility of equipping water storage infrastructure to support the integration of renewable energy into the energy market; (b) the minimum levels of environmental improvement and remediation of the relevant river basin, in line with the planning instruments at river basin level pursuant to Directive 2000/60/EC (Water Framework Directive), mandatorily determining a share of the revenue from the allocation, to be allocated to the financing of measures in district management plans or protection plans aimed at the protection and environmental restoration of water bodies affected by the derivation.

In the context of the sharing of national targets with the Regions, as mentioned above, there will be ongoing discussions with the Regions to promote the efficient and appropriate application of these rules, so as to ensure that hydropower contributes adequately to the objectives.

Law No 118 of 5 August 2022 (Annual Market and Competition Law 2021) followed the provisions of Law n.12/2019, regulating the procedures for awarding concessions for large hydroelectric derivatives within two years of the date of entry into force of the regional laws referred to in paragraph 1-ter, but no later than 31 December 2023. The Regions will promptly inform the Ministry of Infrastructure of the launch and outcome of the procedures for the award of concessions for large hydroelectric derivatives. In the event of failure to adopt regional laws within the prescribed time limits, the Minister for Infrastructure will propose the exercise of the substitute power, with a view to launching the concession award procedures, providing that 10 % of the amount of the concession fees will remain vested in the State assets.

At national level, support tools will be made available, where necessary, also to promote the deployment of new facilities on smaller water networks, for example by exploiting geodetic drops in aqueducts. In addition to simplifying procedures for repowering procedures for small hydroelectric installations in the event of non-substantial modifications, DL 77/2021 revised the Guidelines for the authorisation of installations powered by renewable sources, in order to make hydroelectric and geothermal installations with a generation capacity not exceeding 500 kW of concession power subject to the system of free construction activity.

However, Italy supports greater harmonisation of the rules on hydroelectric concessions at European level.

In the context of the objectives of simplifying authorisations, it is intended to define, by means of State technical rules, the classification of plant changes defined as ‘substantial’ and ‘non-substantial’ (pursuant to Article 5 of Legislative Decree No 28/2011) and, with regard to the aspects of substantial modifications to hydroelectric installations, the unique identification of the plant changes which entail a review of the concessions.

- ***Smaller islands as a laboratory for high levels of penetration of renewables and for electrification of consumption***

Italy has already started a process to progressively cover the needs of smaller islands not interconnected with renewable energy. In this context, Ministerial Decree No 14/07/2017 set targets for the coverage of consumption from renewable sources available locally for each island, defining specific incentives the extent of which was defined by ARERA Decision No 6/11/2018 No 558 and is commensurate with the cost of the avoided fuel. In addition, on these islands, the aim is to promote the modernisation of the electricity grids so as to enable a high penetration of renewables and the implementation of pilot projects, aimed at the high use of renewable sources by means of storage systems, development of electricity transport, integration of the electricity system with the isolated water system and modulable demand on the island.

Decree-Law No 1 of 2022 March 17, as coordinated with the conversion law of 27 April 2022, provides for an update of Ministerial Decree No 14/2/2017 on the energy transition of non-interconnected smaller islands. In particular, it is expected to reach the full coverage of the energy needs of smaller islands that are not interconnected through energy from renewable sources by 31 December 2026. To this end, the update of the measure must provide for the conversion of fossil fuel energy production facilities to renewable sources by 2026 by electricity companies, through investment plans including distribution networks.

In addition, the RRP provides for an investment M2C1 3.1, called the 'Verdi Islands', for the financing and implementation of energy projects (such as renewable sources, electricity grid, energy efficiency), water (such as desalinisation), transport (cycling paths, zero-emission buses and boats) and waste (e.g. separate collection) in small islands not related to the mainland. The beneficiaries of the assistance are the 13 municipalities of the 19 small islands. The total amount of the investment is EUR 200 million. In order to access the resources, at least three of the types of eligible interventions on each island must be implemented. In September 2022, Directorial Decree No 219 of 27 September 2022 approved the ranking list containing 142 investment projects with a total value of approximately EUR 200 million in the 19 smaller non-interconnected islands, and the implementation process will therefore continue.

- ***OTHER MIXED MEASURES TO PROMOTE RENEWABLE SOURCES***

- ***Cohesion policies***

Cohesion policy, as further clarified in paragraph 3.2, is implemented through 5 European Structural and Investment Funds (ESIF) and the National Development and Cohesion Fund (FSC).

All these plans and programmes at both national and regional level, with the 2014-2020 programming period, provided for specific lines of action to promote renewable sources and energy efficiency.

As part of the Development and Cohesion Plan (instrument for implementing the FSC) 2014-2020 of the MASE, the measure of the National Energy Income Fund was also introduced by the Ministerial Decree of 8 August 2023, namely the establishment of a revolving fund for the construction of photovoltaic installations in self-consumption, in favour of households in a state of economic distress. The measure provides that MASE is the owner of the measure and that the fund is managed and implemented by Gestore dei Servizi Energetici S.p.A. The measure, which pursues the objective of combating energy poverty, reducing energy spending and promoting the development of photovoltaic self-consumption, will be addressed in particular to the regions of the Mezzogiorno. The mechanism provides that the beneficiary shall not bear the initial investment cost and that the beneficiaries must (a) transfer to GSE the energy that is not self-consumed or unshared for self-consumption, (b) transfer to GSE the contribution related to self-consumed or shared energy and (c) no access to other forms of facilitation relating to the same installation. The exploitation of the annual economic resources referred to in points (a) and (b) above is intended to repay the aid granted and shall therefore be paid back annually by GSE into the fund. All self-consumed electricity remains at the disposal of the recipient. The resources allocated to the measure amount to EUR 200 million. It is estimated that around 100-180 MW of photovoltaic installations serving 30-60.000 households can be installed with these resources; further installations may be installed in view of the diversion of the bottom. By Ministerial Decree of 8 August 2023, the Fund was established and the Fund was approved by Directorial Decree No 242 of 27 May 2024. Following the adoption of the Funding Regulation, the notice for participation in the incentive mechanism is to be published and the digital IT platform will be activated for the acquisition of applications for access to the facilities.

In the same direction as the 2014-2020 programming period, the 2021-2027 programming period, as defined in the Partnership Agreement between Italy and the European Commission on the 2021-2027 programming cycle approved by the EC Implementing Decision on 15 July 2022. In particular, policy objective 2 'A greener Europe' includes the specific objective 'energy', which provides that support for renewable sources should focus primarily on interventions for thermal and electrical self-consumption in public buildings, integrated with energy efficiency, and innovative and experimental interventions (e.g. green hydrogen). District heating is also planned to be deployed and energy communities set up for the expected environmental, economic and social benefits at local level.

Under the ESI Funds, one of the objectives to be pursued is the promotion of renewable energy by supporting actions aimed at producing RES, including thermal energy in self-consumption (in combination with storage systems) for businesses. The National Research and Competitiveness Programme for the green and digital transition 2021-2027 also contributes to this objective, with a financial envelope of EUR 262 million for the implementation of measures for the production of renewable electricity for self-consumption promoted by SMEs and the creation of small and medium-size storage systems.

Under the FSC, the Fund's resources, 80 % of the Fund's resources per midday, are used on strategic objectives, which are broken down into 12 thematic areas, including the Energy Area in turn divided into three sectoral areas: energy efficiency; renewable energy; networks and accumulations. It is a priority in the renewable energy sector (a) to promote innovative offshore wind generation projects and (b) support clean technologies with high development potential, such as green hydrogen or other innovative technologies on accumulations.

- ***Tax relief***

Tax deductions for building retrofitting, as indicated in paragraph 3.2, are still active and have played a key role in the development of energy efficiency and renewable thermal sources in the residential sector, as well as photovoltaic.

According to the data provided by ENEA as part of the Superbonus monitoring campaigns, as of 31 March 2023, more than 390.000 plants have been supported for a total of approximately 2.5 GW (investments of approximately EUR 5.8 million); almost one installation for each efficient building. Some 380.000 storage systems were associated with these plants with a total capacity of around 8.5 GWh (investments of around EUR 5.3 million).

On the other hand, around 29.000 installations were installed under the Bonus house with a total of 139 MW in 2021 and, in 2022, around 61.000 installations for a total of 287 MW.

For the measure in question, there is a general reform to strengthen the measure in response to the challenging energy and environmental objectives set out in 2030 and 2 050 in the field of energy efficiency of buildings; for more details, see paragraph 3.2.

❖ **<u>TRANSPORT SECTOR</u>**

In order to achieve the targets for renewables penetration in transport, a number of specific measures had been identified until 2021. These include, first, specific blending obligations for biofuels with fuels released for consumption, based on a quota system which, inter alia, recognised advanced biofuels and biofuels from spent oils and animal fats as a reward for advanced biofuels and biofuels from waste oils and animal fats. Second, it has been expected that fuel suppliers must meet a 6 % GHG savings target since 2020, in terms of GHG emissions on the total fuel released for consumption in that year, compared to a baseline. Finally, incentives have been identified to fulfil the obligation to place biofuels through biomethane and other advanced biofuels; in the period 2018-2022, the production of biomethane and advanced biofuels was encouraged in order to meet the existing obligation to mix fossil fuels with biofuels, through a system of withdrawal of the produced biomethane, with certificates of release for consumption (CIC) issued for ten years. The incentive burden is on obliged entities (oil companies that emit fossil fuel for consumption), does not affect electricity and gas bills, but is likely to be interplayed in the final price at the fuel pump.

Subsequently, in implementation of the relevant provisions contained in Legislative Decree No 199 of 8 November 2021 transposing RED II, by means of a series of decrees updating existing sectoral decrees covering the period 2022-2030, specific measures were introduced since 2023.

First, the new targets for the obligations for release for consumption of biofuels have been set (Ministerial Decree of 16 March 2023 as amended by the Ministerial Decree of 20 October 2023). In particular, there is a general target in terms of the use of renewable sources in the transport sector, regardless of the transport sector into which they are fed, including renewable fuels of non-biological origin – RFNBO (including when used as intermediate for the production of traditional fuels) and recycled carbon fuels – RCF. The obligation is increasing from 2023 (10 %) until 2030 (16 %). Specific targets are also set for advanced biofuels and biomethane, biofuels in petrol and pure biofuels. The scheme confirms specific rewards for advanced biofuels and biofuels from spent oils and animal fats and introduces others for non-food & feed biofuels entering the aviation and maritime sectors as well as for biofuels that are placed in purity. In addition, specific regulatory constraints have been introduced to the use of different biofuel production materials, such as the maximum limit on the use of biofuels produced from both food and feed crops, as well as from UCO and animal fats. From 2025 at the latest, palm oil is only usable if it is qualified as low ILUC risk (indirect effect due to land use change).

In addition, additional incentives were provided for the fulfilment of the biofuel injection obligation through biomethane, using the measures provided for in the RRP (capital contribution on eligible expenditure of the investment incurred and incentive tariff allocated through downward auctions) (Ministerial Decree of 15 September 2022).

The Ministerial Decree of 14 July 2023 governing the guarantee of origin (GO) mechanism, which provides for the issuance, recognition and cancellation of guarantees of origin for renewable energy production, biomethane and hydrogen, including in implementation of the measures provided for in the NRRP, was issued. The revision of the sustainability framework and additional criteria for biofuels and biomethane, RNFBO and RCF is also being finalised, complementing the existing provisions with the new requirements required at Community level to ensure the sustainability of biofuel pathways and to demonstrate compliance. The Decreeis currently being drafted, which will have to ensure the link between the existing monitoring mechanism with the new requirements required at Community level to ensure the sustainability of the biofuel sectors and to demonstrate compliance.

As regards the monitoring of the results of the measures listed above, the Decree is currently being drafted, which will have to ensure the link between the existing mechanism at national level and the mechanism provided for by means of databases that the EU Commission is fine-tuning.

Finally, the RED III Directive will have to be transposed over the next two years, as well as implementing the EU Aviation and Maritime Regulations. In particular, the mandatory quotas for release for consumption until 2030 of the use of RES in the transport sector will have to be updated in order to safeguard the findings of the scenarios described in the previous paragraphs; the RED III will also be implemented by issuing certificates for release for consumption in the case of public renewable electric recharges. In the aviation sector, minimum blending shares of SAF (SAF) will have to be foreseen since 2025 (2 %), increasing every 5 years (6 % to 2030), as well as minimum shares of RFNBO since 2030. Recycled carbon fuels, renewable hydrogen and other low carbon fuels may also contribute to achieving these shares.

In general, there is therefore a challenging path towards the decarbonisation of the sector, which will have to be pursued with a view to technological neutrality. It is of the opinion that it is essential to pursue all possible solutions that could make it possible to achieve this ambitious goal. As regards energy carriers, it is considered essential to continue promoting the uptake of e-mobility, while promoting the uptake of the most virtuous biofuels, with high emission savings and overcoming the food & feed conflict, as well as the research and introduction of the most innovative fuel categories, such as renewable fuels of non-biological origin and recycled carbon fuels. This is a challenge that includes, for all, the availability of raw materials, cost cutting, and competition between end uses. The electricity sector will also face its challenges, including, first and foremost, the lowering of costs and the lifetime of batteries. This challenge will also entail the promotion of all these energy carriers, including in the rail, aviation and maritime sectors.

The adoption of the provisions described above, together with the associated constraints, should make it possible to safeguard the objectives set out above.

For advanced biofuels, i.e. biofuels produced from lignocellulosic materials, non-food crops, agricultural and forestry residues and waste, as well as from industrial waste and residues, it is expected to reach a sub-target of around 10 %. This share will be safeguarded mainly through the construction and operation of biomethane production plants, promoting investment in this field; in addition, research and development activities in the algae sector and in all biomass conversion technologies into advanced biofuels will be strengthened. As regards single-counting biofuels, which include those produced from food & feed crops, a contribution of up to 2.3 % of total sectoral consumption is foreseen, in line with the constraints laid down in Community legislation. In particular, the contribution of palm biofuels and any other high ILUC risk categories is expected to be cancelled. Specific attention should be paid, among the different categories of biofuels, to those that can be injected into purity (without being limited to the maximum quantity that can be blended with conventional fuel), which can therefore contribute more to decarbonisation, where they have characteristics that can achieve high emission savings. To this end, measures will be implemented to promote/oblige the PA to use them.

As regards the contribution of RES electricity, in the road sector, new registrations of electric cars are expected to increase progressively to reach the cumulative target of around 4.3 million pure electric cars or BEVs by 2030, which, if added to plug hybrid cars in, would lead to an overall value of around 6.6 million electrified cars circulating in 2030. Electric mobility development forecasts are linked to the expected technological leap in batteries and will therefore be continuously monitored in regular updates; measures for the deployment of electric ferries will be encouraged. Consideration should also be given to the expected decarbonisation contribution of the deployment of Full Hybrid vehicles. For more details on e-mobility measures, see paragraphs 3.1.3 and 3.2.

As regards the limit on the use of certain types of raw materials for the production of biofuels contained in Part B of Annex IX, Italy has already provided for an overrun; as the list of materials subject to this limit has recently been extended, which initially only provided for waste vegetable oils and animal fats, an increase in the value of up to 5 % is expected to become 10 % taking into account double counting (for more details see paragraph 2.1.2). In particular, priority should be given to UCO harvested on national territory, respecting the circular economy principle and in line with the new objectives of the waste package. In fact, UCOs are considered to have great potential in the production of biodiesel and HVO (hydrotreated vegetable oil) and the production of SAF, the use of which is made compulsory by the Aviation Regulation. For this purpose, national biorefineries are also starting production of HVO for aviation.

In 2030, renewable non-biological fuels (RFNBO) will contribute 2 % of sectoral consumption in 2030 (compared to 1 % required by RED III as a minimum target), mainly using hydrogen. This will be done through use in refinery, direct use in cars and buses as well as hydrogen trains (for some non-electrified sections) or through the injection of methane into the network (currently already blended up to 2 %). Promotion measures should also be launched from research, development and demonstration of the production and use of RFNBO in addition to the direct use of hydrogen.

Finally, recycled fossil fuels, non-renewable fuels produced through carbon recovery, are facing the landscape, with at least 70 % life-cycle emission savings (e.g.: separately collected plastics or fuel obtained from recovery of CO_2 from steelworks). This type of fuel will certainly play a role in achieving decarbonisation, enhancing waste recovery from a circular economy perspective; a process will have to be undertaken to enable the individual types to be classified in terms of production, environment, technical and regulatory aspects.

In general, sustainable alternative fuels, including biogenic fuels, are an effective and environmentally sustainable solution, complementing direct electrification.

Environmental benefits have been demonstrated by numerous studies, including those of the European Commission itself (e.g JEC v5[69]). These benefits underpin the choice to support sustainable alternative fuels as an important element for the decarbonisation of the transport sector (including aviation and navigation, as set out in the FuelEU maritime and ReFuelEU aviation Regulations) as well as fuels of biogenic origin, other renewable sources or recycled carbon.

Indeed, looking at the main benefits of biogenic fuels, it must be pointed out that some sectors to date have greenhouse gas emission saving values comparable to those of RFNBO. In addition, biofuels: (a) they can be used to a large extent in existing infrastructure and conversion systems (therefore called 'drop-in'), allowing for faster intervention than other solutions; (b) they can be produced from already largely technologically mature and commercially operated sectors (hydrotreated and co-processing of oils and fats, production of biomethane from many sustainable matrices, lignocellulosic matrix ethanol, syngas fermentation, etc.); (c) do not increase pressure on critical materials for battery production, facilitating the green transition; (D) they can support the implementation of a green transition along a sustainable trajectory, including socially*(no one is left behind*).

With regard to sustainable alternative fuels of a biogenic nature, one of the key themes is the availability of raw materials, however, in the modern vision on decarbonising the transport sector, the use of alternative fuels produced from food raw materials (2.3 % of sectoral consumption) is limited and, on the contrary, virtuous production chains of advanced alternative fuels can be an enabler for more sustainable agriculture.

The example of the production of biomethane from anaerobic digestion is of particular importance for Italy. According to academic studies, the potential for producing biomethane from anaerobic digestion is[70]6.5 billion cubic metres of biomethane, to be used for uses such as transport and other industrial uses or electricity production (such as biogas). This supply chain has the opportunity to increase the competitiveness and economic and environmental sustainability of farms by:

- Limited use of first harvest crops, in line with the specificities of Italian agriculture. It is estimated that the relative agricultural area is reduced compared to that currently used (less than 200.000 ha: less than 3 % of the Italian UAA for arable land), and to preserve crop rotations for food purposes and to enhance land that is difficult to manage by type of soil due to structural lack of organic matter and/or adverse seasonal climatic trends;

[69] *[69]PRussians et al. (2020) https://publications.jrc.ec.europa.eu/repository/handle/JRC121213*
[70] *The potential contribution of advanced biofuels – Prof. Chiaromonte – Turin Polytechnic*

- Increasing use of second harvest crops, taking into account the specific characteristics of the production sectors in the various areas of the country and the scale of irrigated or irrigable UAA;
- Increasing use of livestock manure in anaerobic digestion, which is almost forced to drastically reduce the overall impact of Italian livestock and at the same time increase the efficiency of organic fertilisation and soil fertility. By 2030, it is estimated that at least 65 % of the livestock manure currently produced will be sent to biogas;
- Increasing use of high-quality agricultural residues and agro-industrial by-products and managed in a virtuous way in accordance with the principles of the circular economy.

The biofuels (and biorefineries) sector can contribute to further reducing emissions and help to close the Effort Sharing Regulation (ESR) gap for Italy by increasing the penetration of low carbon Fuels (LCF), which can be found to be used more closely due to new uses to be expected for agriculture where it can be used as biodiesel or HVO is pure (in newly registered tractors estimated at around 200 thousand units), which is mixed with high percentages (up to 30 % in older tractor models of around 1.3 million units).

The contribution of LCF could increase by an additional 0,6 Mtoe to be allocated to 2 030 in agriculture consumption to replace diesel (currently 1.9 million tonnes of fossil gas oil are consumed in agriculture), contributing to the reduction of ESR emissions. The product would be offered at the same price as fossil gas oil, giving the agricultural sector the opportunity to contribute to decarbonisation and reducing a SAD (environmentally harmful subsidy) by gradually and partially transforming it into SAF (environmentally favourable subsidy).

Account should also be taken of the reduction contribution of the HVO's Particulate, particularly in the areas of the Padano Basin, depending on the length of service of the tractors, but which is still an improvement for this Hard to Abate sector.

The cost differential between HVO and agricultural gas oil would be spread over all gas oil and fossil petrol distributed in Italy, as is now the case with the national obligation of pure or blended bio.

The additional availability of biofuels can be achieved by further strengthening the production capacities of LCF (in Italy, which can activate and increase the national biofuel "value chain" involving both industry and agriculture).

On the industrial side, the MASE-MEF Decree, which is being signed, will provide a contribution of EUR 30 million for each partial conversion (Modulari) of national refineries – redundant in a decarbonisation scenario – which will be able to increase the national supply of biofuels by 2030 and beyond.

Finally, the implementation of the measures preparatory to the development in Italy of B10 (as provided for in RED 3) and E10 will be followed up to take account of the projected growth in the fleet of hybrid petrol cars. With particular reference to E10, the current E5 petrol labels (ethanol content of up to 5 % by volume) will be gradually replaced on petrol pumps at service stations with the E10 petrol labels (ethanol content up to 10 % by volume) which has become compatible with the entire fleet. This will also make it easier for petrol to grow faster in the share of different types of biofuels.

❖ **<u>THERMAL TSECTOR</u>**

In order to achieve the binding national renewable energy target, the contribution of the thermal sector is crucial. Gross final thermal consumption at national level for heating and cooling in 2022 amounts to 51,5 Mtoe, representing around 43.9 % of total final energy consumption.

The main tools that are expected to be used to promote the use of renewable thermal sources are often integrated with those for energy efficiency and are already operational. These are:

- tax deductions for energy efficiency measures and building recovery of existing building stock, both of which are also used for thermal renewable energy;
- The Termico account;
- mechanism of Bianchi Certificates, including the promotion of High Performance Cogeneration;
- obligation to increase renewable thermal energy in heat sales for heating and cooling (OIERT Ministerial Decree);
- large thermal auctions (pursuant to Article 10 of Legislative Decree No 199/2021);
- obligation to integrate renewable sources into buildings;
- contributions to municipalities for investments in energy efficiency and sustainable territorial development;
- promotion of biomethane fed into the natural gas network;
- hydrogen support measures;
- support for district heating.

These measures are summarised below with reference to the relevant parts of thermal renewable energy, including the associated development lines envisaged for the achievement of the 2030 targets on thermal renewable energy. With regard to measures in common with the promotion of energy efficiency, please refer to paragraph 3.2 for a more detailed description of the state of the art and the planned development lines.

In order to stimulate the renewal of old biomass thermal energy plants with efficient and low emission technologies, the update that will be deemed necessary for the described mechanisms will also include, where not already established, the introduction of stricter performance and environmental requirements for biomass heat generators. The introduction of replacement constraints for obsolete heaters and periodic monitoring and maintenance obligations for biomass installations (electronic cadastre) will be considered.

Accordingly, in order to promote the best energy and environmental performance, Annex IV to Legislative Decree No 199/2021 laid down the minimum technological and performance requirements to be met by plants producing thermal energy from renewable sources which require incentives of any kind.

For electric and gas heat pumps, a technologically neutral approach will be maintained, leaving it to the market to select the most efficient option for each application, also taking into account the fact that cooling needs prevail in some regions of the Mediterranean countries. Promotion mechanisms will also be geared towards the deployment of geothermal heat pumps.

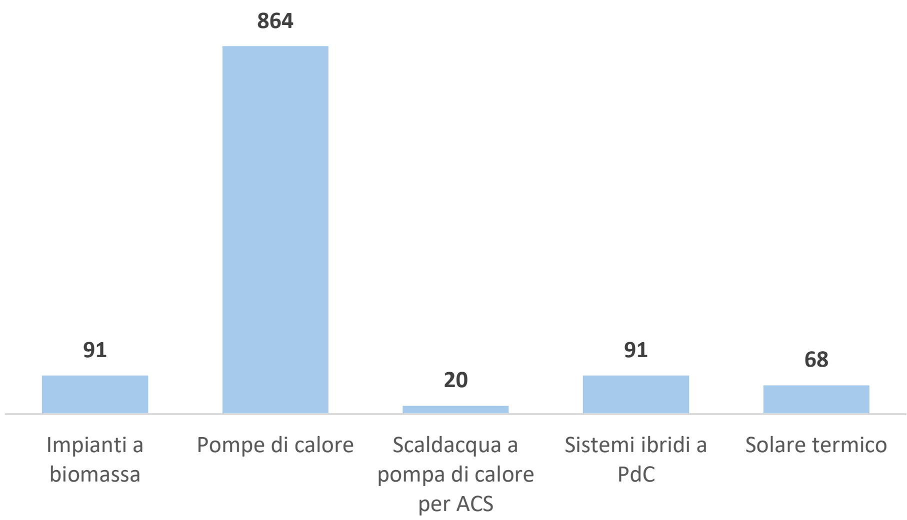
In order to facilitate the installation of solar thermal installations that can meet the demand for heat in a more flexible and effective manner (e.g. by covering the heating needs of buildings), the promotion of hybrid systems will be confirmed.

♦ ***TAX DEDUCTIONS FOR ENERGY RETROFITTING AND RECOVERY OF BUILDING STOCK***

Under the Ecobonus, the installation of solar thermal installations, heat pumps, hybrid heat pumps, heat pump water heaters, as well as biomass and geothermal installations are facilitated.

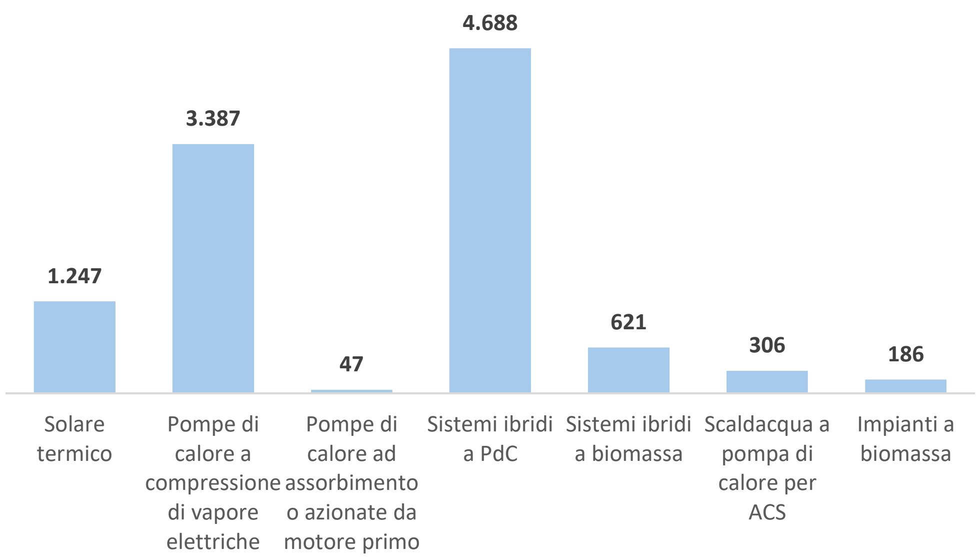
With regard to the installation of thermal renewable plants, over EUR 2 022 billion of investments stimulated by the measure were recorded in 1,1.

Figure 36 – Investments in thermal renewable installations which in 2022 had access to tax deductions for energy renovation of buildings (EUR million) (Source: ENEA Annual report tax deductions 2023)



Investments linked to the Ecobonus must be added to the investments linked to the so-called 'Super Ecobonus', which also allows for measures related to RES thermal energy plants. For these, as of 31 December 2022, investments of around EUR 10.4 million have been supported.

Figure 37 – Investments in thermal renewable plants that had access to the so-called 'Super Ecobonus' (EUR million) on 31 December 2022 (Source: ENEA Annual report tax deductions 2023)



Finally, measures to install solar thermal installations, heat pumps, heat pumps, heat pump hybrid plants, heat pump water heaters and biomass generators in buildings are also eligible under the so-called Bonus casa scheme. On the basis of ENEA data, over 288 actions were funded in 2022 involving the use of renewable energy sources for the production of heat, in particular heat pumps (86 %).

As regards the evolution of the tax deduction mechanism, please refer to Chapter 3.2: Energy efficiency dimension.

♦ ***TERMICO ACCOUNT***

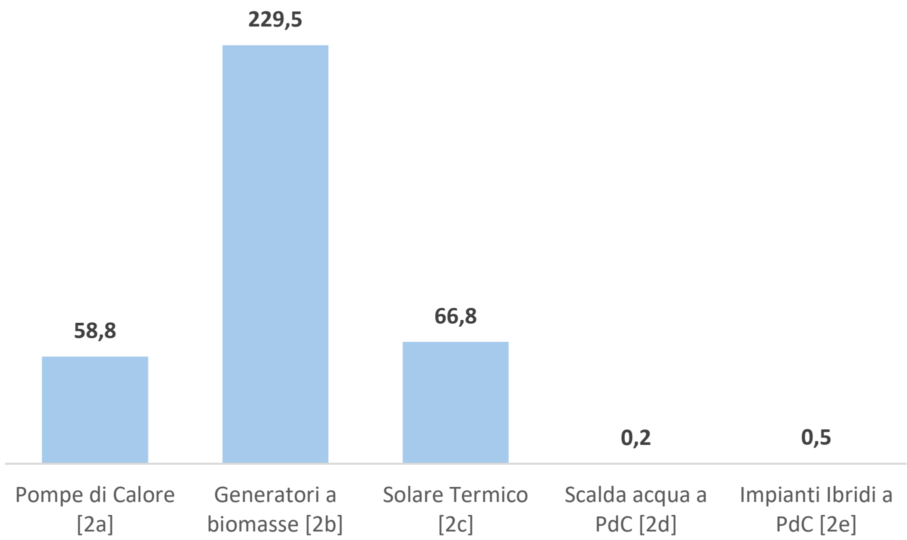
The Ministerial Decree of 28 December 2012, as amended by the Ministerial Decree of 16 February 2016, introduced the 'Termico account', an incentive instrument to encourage the production of renewable thermal energy and, at the same time, to enable the public authorities to have access to energy efficiency measures for buildings and installations. The Thermal Account became operational in July 2013.

In the context of the production of heat from renewable sources, one or more of the following actions by public authorities and private entities shall be encouraged:

- replacement of existing winter air conditioning systems with winter air-conditioning systems, including combined hot water, equipped with heat pumps, electric or gas pumps, using aerothermal, geothermal or hydrothermal energy, together with the installation of heat accounting systems in the case of installations with a useful thermal input exceeding 200 kW; the maximum limit for access to demand for inducement is for installations with a total rated power post operam of up to 2.000 kW thermal;
- replacement of existing winter air-conditioning systems or heating existing greenhouses and rural buildings with winter air-conditioning installations with biomass fired heat generator, together with the installation of heat accounting systems in the case of installations with a useful heat output of more than 200 kW; the maximum limit for access to demand for inducement is for installations with a total rated power post operam of up to 2.000 kW thermal;
- installation of solar thermal installations for the production of domestic hot water and/or as a complement to the winter air-conditioning plant, including combined with solar cooling systems, for the production of heat for production processes or for injection into district heating and cooling networks; in the case of solar field surfaces above 100 m², the installation of heat accounting systems is required; the maximum limit for accessing the application for an incentive request is for installations up to 2.500 m² of gross installed floor area;
- replacement of electric water heaters with heat pump water heaters;
- replacement of existing winter air-conditioning systems with hybrid heat pump systems.

In 2022, around 80 applications for the installation of renewable installations, or around EUR 356 million invested, were given access to the incentives.

Figure 38 – Estimated investments in thermal renewable installations in the 2022 thermal accounts (EUR million) (Source: GSE)



As regards the development lines relating to the mechanism of the Termico Account, please refer to Chapter 3.2: Energy efficiency dimension.

♦ *WHITE CERTIFICATES*

The Bianchi Certificates are negotiable certificates certifying the achievement of energy savings in energy end-use through energy efficiency improvement measures and projects.

The mechanism shall also promote the implementation of projects involving the use of renewable sources for non-electric uses, in relation to their capacity to increase energy efficiency and generate non-renewable energy savings.

The Bianchi Certificates are also issued for the energy savings generated by Cogeneration plants in Upper Rendimento, including renewable installations and installations connected to district heating networks.

As regards the evolution of the White Certificates mechanism, please refer to Chapter 3.2: Energy efficiency dimension.

♦ *MR OIERT*

Article 27 of Legislative Decree No 199/2021 provides that, from 1 January 2024, companies selling heat in the form of heat for heating and cooling to third parties for quantities exceeding 500 TEP per year are to ensure that a share of the energy sold is renewable. The provision refers to a decree of the Minister for defining and implementing the obligation. In particular, the current draft decree defines:

- the obligation to increase renewable thermal energy in the sale of energy according to annual trajectories consistent with the INECP targets;
- how to comply with: Go, physical RES production, compensatory contribution expressed in terms of EUR/toe;
- notifications for compliance with the obligation and related checks;
- the allocation of the resources transferred to the fund set up at CSEA (large thermal auctions).

This obligation falls on entities (public or private, in any corporate form) carrying out thermal energy sales activities in the form of heat for heating and cooling (excluding process heat) to final thermal customers for more than 500 toe.

The draft decree was put into public consultation which ended on 31 January 2024. In particular, contributions were submitted from the main trade associations and individual operators (Utilities, DH and ESCO).

The current draft decree provides for growing trajectories to increase the renewable thermal energy obligation that obliged entities are required to comply, based on the historical RES share. The increments will be sized to ensure:

a) reaching at least a renewable share in district heating by 2030 at least equal to the total share of the thermal sector;
b) the regression of the obligation to increase on the basis of the RES share achieved.

Compliance with the obligation is achieved by cancelling the guarantees of origin referred to in Ministerial Decree No 224 of 14 July 2023.

- ***LARGE INSTALLATIONS (EX ARTICLE 10 OF LEGISLATIVE DECREE NO 199/2021)***

Article 10 of Legislative Decree No 199 of 8 November 2021 provides that, in the context of the update of the Decree of the Minister for Economic Development of 16 February 2016 (the 'Termico Account 2.0'), a framework is to be introduced to encourage interventions for the production of thermal energy from large renewable sources through competitive access mechanisms. In this respect, it was considered appropriate, given the complexity of the measure to be introduced and given that the purpose of the heat account is to encourage measures to produce thermal energy from renewable sources and small energy efficiency measures, to proceed with a separate measure from the aforementioned Decree of 16 February 2016. The technical investigation is currently ongoing.

- ***OBLIGATION TO INTEGRATE RENEWABLE SOURCES INTO BUILDINGS***

Annex 3 to Legislative Decree No 199/2021 transposing the REDII Directive identifies obligations for the integration of renewable sources into new buildings or buildings undergoing major renovation.

These buildings must be designed and constructed in such a way as to ensure, through the use of renewable installations, the simultaneous coverage of 60 % of the expected consumption of domestic hot water and 60 % of the sum of the expected consumption for the production of domestic hot water, winter air conditioning and summer air-conditioning. The obligations described above cannot be fulfilled through installations from renewable sources which produce only electricity which, in turn, food for the production of heat with Joule effect.

The electrical power of plants powered by renewable sources which must be installed above or inside the building or its appliances, measured in kW, shall be calculated in accordance with the formula: P = k * S, where: K is equal to 0,025 for existing buildings and 0,05 for new buildings; S is the floor area of the building at the ground level, i.e. the projection to the ground of the building gauge, measured in m^2; appliances shall not be taken into account when calculating the area on the plant, but on which the installation of the installations is permitted.

The obligations described above do not apply where the building is connected to an efficient district heating and/or cooling network within the meaning of Legislative Decree No 102 of 4 July 2014 transposing the EED, provided that district heating covers the entire heat energy demand for heating and/or cooling covers the entire demand for thermal energy for cooling.

For public buildings, the percentage obligations are raised to 65 % and the mandatory power requirements must be increased by 10 %.

In the event that an appropriate report drawn up by an authorised designer is declared technically impossible to comply with the obligation, it is nevertheless established that an appropriate non-renewable primary energy value should be obtained, strictly calculated for the sum of winter air conditioning, summer air-conditioning and domestic hot water production services.

The obligation to integrate renewable sources into buildings, which has brought benefits with regard to the improvement of the energy performance of buildings and the deployment of renewable thermal sources, must be made more effective in order to broaden the scope and ensure its application in all cases. With this intention, Legislative Decree No 199/2021 provides that, from 1 January 2024, the obligations are to be restated at least every five years, taking account of technological developments. When reviewing the obligations, the scope of these obligations must be assessed to cover buildings undergoing major first-level renovation, as well as to buildings of categories E2 (Office buildings and similar buildings), E3 (buildings for hospitals, clinics or nursing homes and similar establishments) and E5 (Buildings used for commercial and similar activities)[71], with a useful floor area of more than 10.000 square metres, even if not renovated.

In addition, it is planned to update the system of obligations by making it simpler and immediately applicable, for example by introducing a list of renewable technologies, from which the designer will be able to choose, on a case-by-case basis, on the basis of the characteristics of the building, facilitating the integration of traditional technologies with renewable ones, including through the use of hybrid installations. In extending the scope of the obligation, synergies with existing promotion instruments may be envisaged in order to optimise the cost/benefit ratio of investments for the installation of renewable thermal energy plants. In this regard, Legislative Decree No 199/2021 provides that renewable installations constructed for the purpose of fulfilling obligations, with the exception of those built for new buildings, shall have access to the State incentives provided for the promotion of renewable sources, including guarantee funds and revolving funds for the provision of low-interest loans, subject to compliance with the criteria and conditions for access and cumulation laid down by each mechanism.

With regard to situations where it is technically impossible to comply with the obligations to cover the energy needs of buildings subject to first-level renovation, the possibility of a procedure for the installation of the obligation quota by the owner in another building, even if not owned by the owner, or of transferring them to the local authority which may cumulate them in order to reach appropriate shares for interventions in public buildings, will be considered, provided that this is compatible with the constraints linked to the Energy Efficiency Directive for buildings.

On the basis of the results of the measures described above and in line with the measures for electricity renewables, as well as what will be laid down in the EPBD, the pros and cons of introducing obligations on minimum shares of renewable sources will also be assessed for certain categories of existing buildings, such as tertiary buildings.

- ***CONTRIBUTIONS TO MUNICIPALITIES FOR INVESTMENTS IN ENERGY EFFICIENCY AND SUSTAINABLE TERRITORIAL DEVELOPMENT***

Decree-Law No 34 of 30 April 2019 (Decree Law on Growth) established a contribution to municipalities, up to a maximum of EUR 500 million for 2019 from the Development and Cohesion Fund (FSC) for measures relating to investments in the field of energy efficiency and sustainable

[71] *referred to in Article 3 of Presidential Decree No 412 of 26 August 1993*

territorial development. The contribution shall be allocated to each municipality on the basis of the resident population on 1 January 2018, as follows:

- EUR 50,000 to municipalities with a population not exceeding 5.000;
- EUR 70,000 to municipalities with a population of between 5.001 and 10.000 inhabitants;
- EUR 90,000 to municipalities with a population of between 10.001 and 20.000 inhabitants;
- EUR 130,000 to municipalities with a population of between 20.001 and 50.000 inhabitants;
- EUR 170,000 to municipalities with a population of between 50.001 and 100.000 inhabitants;
- EUR 210,000 to municipalities with a population of between 100.001 and 250.000 inhabitants;
- EUR 250,000 to municipalities with a population of more than 250.000 inhabitants.

The contributions referred to in the preceding paragraph shall be allocated to public works relating to:

- energy efficiency, including interventions related to public lighting, energy savings of publicly owned and publicly owned buildings, as well as the installation of plants for the production of energy from renewable sources;
- sustainable territorial development, including actions on sustainable mobility, adaptation and security of schools, public buildings and municipal heritage and the removal of architectural barriers.

With effect from 2020, for the projects referred to above, Decree Law on Growth authorised the implementation of a multiannual funding programme, the actual resources of which are distributed among municipalities with a population of less than 1.000 inhabitants, allocating the same amount to each municipality.

By means of Directorial Decrees of 14 May and 10 July 2019, the Ministry of the Environment and Energy Safety established, respectively, the amount of the contribution allocated to each Italian municipality and the detailed rules for implementing the measure (eligible measures, the aid payable and the arrangements for its payment, monitoring of the measure).

The 2020 Budget Law allocates contributions to municipalities, up to EUR 500 million per year, for investments in public works in energy efficiency, including measures aimed at the efficiency of public lighting, the energy saving of buildings owned by public property and public housing, and the installation of plants for the production of energy from renewable sources. These contributions may also be used by municipalities for sustainable territorial development projects, including measures on sustainable mobility, as well as measures to adapt and secure schools, public buildings and municipal heritage and to remove architectural barriers.

Over the years, the Fund has been increased several times. Recently, Decree-Law No 19 of 2 March 2024, converted with amendments into Law No 56 of 29 April 2024, provided (Article 1 (10-bis)) that 'In order to accelerate the strategic measures necessary to bring the air pollution situation within the limits laid down in Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 and for the purposes referred to in Article 10 (1) (d) of Law No 88 of 7 July 2009, the Fund's resources shall be increased by EUR 10 million for 2024, EUR 20 million for each of the years 2025 and 2026, by EUR 30 million for 2027 and EUR 35 million for 2028'.

♦ ***DEVELOPMENT OF BIOMETHANE, ACCORDING TO CRITERIA FOR THE PROMOTION OF THE CIRCULAR ECONOMY***

The NRRP measure 'Development of biomethane according to criteria for promoting the circular economy' (Mission 2, Component 2, Investment 1.4) aims to support investments in the construction of new biomethane production plants and for the conversion, in whole or in part, of existing biogas plants, making available the resources provided for in the RRP amounting to EUR

1.92 million. Biomethane injected into the natural gas network is supported through capital support (up to 40 % of the costs incurred) and an operating incentive (incentive tariff applied to net biomethane production).

The incentives provided for in the Ministerial Decree of 15 September 2022 may be granted to newly built biomethane production plants, agricultural or waste, and measures to convert existing biogas electricity plants to biomethane (in whole or in part). Biomethane produced and fed into the natural gas network can only be used for the transport or heat sector. In addition, in line with policy priority 2, in order to increase biomethane production under Investment M2C2 I1.4, under the fourth competitive procedure opened on 03 June 2024, the amendment on the measure to the EC Decision on the implementation of the NRRP consisting of the possibility of including the exploitation of the organic fraction of municipal solid waste (FORSU) for the conversion and improvement of the efficiency of existing agricultural biogas plants has been transposed. Three competitive procedures were launched during 2023. Currently, 157 projects are ranked for a total production capacity of around 71.950 Smc/h. On 3 June 2024 GSE opened the fourth competitive procedure.

♦ ***SUPPORT FOR DISTRICT HEATING***

In order to exploit the potential of district heating, the tools currently available to support the new construction and expansion of urban heat distribution infrastructure will be strengthened, especially where heat production hubs are close to consumption sites. With this in mind, in order to exploit the potential of district heating described in Mission 2, Component 3, investment 3.1 '*Development of district heating systems*' was introduced to promote the deployment of efficient district heating networks through the construction of new networks or the extension/modernisation of existing networks.

The measure was implemented by Ministerial Decree No 263 of 30/06/2022 and Public Notice No 94 of 28/07/2022. Following Commission Decision 2023/C 6641 final of 29 September 2023, of the 29 projects eligible for the ranking referred to in DD No 435 of 23/12/2022 of the DGIE of MASE, 14 were found not to be compatible with the DNSH principle. However, these projects were eligible from the CO2 auction resources for 2022, pursuant to Article 10 of Decree-Law No 181 of 9 December 2023. Consequently, the NRRP resources released led to a slippage of the ranking list. To date, a total of 50 projects are eligible, generating around 0,1 Mtoe/year.

❖ **MEASURES TO PROMOTE HYDROGEN**

♦ ***THE EUROPEAN AND NATIONAL CONTEXT***

In July 2020, the European Commission published a '*Hydrogen Strategy for a climate-neutral Europe*' to speed up the development of clean hydrogen, with a step-by-step trajectory to accelerate hydrogen development over three strategic phases from 2020 to 2050 (40 GW, i.e. 10Mton to 2030 and 500 GW by 2050, i.e. a share of hydrogen in the European energy mix up to 13-14 %). The importance of the hydrogen carrier is also confirmed in the report on the strategy of the European Parliament's Committee on Industry, Research and Energy (ITRE) of 18 March 2021 and the REPowerEU plan confirming the 2030 renewable hydrogen self-production target and proposing an import of the same quota.

With this in mind, the European Hydrogen Bank (EHB) was set up by COM (2023) 156 to promote the deployment of hydrogen through four pillars, which have been operational since 2023: two are financing mechanisms for the creation of the internal market and for imports; the third is linked to transparency and coordination, i.e. the assessment of demand, infrastructure needs and data on flows and costs; the fourth relates to the streamlining of existing financial instruments, coordinating them and with new public and private funding, both in the EU and internationally. In particular, under the EHB, a European auction system has been set up to incentivise the “kg” of hydrogen produced for 10 years of operation, through a fixed premium scheme, using both the Innovation Fund and Member States’ resources. The initiative will contribute to the objectives of the Green Deal Industrial Plan and the EU’s objective of achieving climate neutrality by 2050. The first European Hydrogen Bank auction for the production of RFNBO hydrogen was launched in November 2023, with a budget of EUR 800 million and ended in February 2024.

The results of the first pilot auction were published on 30 April 2024. 132 projects from 17 European Economic Area countries participated. Of these, 13 were excluded for non-compliance with the eligibility and eligibility criteria, while 7 projects were pre-selected to receive the incentive. The pre-selected projects, once the grant agreement has been signed and put into operation, will receive a total support of around EUR 720 million over the 10 years of operation and production of RFNBO hydrogen.

From the point of view of the State aid and regulatory framework, the European framework is being consolidated: all State aid frameworks (CEEAG of February 2022, TFTC Russia-Ukraine and GBER of March 2023) have established aid schemes linked to the production and use of low-carbon and renewable hydrogen. At the same time, the delegated acts implementing Directive (EU) 2018/2001 entered into force in June 2023, namely the Renewable fuels of non-biological origin (RFNBO) delegated act (Article 27(3) of the Directive) and the so-called greenhouse gas (GHG) delegated act (Article 28(5) of the Directive), which set out the conditions for the recognition of renewable hydrogen and the calculation of the share of emissions linked to its production.

Moreover, of significant importance is the European Hydrogen Backbone initiative, a study launched through cooperation between 32 European energy infrastructure operators, with the aim of accelerating Europe’s decarbonisation path by defining the key role of hydrogen infrastructure. In fact, five Pan-European Hydrogen Supply and Import Corridors were defined in the EHB Report at 2030, linking industrial clusters, ports and Hydrogen Valleys to regions with abundant hydrogen production. The backbone through Italy will enable the connection of North Africa to Central Europe through the Italian interconnection points at Tarvisio and Passo Gries, contributing to the European import targets set by REPowerEU.

This includes the SoutH2 Corridor project, of which the Italian backbone is an integral part, which received political support from the Ministries of Energy of Austria, Germany and Italy by signing a letter of support in May 2023. The project, where Snam plays a coordinating role, consists of an infrastructure of 3.300 km and will allow for the import of renewable hydrogen produced from North Africa and transport hydrogen produced by the national Hydrogen Valleys, Italy (Sicily as entry point), to Austria and Germany, making it possible to meet some preliminary estimates of around 40 % of the European REPowerEU renewable hydrogen import target (4Mton/year).

A dedicated hydrogen infrastructure in Hydrogen Valley in Puglia is further planned on national soil, included by the European Commission as part of the IPCEI hydrogen projects approved in February 2024 as part of the Hy2Intra wave. The infrastructure put in place by Snam is part of the broader framework for the development of the hydrogen supply chain involving other primary industrial operators active in Puglia.

At national level, the Preliminary*Guidelines were published at the end of 2020: National Hydrogen Strategy*’, which was a very challenging objective, a 2 % penetration of the hydrogen carrier in final energy demand, namely the installation of 5 GW of electrolysers and the production of around 0,7Mton/year of renewable hydrogen. At the same time, two major southern regions, Sicily (January 2021) and Puglia (December 2022), published their own strategies for the promotion of hydrogen, with challenging targets for 2030. Under the NRRP, more than EUR 3MLDEUR of investments and proposals for two reforms to promote hydrogen deployment have been allocated as shown below.

In addition, the National Hydrogen Strategy is being finalised, where, based on a thorough characterisation of potential hydrogen demand in key HTA industrial sectors and transport, hydrogen penetration scenarios will be defined due to the level of decarbonisation identified, the different existing decarbonisation options and possible alternatives for hydrogen production and supply.

Finally, please note the letter of political support signed by the Ministries of Energy of Austria, Germany and Italy in May 2023 for the development of the 'Southern Hydrogen Corridor' in the European Union (where SNAM plays a coordinating role) of 3.300 km, which will allow the import of renewable hydrogen produced from North Africa and transport hydrogen injected by national hydrogen valleys from Italy (Sicily as an entry point) to Austria and Germany, making it possible to meet, according to preliminary estimates, around 40 % of the REPowerEU renewable hydrogen import target (4Mton/year).

Considering that a large part of nationally produced renewable energy comes from intermittent and non-programmable sources, such as wind and photovoltaic, and whereas further exponential growth in the installation of renewable electrolysis processes is expected to make an important contribution to the future national energy system. Hydrogen produced from technologies other than electrolysis, bio-based, thermochemical and biothermochemical technologies (such as pyrolysis, gasification, SMR biomethane) may also be added to this.

As an energy carrier, hydrogen, in addition to ensuring the decarbonisation of the *hard-to-abate* (HTA) and transport sectors, can enable some additional functions such as large-scale and long time accumulation and transport of large amounts of energy over long distances, supporting the development of an energy system with high levels of resilience, security of supply, infrastructure redundancy.

♦ *THE POTENTIAL OF HARD-TO-ABATE SECTORS*

HTA sectors play a key role in the Italian industrial fabric, generating 5 % of national gross value added[72]. With regard to the emission impact, HTA sectors, with 84 $MtCO_{2eq}$, account for 20 % of total direct$_{CO2}$ emissions (2019) at national level. Decarbonising these sectors requires the adoption of a range of technological tools and solutions, including the use of hydrogen, especially where direct electrification is not possible or cannot be implemented for the type of good produced. For these sectors, however, the recovery of waste heat is a very effective priority action to be taken to reduce emissions and consumption.

A sensitivity analysis (ENEA-Confindustria study), assuming the replacement of 20 % of natural gas currently used for thermal purposes with renewable hydrogen, with the same heat output, points to a potential demand for hydrogen at national level of around 0,24 Mton/year. Such hydrogen demand would require an installed electrolysis power of 7,2 GWe (assuming approximately 2 000 hours of operation and efficiency of 60 %). In detail, excluding the refining sector, which is the sector with the highest consumption of hydrogen as process gas (feedstock), the paper sector is the one with the highest consumption of hydrogen as service gas in thermal applications, with approximately 53 kt/year, followed by steel with 42 kt/year, chemistry with 40 kt/year, ceramics with 30 kt/year, cement with 29 kt/year and glass with 20 kt/year. Finally, if the potential for transformation from grey hydrogen to green or renewable hydrogen is also taken into account of what is currently produced and consumed as a feedstock (approximately 366 kt/year) in the

[72] *Source: Decarbonisation of Hard To Abate sectors, Boston Consulting Group 2021*

refining, petrochemical and chemical industry, the targets set in the MISE Guidelines could be reached by almost 87 %.

The deployment of hydrogen as a lever to decarbonise industrial sectors would lead to a decrease from 2 % to 8 % in the existing CO_2 shares (2019). Overall, this would lead to a 3 % reduction of the 84 Mton CO_2 emissions (scope 1) emitted by the industrial sector and the related ETS savings.

Inorder to test the market readiness towards hydrogen, Snam has launched in recent months a market investigation "Enquiry into the potential of the hydrogen market". The survey, targeting Italian and foreign operators and active from February to May 2024, found that the hard-to-abate sectors participated widely not only in Italy but also in Austria and Germany. The results revealed allow to estimate a demand for hydrogen which, in line with the REPowerEU objectives, could be partially met by national production and partly by leveraging import.

♦ *POLICIES TO PROMOTE GREEN AND RENEWABLE HYDROGEN*

Italy plans to achieve its 2030 national targets by using the following measures, as well as further participation in European projects.

▪ *Incentives for hydrogen production*

The main policy to promote renewable hydrogen and bio-hydrogen will be through the tariff mechanism provided for in Article 11 (2) of Legislative Decree No 199/2021. The measure will ensure that the operating costs of hydrogen production facilities are covered, taking appropriate account also of investment costs. The draft decree, which is being finalised, has the following objectives:

- define renewable hydrogen unambiguously;
- establish an operating incentive to accelerate the production of hydrogen produced from renewable sources for use in transport and industrial sectors that are difficult to decarbonise consumption;
- define the procedure for access to the facilities referred to in Ministerial Decree No 347 of 21 September 2022;
- define the arrangements for combining the operating incentive rates and the NRRP contributions referred to in Ministerial Decree No 463 of 21 October 2022.

The provision is that the measure, in analogy with the provisions of the CEEAG, provides for a competitive bidding process downwards through a contract-for-difference mechanism. Given the high cost of production, hydrogen will have to be allocated to the transport and hard-to-abate sectors, given the objectives of the phyto-fot-55 % and the difficulty of decarbonising these sectors.

On 4 March 2024, the public consultation of the draft decree was completed and, within the summer period, the draft decree is planned to be sent to the European Commission for assessments of the aid scheme.

▪ *Hydrogen research and development*

One of the enablers for hydrogen penetration will be the development and deployment of hydrogen value chain technologies meeting the criteria of sustainability, economic competitiveness, environmental protection and security of energy supply. Research should support the development of the entire technology chain; in particular, short-, medium- and long-term research priorities can be identified depending on the current maturity of the specific technologies, the availability of renewables, the readiness of those sectors that represent the demand for hydrogen (industry, mobility and transport, civil and residential, energy generation).
The short-term objectives refer to the needs for further research, development and demonstration of materials and technologies for production, accumulation and use ready for scaling-up and

already developed at medium to high TRL (TRL 6-8, with application in 1-3 years); the medium-term objectives refer to the further development of technologies and processes that have been validated at laboratory level (TRL 4-6, with expected application in 3-10 years), and finally, the long-term objectives refer to frontier research capable of providing disruptive solutions (TRL 1-4, time framework for application > 10 years).
The main technological challenges to be addressed are identified in the following:

- fundamental and applied research to foster breakthrough innovation and new technologies;
- reduce the costs of technologies by including those related to their management, increase reliability, efficiency, durability and safety, and develop new materials and processes to support increased performance;
- integrate hydrogen production into the energy system;
- increasing the role of hydrogen in a circular economy context;
- increase the resilience of the energy system by creating decentralised economies based on green hydrogen.

With this in mind, the definition of a specific measure is foreseen under RepowerEU.

- ***Hydrogen as a management of over-generation of renewable energy***

The Regulatory Authority for Energy Networks and Environment (ARERA) established at the Cassa per i Servizi Energetici e Ambientali (CSEA) a fund of EUR 35 million, financed by part of the CrVI tariff component, intended to encourage pilot management optimisation projects and innovative uses of natural gas infrastructure, regulated by Decision 404/2022/R/gas. The development of pilot projects shall aim at optimising the management and innovative use of existing gas infrastructure, in relation to the prospects for energy transition and decarbonisation of the economy. Pilot projects may cover: innovative solutions for the production and entry into the transmission network of gas produced from renewable sources; power to gas/hydrogen and innovative uses of transmission networks; injection of biomethane and renewable gases into distribution networks; possible use of natural gas distribution networks as an enabler of the exploitation of renewable sources with a view to the possible development of converging solutions between the gas and electricity sectors.
The Authority has adopted specific measures to regulate temporary derogations or suspensions of regulatory provisions which could hinder the development of technological innovations, products or new business models.
The procedures for submitting the application and the minimum content were laid down in Decision No 9/22 of 20 December 2022. Applications for the admission of pilot projects to the incentive treatment were submitted to the Authority with effect from 15 January 2023, with a deadline for submission to 15 April 2023.

- Project Area 1: methods and tools for optimised network management (maximum eligible contribution 5 MEUR);
- Project Area 2: uses innovative existing infrastructure in relation to their capacity to accommodate so-called renewable gases, including hydrogen, P2x2P applications enabling the gas system to be connected with the electricity system (sector coupling) and carbon capture, sequestration and/or utilisation (CCU) activities (maximum eligible contribution of EUR 5 million);
- Project Area 3: innovation measures on regulated infrastructure in the natural gas supply chain aimed at increasing energy efficiency (maximum eligible contribution EUR 2.5 million).

The final ranking was published in December 2023, projects will last three years, trials must be completed and documented by 31/12/2026.

Finally, it is important to highlight the role that underground hydrogen storage may have at country level by providing a service of progressively mitigating the volatility of increasing RES production and flexibility to the system.

♦ *HYDROGEN IN THE NRRP*

Under the NRRP, particular relevance was attributed to hydrogen with 6 investments activated, totalling EUR 3.64 million and 2 reforms. All the measures initiated are summarised below.

- ***Investment 3.1: Production in industrial brownfield***

The Investment aims to incentivise (EUR 500 million) the deployment of at least 10 hydrogen production projects in decommissioned industrial areas with an average capacity of at least 1-10 MW each. By public notice of 15 December 2021, the Minister for the Ecological Transition invited the Regions and Autonomous Provinces to submit their expressions of interest in selecting proposals under the above-mentioned Investment, with a view to managing them; all regions and autonomous provinces have submitted expressions of interest. In addition, Article 33 (3) (b) of Decree-Law No 152/2021 provided that DARA is to support the regions and autonomous provinces in drawing up projects of particular strategic importance, in line with the lines of the NRRP, known *as flag* projects. By a memorandum of understanding of 13 April 2022 between the Ministry of Regional Affairs and Self-Government and the Ministry of Ecological Transition, it was provided that the flag projects should also cover Investment 3.1 referred to above and that a reserve would be made available from the NRRP resources. The Decree of 21 October 2022 laid down the general implementation framework for the investment in question by providing, inter alia, that EUR 450 million should be allocated to hydrogen production projects in disused industrial areas and EUR 50 million for flag projects. While the latter are still in the process of being defined, in Public Notice No 427 of 23 December 2022 it was defined as a 'standard call', which was then used by the Regions for the publication of their notices.

In June 2023, following the publication of all the regional lists, 54 projects were eligible, of which 16 projects were partially eligible for lack of resources. Following some withdrawals and changes in projects, residual resources, the 16 partially eligible projects were fully financed by Directorial Decree No 164 of 17 April 2024. That decree, inter alia, defined how the additional RepowerEU resources, amounting to EUR 90 million, will be allocated, which will allow the admission of an additional 9 projects.

- ***Investment 3.2: Use of hydrogen in hard-to-abate sectors***

The Investment aims to incentivise (EUR 2 million) the decarbonisation of industrial sites belonging to the hard-to-abate sectors through the use of green and renewable hydrogen.

The Decree of 21 October 2022 defined the general implementation framework for the investment in question by providing, inter alia, that EUR 1 million would be allocated to the project of DRI SpA, in accordance with Article 1 (1-quater) of DL 142/2019, and the remaining billion to decarbonise the other hard-to-abated sectors through the use of hydrogen. At the same time, the Decree provided that the use of hydrogen should cover at least 10 % of the fossil sources used before intervention, with a reserve for projects that are particularly virtuous, i.e. those involving the use of hydrogen in more than 90 % of the fossil sources before intervention.

Decree-Law No 19/2024 established that the project of DRI SpA was to be implemented through national resources, while public notice No 254 of 15 March 2023 implemented the PNRR measure. At the closure of the gateway, 30 projects were submitted; out of these 2 R & S projects have been approved, 9 were rejected or withdrawn, the rest are under assessment.

- ***Investment 3.3: Hydrogen testing for road transport***

In line with the European strategy, the aim was to promote the production and use of hydrogen in transport through the deployment of a network of hydrogen refuelling stations (HRS). In October 2022, the MIMS Decree setting out guidelines for the implementation of testing the use of hydrogen in road transport was published. The resources allocated by the NRRP to the investment in question (EUR 230 million) are directed towards the deployment of at least 40 HRS for light and heavy duty vehicles by 30 June 2026, with the aim of approaching the targets set out in the Alternative Fuels Infrastructure Regulation (AFIR), which provides for the deployment of HRS, capable of serving all urban nodes and points per 200 km along the TEN-T core network. In March 2023, the MIT published the ranking of projects for hydrogen road refuelling stations eligible for funding. There are 36 projects with a total funding of EUR 103 million, compared with available resources of EUR 230 million.

- ***Investment 3.4: Hydrogen testing for railway mobility***

In March 2023, the MIT approved Executive Decree No 144 of 31/3/2023 for the allocation of resources under the NRRP for the investment in question (EUR 300 million). EUR 276 million has been allocated for the deployment of renewable hydrogen production, storage and refuelling facilities and EUR 24 million for the acquisition of hydrogen-powered trains. As regards hydrogen production and storage facilities, resources will be broken down as follows: Lombardy Region, Ferrovienord S.p.A., line Brescia-Iseo-Edolo (EUR 97.2 million); Governmental Management Ferrovia Circumetnea, Governmental Management Ferrovia Circumetnea, Circumetnea line (EUR 15.4 million); Campania Region, Ente Autonomo Volturno s.r.l., SMCV Piedimonte line (EUR 29 million); Puglia Region, South East Ferrovie and Servizi Automobilistica s.r.l., Lecce-Gallipoli, Novoli-Gagliano and Casarano-Gallipoli (EUR 13.4 million); Calabria Region, Ferrovie della Calabria, line Cosenza-Catanzaro (EUR 45,1 million); Autonomous Region of Sardinia, ARST Spa, Saxarian-Alghero lines (EUR 30 million), Macomer-Nuoro (EUR 30,3 million) and Monserrato-Isilos (EUR 14.4 million). On the other hand, as regards the purchase of rolling stock, the EUR 24 million earmarked for this purpose was allocated entirely to the Region of Puglia, and through Ferrovie del Sud Est and Servizi Automobilistica s.r.l., for the Lecce-Gallipoli, Novoli-Gagliano and Casarano-Gallipoli routes.

- ***Investment 3.5: Hydrogen Research and Development***

Please refer to paragraph 4.6.

- ***Reform 3.1: Administrative simplification and reduction of regulatory barriers to hydrogen deployment***

The reform develops on several lines of action all aimed at fostering the deployment of green and renewable hydrogen as a new energy carrier. The following activities are foreseen:

- issuing technical safety standards on production, transport (technical and regulatory criteria for the introduction of hydrogen into the natural gas network), storage and use of hydrogen through decrees of the Ministers of Interior and Ecological Transition. The standard was implemented through the update of the Ministerial Decree of 18 May 2018;
- administrative simplification for the deployment of small green hydrogen production plants. The measure was implemented through Article 38 of Legislative Decree No 199/2021;
- regulating the participation of hydrogen production facilities in network services, issued by ARERA;
- system of guarantees of origin for renewable hydrogen, implementing Article 46 of Legislative Decree 199/2021. The Decree is being finalised;
- measures to enable the deployment of hydrogen refuelling stations in motorway service areas, logistic warehouses, ports, etc. by agreement between MASE and MIT to define the refuelling areas selected along the refuelling station premises for the construction of H_2

corridors, starting from the regions of Northern Italy to the Padana Pianura Padana and logistics hubs.

- ***Reform 3.2: Measures to promote the competitiveness of hydrogen***

The reform provides for the establishment of:

- tax incentives to support green hydrogen production;
- measures for the uptake of green hydrogen consumption in the transport sector through the transposition of the European RED II Directive.

With regard to the first measure, Article 23 of DL 36/2022 provided that electricity used in electrolysis installations for the production of green hydrogen is not subject to the payment of general charges relating to the electricity system. In order to implement the measure, Ministerial Decree No 347 of 21 September 2021 was issued, which defined the general criteria for the incentive mechanism, providing, inter alia, for the adoption of an ARERA resolution laying down the technical implementing conditions and a subsequent decree establishing the aid scheme (Decision No 557/2022/R/EEL of 8 November 2022). Instead, the decree establishing the aid scheme will be implemented as part of the decree establishing the hydrogen tariff mechanism referred to above.

- ***Investment 5.2: Hydrogen***

The purpose of the Investment is to incentivise (EUR 0.45 million) the construction of production plants with a total power of at least 1 GW/year. Ministerial Decree No 168 of 27 April 2022 defined the general implementation framework for the investment in question, providing for three lines of action:

- implementation of projects relating to the construction of industrial installations for electrolyser production under the IPCEI Fund (EUR 0.25 million);
- further projects relating to the construction of industrial installations for electrolyser production, with a view to achieving the target of 1 GW/year of production capacity at 2026 (EUR 0.1 million);
- investment programmes aimed at developing the production chain of electrolysers and/or their components (EUR 0.1 million).

Compared to the action line referred to in the first point, two projects were selected by MASE in June 2022 for the construction of electrolysers plants with a total capacity of 800 MW per year to be achieved by June 2026. A plant for the production of electrolysers with PEM technology and fuel cell components will be built in the municipality of Cernusco on Naviglio by a Joint Venture between Industrie De Nora and Snam. The other electrolyser plant with a capacity of 300 MW per year will be built by Ansaldo Energia in the Municipality of Genoa.

With regard to the second line, Public Notice No 510 of 13 November 2023 was published. Given the few project proposals submitted, the gateway was reopened until 13 March 2024. At the closure of the gateway, 4 project proposals have been received, currently under assessment, for an estimated production capacity of more than 300 MW.

In comparison with the third line, Public Notice No 492 of 13 October 2023 was published. Given the few project proposals submitted, the gateway was set aside until 13 March 2024. At the close of the gateway, 15 project proposals have been received, currently under evaluation.

II. Where relevant, specific measures for regional cooperation, as well as, as an option, the estimated excess production of energy from renewable sources which could be transferred to other Member States in order to achieve the national contribution and trajectories referred to in point 2.1.2

Regional RES cooperation with neighbouring countries (Malta, Croatia, Austria, Greece and France) could be based on sharing offshore development projects (offshore wind, tidal, wave) and related maritime shipbuilding sector, opening up support mechanisms, electricity interconnections, pipelines and natural gas supplies. As regards the statistical transfer on which discussions have been discussed, all States have remained possible, as it will be a need to assess only on the way forward.

III. Specific measures on financial support where applicable, including Union support and the use of Union funds, to promote the production and use of energy from renewable sources in the electricity, heating and cooling and transport sectors.

As described in detail in point i above, many measures envisaged to achieve the objectives are of an economic nature and therefore provide for financial support, both in the form of incentive tariffs paid during operation of the plant/intervention, as is typically the case in the electricity sector, or in the form of capital contributions. With particular reference to the latter case, we would point out that, as set out in detail in point i, some of the measures adopted provide for support from Union funds and, in particular, through NRRP resources. These include, for example, measures for agrotaic, park, support for biomethane, support for the deployment of district heating infrastructure and green hydrogen.

IV. Where applicable, the assessment of the support for electricity from renewable sources that Member States are to carry out pursuant to Article 6(4) of Directive (EU) 2018/2001

The evaluation of the effectiveness of support for renewable electricity and its main distributional effects on different categories of consumers and investments is carried out as part of the monitoring of the Plan.

Italy has been promoting the deployment of renewable installations with different mechanisms for many years. The main promotion tool in the electricity sector is tariff incentives managed by GSE. Almost 1.8 million agreements with private and public entities were managed in 2022. These agreements support the operation of 1.2 million renewable installations, with a total capacity of around 40 GW. The incentivised renewable energy related to these installations amounts to 60 TWh. The overall burden of incentives for electricity generation amounts to EUR 6.3 million in 2022, with the largest contribution from the photovoltaic source, amounting to EUR 5.7 million. The resources to finance these incentives are collected from electricity bills, in particular from the ASOS tariff component of system charges, which for a typical household (assumed electricity consumption of 2.700 kWh) in 2 021 resulted in an annual expenditure of around EUR 60 compared to an electricity bill of approximately EUR 630; in previous years, system charges had a larger impact, up to around 20 %, but system burden mitigation measures were implemented in 2021, such as support to households in a context of high energy prices, and this policy envisaged full cancellation in 2022, given the exceptionally high energy prices. The costs incurred by the community correspond to a number of benefits, including an equivalent theoretical energy savings that can be calculated in approximately 11,2 Mtoe of fossil primary energy and avoided emissions of greenhouse gases estimated at around 38 $MtCO_2eq$. Economic and employment benefits should also be further included in the benefits.

v. Specific measures to introduce one or more contact points, streamline administrative procedures, provide information and training and facilitate the adoption of long-term

power purchase agreements. Summary of policies and measures under the framework to be implemented by Member States pursuant to Article 21(6) and Article 22(5) of Directive (EU) 2018/2001 to promote and facilitate the development of self-consumption and renewable energy communities

In paragraph 3.1.2 (i), the measures to support the deployment of renewable installations have been deepened. These included the process of supporting collective self-consumption configurations and energy communities, which first provided for a transitional incentive framework and thus, from 2024 onwards, an update of the support through the adoption of Ministerial Decree No 7/12/2023, both in terms of size and perimeter of feasible configurations and in terms of the extent of support, partly also through NRRP resources. The same paragraph also describes measures to promote long-term contracts (PPAs) mainly through tools to promote supply-demand matching, aggregation and mitigation of contractual risks.

With regard to permitting procedures, a gradual simplification and streamlining of permitting procedures has been undertaken to speed up the installation of plants for the production of energy from renewable sources. In addition, the geography of competences between the bodies involved changed significantly compared to the early 2000s, with a shared power role between the State and the Regions on energy and environmental issues.

The main procedural steps provided for in the legislation in force, pending their reorganisation by means of the final approval of the Consolidated Energy Act provided for in the new 2023 RRP and Law No n.118/2022, for the construction of plants with renewable sources, differentiated according to size, technological characteristics and installation areas, are: the Single Authorisation, the Simplified Licensing Procedure, the Declaration of Initial Works, and the Communication to the Municipality. Please refer to paragraph 3.1.2.i for more details on the simplification of permit-granting procedures and the identification of suitable areas.

As regards training, Italy has already adopted a training standard for the installation and maintenance of renewable energy plants.

As regards information, portals with information on national incentives for renewable sources, costs and benefits of systems have already been introduced. Information guides, tools and simulators are already available through the sharing of the important knowledge and data available from the GSE, the entity in charge of managing the main support mechanisms for renewable sources, and at ENEA (which acts as an Energy Efficiency Agency).

VI. Assessment of the necessity to build new infrastructure for district heating and cooling produced from renewable sources

As a result of the most recent evaluation report on the national potential for applying Cogeneration in Upper Rental and efficient district heating, provided for in Article 14 of the EED and drawn up by GSE in 2021, the technical potential to exploit efficient district heating is estimated at around 57 TWh (approximately 6 times the current levels of development).

An important contribution to the development of efficient district heating systems will be ensured by the aforementioned Component 3 – Measure 3 of Mission 2 of the RRP, which finances projects relating to the construction of new networks or the extension of existing networks, in terms of supplied customers, including their fuelling facilities, with priority being given to the development of efficient district heating, i.e. based on the distribution of heat generated from renewable sources, waste heat or cogenerated heat in high-efficiency installations.

In general, all the measures in this plan (in particular those aimed at decarbonisation, the development of renewables and energy efficiency) can lead overall to an enabling framework also for district heating and district heating from renewable sources.

VII. Where applicable, specific measures on the promotion of the use of energy from biomass, especially for new biomass mobilisation taking into account:

— the availability of biomass, including sustainable biomass: both domestic potential and imports from third countries

— *other uses of biomass in other sectors (agriculture and forestry); as well as measures for the sustainability of biomass production and use*

3.1.3 Other elements of the dimension

I. Where applicable, national policies and measures affecting the EU ETS sector and assessment of the complementarity and impacts on the EU ETS

For sectors covered by the EU ETS, it will particularly contribute to coal phase-out, as well as a significant acceleration of renewables and energy efficiency in processing processes, including by valorising the possible contribution of the CSS and focusing on the development of alternative green fuels such as biomethane and hydrogen in final and energy uses, including hard-to-abated industrial sectors. The reduction of emissions to air from the ETS sector will also be ensured by the implementation of CO_2 capture, transport and storage.

As a result of the above, in the EU-ETS sector a target of -62 % is reached, in line with the overall EU target.

Among the policies and measures with an impact, inter alia, on the ETS sectors, the coal *phase out* and the ecological transition fund are described below, although the latter is, to a lesser extent, also for installations outside the scope of the ETS Directive.

❖ **PHASE OUT OF COAL**

The objectives set out in the INECP 2019

Italy committed itself, already before 2019, to plan the gradual cessation of coal-fired electricity production by 2025. In the INECP 2019, this objective was defined more precisely, in particular as regards the conditions necessary to achieve it. The abandonment of coal has been gradually assumed through a first significant *step* in 2021, compensated, in addition to a significant increase in renewable energy production, but also by a flexible generation infrastructure plan, grid development and increased storage systems. The parallel implementation of the process of decommissioning of coal-fired groups and the development of the infrastructure mentioned above was considered essential in order to achieve the result without creating any problems for the adequacy of the electricity system and, consequently, in a situation of full safety for the national energy system.

Although the contribution of coal-fired thermal power generation in Italy is limited in comparison with other European countries, it was therefore considered that the decarbonisation dimension should therefore go hand in hand with the dimension of security and economy of supply. In addition to contributing to the adequacy of the system, coal-fired power plants contribute to:

- the stabilisation of voltage profiles in specific nodes and parts of the network, keeping them within regulatory limits, for both safety and quality of service purposes;
- the provision of inertia to the system, the reduction of which may lead to a tightening of frequency variations (in terms of magnitude and speed of disruption) that need to be mitigated by services characterised by extremely rapid response times;
- maintaining appropriate short circuit power levels in network nodes, which is essential to contain the severity of voltage holes and to ensure the proper functioning of the HVDC protection systems and connections.

An initial identification of the infrastructure works needed to be able to carry *out the phase out* of coal was carried out by Terna, on the basis of well-established methods of analysis, and is contained in the National Energy Strategy (SEN) 2017. In the INECP 2019, in the light of the new energy scenarios at international level and the new objectives shared at European level, the analysis was refined and led to the identification of a number of enabling objectives in more detail, namely:

- new gas capacity of around 3 GW, of which around 50 % is substantially connected to *the phase out*, consistent with regional planning and regulation (landscape and environmental);
- new centralised storage systems for 3 GW (hydroelectric and electrochemical) in the centre-south, south and Sicily;
- reinforcement of the transmission network in the Brindisi Hub for operational safety (already authorised and being implemented);
- new Adriatic backbone for at least 1 GW of transport capacity;
- installation of at least 3.000 MVAR of new synchronous compensators, in particular in southern and centre-south areas, to address what will be the resulting source of voltage regulation needs;
- in connection with the *phase out* of coal in Sardinia, the construction of the new Sardegna-Sicilia-Continente electricity interconnection (Sardegna-Sicily section still to be authorised), together with new gas generation capacity or storage capacity for 400 MW located on the island, as well as the installation of compensators for at least 250 MVAR.

The realisation of the new gas generation capacity and the necessary storage systems would have been facilitated through the *Capacity Market*, as price signals on spot markets were not such as to support the realisation of the new investments. The mechanism, operated by the TSO Terna, should have supported both the deployment of new gas power and the development of electrochemical storage systems, while further measures, which were not yet identified at that time, should have facilitated the development of electrochemical storage systems.

Progress of activities aimed at achieving the objectives of the INECP 2019

The scenarios leading to the definition of the framework set out in the previous paragraph have changed dramatically over the last 2-3 years due to the problems caused by the Pandemia Covid 19 and the conflict in Ukraine, which made it essential to adopt new funding instruments (NRRPs and Repower EU) at European level, as well as to share the new and more challenging objectives of the FF55 package. These events, together with the occurrence of adverse climatic conditions such as prolonged summer warm waves and exceptional droughts, forced to review the safety conditions of the national energy system, making it indispensable to increase system resilience levels.

The energy system has therefore had to cope with a heavy gas emergency, driven by the conflict in Ukraine and exacerbated by sudden increases in raw material prices and, consequently, in electricity. In order to address these problems, it was essential to proceed with a series of emergency measures, mainly gas side (see reference paragraph), including, with specific reference to the electricity system, a programme to maximise generation using alternative fuels to gas; in that regard, the Minister for the Environment and Energy Security requested Terna to draw up and implement a specific programme, the objective of which was to achieve savings of 1,8 bcm of gas between September 2022 and March 2023.

The events described above have had an important impact on the objectives set out in the INECP 2019, with particular reference to the *phase out* of coal. Therefore, it is essential to verify in detail what has been achieved in relation to the enabling objectives set out in the INECP 2019, as well as of the additional measures introduced to address the problems that have arisen later, in order to assess the sustainability of the objective in order to ensure the safety of the system.

With regard to the concrete results relating to initiatives designed to achieve the objectives of the INECP 2019, please note the following:

- 56 electrochemical storage facilities in authorised stand configuration (this includes installations authorised with AU Statale with regional AU and municipal PAS) for a total capacity of approximately 3 500 MW;
- 4 hydroelectric pumping plants in the permit-granting phase for a total capacity of approximately 1.500 MW. However, this figure will have to be revised downwards (estimate

1.000-1.200) as two of these projects remain in the same basin, so only one of them can be implemented;
- 15 authorised initiatives on RTN (upgrading, replacing turbines or creating new groups) for a power increase of 4 300 MW (already taking into account the divestments of Marghera 560 MW and MONTANASO Lombardo 300 MW). Of these, 9 initiatives per 2.12 GW with implementation activities launched with entry into operation by 2025;
- 16 authorised initiatives for thermoelectric installations (upgrading or replacement of existing turbines or the outputs of gas thermoelectric groups), of which 5 are new power stations with a total capacity of approximately 3.500 MW, 7 are upgrades for an additional capacity of approximately 610 MW and 4 concern retrofitting or refurbishment without any increase in power, so that the additional capacity of around 4.100 MW authorised is expected to enter into operation gradually between 2023 and 2026.

With regard to the divestment of the coal-fired power plants, in addition to the exit from service of the Gualdo Cattaneo – Bastardo (PG) plant (75 MW) (PG) (70 MW) and the BS2 group of the Federico II plant in Brindisi (660 MW), we would point out that the four groups of the ENEL plant in Fusina (VE), totalling 760 MW, and the ENEL thermal power plant in La Spezia, with a capacity of 600 MW, have been put out of service. In addition, the Monfalcone power plant (315 MW), which, although not yet formally shut down, is no longer authorised for energy markets since May 2024.

The completion of the phase – out process will require the decommissioning of the other coal-fired plants (Civitavecchia, Brindisi, Sulcis, Fiumesanto), totalling around 4.650 MW, of which 1.000 MW in Sardinia.

The actions already implemented and planned are adequate to enable the phase-out of coal-fired power plants still operating on the Continent. In this respect, the table below shows the coal-fired capacity that can be phased out on the Continent in the coming years by and before the date indicated in the table below.

Table 37 – Deployment of coal-fired capacity on the Continent

Month/year	Capacity enabled for decommissioning (MW)	Technical constraints to divestment
By December 2024	605	Entry into service of generation and storage capacity contracted in CM auctions
By April 2025	1.210	
By January 2026	1.865	

For Sardinia, however, the development of RES, accumulations and new interconnections with the Continente (Tyrrhenian link, SACOI 3) are essential to ensure the technical grid security conditions necessary to complete the abandonment of coal in electricity production (total around 1.000 MW) and to date there are technical difficulties in achieving this goal fully by 2025. It is therefore realistic, as mentioned above, to start the phase-out in the island in any event from 2025 (the planned date for the actual entry into service of the storage capacity contracted in Sardinia for the 2024 CM auctions) and complete the process in 2028. The table for Sardinia is set out below in the light of the considerations set out below.

Table 38 – Deployment of coal capacity in Sardinia

Month/year	Capacity enabled for decommissioning (MW)	Technical constraints to divestment
April 2025	445	Entry into service of the storage capacity contracted in Sardinia for CM 2024 auctions
January 2028	250	Entry into operation of the first West branch cable Tyrrhenian Link
January 2029	265	Completion of Tyrrhenian Link

With reference to the Commission's recommendation to ensure alignment between the coal phase-out schedule outlined in the Territorial Plans for a Justification Transition and the NECP, with particular attention to the Sulcis Iglesiente (Sardinia), please note the following:

- the phase out of coal in the Sulcis thermoelectric power plant, regardless of conversion or closure, will have a negative impact on the plant's direct and ancillary workers (estimated in total between 400 and 1.200 units according to the Italian National Just Transition Fund 2021-2027 programme). The related re-skilling needs (included in the actions of the JTF plan) will have to accompany the gradual phase out process outlined above with timeframes prior to the final phase out;
- we would also point out that the emissions from the Sulcis power plant, which is covered by the ETS, have already been progressively reduced in recent years despite the extraordinary national plan implemented following the Russian-Ukrainian war to curb natural gas consumption, the objectives of which are also to increase thermoelectric production using fuels other than gas, including coal, from 1 August 2022 to 31 March 2023.

Table 39 Sulcis thermal power plant emissions in ETS 2021-2023 ($ktCO_2$):

Year	Emissions ($ktCO_2$)
2021	1.571
2022	1.390
2023	1.293

- finally, we would point out that the Just Transition Plan covers the entire area of Sulcis Iglesiente and is not limited to the activities of the coal-fired thermoelectric power plant, but also extends to mining activities of coal mines for a few years which have been decommissioned and subject to remediation programmes and the Portovesme steel industrial hub, which was also created in connection with the mining activities of the area.

With regard to the new measures implemented in the period 2019-2023, in view of the average planning and authorisation times for works, priority was given to speeding up authorisation procedures in order to achieve the objectives and encourage all the authorities involved to adhere to the results. To this end, Decree-Law No 76/2020 (DL Simplifications) was adopted in July 2020, converted into Law No 120 of 2020, which provided for a specific authorisation procedure for electrochemical storage facilities and a simplified procedure for minor modifications to existing thermoelectric installations, with particular reference to changes aimed at increasing their efficiency and reducing their environmental impact.

The provisions of Decree-Law No 76/2020 were subsequently amended by Decree-Law No 77/2021 of May 2021, converted into Law No 108 of 2021 on 'Governance of the National Recovery and Resilience Plan and first measures to strengthen administrative structures and to speed up and streamline procedures', which provided for significant simplifications of environmental assessment procedures, excluding stand-alone accumulations required to provide flexibility services for the national electricity grid.

As regards authorisation procedures, Law 34/2022 laid down the authorisation procedures for pure pumping plants (Legislative Decree No 387/2003), conferring State competence and providing for a single authorisation with the binding opinion of the MIT and after the acquisition of the appropriate water concessions. More recently, by converting the DL PNRR into law (Law No 41/2023), new rules were introduced for the authorisation of electrochemical accumulations, providing for a single State procedure under Article 12 of Legislative Decree No 387/2003, for a maximum period of 60 days, without the need to acquire the regional agreement.

As regards the instruments to stimulate new investments in the sector, the *capacity market* has certainly fostered the development of measures for new generation gas, contributing inter alia to the renewal of the power park module towards more environmentally sustainable and efficient structures. The last Capacity Market auction, which took place in 2022 with delivery year 2024, allowed Terna to procure a total of new capacity73 of around 4.5 GW, of which 2.5 GW of new gas capacity.

Overall, the power quota contracted in all *capacity market* auctions is appropriate to ensure that phase out can be carried out throughout the national territory if authorised and completed within the prescribed timeframe.

At present, therefore, compared to the framework set out in the INECP 2019, as part of the overall measures (new RES generation, accumulations, networks, flexible generation, other network works) to be carried out for target 2030, it will be essential to ensure that the following enabling conditions are met in order to secure the phase-out scenario from coal:

- an increase in electricity demand in line with Terna's current forecasts and contained in the joint scenario document Terna Snam, therefore in the absence of possible significant increases currently unforeseeable;
- RES growth in line with the 2030 targets described in paragraph 3.1.2;
- a development of the accumulation in line with the 2030 targets described in paragraph 3.2);
- the operational revenues of power generating modules selected under the *capacity market* (auctions 2022, auctions 2023 and 2024 auctions), including those currently not yet authorised, whose entry into operation has been estimated on the basis of the best information available to date;
- the entry into operation of the adaptation and reinforcement of the electricity grid as provided for in RTN's development and security plans, in particular with regard to interconnections with the largest islands;
- the absence of divestment of gas generating installations currently in operation (e.g. for reasons of economic viability); in this regard, we would point out that the Minister for the Environment and Energy Security, by Decree No 180 of 9 May 2024, approved the new rules governing the system of remuneration for the availability of electricity production capacity for the purposes of carrying out competitive procedures for the supply of capacity for the delivery years 2025, 2026, 2027 and 2028;
- the absence of significant reductions in import availability, in particular from the northern border (e.g. widespread issues of unavailability of French nuclear capacity).

[73] *The new capacity includes both the construction of new installations and the redevelopment of existing installations.*

In any case, the availability of coal plants for final release will be confirmed close to the months indicated in the tables on the basis of the actual occurrence of the above assumptions, with particular reference to the state of adequacy of the electricity system.

❖ **INDUSTRIAL ENERGY TRANSITION FUND**

The fund entitled 'Energy Transition Fund in the industrial sector', established by Legislative Decree No 30 of 13 March 2013, as replaced by Article 13 (2) of Decree-Law No 101 of 3 September 2019, converted with amendments into Law No 128 of 2 November 2019, is fed in accordance with Article 23 (8) of Legislative Decree No 47 of 9 June 2 020 in compliance with European State aid legislation and the legislation on the greenhouse gas emission allowance trading system (ETS).

Specifically, the annual share of revenues from the auctioning of EU ETS allowances, exceeding the value of EUR 1.000 million, is allocated, up to a maximum total of EUR 100 million for 2020, EUR 150 million for each of the years 2021 to 2024 and EUR 300 million per year from 2025 onwards, to the Energy Transition Fund in the industrial sector, with a quota of up to EUR 10 million allocated to the financing of decarbonisation and energy efficiency measures in the industrial sector and the remaining share for the purposes referred to in Article 29 (2) of Legislative Decree No 47/2020, aid to compensate indirect costs related to greenhouse gas emissions passed on in electricity prices incurred by certain undertakings operating in sectors and subsectors that are deemed to be exposed to a significant risk of carbon leakage.

"Carbon leakage" refers to a scenario of increasing global greenhouse gas emissions in which companies transfer production outside the European Union because they cannot pass on the cost increase caused by the EU-ETS to their customers without losing an important market share.

Addressing the risk of carbon leakage serves an environmental objective, since the aid aims to avoid an increase in global greenhouse gas emissions due to shifts of production outside the Union, in the absence of a binding international agreement on reduction of greenhouse gas emissions.

Thus, Decree No 466 of the Minister for Ecological Transition of 12 November 2021, published in Official Gazette General Series No 304 of 23 December 2021, implemented Article 29 (2) of Legislative Decree No 47 of 9 June 2020, laying down criteria, conditions and procedures for the use of the Fund's resources for the compensation of indirect emissions costs and pursuing three specific objectives: minimise the risk of carbon leakage, maintain the objective of the EU-ETS to achieve cost-effective decarbonisation and minimise distortions of competition in the internal market, with an aid intensity that does not fully compensate for the costs of EU allowances passed on to electricity prices.

❖ **CARBON CAPTURE AND STORAGE (CCS): MEASURES**

The CO2 storage sector is regulated in Italy by Legislative Decree No 162/2011, which transposed Directive 2009/31/EC and sets out a regulatory framework to enable CO2 to be stored in suitable geological formations.

Decree-Law No 76/2020 renewed the legislative framework transposing the Directive by introducing special simplification rules, providing in Article 60-bis for the suitability of spent offshore hydrocarbon deposits for use in experimental programmes for the geological storage of CO2. DL 77/2021 recognised CCUS as strategic and of public interest for the achievement of the PNIEC and NRRP objectives and therefore subject to State EIA carried out by the Commission's PNIEC-NRRP. Decree-Law No 181/2023, converted into law, with amendments by Law No 11 of 02/02/2024, last amended Legislative Decree No 162/2011, further supplementing the regulatory framework for CO2 storage permits. In particular, the DL has: clarified the procedure for granting permits to carry out experimental storage programmes, as defined in the standard; provides that MASE may grant non-provisional permits to carry out storage projects (including non-experimental) storage projects in offshore spent hydrocarbon deposits, on the basis of their suitability already established by law; excluding the competition procedure for granting storage permits to holders of permits to carry out experimental programmes, as well as exploratory licences; definitively established the criteria for the assessment of competing authorisation applications; provides that the amount of the financial collateral is defined at the authorisation stage, also taking into account the applicant's capabilities and rating level; quantifying the administrative burden placed on operators; the Ministry will make available to the public environmental information on the geological storage of CO2, including in the context of experimental programmes.

The DL has also set a path for the future development of the CCS sector by providing for the development by the MASE of a preparatory study, inter alia: (I) review the existing legislation relating to the CCUS supply chain, (ii) develop technical and economic regulation schemes for CO2 transport and storage services, (iii) draw up technical rules for the design, construction, testing, operation and surveillance of CO2 transport networks, (iv) define the arrangements for the remuneration of the various stages of the CCUS supply chain.

It is also envisaged that, within six months of the entry into force of the Law converting the DL, a Ministerial Decree laying down the technical regulation for the design, construction, testing, operation and surveillance of transport infrastructure and services will be adopted. In addition, the DL provides that, within six months of the date of preparation of the preparatory study, a Ministerial Decree is to be adopted to regulate the procedures for third party access to transport and storage networks.

The DL itself also regulated further aspects, including the inclusion of the works necessary for storage under the experimental programme and the transport of CO2 as public utility infrastructure within the meaning and for the effects of Presidential Decree No 327/01.

The study referred to in DL 181/23 was launched in early 2024 and will be finalised by summer by setting out the strategic guidelines for completing the regulatory framework and business model to launch the CCUS chain by identifying in particular:

- *The governance model of the supply chain:* roles and activities of the various actors involved in the CCUS chain. The legislation will extend the competences of the various bodies involved in the CCUS processes and define the legal and economic arrangements for the activities carried out, as well as the transfer of ownership of CO2 along the chain.
- *Regulation of CO2 transport activities and geological storage*: transport by network and geological storage of CO2 will be regulated as regulated utilities. Third party access to network transport infrastructure and storage will take place under transparent and non-discriminatory conditions, providing for appropriate levels of unbundling and a certain, transparent and pre-defined tariff system based on pre-defined criteria applying an efficiency principle. Transport and storage infrastructure development plans that are part of the regulated utilities will be approved on the basis of a cost-benefit analysis demonstrating its system utility and consistency with national decarbonisation objectives. It is also envisaged to identify last resort guarantee instruments designed to mitigate the risks of operators, such as those arising from a temporary mismatch between supply and demand levels of transport and/or storage services, typical of the start-up phases.
- *Support schemes*: dedicated mechanisms will be set up to support CO2 capture processes by emitters, which will take into account not only the investment and operational costs of the capture processes and the associated costs related to transport and storage services;

support mechanisms in the form of contracts for difference will also take into account the avoided cost related to the EU ETS. Access to these support mechanisms will be appropriately regulated taking into account, inter alia, the different economically available designs and alternative decarbonisation solutions.

The Ministry of the Environment and Energy Security has also set up a further working group to define the Technical Regulation for the design, construction, testing, operation and surveillance of carbon dioxide (CO2) transport networks pursuant to Article 7 (4-bis) of Decree-Law No 181/2023, converted with amendments into Law No 11 of 2 February 2024. The technical regulation tobefinalised this year will provide a numberof criteria to be met for the construction and operation of gas CO2 transport networks up to the delivery points to storage facilities and industrial users, including: transport system safety management, criteria for network design, materials, construction aspects, network managementmodalit, inspection and maintenance attraction, connection with emitters and criteria for the conversion of existing gas pipes.

As regards the public financial support available for investments in CO2 capture, transport and storage, Europe makes available to the CCUS a number of funds to support decarbonisation, covering all design stages, from research under Horizon Europe (first Horizon 2020) to commercial pilot and demonstration projects under the Innovation Fund, to the deployment of the infrastructure, in the case of Joint Interest Projects, with Connecting Europe Facility.

The recent European Commission Communication “Industrial Carbon Management Strategy” also provided that, as of 2024, the Commission will work with Member States on a possible Important Project of Common European Interest (IPCEI) on CO2 transport and storage infrastructure. In Italy, the Fund for Sustainable Growth (FCS) is intended to finance industrial research and experimental development programmes – consistent with the objectives of the Green and Innovation Deal – for all enterprises, while only SMEs support is provided for the industrialisation phase.

II. Policies and measures to achieve other national targets, if applicable

❖ **ADAPTATION TO CLIMATE CHANGE**

The National Adaptation to Climate Change Strategy, adopted in 2015, set out a national framework for the impacts of climate change on environmental resources and processes and socio-economic systems in Italy and developed a national vision of the ways forward to address it. In implementation of the Strategy, at the end of the Strategic Environmental Assessment procedure, the National Plan for Adaptation to Climate Change (PNACC) was approved by Decree No 434 of the Minister for the Environment and Energy Security of 21 December 2023, published in Official Gazette of the Italian Republic No 42 of 20 February 2024.
The UNACC lays the foundations for short and long-term action, based on two levels of intervention: one ‘systemic’, the other ‘address’. On a systemic level, the NECP aims to build an organisational environment focused on the governance system and knowledge development. The governance structure is represented by the Observatory, composed of:

- a collegiate governing and coordinating body (Committee);
- a technical and administrative support structure (Secretariat);
- a consultative and dissemination body (Forum).

The steering function, in particular towards the regional and local level, is carried out by means of a framework within which the planning and implementation of adaptation actions can be developed. First, a comprehensive framework (action database – Annex IV to the NECP IV) is defined for possible adaptation options, consisting of sectoral measures, which will be applied in the sectoral and cross-sectoral plans in the ways that will be identified by the governance structure.

In addition, two guidance documents for the establishment of regional and local climate change adaptation strategies/plans are attached to the PNACC.
The implementation phase of the PNACC, managed by the governance structure, is aimed at planning and implementing adaptation actions in the different areas, through the definition of priorities, roles, responsibilities and funding sources/instruments and, in addition, by removing barriers to adaptation consisting both of lack of access to viable solutions and regulatory/regulatory/procedural impediments. The results of this activity will converge into sectoral or cross-sectoral plans, outlining the actions to be implemented.

In the National Adaptation to Climate Change Plan, the INECP is mentioned as one of the national acts relevant to climate change adaptation. A number of areas for the relationship between climate change and energy are also mentioned. With a view to building a climate resilient energy system in the short and medium term and capable of developing consistently also in the long-term scenarios, there are possible adaptation options referring not only to the energy sector but also to other areas. With regard to the management of water resources, also with a view to the resilience of the energy system to increasingly frequent resource scarcity, the framework of possible measures identified in the NECP includes, for example, measures aimed at rationalising water consumption, optimising demand management, reducing losses in distribution networks, upgrading water courses in view of maintaining vital outflows and ecological quality in situations of changes in future thermo-pluviometric regimes. Further possible adaptation proposals that serve the sustainability objectives of the energy system can be found, for example, in the areas of: marine environments, terrestrial ecosystems, forests, agriculture, soil and land, where the issue of biodiversity protection is present across the board.

In parallel with the activities foreseen by the PNACC, adaptation initiatives are ongoing in Italy to combat certain climate phenomena. Already in 2021, the Ministry of the Environment and Energy Security (then known as the Ministry of Ecological Transition) launched, in cooperation with the Higher Institute for Environmental Protection and Research (ISPRA) and the National Association of Italian Municipalities (ANCI), the ‘experimental programme for measures to adapt to climate change in urban areas’, aimed at increasing the resilience of urban centres to the risks posed by climate change, with particular reference to heat waves and extreme rainfall and droughts.
This is the first initiative to set up these objectives at national level, aimed at municipalities with a population of over 60.000 inhabitants, aimed at fostering local planning for climate change adaptation and testing of measures to be implemented in urban areas to reduce cities’ vulnerability to ongoing and expected impacts of climate change.
In particular, the programme, with a budget of approximately EUR 80 million, has granted funding for operations proposed by 80 municipalities to carry out *green, blue and grey measures*, as well as *soft* measures. More specifically, measures have been financed for the implementation of:

- green spaces in urban areas and peri-urban reforestation;
- flooring or shading structures using reflective/low heat absorption materials;
- green roofs and walls, vertical woods, shaded barriers, insulation systems and natural ventilation of public buildings;
- systems for the collection and accumulation of storm water and reclaimed waste water with a view to recycling for non-human use;
- pedestrian areas, parking areas, squares, with existing flooring removal and restoration of soil permeability;
- sustainable urban drainage solutions, such as multifunctional spaces or storm water drainage facilities.

In addition, measures to improve local knowledge and foresight capacity, as well as to develop municipal planning tools for adaptation, awareness-raising, training and participation at local level, are also supported.

Some of the structural interventions financed by the Programme directly address the decarbonisation dimension. Others, by affecting the energy efficiency of public buildings and the management of water resources, also have an impact on the dimensions of energy efficiency and security.
The experimental programme is structured in such a way as to give *priority* to green measures, to be implemented through the deployment of *Nature-based solutions* (NBS), i.e. nature-based solutions. Interventions are expected to be completed by the end of 2024, subject to extensions, after which their effectiveness can be assessed through the use of appropriate indicators.
The issue of infrastructure resilience is also important for the achievement of the objectives and targets of the Energy Union.
Article 2 (42) of the Common Provisions Regulation (Regulation (EU) 2021/1060 of the European Parliament and of the Council of 24 June 2021) defines climate proofing as 'a*process to prevent infrastructure from being vulnerable to potential long-term climate impacts, while ensuring that the energy efficiency first principle is respected and that the level of greenhouse gas emissions from the project is consistent with the 2050 climate neutrality objective'*.
In order to make these principles operational, the aforementioned Regulation assigns to the managing authorities, when selecting the operations to be eligible for financing, the task of ensuring climate proofing of investments in infrastructure with a expected duration of at least five years.
The recommended methodology to carry out climate proofing of infrastructure investments in the period 2021-2027 is described in the Communication from the European Commission "Technical Guidelines for Climate-proofing Infrastructure 2021-2027" (2021/C 373/01), published in September 2021.
In order to facilitate compliance by the Italian Managing Authorities with this important requirement, the Department for Cohesion Policy of the Prime Minister's Office adopted, in October 2023, the 'Guidelines for climate proofing of infrastructure projects financed by cohesion policy 2021-2027' (hereinafter the Guidelines), established in cooperation with the Ministry of the Environment and Energy Security, the JASPERS initiative of the European Investment Bank (EIB) and the European Commission, in dialogue with the managing authorities for national and regional ERDF programmes and their technical structures.
Following the adoption of the Guidelines, the DPCoe Working Group, MASE, JASPERS has launched several initiatives to provide additional operational tools and strengthen the scientific and technical expertise necessary for the implementation of the Guidelines and Guidelines, in order to make infrastructure investments financed by the European Funds effectively climate-proof.

III. Policies and measures to achieve low emission mobility (including electrification of transport)

This paragraph lists the main transport policies contributing to the reduction of GHG emissions and other objectives of the Plan.

As indicated in Cap 2 and Cap 4, the transport sector remains crucial for achieving the new and more ambitious ESR target. With this in mind, it will be necessary to identify and promote additional measures to reduce mobility demand through the modal shift of people and goods and the development of the necessary infrastructure, as well as to encourage greater uptake of alternative modes of transport. In addition, looking ahead, a boost to the decarbonisation of the sector comes from the revision of the ETS Directive, which provides, inter alia, for the creation of an ad hoc ETS, which will also cover the transport sector: the cap and trade mechanism will complement identified national policies and measures from 2027 onwards.

It should be noted that the issue of "biofuels" is dealt with in paragraph 3.1.2, and that the financing of low-emission vehicles and the freight modal shift have been dealt with in more detail in section 3.2 as part of the description of energy efficiency policies.

❖ **LOW-EMISSION MOBILISATION AND UPGRADING OF INFRASTRUCTURE**

♦ ***RENEWAL OF THE CAR FLEET***

▪ ***Vehicle Ecobonus***

The Government intends to promote a progressive reduction of diesel and petrol vehicles in order to limit pollutant emissions and achieve the objectives of the Paris Agreement on climate change. To this end, a number of financing measures have been envisaged to favour low-emission vehicles (see section 3.2 for details of the measure).

▪ ***Obligation to purchase alternative fuel vehicles for public authorities***

The 2 020 Budget Law established that, as of 1 January 2020, when public authorities are renewing their fleet with the purchase or lease of at least two vehicles, they are obliged to ensure that no fewer than 50 % of vehicles purchased or leased are electric, hybrid or hydrogen road transport vehicles, within the limits of the budget resources allocated to this type of expenditure.

The purpose of the measure is to speed up the provisions of Article 18 (10) of Legislative Decree No 257/2016 (transposition of the DAFI Directive) by providing that public administrations, bodies and institutions which are dependent on or controlled by them, the regions, local authorities and public utility operators for activities carried out in the provinces with high particulate pollution$_{PM}$ 10, when replacing their respective fleet of passenger cars, buses and utilities, including those for the collection of municipal waste, are obliged to purchase at least 30 % by 2022, 50 % by 2025 and 85 % by 2030 of electric vehicles and hybrid vehicles with external, methane and hydrogen recharging, as well as electric or methane in the case of buses.

▪ ***Renewal of vehicles used for the carriage of goods***

With a view to encouraging the development of commercial vehicles powered by alternative fuels, the Ministerial Decree of the Minister for Infrastructure 221/2018 provided incentives for the year 2018 for the acquisition of industrial vehicles with alternative motorisation to gases used for the transport of goods with a total laden mass of 3.5 tonnes or more with alternative traction to CNG methane, liquefied natural gas LNG and electricity (full electric).

To this end, resources of around EUR 33.6 million have been earmarked for initiatives to carry out capital investment projects for the renewal of the vehicle fleet of road transport companies.

▪ ***Tax measures***

Since July 2020, the 2020 Budget Law tightens the taxation of the ancillary benefit on the most polluting and newly registered company cars. The ancillary benefit decreases to 25 % on company cars with CO_2 emissions below 60 g/km; remains at 30 % for those emitting more than 60 g/km up to 160 g/km. For vehicles with emissions exceeding 160 g/km and up to 190 g/km, the taxation rate increases to 40 % (50 % from 2021), while for all cars with emissions exceeding 190 g/km it rises to 50 % (60 % from 2021).

Decree-Law No 124 of 2019, converted into law by Law No 157 of 19 December 2019 (known as Decree-Law No 2020 of) extends the application of the super reduced rate of VAT to the supply of hybrid and electric motor vehicles and vehicles to persons with reduced or impeded permanent motor capacity, blind persons, deaf people and their families, and to the costs of services provided by workshops to adapt those vehicles to the needs of drivers. In addition, there is an exemption from the tax on entry tax, the provincial supplement to the tax on registration and the registration duty on acts of entry or declaration.

♦ ***UPGRADING OF INFRASTRUCTURE***

As regards the upgrading of infrastructure, Directive 2014/94/EU on the deployment of alternative fuels infrastructure established a framework of common measures for the deployment of alternative fuels infrastructure in the EU by requiring Member States to establish national policy frameworks to create markets for alternative fuels and to ensure the availability of an adequate number of publicly accessible recharging and refuelling points, in particular to allow for the free cross-border movement of alternative fuel vehicles and vessels on the TEN-T network.

In 2016, by Legislative Decree No n.257/2016 transposing the FASI Directive, measures were introduced to promote the development and deployment of e-mobility, in particular:

- measures to facilitate the deployment of recharging infrastructure in new buildings (Article 15 (1) and (2)).
- measures to support the deployment of recharging infrastructure for electric vehicles;
- simplification of building permits by uniquely identifying declarations, certificates, certification and technical works to be submitted for the application for a permit for the installation of charging infrastructure (Article 15 (4));
- introducing an obligation for public authorities, bodies and institutions which are dependent on or controlled by them, regions, local authorities and utilities operators which they control, when replacing their respective car, bus and municipal waste collection fleet, purchasing at least 25 % CNG, LNG and electric vehicles (Article 18 (10));
- modification of the Italian Highway Code concerning regulation of dedicated stopping and parking areas (Article 17 (1));
- provision for the conclusion of an agreement to ensure the creation of single positions in terms of parking regulations, access to internal areas of cities, incentive measures and harmonisation of common measures and objectives in the national territory concerning charging infrastructure networks serving electric vehicles (Article 17 (2));
- measures to stimulate the installation of alternative fuels infrastructure in new and renewed fuel distribution plants (Art. 18).

In Italy for a number of years, there has been a trend of increasing new charging infrastructure (around 41.000 in March 2023), but numbers are not yet able to meet the expected recharging needs in the coming years (some 183.467 electric cars running in Italy on 31 March 2023) with full electric registrations expected to grow very strongly in the coming years.

In this context, and in parallel with the work to define the Regulation of the European Parliament and of the Council on the deployment of alternative fuels infrastructure, repealing Directive 2014/94/EU of the European Parliament and of the Council, the draft decrees provided for in Mission 2, Component 2, Investment 4.3 of the National Recovery and Resilience Plan, were implemented in order to incentivise the deployment of recharging infrastructure for fast and ultra-fast electric vehicles, also supporting the transition of the distribution network for traditional fuels, advanced and sustainable biofuels and with the ultimate goal of achieving a charging network uniformly distributed throughout the national territory. The decrees, pursuant to Article 14 (1) (g) of Legislative Decree No 199 of 8 November 2021, define criteria and procedures for granting such non-repayable benefits in order to establish – in accordance with the milestones provided for in the NRRP for the measure in question – at least 7.500 super-fast charging stations for electric vehicles on extra-urban roads (excluding motorways) and at least 13.755 fast recharging stations in urban centres. A total of EUR 359.943.750 is allocated over the three-year period 2023-2025. As regards the installation of new colonies in urban centres, the resources allocated are also allocated to EUR 353.159.625 over the three-year period 2023-2025.

In addition to the PNRR measure, which focuses on the creation of a public charging network spread evenly across the national territory, a private charging measure was also adopted in order to facilitate the deployment of electric recharging points for motor vehicles through the payment of the contribution provided for in Law No 126 of 13 October 2020 establishing a fund of EUR 90 million for private entities, identified by the law in companies of all sizes and operating in all sectors, and natural persons engaged in the arts and professions.

The National Single Platform (PUN) was also followed up by Decree No 106 of 16/03/2023 on the procedures for the operation of the national single platform for recharging points for electric vehicles.

The UNDP originally provided for in Article 8 of Legislative Decree No 257 of 16 December 2016 implementing Directive 2014/94/EU on the deployment of alternative fuels infrastructure, the financial allocation of which was provided for in Article 45 (3) of Legislative Decree No 199 of 8 November 2021, makes it possible to carry out the population census of publicly accessible recharging infrastructure, the associated recharging points, as well as their operators (Charging Point Operators) and e-Mobility Service Providers (E-MPS), while ensuring the uniformity and homogeneity of the information contained therein. It is a necessary element for the deployment of electric vehicles in the country and the development of a market for charging services linked to it, and for the effective planning of public and private interventions and investments.

The PUN defines a 'single' national access point through which the data it manages is made accessible for use by end-users. The PUN shall provide, in particular, the following basic services:

- info-mobility services for end-users holding electric vehicles (such as, but not limited to, geolocation of publicly accessible charging infrastructure, the technical characteristics of the relevant charging devices, as well as data on the operational status, availability for the provision of the recharging service and the ad hoc prices applied therein);
- services supporting economic operators;
- spatial planning and governance support services for local and regional authorities, which are useful for planning the installation, deployment and management of publicly accessible recharging infrastructure.

Evolutionary lines

The EU RED III Directive, currently under approval, also provides for the introduction of a mandatory credit mechanism for renewable energy injected into public charging transport similar to that already implemented for biofuels and biomethane (leaving it open to Member States to extend this mechanism also to private charging, without prejudice to the ability to demonstrate that energy is used for vehicles).

The proposal for a Regulation of the European Parliament and of the Council on the deployment of alternative fuels infrastructure, repealing Directive 2014/94/EU of the European Parliament and of the Council, seeks to ensure the availability and usability of a comprehensive and widespread network of alternative fuels infrastructure across the EU. All users of alternative fuel vehicles (including vessels and aircraft) need to be able to move through the EU at ease, enabled by key infrastructure such as motorways, ports and airports. It is consistent with the other policy initiatives of the Fit for 55 % package and complements in particular:

- regulations setting CO2 emission performance standards for new passenger cars$_{\text{and}}$ new light commercial vehicles, as well as heavy-duty vehicles;
- the legislative proposal for setting new CO2 emission performance standards for new$_{\text{passenger}}$ cars and new light commercial vehicles after 2020, also part of the Fit for 55 % package.

CO2 emission performance standards provide a strong push for the development of low- and zero-emission vehicles, thus also creating demand for alternative fuels infrastructure. This initiative will enable this transition by ensuring that sufficient publicly available recharging and refuelling infrastructure is in place for light- and heavy-duty road transport vehicles.

This proposal for a Regulation is mutually reinforcing with the revision of the Renewable Energy Directive, the proposal for a Regulation of the European Parliament and of the Council to ensure a level playing field for sustainable air transport (the EU Aviation initiative) and the proposal for a Regulation of the European Parliament and of the Council on the use of renewable and low-carbon fuels in maritime transport (FuelEU Maritime initiative); those instruments shall set obligations for the supply and demand of renewable and low-carbon transport fuels and promote an increase in the supply or demand of sustainable alternative fuels in one or more transport modes.

❖ **THE REDUCTION MEASURES TO REDUCE THE MOBILITY DOMANCE**

Measures aimed at reducing GHG emissions should be encouraged to shift user travel from private to public transport through modal shift and soft mobility, as well as to provide tools for mobility planning.

♦ ***MEASURES TO PROMOTE MODAL SHIFT***

- ***Strengthening Local Public Transport (LPT)***

The main purpose of drawing up the National Strategic Plan for Sustainable Mobility provided for in Article 1 (613) to (615) of Law No 232/2016 (Budget Law 2017) is to renew the TPL bus fleet by purchasing alternative buses (electricity, hydrogen, methane) and its infrastructure network (e.g. vehicle charging facilities) so as to allow the complete replacement of vehicles currently in circulation, now at the limit of their useful life, with vehicles with low environmental impact.

A total state budget of EUR 3.885 billion was earmarked for this purpose in the period from 2019 to 2033. The resources are disbursed in 3 five-year periods starting in 2019, with different ranking lists, respectively, to allocate contributions.

In addition, the 3 directorial decrees concerning the arrangements for the disbursement, reporting and monitoring of resources were issued.

Table 40 - Summary of measures for the delivery, reporting and monitoring of resources for the strengthening of LPT

Beneficiary entity	Period	Resources	Interministerial Decree on the allocation of resources	DD arrangements for delivery, reporting and monitoring of resources
Regions	2019-2033	EUR 2.200 million	No. 81 of 14/02/2020	DD No 134 of 27/05/2021
High pollution cities of Pm10 and Azoto dioxide	2019-2023	EUR 398 million	No. 234 of 06/06/2020	DD No 175 of 22/06/2021
municipalities and metropolitan cities with more than 100.000 inhabitants	2019-2033	1.102 + 185 million of the Investment Facility 2019	No. 71 of 09/02/2021	DD No 287 of 16/11/2021

In addition, the National Strategic Plan for Sustainable Mobility has provided for funding of EUR 100 million to support the competitiveness of companies in the road transport sector, with a view to transitioning towards more modern and sustainable forms of production, with particular reference to research and development of alternative feeding methods to diesel. With NRRPs, an additional EUR 250 million was added for new projects for the green and digital transformation of the bus industry. In addition to the Strategic Plan, Ministerial Decree No 530 of 23/12/2021 allocated the resources provided for the purchase of zero-emission buses (electric and hydrogen) and their support infrastructure for a total amount of EUR 2.415 million, of which EUR 1.915 million from the NRRPs and EUR 500 million under the legislation in force.

- ***Progressive ban on the circulation of more polluting buses***

In addition, the renewal of the rolling bus fleet was facilitated by the provisions of Article 1 (232) of Law No 190, which prohibited the circulation of motor vehicles of categories M2 and M3 fuelled with petrol or gas oil with Euro 0 pollution control characteristics throughout Italy from 1.1.2019.

Evolutionary lines

Article 4 (3a) of Decree-Law No 121 of 10 September 2021 (and subsequent amendment of the Milleextensions Decree) provided that buses, which are used for local public transport services, fuelled with petrol or diesel fuels of the oldest emission classes are to be phased out and, therefore, from 30 June 2022, EUR 1 and, as from 1 January 2024, buses with petrol or diesel Euro 2 and Euro 3 may no longer be circulated. This ban resulted in an important lowering of the average age between 2022 and 2023, from 10.41 years in 2022 to 9.73 years in 2023.

- ***Sustainable Mobility Fund***

Set up by the Budget Law for 2022 (with regard to the allocation of funding by means of DI No 347 of 21/10/2022 and the 2023 Budget Law amounting to approximately EUR 1.9 million for the period 2023-2034), the Fund, intended to support the ecological transition of the transport sector, thereby contributing to the achievement of the emission reduction targets set out in the European Commission’s Fit for 55 package, will finance the greening of buses, the purchase of hydrogen trains, the construction of cycle paths, the development of intermodality in freight transport, the adoption of alternative fuels for ships and aircraft, the conversion of airports, the renewal of vehicles for transport. EUR 1 billion is intended to improve the sustainability of urban mobility and reduce pollutant emissions in 44 municipalities and metropolitan areas with more than 100.000 inhabitants.

- ***Rapid mass transport systems***

In the strategy to support local public transport, "rapid mass transport", which covers high-capacity power supply systems (metropolitan, tramway, trolleybus and similar systems) plays a major role. In view of these needs, a significant funding programme has been launched starting in 2017 (the Budget Law for 2 017 provided for the establishment of the investment fund). MIT is managing resources in the sector of around EUR 14 million, to which additional NRRP funds of EUR 2.2 million are to be added, with the deployment of 240 km of network equipped for rapid mass transport infrastructure.

Evolutionary lines

In 2022, in order to further promote rapid mass transport, additional State resources (DI MIT-MEF 97/2022 and Ministerial Decree MIT 409/2022) were allocated to the extension and upgrading of the metropolitan network and rapid mass transport, amounting to EUR 4.8 million. The measures financed in 2022 (by means of the above-mentioned decrees) will establish rapid mass transport infrastructure of approximately 50 km, of which 40 of metro and 10 tramway lines, plus two cableway installations for a length of approximately 4 km.

❖ **RAIL TRANSPORT**

In the field of rail transport, the MIT has over the last few years provided for funding amounting to EUR 1.75 million, broken down as follows:

- MINISTERIAL DECREE NO 408/2017: 2015-2016: for the renewal of railway rolling stock, the Stability Law for 2016 (Article 1 (866) of Law No 208 of 28 December 2015) allocated EUR 640 million between 2019 and 2022. The minimum regional co-financing of 40 % leads to a total amount of EUR 1 million.
- FSC funds 2014-2020 Development and Cohesion Plan (SGP) – MIMS – Axis F: EUR 775 million of State financing. In this case too, there is provision for co-financing by the Regions of at least 40 % of the total cost of supplies (provided by the regions which have not renounced it pursuant to Article 200 (7) of Decree-Law No 34 of 19 May 2020) and 80 % of the resources are allocated to the Mezzogiorno regions (Table 2.B).
- FSC Funds 2014-2020 Development and Cohesion Plan (SGP) – MIMS-Axis C: EUR 158.70 million of investment to enhance rapid mass transport in transport in urban and metropolitan areas.
- Ministerial Decree No 164 of 21/04/2021: EUR 169.5 million of State financing from 2021 to 2033.

In addition, an intervention programme for the upgrading of railway lines and the simultaneous upgrading and/or renewal of the rolling stock amounted to EUR 1.550 million, of which EUR 278.41 million was earmarked for the renewal of the rolling stock on iron, was also financed within the RRP. The resources were allocated by Ministerial Decree No 363 of 23/09/2021.

Finally, Ministerial Decree No 319 of 09/08/2021, through the National Recovery and Resilience Plans, allocated resources between the regions and the autonomous provinces of Trento and Bolzano for the purchase of electric or hydrogen trains totalling EUR 500 million, of which 50 % was allocated to the southern regions. The measure provides for the purchase of 50 new trains to replace an equivalent number of trains by the second half of 2026. The Decree in question provides that the beneficiaries must purchase at least 1 trains by 31/12/2024 and complete the supply programme by 30/06/2026.

❖ **MODAL SHIFT IN FREIGHT TRANSPORT**

Increasing the share of freight transport by sea and rail by limiting the use of the road vehicle to the "last mile" is a necessary measure to achieve the ESR targets. To date, the measures taken on the modal shift are the "Marebonus" and "Ferrobonus". Please note that these measures are addressed in detail in paragraph 3.2.

❖ **SOFT MOBILITY MEASURES**

In order to reduce emissions related to private mobility, given the ambitious and challenging ESR targets, and the important contribution of the transport sector in terms of emissions, it will be necessary to identify a number of additional measures to promote soft mobility in order to achieve the ESR target. It will be necessary to promote investments aimed at:

- development of cycling through cycle paths;
- promote shared mobility (bikes, low- or zero-emission car and motorcycle sharing);
- integration between sustainable mobility services (e.g. resting facilities for cycles or car and bike sharing services close to public transport stops) and interchange parking;
- promoting smart working tools and reducing working days to equal hours worked;
- promotion of carpooling;
- development of ITS (traffic management, infomobility, smart roads).

In this regard, we would point out that the 2016 and 2017 Budget Laws financed the national tourist cycle system with national resources totalling EUR 372 million from 2016 to 2024 and that the 2 019 Budget Law established the Fund for interurban cycling with an allocation of EUR 2 million for 2019.

Ministerial Decree No 344 of 12 August 2020, published in the Official Gazette of 10 October 2020, aims to expand the urban and metropolitan cycling network so as to meet mobility needs while at the same time helping to limit the use of private motor vehicles and overcrowding in public transport. For these purposes, funding of approximately EUR 137 million is foreseen for the design and construction of cyclists and measures relating to the safety of cycling. On an experimental basis, approximately EUR 4 million was earmarked for the immediate construction of cycle paths connecting universities and major railway stations, in order to facilitate last-mile journeys using 'soft' modes of transport (Ministerial Decree No 73 of 16/03/2021).

The NRRP funds issued Decree No 509 of 15/12/2021 allocating the resources allocated to municipalities over 50.000 inhabitants which are universities, totalling EUR 200 million, including EUR 150 million from NRRP funds and EUR 50 million from projects under existing legislation, to strengthen cycling in urban and metropolitan areas. The measure provides for the construction of approximately 565 km of urban and metropolitan cycle paths by the second half of 2026.

In addition, we would point out the following measures for MASE:

- Case-work school experimental programme

Decree No 208 of the Minister for the Environment and the Protection of Natural Resources and the Sea of 20 July 2016 established the National Experimental Programme for Sustainable Mobility in Case-School and Case-Work, which co-finances the implementation of projects drawn up by local authorities, including in an associated form, and covering a territorial area with a population of more than 100.000 inhabitants, aimed at encouraging urban mobility initiatives other than private cars, in order to reduce traffic, pollution and parking of vehicles near schools and workplaces. A total of 80 projects are eligible for co-financing, with a total value of around EUR 164 million.

- Programme Incentivation Mobility Sustainable Urban Mobility

The Programme for the Incentivation of Sustainable Urbana Mobility (Primus), established by the Ministry of the Environment and the Protection of Natural Resources and the Sea by Decree No 417 of 21 December 2018, subsequently amended by Decree No 4 of the Directorate-General for Climate, Energy and Air of 19 February 2020, is being implemented. The programme, aimed at municipalities with a population of at least 50.000 inhabitants, aims to reduce road traffic through the creation of new cycle paths for commuting between home and school and home cities, the development of urban sharing mobility and the promotion of mobility management activities. With a budget of more than EUR 16 million, the programme provides for the co-financing of 46 projects, with a total cost of more than EUR 26 million.

- Sustainable educational transport

Decree No 222 of the Minister for the Environment and the Protection of Natural Resources and the Sea of 28 October 2020 approved the financing programme for the promotion of sustainable school transport, addressed to municipalities with a population of more than 50.000 inhabitants affected by EU infringement procedures No 2014/2147 and/or No 2015/2043 for failing to comply with Italy's obligations under Directive 2008/50/EC on air quality. In November 2021, 19 projects were eligible for funding, amounting to more than EUR 18 million.

- Cargo Bike

Article 1 (698) of Law No 178 of 30 December 2020 grants micro and small enterprises engaged in last-mile urban freight transport activities an annual tax credit, up to a maximum of EUR 2 million for 2021, up to a maximum of 30 % of the costs incurred for the purchase of cargo bikes and cargo bikes with assistance up to a maximum annual amount of EUR 2,000 per year for each beneficiary undertaking.

Evolutionary lines

MIT MEF Decree No 417 of 28/12/2022 provided for the measure 'Promoting modal Shift and Intermodality'. The resources shall be allocated to regions for the financing of sharing mobility services projects. The resources are approximately EUR 45.5 million for the three-year period 2022-2024, broken down as follows.

Table 41 – Allocation of resources

Year	Resources (EUR)
2022	14.923.662
2023	15.223.662
2024	15.223.662

Eligible projects are exclusively sharing mobility services, mainly electrically or muscular, complementary to local and regional public transport services, and in particular the implementation and promotion, provision, strengthening and strengthening of:

- vehicle sharing services, both with a station-based and free-floating operating model, including the geographical and/or hourly extension of the area of coverage of already activated vehicle sharing services;
- carpooling services as a measure of corporate or institutional mobility management;
- Demand Responsive Transit Services;
- other services complementary and incentivising services to shared and innovative mobility services.

❖ MOBILITY PLANNING

♦ *SUMP: URBAN PLANS FOR SUSTAINABLE MOBILITY*

With Ministerial Decree No 444/21, the adoption of SUMPs became a prerequisite since January 2023 for access to funding for both the Massa Report and the Ciclability. Throughout 2 022, the adoption of SUMPs was a rewarding element in the possible allocation of resources relating to the transport of Massa Report and Cyclways. The Platform of the LPT Policy Observatory has become the system for monitoring and verifying the adoption of SUMPs by local authorities.

As part of the inter-ministerial technical monitoring table, provided for in Article 4 (4) of Ministerial Decree No 397/2017, of which, in addition to the MIT, the MITE, the MEF, the Ministry of Tourism, the Ministry of Tourism, the ANCI and the Regions, the drafting of SUMPs is being monitored and assessed.

Evolutionary lines

A SUMP Vademecum has been put in place to assist institutions in drafting/updating SUMPs. This document, which describes in more detail the procedural steps needed to draw up SUMPs, in accordance with the Italian and European guidelines, was sent to all members of the table in July 2022 to transpose any comments and/or additions. In September 2022, the Vademecum was shared with the SUMP Technical Table at its meeting on 27/09/2022 and then published on the Ministry's institutional website.

♦ *THE BICI PLAN GUIDELINES*

In accordance with Article 6 of Law No 2 of 11 January 2018 'Provisions for the development of cycling and the establishment of the national cycling network', municipalities with a population of more than 100.000 inhabitants (not part of metropolitan cities) and metropolitan cities shall draw up and adopt urban plans for cycling, known as 'bicibility plan', as SUMP plans. The guidelines, drawn up by the working group composed of representatives of the DG for Transport Systems to Fixed Facilities and Local Public Transport, the Technical Office of Mission, the ANCI and the AIIT (Italian Association for the Engineering of Traffic and Transport), published in October 2020 on the MIT website, are intended to provide useful guidance and guidance for the drafting of biciplans also to local administrations of all sizes wishing to equip themselves with this tool.

These guidelines have been incorporated, at least in part, into the Master Plan for Cycling adopted in August 2022.

♦ *GUIDELINES FOR DRAWING UP AND IMPLEMENTING THE PLAN FOR COMMUTING (PSCL)*

Directorial Decree No 209 of 04/08/2021 of the Ministry of Ecological Transition approved the guidelines for drawing up and implementing the commuting plans provided for in Article 3 (5) of Interministerial Decree No 179 of 12 May 2021.

The preparation of PSCLs is an essential element in the increasingly widespread adoption of sustainable mobility initiatives aimed, in particular, at rationalising systematic commuting and thus reducing individual travel with private vehicles.

The PSCLs also aim at a more effective distribution of local public transport users, to coordinate the start and end times of economic, working and local, urban and extra-urban public transport services.

♦ ***TECHNICAL TABLE SUL MOBILITY MANAGEMENT***

The technical table on mobility management, set up at the Ministry of Infrastructure and Sustainable Mobility by Decree No 231 of 22 July 2022, of which, in addition to the MIT, the MITE, ANCI, representatives of metropolitan cities and large and medium-sized towns, is one of its tasks:

- consolidating the network of area mobility managers;
- propose possible amendments to Interministerial Decree n.179/2021 or indications for new regulatory proposals;
- propose analyses and studies on mobility management activities at urban and metropolitan level;
- support the role of local mobility manager in defining and implementing sustainable local mobility policies.

❖ **THE MARITIME SECTOR**

The maritime sector, which is vital for the movement of goods across the globe, has been estimated to affect around 3 % of total GHG emissions. The revision of the strategy for reducing greenhouse gases from the maritime sector adopted in 2018 by the International Maritime Organisation (IMO), the United Nations Specialised Maritime Agency for Maritime Transport, was approved on this issue in July 2023. Compared to the previous wording, the target of net zero greenhouse gas*emissions*from ships has been set around 2 050. This is a significant increase in ambition compared to the previous 2018 strategy, which aimed to reduce ship emissions by 50 % over the same time horizon.

In order to achieve this target, an important intermediate target was set to achieve, in 2030, at least 5 % of the total energy production of the maritime sector through the use of low/zero GHG emissions technologies, while providing for a commitment to cercar-cars and to increase these percentages to 10 %.

This will enable the sector to start the transition by providing a clear scenario for the maritime and fuel industries that can therefore promote and incentivise investment in new technologies and fuels. In order to ensure that the sector meets these targets, it has been decided to carry out interim checks in 2030 and 2040, for which a reduction rate of 20 % in 2030 and 70 % in 2040 compared to 2008 emissions will have to be achieved, while striving to increase these values to 30 % and 80 % respectively. It should be stressed that ambition levels take into account the full life-cycle greenhouse gas emissions of marine fuels (*well-to-wake*), thus avoiding a “*well-to-tank*” emission shift.

This comprehensive review of the strategy should be based on a set of instruments, including the possibility of mechanisms linked to the creation of an emission trading system for the shipping sector, which penalises greenhouse gas emissions and the revenues from which should be directed at supporting the least technologically advanced countries in order to enable them to achieve their objectives.

At European level, however, the extension of emission trading obligations for the shipping sector is also accompanied by the obligations to reduce GHG laid down in Regulation (EC) No 2023/1805 on the use of renewable and low-carbon fuels in maritime transport, known as the Fuel EU Regulation, repealing Directive 2009/16 EC on port State control.

The following GHG reduction percentages have been set: 2 % as from first January 2025, 6 % as from first January 2030, 14.5 % from first January 2035, 31 % as of first January 2040, 62 % from first January 2045, 80 % from first January 2050.

In addition, following the revision of the ETS, the shipping sector has been included among those subject to the monitoring, reporting and return obligations of annual greenhouse gas emissions from each individual ship, calculated as CO_2 equivalent.

All of the above actions, as already specified, aim to reduce GHG emissions through reduction targets that aim to make the use of green technologies economically viable compared to the use of conventional fuels, which are indirectly penalised.

Under the above regulation, it is also required to connect to the port's electricity network to ships that berth in ports covered by Article 9 of the Alternative Fuels Infrastructure Regulation, as from 1 January 2030.

For container and passenger ships, that obligation has been extended, as from 1 January 2035, to ports not covered by Article 9, but in any event equipped with the necessary infrastructure.

However, this timetable may also be brought forward to 2030 if, following consultation with all stakeholders directly concerned, the necessary conditions are met for the ship to be properly connected to the port's electricity grid.

In order to meet the reduction commitments set out above, it is therefore necessary to implement actions enabling the reduction of GHG, which can be achieved through:

- increasing the energy efficiency of ships;
- use of new low fuels – zero GHG emissions;
- use of new technology systems for capturing and sequestering GHG emissions, currently in the experimental phase.

To accompany this complex transition phase, it will be crucial, in addition to promoting technological development in this sector, to ensure the availability of alternative fuels to fossil fuels through the upgrading of production systems and the deployment of the storage and refuelling infrastructure necessary for their deployment. This is a pressing need, given that zero-emission ships in 2050 will have to be built shortly, if not today. It is therefore important to quickly give a clear signal to the sectors involved and to ensure a certain operational framework for the investments to be made for fleet renewal; a request from stakeholders themselves, who are concerned by the current uncertainty about the future availability of fuel and infrastructure, which jeopardises the ambitions to achieve decarbonisation objectives.

In order to reach them, maritime transport will need to undergo a profound transformation in the near future, requiring precise planning choices by the government, not only with regard to reduction measures, but above all with regard to the entire supply and distribution chain, possible incentive measures and the management of the ETS applied to the maritime sector.

IV. Where applicable, national policies, timelines and measures planned to phase out energy subsidies, in particular for fossil fuels

The importance of action to rationalise and eliminate inefficient fossil fuel subsidies has been emphasised several times at the various G20 summits, which took place since 2009. At the G20 Pittsburgh Summit in 2009, countries committed themselves to rationalising and eliminating inefficient fossil fuel subsidies in the medium term that encourage their waste. In 2 018, Italy voluntarily submitted to the G20 peer review, drawing up and discussing a national report on fossil fuel subsidies, in parallel with Indonesia.

A similar political commitment reaffirmed in September 2023 with the G20 Leaders' Declaration in New Delhi:

We*will step up our efforts to implement the 2009 Pittsburgh commitment to phase out and rationalise inefficient fossil fuel subsidies in the medium term that encourage waste and commit to achieving this goal, while providing targeted support to the poorest and the most vulnerable.*A second step is the establishment of a governance mechanism to assess and prioritise the removal of environmentally harmful subsidies. In 2021, Article 4 of Decree-Law No 22 of 2021 March 1 established the Interministerial Committee for Ecological Transition (CITE) within the Prime Minister's Office with the task of coordinating and planning national policies for the ecological transition (without prejudice to the competences of the Interministerial Committee for Economic Planning and Sustainable Development). The CITE shall be chaired by the Prime Minister (or in his place by the Minister of MASE) and shall be supported by a Technical Support Committee: it is responsible for the approval, implementation, monitoring and updating of the Ecological Transition Plan (ETP) in line with the objectives and priorities set out at European level, taking appropriate steps to overcome any obstacles and delays.

Finally, according to Article 4, the CITE is to decide on the reorganisation of environmentally harmful subsidies referred to in Article 68 of Law No 221 of 28 December 2015 and, in this context, the Technical Support Committee is to carry out the tasks of the former Commission for the study and development of proposals for the ecological transition and the reduction of the SADs (Article 1 (98) of Law No 160 of 27 December 2019).

With regard to harmful subsidies, the MASE shall send to the Chambers and the CITE, by 15 July each year, a report on the results of the update of the Catalogue and proposals for the phasing out of environmentally harmful subsidies and the promotion of environmentally favourable subsidies, including with a view to contributing to the realisation of the ETP.

Italy, through mapping the Catalogue and setting up a government mechanism, allowing for a weighted assessment of policy options and the preparation of possible compensatory measures for taxation and public finances, is now best placed to meet the commitment to phasing out inefficient subsidies.

A number of ways to go ahead are being studied by the public administration. Some subsidies are relatively easy to reform; some need further insights; others require agreements at European (e.g. ETS free allowances) or global agreements (e.g. international aviation and maritime fuel exemptions, linked to ICAO and IMO Conventions).

The revenue – the quantification of which, as stated above, is conditioned by economic and competitive variables – resulting from the reform or elimination of inefficient subsidies in the energy sector will have to compensate the economic actors benefiting from them, for greater social acceptability of their reduction/elimination, encouraging the search for innovative national solutions and maximising the opportunities of the energy and ecological transition in the sectors directly involved. More generally, the optimisation of the opportunities associated with the elimination of environmentally harmful subsidies should be sought in the context of a broader tax reform, shifting the tax burden away from labour and business to polluting activities and the exploitation of natural resources, as advocated by the main international institutions.

In 2021, the CITE started the reform process starting with the elimination of five fossil subsidies (included in the priority list identified by the INECP 2019), as laid down in Article 18 of Decree-Law No 4 of 27 January 2022, with an annual avoided financial effect of EUR 105.9 million. This measure is a first political signal in implementation of the EU and international government commitments.

In 2022, following the energy crisis and in support of all electricity users, the tariff components A_{SOS} and A_{RIM} were cancelled and the revenue foregone was covered by the resources made available by the Government, as reported in Arera Report 352/2023/I:

- for the cancellation of components A_{SOS} and A_{RIM} in the first quarter of 2022, the 2022 Budget Law and the Sostegni-ter Decree made available EUR 1.800 million and EUR 1.200 million respectively for a total of EUR 3.000 million;
- for the cancellation of components A_{SOS} and A_{RIM} in QII 2022, Decree-Law No 17/2022 made available an additional EUR 3.000 million;
- for the cancellation of components A_{SOS} and A_{RIM} in Q2022, Decree-Law No 80/2022 made available an additional EUR 1.915 million;
- for the cancellation of components A_{SOS} and A_{RIM} in QIV 2022, Decree-Law No 115/2022 made available an additional EUR 1.100 million.

Since, as a result of the above-mentioned cancellation provisions, the energy subsidy *on Measure 6/92 of the Interministerial Committee of Prices (‘CIP6’)* was transferred by the private user to public expenditure, the financial effect for 2022 is in the context of the monitoring of energy incentives.

In the course of 2023, an inter-directional table was set up within the MASE, with the dual aim of discussing the relevant issues falling under the subsidies monitored by the Catalogue and to foster coordination for the technical support to be provided to policy activities in the field of environmental tax reform. Among the *outputs* of the Tavolo, there is a collaboration with the Mef to redefine subsidies from the point of view of climate impacts; the aim is to provide an estimate in terms of tonnes of CO_2 issued for millions of euros spent on a tax measure.

The data and assessments contained in the Catalogue were taken into account in the context of the revision of fossil fuel excise duties on the basis of the enabling law on tax reform, referred to in the 2023 Economic and Financial Document update. Of particular importance for the environmental tax reform is Article 12 of the Tax Delegation Law (Law No 111 of 9 August 2023), which explicitly refers to the adjustment of the rates of excise duty on energy products and electricity, taking into account the environmental impact of each product.

In the course of 2023, the *European Semester Council Recommendations on Italy’s National Reform Programme* called for the integration of the National Recovery and Resilience Plan with the objectives and measures of the RePower EU for Energy Independence and Efficiency, the amendment of which is permitted by Regulation (EU) 2023/435. The review process initiated by the Government to address the recommendations ended at the end of 2023 with the addition of Mission 7, which provides for the 2 reform of the request for the reduction of environmentally harmful subsidies on the basis of the annual catalogue of environmentally harmful subsidies, published by the MASE, by 2025 (M7-5), with a first objective to reduce SADs and define a further gradual reduction path.

In this context, the reform process will continue in the short and medium term, with 18 subsidies (Table 42) having an environmental impact relevant to the Energy and Climate Plan and identified as inefficient. This process should involve the relevant administrations and representatives of the citizens and businesses concerned in order to identify possible compensation.

Table 42 - List of energy subsidies/subsidies to be assessed for reforms

N	Name	Reference standard	Financial effect (million EUR)				
			2018	2019	2020	2021	2022
1	Tax advantages for workers who use the company car in a mixed way	Article 51 (4) (a) TUIR; Articles 1 (632) and 633 of Law No 160 of 27 December 2019	1.231,0	1.231,0	1.231,0	1.231,0	1.231,0

N	Name	Reference standard	Financial effect (million EUR)				
			2018	2019	2020	2021	2022
2	Excise duty on electricity used in dwellings	Article 52 (3) (e) of Legislative Decree No 504 of 26 October 1995 (Consolidated Text on Excise Duties); Article 17 (6) of Decree-Law No 41 of 23 February 1995	591,8	578,7	582,3	591,8	554,2
3	Gas oil and LPG used for heating in geographically or climate disadvantaged areas (mountainous Sardinia smaller islands)	Article 8 (10) (c) of Law No 448/98; Article 2 (12) of Law No 203/08; Article 1 (242) of Law No 190/2014; PRIME MINISTERIAL DECREE 15/01/1999	152,8	152,8	152,8	60,6	60.6
4	Exemption from consumption tax for lubricating oils used in the production and processing of natural and synthetic rubber	Article 62 (2) TUA (Legislative Decree No 504 of 26 October 1995)	78,8	78,8	78,8	78,8	78,8
5	Exemption on the product rates of natural gas and oil cultivation (royalty)	Article 19 of Legislative Decree No 625 of 25 November 1996; Article 45 of Law No 99 of 23 July 2009, as amended, pursuant to Articles 736 and 737; Law No 160 of 27 December 2019	52,0	52,0	5,0	5,0	5,0
6	Flat-rate deduction from business income in favour of operators of fuel distribution plants	Article 21 (1) of Law No 448/1998; Article 6 (3) of Law No 388/2000; Article 1 (129) of Law No 266/2005; Article 1 (393) of Law No 296/2006; Article 1 (c) of Law No 244/2007; Article 1 (c) of Legislative Decree No 194/2009; Article 2 (5) of Decree-Law No 225/2010; Article 34 (1-3) of Law No 183/2011	41,1	42,5	39,3	42,5	45,0
7	Reduction of excise duty on natural gas used for thermoelectric industrial uses excluding persons with consumption exceeding 1 200 000 m³ per year	Article 4 of Decree-Law No 1 of 2001 October 356 converted into Law No 418 of 30 November 2001 and became a structural advantage within the meaning of Article 2 (11) of Law No 203 of 22 December 2008	29,1	29,0	7,4	29,1	28,7
8	Cost reduction for the National Armed Forces	Table A point 16-bis TUA (Legislative Decree No 504 of 26 October 1995)	15,7	12,6	4,7	5,6	3,9
9	Reduction of excise duty on LPG used in centralised installations for industrial uses	Table A point 15 TUA (Legislative Decree No 504 of 26 October 1995)	11,3	11,8	13,0	11,8	15,7

N	Name	Reference standard	Financial effect (million EUR)				
			2018	2019	2020	2021	2022
10	Reduction of the standard rate of excise duty on fuel for taxi	Table A point 12 TUA (Legislative Decree No 504 of 26 October 1995)	10,6	11,8	8,5	11,4	12,0
11	Reduction of excise duty on motor vehicle fuels	Table A point 13 TUA (Legislative Decree No 504 of 26 October 1995)	2,4	2,4	2,4	2,4	2,4
12	Exemption from excise duty on fuels for drying up and installing flooded land in flooded areas	Table A point 6 TUA (Legislative Decree No 504 of 26 October 1995)	0,5	0,5	0,5	0,5	0,5
13	Exemption from excise duty on water lifting fuels in order to facilitate the cultivation of run-off land on reclaimed land	Table A point 7 TUA (Legislative Decree No 504 of 26 October 1995)	0,5	0,5	0,5	0,5	0,5
14	Reduction of excise duty on fuels for experimental testing and testing of aviation and marine engines	Table A point 8 TUA (Legislative Decree No 504 of 26 October 1995)	0,5	0,5	0,5	0,5	0,5
15	Reduction of excise duty on natural gas used in construction site uses in fixed engines and field operations for the extraction of hydrocarbons	Table A point 10 TUA (Legislative Decree No 504 of 26 October 1995)	0,2	0,2	0,3	0,2	0,2
16	Exemption from excise duty on energy products injected into blast furnaces for production processes	Table A point 16 TUA (Legislative Decree No 504 of 26 October 1995)	d.q.	d.q.	1,0	d.q.	1,0
17	Preferential VAT for electricity and gas for the use of agricultural and manufacturing companies	Table A part III of Presidential Decree No 633/1972 (preferential VAT 10 %)	d.q.	d.q.	d.q.	d.q.	d.q.
18	Preferential VAT for crude mineral oils fuel oils	Table A part III of Presidential Decree No 633/1972 (preferential VAT 10 %)	d.q.	d.q.	d.q.	d.q.	d.q.
	Total environmentally harmful energy subsidies (including fossil fuels) to be reformed as a priority		2.218,3	2.205,1	2.128	2.071,7	1.979,4

The key elements of the reform should therefore be the 'graduality principle' to give time to productive sectors to develop, test and implement less polluting technological and energy solutions, and the 'compensation principle', at least in cases where the elimination of the subsidy could lead to a loss of competitiveness for the sectors most dependent on fossil fuels, in order to avoid undermining the economic and employment opportunities associated with the gradual decarbonisation of the economy.

3.2 Dimension energy efficiency

Planned policies, measures and programmes to achieve the indicative national energy efficiency contributions for 2030 as well as other objectives referred to in point 2.2, including planned measures and instruments (also of a financial nature) to promote the energy performance of buildings, in particular with regard to the following:

I. Energy efficiency obligation schemes and alternative policy measures under Articles 7a and 7b and Article 20(6) of Directive 2012/27/EU and to be prepared in accordance with Annex III to this Regulation

In order to achieve the cumulative final energy savings to be achieved over the period 2021-2 030 in order to meet the Energy Efficiency Directive target for mandatory schemes, Italy will use the Bianchi Certificates obligation scheme and a set of alternative measures that are mostly already implemented, which will be reviewed and strengthened in the coming years in order to ensure that the targets are met.

In order to achieve improved effectiveness in existing support schemes, the focus has been on promoting greater specialisation of instruments by sectors and interventions, with the aim of eliminating overlaps and competitiveness between measures, concentrating resources, facilitating access, and maximising savings.

In particular, the instruments dedicated to promoting energy efficiency in force and monitored to achieve the savings target set out in Article 8 EED III (formerly Article 7 EED II) are as follows:

- the schedule of obligations for the Bianchi Certificates;
- tax deductions for energy efficiency measures and the recovery of existing building stock;
- the Termico Account;
- the National Energy Efficiency Fund (FNEE);
- the Transition Plan 4.0 and 5.0 (former Enterprise Plan 4.0);
- the Programme for Energy Requalification of Central Public Administration Buildings (PREPAC);
- the National Information and Training Plan for Energy Efficiency (BIP);
- the Kyoto Fund;
- some NRRP measures;
- cohesion policies;
- the energy saving target for the public administration;
- the application of minimum energy performance requirements in the building and management of thermal installations;
- a package of sustainable mobility measures including:
    - the overhaul of the local public transport vehicle fleet;
    - modal shift in freight transport (Marebonus, Ferrobonus);
    - vehicle eco-bonus;
    - electrification of port quays (Cold ironing).

All the above measures, either already in operation at national level or in the start-up phase, will be summarised in the following paragraphs, including for each of them an estimate of the expected savings that together meet the savings targets set out in Chapter 2.2.

The estimated savings resulting from the measures listed above and included in this chapter are carried out taking into account the appropriations programmed in the coming years and, where not available, assuming their operation and financing until 2030.

A number of measures to promote energy efficiency have been implemented and planned in Italy, in particular in the transport sector, which may be monitored and reported following the ongoing in-depth work.

Please also refer to the report annexed to the INECP 2020, drawn up on the basis of Annex III to Regulation (EU) 2018/1999 on the Governance of the Energy Union (in which the measures and methods adopted by the Member States for the application of Article 7 of Directive 2012/27/EU are notified) for further details and detailed treatment of many of the individual measures described below (beneficiaries, involved and responsible for implementation, eligible measures, methods for calculating savings, monitoring, verification and audit).

❖ **WHITE CERTIFICATES**

The 'Bianchi Certificates' mechanism, last regulated by the Ministerial Decree of 21 May 2021, is based on the obligation imposed on electricity and gas distributors with more than 50.000 customers to achieve a minimum amount of savings on an annual basis: in particular, obliged entities demonstrate that they comply with the obligation by means of negotiable securities (specifically CB), which certify savings in energy end-use made by qualified third parties (a certificate is equivalent to the savings of a Petrolio-TEP Equivalent TEP). The obligation shall be determined on the basis of the ratio between the quantity of electricity and natural gas distributed by individual distributors and the total quantity distributed in the national territory by all obliged entities. Obliged entities may fulfil their obligation by directly implementing the energy efficiency projects for which CBs are recognised by the GSE or, alternatively, by buying the securities through trading on the CB market managed by the Energy Market Operator (GME) or through bilateral transactions. The mechanism has recently been innovated and implemented by the following measures:

- the DGCEE Directorial Decree of 3 May 2022 on updating and supplementing standardised projects. The main changes introduced include: clarification of baseline consumption, new ways of submitting projects, introduction of integrated energy efficiency projects, reward for measures implemented in the implementation of farm management systems and LCA studies. In addition, the Decree introduced new project fiches with a view to: replacement of a pump with a more efficient pump; installation of air and water condensed compression electric refrigerator units, replacement of fossil-fuelled boilers for the production of heat energy with heat pumps; replacement of heat pumps for heat production by heat pumps; new installation of compressed air production installations; replacement of public lighting systems; replacing luminaires with led lamps; connecting new users to district heating networks; replacement of a boiler with a higher efficiency. Finally, the Directorial Decree updates the table of eligible interventions under the CB mechanism;
- the DGCEE Directorial Decree of 4 May 2023 on the updating and integration of standardised projects, which introduced a new standardised project entitled '*Adoption of efficient reporting and management systems*', and amended two projects already approved by the Decree of the Minister for Economic Development of 10 May 2018, respectively '*Purchase of hybrid vehicles*' and '*Purchase of electric vehicles powered by renewable energy'.*

Since the Bianchi Certificates mechanism became operational (2006) until 2023, total additional primary energy savings of around 29,3 Mtoe have been certified and around 58.5 million energy efficiency certificates have been recognised.

The trend in the rate of submission of new projects decreased over the three-year period 2019-2022. In particular, from 2019 to 2020 the reduction was 17.51 %, from 2020 to 2021, a slight reduction of 2.97 %, the reduction in the submission rate again increased by 31.51 % between 2021 and 2022. While between 2019 and 2022, there is the highest reduction rate of 45.18 % in less projects submitted.

On the other hand, as regards the sectoral distribution of the measures submitted and approved in the three-year period 2019-2022, there is a clear prevalence of interventions in the industrial, network, services and transport sectors.

However, in 2023, GSE recognised a total of 1.029.558 TEE. The overall trend in licences recognised in 2023 shows an increase of around 33 % in the number of recognised licences compared to 2022, where around 774.000 licences were recognised.

In the first half of 2023, around 900 new requests were submitted. In the period July 2021 to June 2 023, the trend in the number of requests shows volumes that fluctuate around an average of 131 monthly requests.

In the first half of 2023, 447 TEE were issued. In sectoral terms, EERs are recognised for projects carried out in the industrial sector, amounting to 51 % in the first half of 2023.

In terms of new annual savings, valid for the achievement of the target of savings from active policies set by the EED, the primary energy savings certified in 2 023 are 462.801 toe.

Planned evolutionary lines

The process of updating the White Certificates mechanism is being carried out with a view, first, to strengthening the measure. Second, measures to ensure simplification, optimisation of methodologies for quantification and recognition of energy savings, shortening time for approving, issuing and offering securities on the market are under consideration. These aspects of improvement are considered crucial for the effective continuation of the measure in the period 2021-2030 and to overcome the crisis resulting from the progressive reduction of the measures implemented under the CB mechanism, due both to the complexity of the operation of the mechanism (access/reporting/recognition phase of incentives) and the introduction in 2018 of a ceiling for the economic compensation granted to each individual Bianco certificate produced, set at EUR 250/TEP.

The reinforcement of the mechanism will provide for a new system of incentivising savings, according to the following criteria:

- downwards auctions covering the economic value of the saved TEP [EUR/TEP];
- *pay as bid* criterion with constant value for the incentive period specified in the tender run by GSE;
- auctions on specific technologies, project types, policy areas or economic sectors;
- the auction base value linked to the evolution of CB prices, the specificities of the technology or project type, the positive environmental externalities generated;
- access to auctions reserved for entities supporting the investment in line with the CB mechanism;
- covering the costs of the mechanism from electricity and natural gas tariffs.

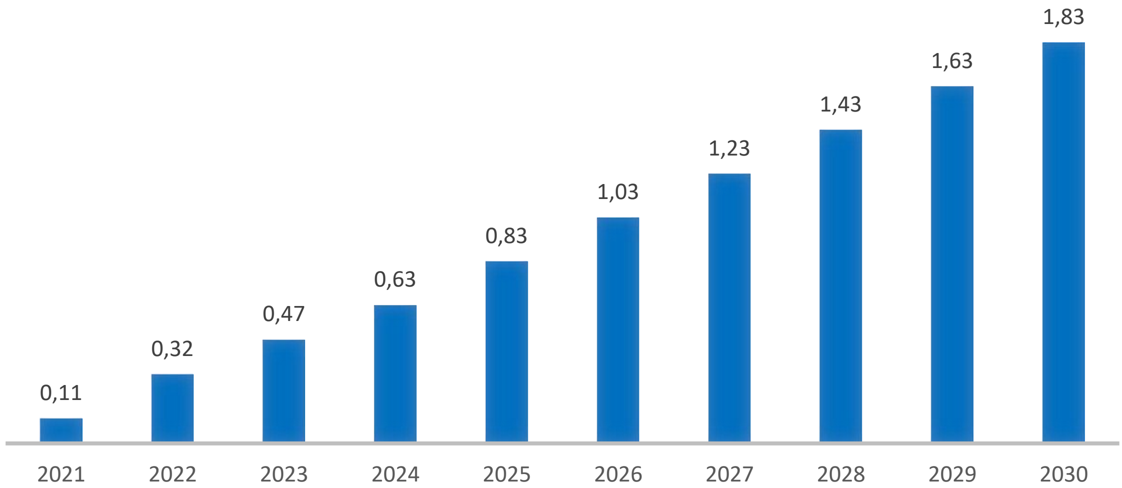
On the eligible side, the most effective promotion of those in the civil and transport sectors, including through the development of behavioural measures, will be crucial. In addition, more attention will be paid to supporting operators. These aspects are relevant to the necessary improvement in the quality of the projects submitted, also to the benefit of the administrative burden borne by GSE.

Finally, an important contribution to the reduction of consumption can be derived from measures aimed at the efficiency of data centres. In this regard, the launch of a study to assess the possibility of extending the CB mechanism to such cases is under assessment.

Estimate of energy indicators

In order to estimate the contribution of the White Certificates mechanism to the savings targets, the final energy savings of the measures already implemented and promoted by the mechanism since 1 January 2021 and the new ones estimated to be generated in the following years and will continue to generate benefits until at least 31 December 2030. The figure below shows an estimate of the annual generation of these savings of around 9,5 Mtoe of final energy in cumulative value.

Figure 39 – Annual final energy savings expected from new measures promoted under the Bianchi Certificate (Mtoe) mechanism



❖ <u>**TAX DEDUCTIONS FOR ENERGY RETROFITTING AND RECOVERY OF BUILDING STOCK**</u>

In order to facilitate the renovation of residential buildings, several incentive measures have been put in place to date, which adopt the tax deduction mechanism. Among these:

- <u>Superbonus</u>: recognises, until 2025, a deferred deduction over 4 years with decreasing rates (110 %, 90 %, 70 %, 65 %) depending on the type of beneficiary, for energy and seismic regeneration measures. The measure is financed for approximately EUR 14MLDEUR from NRRP resources (M2C2-I.2.1), approximately EUR 4,5MLDEUR with resources from the National Plan complementary to the NRRP and national resources from budgetary planning 2021-2026.
  As of May 2024, the total number of sightings amounted to around 496.000 units, representing a total of around EUR 117 billion in investments eligible for funding (EUR 112 billion for works already completed);
- <u>Ecobonus</u>: recognises, until 2024, a deferred deduction over 10 years with varying rates (50-75 %) depending on the type of energy efficiency intervention carried out. The measure is financed by national resources from budgetary planning. From 2007 to 31 December 2022, more than 4.6 million operations were implemented and around EUR 38 billion in investments were activated; from 2014 to 2020, the investment rate mobilised was constant and slightly above the EUR 3MLDEUR alone, in 2021 and 2022 alone, also thanks to the instruments of the sale of the credit and discount on invoice, more than EUR 2 million of investments were carried out, or around EUR 14.4 billion in investments;
- <u>Home bonus</u>: acknowledges, until 2024, a deferred deduction of 50 % in 10 years for individual building retrofitting, including energy efficiency measures;

- Household appliance bonuses: acknowledges, until 2024, a deferred deduction of 50 % for the purchase of high-efficiency household appliances in 10 years;
- Sismabonus: acknowledges, until 2024, a deferred deduction over 10 years with variable rates (50-85 %) for measures to reduce the seismic risk of buildings, including in conjunction with energy efficiency measures;
- Other bonuses: they grant variable deductions (50-75 %) over 5-10 years for individual non-energy interventions such as green Bonus and Bonus to remove architectural barriers. In addition, the Water Bonus and the Electric Revival Bonus were active until 2021 and the façade bonus until 2022.

These deductions are also accompanied by supporting financial instruments, namely the transfer of the debt and the discount on the invoice referred to in Article 121 of Decree-Law No 34/2020.

Planned evolutionary lines

In order to respond to the challenging targets for the residential sector in 2030 and 2050 laid down in the new EED and EPBD ('green case') directives and this Plan, it is envisaged to implement a general reform of deductions, which addresses with an integrated and efficient approach the renovation of existing residential buildings and exceeds the current fragmentation of the various deductions currently in place.

An integrated approach would make it possible to optimise the timescales and costs of renovating a building, encouraging deep renovation measures with a view to sustainability affecting various areas: energy efficiency, renewable energy production and electrification of consumption; digitalisation of buildings and dialogue with other infrastructure such as transport; safety with regard to seismic aspects and firefighting; environmental protection in relation to the reduction of water consumption and the use of green.

The reform of the regulatory framework will therefore cover all these aspects together, providing for a modulation of benefits according to the overall performance achieved by the building, to be achieved through interventions with various levels of priority. The reform will have to last for at least 10 years in order to respond to the challenging targets for the residential sector. In particular, it shall:

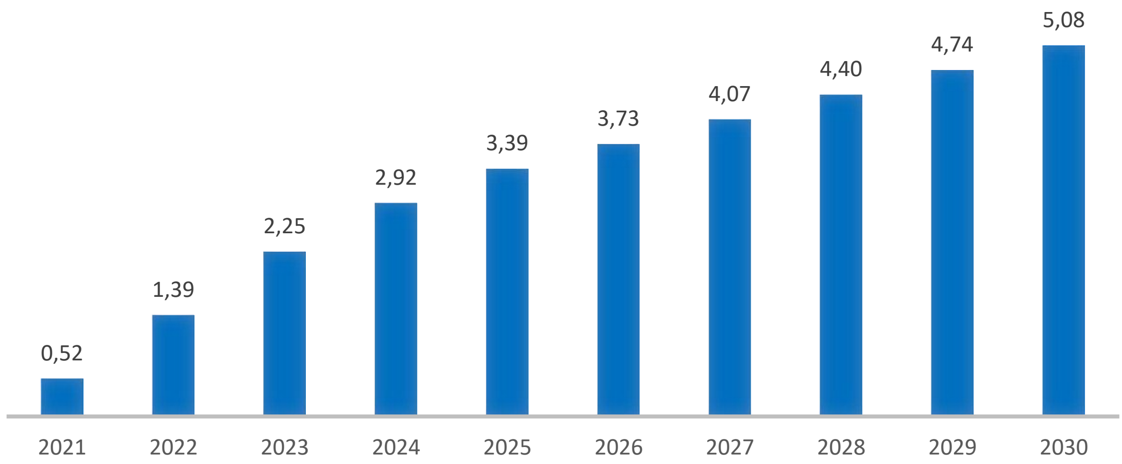
- it is mainly addressed to building units subject to the obligation of Directive 1275/2024 known as 'green case' (first houses, building units with low energy class, situations of energy poverty, etc.);
- ensure benefits distributed over a maximum of 10 years;
- allow both individual and deep energy retrofitting (combination of several interventions);
- ensure reduced benefits for individual interventions and, for deep energy retrofitting, increasing benefits depending on the energy performance achieved, also taking into account seismic performance for high-risk areas. Energy interventions will be 'driving' in relation to all other interventions;
- ensure specific all-encompassing maximum costs both for individual interventions and for deep energy retrofitting, simple verification and unambiguous measures for the entire national territory;
- be accompanied by financial support instruments, such as low-interest financing, including to cover total investment costs, with favourable conditions for people affected by energy poverty. In this context, synergies with the reform of the National Energy Efficiency Fund are also envisaged.

Estimated energy savings achievable

The results achieved by the activation of the instrument to date have been significant and allow an estimate of the savings potential of the mechanism in future years and until 2030. The figure below shows the estimated annual savings that can be achieved until 2030, taking into account the contributions linked to the existing measures, i.e. those resulting from new investments stimulated by the reform.

The overall contribution of the measure to the above targets is approximately 32,5 Mtoe of final energy in cumulative value.

Figure 40 – Final energy savings for tax deductions (Mtoe)



❖ **<u>TERMICO ACCOUNT</u>**

The Termico Account is the tool made available to private individuals and to the public authorities to encourage small measures to increase energy efficiency and to produce thermal energy from renewable sources. The mechanism is governed by the Ministerial Decree of 16 February 2016, which updated the Ministerial Decree of 28 December 2012, which contributes to the achievement of the national targets for renewable energy and energy efficiency.

The measures that can be incentivised through the Termico account are aimed at upgrading the building stock through a process of transforming the construction and installation design by replacing pre-existing elements and work to achieve efficiency by stimulating the reduction of the demand for heat, the production of energy required through more efficient appliances and, finally, the use of renewable sources for the production of the heat required for end uses.

From the launch of the Mechanism (2013) to 31 December 2023, some 683 thousand requests for incentives and committed EUR 2 billion and EUR 245 million were received, of which:

- EUR 821 million for operations carried out by the PA;
- EUR 1 billion and EUR 424 million for private actions.

In 2023, more than EUR 326 million of incentives were granted direct access through the Termico account, of which more than EUR 212 million was granted to private entities for the production of thermal energy from renewable thermal sources and over EUR 114 million for energy efficiency and heat production from renewable thermal sources in public administration buildings.

The incentives reserved by the PA in 2023 amount to approximately EUR 136 million, in particular for nZEB buildings (approximately EUR 105 million).

Between 2013 and 2023, around 631 direct access requests were contracted with the Termico account for plants for the production of thermal energy from renewable thermal sources, in particular biomass generators (around 376 measures), solar thermal installations (over 169 interventions) and heat pumps (around 82 measures).

In 2023, there was a 22 % growth in the number of thermal renewable plants contracted under the Termico Account Mechanism, compared to 2022; this trend is driven in particular by heat pumps (+ 116 %) and solar thermal (+ 31 %). The evolution of the biomass sector remains almost constant at the sustained levels of the past.

The final energy savings resulting from interventions carried out on a cumulative basis 2021-2022 amount to 0,483 Mtoe.

Planned evolutionary lines

Although the Termico account started with low demand volumes, it has shown an important trend of increasing results, particularly for the renovation of public administration buildings through the use of the booking tool. The mechanism of the Termico account is an incentive instrument that is suitable for encouraging the implementation of measures to improve the efficiency of public administration buildings, both because they are denied access to tax deductions and the possibility of access to incentives by booking, which is useful not only for the possibility of recognising incentives in advance of the implementation of the measures, but also because it can facilitate access to additional complementary sources of funding. For this reason, it is planned to adjust the ceiling available to the PA.

The process of updating the framework of the Termico Account is underway, taking into account the evolutive lines set out in national legislation and the Memorandum of Understanding establishing the 'Action Plan for the Improvement of Air Quality' signed by the competent central government authorities and the regions and autonomous provinces involved in the problem of exceedances of air pollutant limits. The evolution of the reference regulatory framework for energy efficiency has also contributed to the revision of the Framework. In particular, it notes the update of the directives on the energy performance of buildings (EPBD), energy efficiency ('EED') and the promotion of renewable sources (RED).
From 28 March 2024 to 10 May 2024, the public consultation on the draft Conto Termico Decree 3.0 took place, with the aim of sharing the main contents of the update and gathering comments and insights from stakeholders, including on the impact on competition and the proportionality of the measure, for the conclusion of the process of drafting the Decree.

In the draft Conto Termico Decree 3.0, the range of entities expanded and diversified. It is envisaged that renewable energy communities, self-consumption configurations and third sector entities can also participate in the incentive mechanism. Private entities, including entities in the third sector, are expected to: in residential civil matters, the possibility of incentivising only small interventions for RES heat production and for the installation of high-efficiency systems; in the field of non-residential civil matters, all the operations eligible for benefit from the 3.0 Termico Account.

With regard to eligible interventions, energy efficiency, the following measures are added:

- installation of infrastructure elements for private charging of electric vehicles, including open to the public;
- installation of solar photovoltaic installations and related storage systems, in the building or its appliances.

There is a binding condition for these interventions: are carried out in parallel with the replacement of existing winter air-conditioning systems with electrically driven heat pumps.

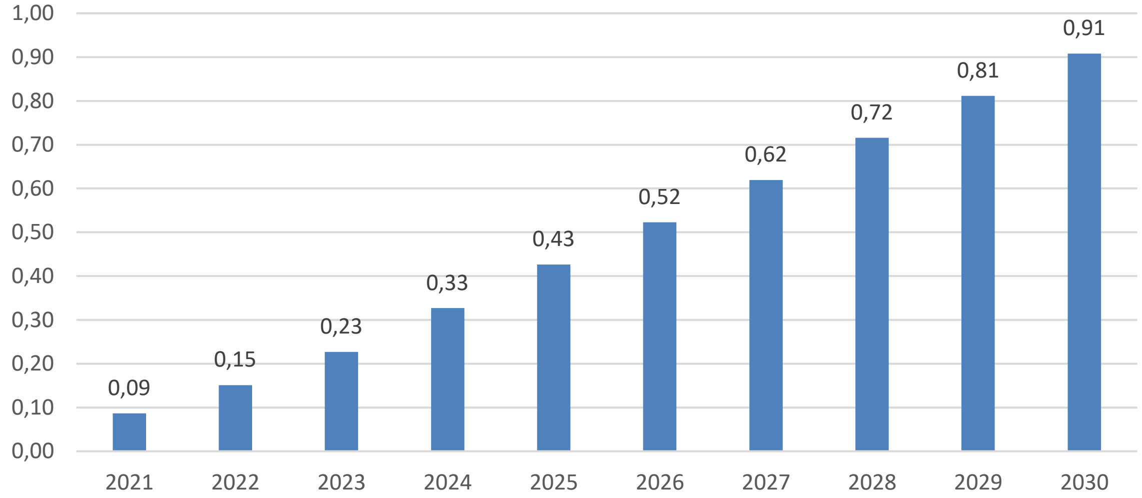
With regard to small measures for the production of thermal energy from renewable sources and high-efficiency systems, the list is more structured, seeing the disappearance of the incentive for condensing boilers and adding the installation of renewable micro-cogeneration units and the connection to district heating. For each operation, the specific eligibility conditions are then detailed, in addition to the fact that expenditure ceilings and arrangements for accessing the contribution are in place.

Also in the context of the Termico account, in order to promote the use of thermal energy from renewable sources, in implementation of the provisions of Article 10 of Legislative Decree 199/2021, the study is ongoing to establish an auction mechanism to incentivise plants for the production of thermal energy from renewable sources.

Estimated energy savings achievable

The results achieved by the activation of the instrument to date make it possible to estimate the savings potential of the mechanism in future years and until 2030. The figure below shows the estimated annual savings that can be achieved until 2030. The overall contribution of the measure to the above targets is approximately 4,8 Mtoe of final energy in cumulative value.

Figure 41 – Final energy savings foreseen for the Termico Account (Mtoe)



❖ **<u>NATIONAL ENERGY EFFICIENCY FUND</u>**

The National Energy Efficiency Fund (FNEE), established by Article 15 of Legislative Decree No 102/2014, is a mixed fund intended to finance energy efficiency measures. Active since May 2019, it has been governed by the Ministerial Decree of 22 December 2017 and managed by Invitalia, with a budget of approximately EUR 350 million. The FNEE is divided into two sections: 30 % of the resources are earmarked for the granting of guarantees and 70 % for the provision of subsidised financing, with a rate of 0.25 %.

From the start of the Facility to 31 December 2023, 24 energy efficiency projects have been eligible for funding, with a total value of around EUR 19 million, corresponding to more than EUR 34 million of investments activated, with expected savings of around 4 ktoe.

Planned evolutionary lines

Under the NRRP (M2C3), reform 1.1 "*Simplification and acceleration of procedures for energy efficiency measures"* included updating and upgrading the FNEE *(under reform 1.1c*).

This reform was implemented by means of Article 1 (514) of Law No 234 of 30 December 2021, which introduced a non-repayable share, as an additional tool to accompany those already active.

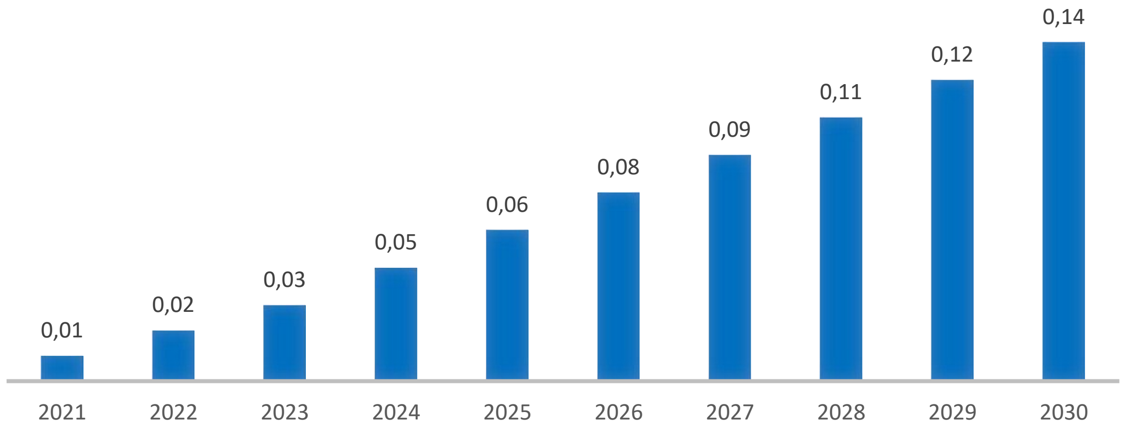
In addition, a deeper reform of the measure is being finalised, which insists on the following points:

1. improve the effectiveness of the subsidised financing instrument by activating the capital section referred to in Law No 234/2021. The provision is to target the contribution exclusively to measures relating to the public non-residential civil sector and to any intervention carried out through EPC contracts;
2. activate the Guarantee Section, including for the civil residential sector. The provision is to finalise the decree to activate the section and, within that section, to introduce a sub-section dedicated to energy renovation measures for buildings within the framework of the Ecobonus, in accordance with Law No 205/2017;
3. improve the promotion of the Facility. It is envisaged to introduce a communication campaign, which will see Invitalia an active part of the process, together with GSE and ENEA, as operators of other measures that can be combined with the advantages of the FNEE (white certificates, thermal accounts, tax deductions), which could create a financial "product" that is attractive to the market;
4. reduce the complexity of the mechanism through the exclusive application of the GBER, simplify the objective scope of the measure in relation to the personal scope, eliminate the steering booth as the body issuing the final outcome of individual investigations, simplify the investigation procedure by coordinating with other facilitative instruments;
5. introduce other measures to strengthen and adapt to the new GBER, also aimed at greater coordination with other facilitative instruments in cases of possible cumulation with the latter.
6. improve the effectiveness of the measure by working together with the EIB, with the provision for the establishment of a Fund for the Funds.

Estimated energy savings achievable

The Fund has been fully operational since May 2019. The figure below shows the estimated annual savings that can be achieved until 2030, based on the performance of the measure at 2021. The overall contribution of the measure to the above targets is approximately 0,7 Mtoe of final energy in cumulative value.

Figure 42 – Final energy savings foreseen for the National Energy Efficiency Fund (Mtoe)



❖ **<u>TRANSITION PLAN 4.0 AND 5.0 (EX ENTERPRISE PLAN 4.0)</u>**

It is a measure that brings together several legislative measures to provide tax credits to stimulate investment by companies in innovation and sustainability, including:

- tax credit for investment in capital goods: to support and incentivise companies that invest in new, tangible and intangible capital goods that are instrumental in the technological and digital transformation of production processes;
- tax credit for research and development, technological innovation, design and aesthetic design: to stimulate investment in research and development, technological innovation, including in the context of paradigm 4.0 and the circular economy, design and aesthetic conception;
- training tax credit 4.0: it aims to support businesses in the technological and digital transformation process by creating or consolidating the skills in enabling technologies needed to achieve the paradigm 4.0.

Planned evolutionary lines

Article 38 of Decree-Law No 19 of 2 March 2024 (so-called PNRR Decree) launched the measure called Transition 5.0, as an integral part of Mission 7 ‘REPowerEU’. The budget is EUR 6.3 billion for the years 2024 and 2025. The entry into force of this measure is subject to the adoption of the inter-ministerial implementing decree which is being published.

The measure is an evolution of the 4.0 Plan concept and promotes investment in new digital technologies aimed at rationalising energy consumption. There are two separate routes for investment in new capital goods on Italian territory: the 4.0 digital transition and the most ambitious digital and energy transition 5.0. The benefits offered by both transitions for the same investment are not allowed to be cumulated.

Transition 5.0 requires the achievement of specific energy efficiency targets through the adoption of goods 4.0 and provides incentives for different investment categories, including digital assets 4.0, the installation of devices for self-generation of energy from renewable sources and staff training programmes.

The procedure for accessing the tax credit involves the Energy Services Manager (GSE) and includes various stages, from booking to final certification. It is necessary to provide regular reporting and technical certifications attesting to the energy savings achieved, as well as verification by the statutory auditor and confirmation of the integration of assets into the company.

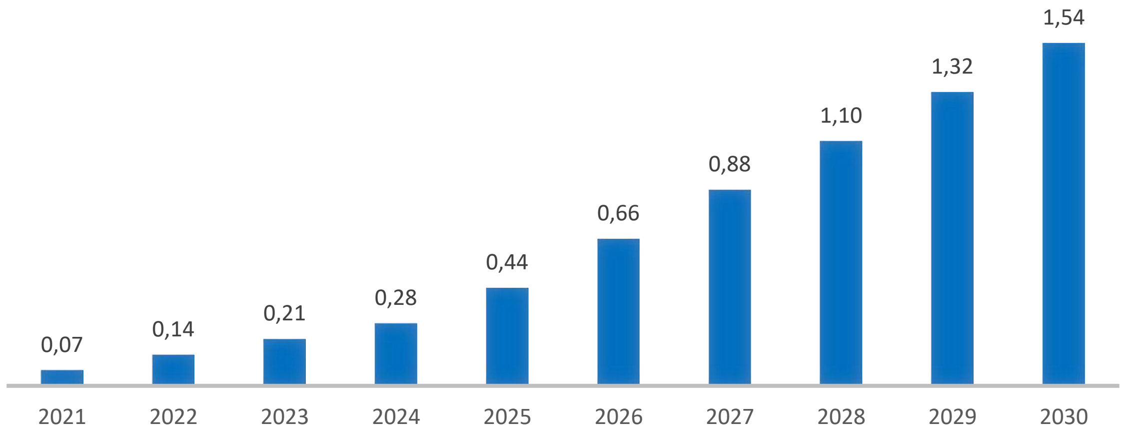
The amount of the tax credit is related to expenditure incurred and may be up to 45 % on the basis of the actual reduction in energy consumption obtained. For SMEs, additional incentives are foreseen regarding the costs of energy-saving certifications. The method of use provides for compensation via F24 by 31 December 2025, with the possibility of settling any remaining allowances in 5 equal annual instalments.

In summary, Transition 5.0 provides a structured and targeted incentive to encourage investments that combine digitalisation and energy savings, with more advanced rules of use and monitoring than in the previous Transition Plan 4.0.

Estimated energy savings achievable

For energy efficiency measures carried out in accordance with the Transition Plan 4.0 and 5.0, a cumulative saving of 2030 Mtoe of final energy was estimated at 6,6 Mtoe of final energy, assuming that the measures described above in the Industry 4.0 Plan, or similar, remain in place until 2030.

Figure 43 – Final energy savings foreseen for Transition Plan 4.0 and 5.0 (Mtoe)



❖ **ENERGY REHABILITATION PROGRAMME FOR THE PUBLIC ADMINISTRATION (PREPA) (FORMERLY PREPAC)**

The objective of the programme is to achieve an annual efficiency of at least 3 % of the useful air-conditioned area of the State's building stock through the provision of capital financing amounting to 100 % of the eligible costs, as provided for in Article 5 of Legislative Decree No 102/2014. The projects are evaluated with technical support from GSE and ENEA, while funding is granted by MASE. However, the implementation phases are managed directly by the Ministry of Defence for the buildings in charge of which it is responsible, or by the Provveditorati per le Opere Pubbliche, including with the support of the Demanio Agency. The project proposals approved in the period 2014-2 018 have always ensured that the upgrading target is met, with lower performance since 2019. Out of some 310 projects approved as at 30 April 2024 (around EUR 428 million of investment), 86 are being carried out and/or completed.

Planned evolutionary lines

In order to speed up the implementation phase of the projects, under the RRP (M2C3), reform 1.1 "*Simplification and acceleration of procedures for energy efficiency interventions"* included a reinforcement of the PREPAC *(under reform 1.1d*). To this end, Article 19 of Decree-Law No 17/2022 introduced a provision under which the Demanio Agency may assist interregional public works provveditorates in carrying out the measures, including by using electronic purchasing and negotiation tools.

Taking into account, however, that, in implementing Legislative Decree No 102/2014, the measure will be active until 2030, it is considered appropriate for a thorough reform of the measure, also in view of the minimum requirement for energy retrofitting of buildings in all local public administrations and the minimum annual energy savings imposed by the EED Directive when it is published. Consequently, it is envisaged to create a mechanism for allocating this obligation at regional level, maintaining central governance at MASE. The system should therefore include:

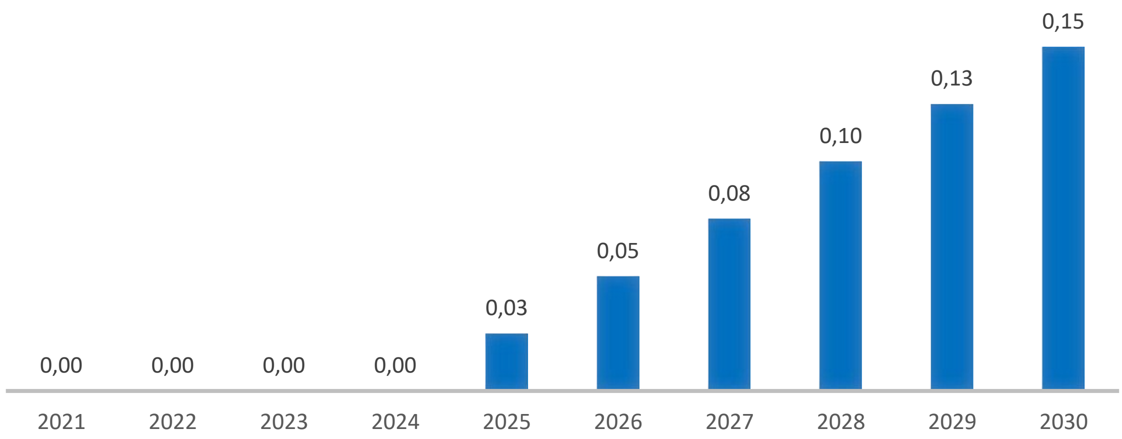
- a quantification of the obligations (central and regional), on the basis of a precise identification of the building stock concerned, including the information from the National Portal on the energy performance of buildings;
- the establishment of a regulatory framework for linking all existing national mechanisms (thermal accounts, FNEE, Kyoto Fund, white certificates) affecting public administration buildings in order to maximise the use of resources;

- the provision that all regional sector programmes must contribute to achieving this objective;
- the introduction of simplification measures for the implementation of energy efficiency measures, both with reference to the Public Procurement Code and with regard to the use of CONSIP negotiation tools;
- the definition of an incentive mechanism for interventions or types of buildings not already covered by other national measures, providing for incentives of up to 100 % of eligible costs, mainly using the capital contribution, possibly supported by the share of low-interest financing;
- the establishment of a detailed monitoring system for all the mechanisms currently in place (both national and regional) affecting public administration buildings.

Estimated energy savings achievable

For energy efficiency interventions carried out in accordance with the prepa, cumulative savings in 2030 were estimated at 0,54 Mtoe of final energy, resulting from new projects carried out from 2025 onwards and estimated on the basis of the achievement of the retrofitting target set out in Article 6 EED III.

Figure 44 – Final energy savings under the prepa measure (Mtoe)



❖ **INFORMATION AND TRAINING PROGRAMMES FOR ENERGY EFFICIENCY**

Article 13 of Legislative Decree No 102/2014 provided that ENEA, from 2021 until 2030, is to implement a three-year information and training programme (BIP) aimed at promoting and facilitating the efficient use of energy. The cornerstones of the first BIP 2021-2 023 are the enhancement of active incentive instruments and the promotion of a culture aimed at the renovation of buildings. The BIP is the framework for communication and dissemination activities of the initiative: Italy in Class A, national campaign carried out by ENEA.

Planned evolutionary lines

Legislative Decree No 102/2014 provides for an amount of EUR 3 million for each of the years 2021 to 2030, from the share to be paid by the Ministry of the Environment and Energy Security (MASE) of the annual revenues from the auctioning of CO_2 emission allowances.

In the period 2021-2030, further emphasis will be placed on information and training activities and the launch of a new programme will therefore be assessed on the basis of the experience with the BIP being implemented. In any case, the following will be ensured:

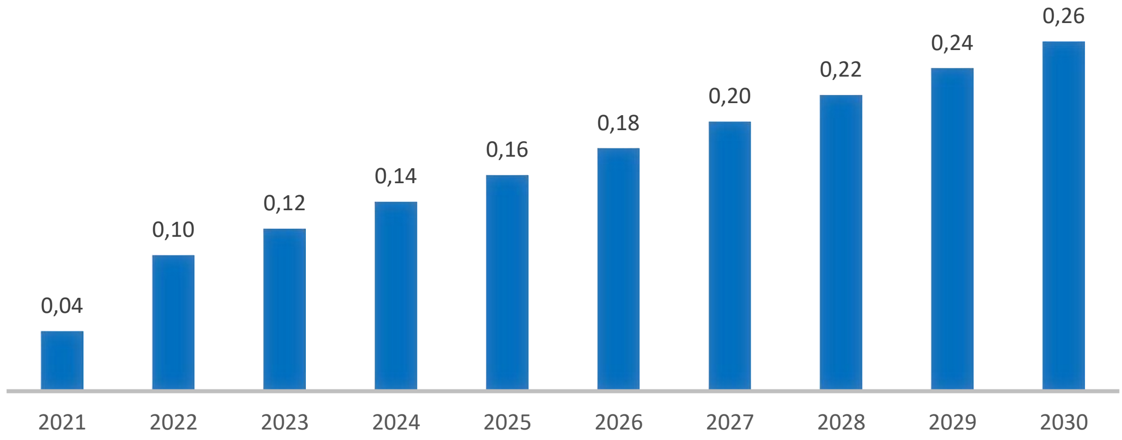
- the valorisation of active incentive instruments;
- promoting energy efficiency in the civil sector (residential and tertiary);
- promoting the decarbonisation of the industrial sector through end-use efficiency, electrification of consumption and renewable gases in hard-to-abated sectors, including by valorising the activities carried out in the field of energy audits.

Finally, the topic of monitoring the savings generated by awareness-raising policies will be further explored in order to provide ever more robust support for decisions in this area, as well as for the achievement of energy efficiency targets.

Estimated energy savings achievable

For energy efficiency measures carried out through consumer information and training programmes, a cumulative saving of 1,7 Mtoe of final energy was estimated at Mtoe of final energy in 2030.

Figure 45– Annual final energy savings expected from the information and training programme (Mtoe)



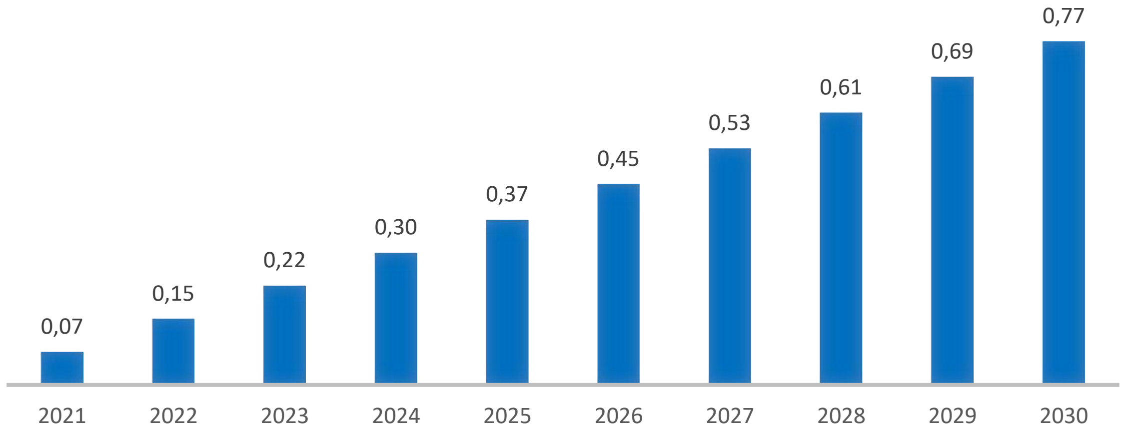
❖ **<u>KYOTO FUND</u>**

For the description of the measure and its main development lines, see Part VIII of this paragraph.

Estimated energy savings achievable

For energy efficiency actions under the Kyoto Fund, cumulative savings of 4,2 Mtoe of final energy were estimated to be Mtoe of final energy in 2030.

Figure 46– Annual final energy savings expected from the Kyoto Fund (Mtoe)



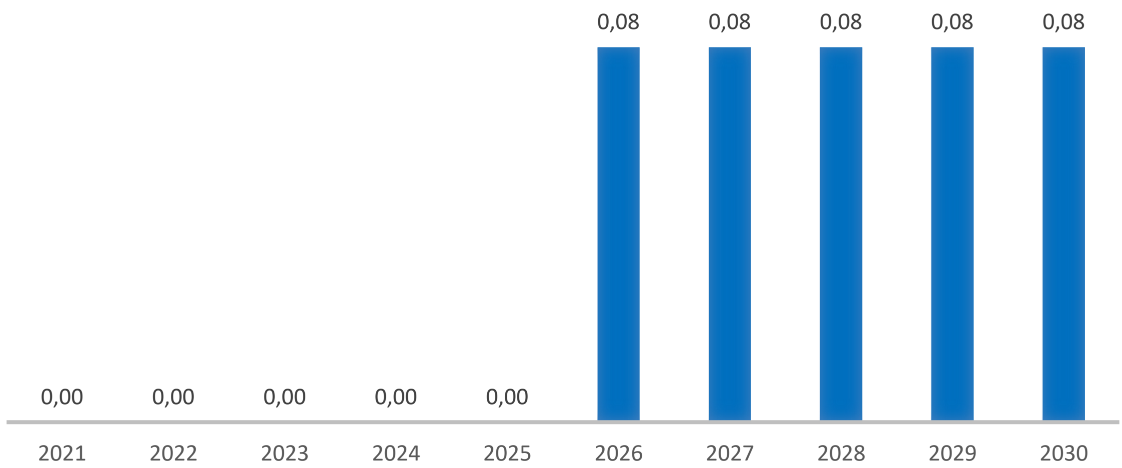
❖ **NRRP MEASURES**

For the description of the measures, see Part VIII of this paragraph.

Estimated energy savings achievable

For energy efficiency measures carried out under the NRRP measures, a cumulative saving of 2030 Mtoe of final energy was estimated at 0,4 Mtoe of final energy.

Figure 47– Annual final energy savings expected from NRRP measures (Mtoe)



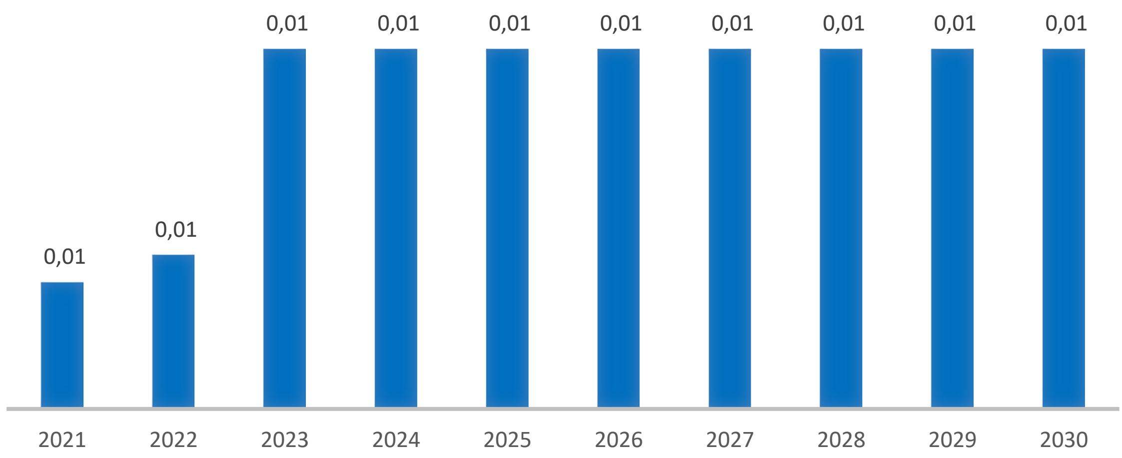
❖ **COHESION POLICIES**

For the description of the measures, see Part VIII of this paragraph.

Estimated energy savings achievable

For energy efficiency interventions carried out through cohesion policies, a cumulative saving of 0,07 Mtoe of final energy was estimated at Mtoe of final energy in 2030.

Figure 48 – Annual final energy savings expected from cohesion policies (Mtoe)



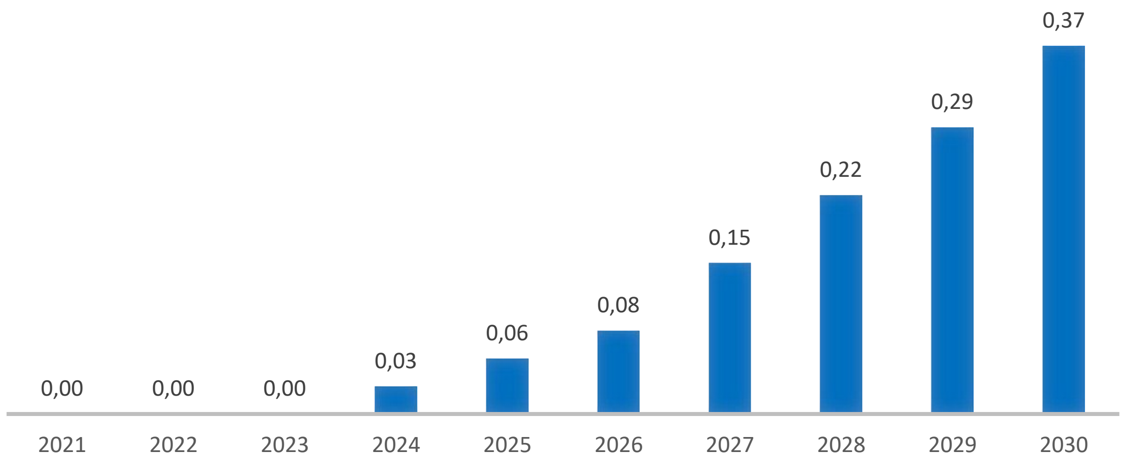
❖ **ENERGY SAVING TARGET FOR PUBLIC ADMINISTRATION**

For the description of the public administration energy savings target, please refer to Par. 2.2 (4) where the calculation of the target under Article 6 EED III is carried out.

Estimated energy savings achievable

Assuming the achievement of this target, a cumulative saving of 2030 Mtoe of final energy was estimated at 1,19 Mtoe.

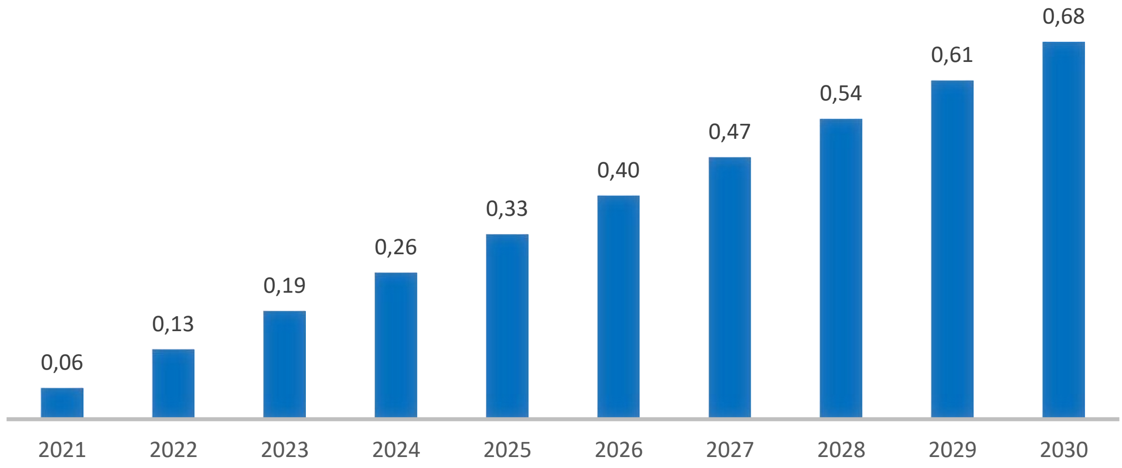
Figure 49 – Annual final energy savings expected from the public administration savings target (Mtoe)



✞ **MINIMUM REQUIREMENTS FOR EDIFICAL AND GESTIONS OF TERMIC IMPLANTS**

The estimate of the energy savings resulting from the application of the minimum efficiency requirements laid down in the EPBD for existing buildings subject to renovation, corrected by the savings of the measures accessing the incentive mechanisms described in this paragraph, as well as the effects of the application of the update of Presidential Decree No 74/2013 on the management of thermal installations (see description of the measures in Chapter 2.2) amountsto 3,7 Mtoe of final energy savings in terms of cumulative savings in 2030.

Figure 50 – Annual final energy savings expected from minimum requirements (Mtoe)



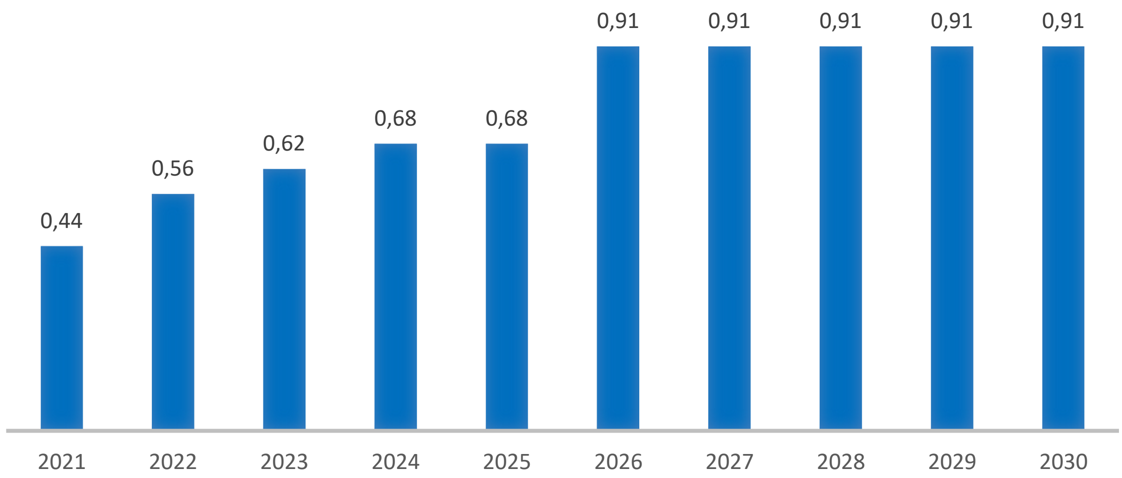
❖ **SUSTAINABLE MOBILITY PACKAGE**

There are a number of national and local measures active in the transport sector aimed at reducing consumption and emissions. The overview of the main measures in the transport sector is provided in paragraph 3.1.3 on, inter alia, low-emission mobility. This paragraph addresses two types of measures that are expected to make a significant contribution to achieving the minimum energy savings target set for mandatory schemes. They are:

- the renewal of the local public transport fleet;
- measures to promote modal shift in freight transport;
- the vehicle eco-bonus;
- the electrification of quays, or cold ironing.

It has been estimated that, as a result of all the measures envisaged to promote energy efficiency in the transport sector, a cumulative savings of around 8,3 Mtoe of final energy will be achieved in 2030.

Figure 51 – Annual final energy savings expected from sustainable mobility measures (Mtoe)



A brief analysis of the main measures included in the Sustainable Mobility Package is set out below.

❖ **RENEWAL OF LOCAL PUBLIC TRANSPORT FLEET**

For the description of the measure and its main development lines, see paragraph 3.1.3.

Estimated energy savings achievable

It has been estimated that, as a result of the measures envisaged for the renewal of public passenger vehicles, a cumulative savings of 0,02 Mtoe of final energy will be achieved in 2030.

❖ **MODAL SHIFT IN FREIGHT TRANSPORT (MAREBONUS, FERROBONUS)**

Two measures are in place to encourage modal shift in freight to modes of transport (ship, rail) with lower energy consumption per tonne kilometre transported: Marebonus and Ferrobonus.

The Marebonus provides, in accordance with Article 1 (649) of Law No 208 of 28 December 2015, for contributions to implement modal choices aimed at improving and optimising the intermodal chain, thereby decongestion of the road network and reducing the negative externalities of freight transport by increasing the use of Ro-Ro and Ro-Pax maritime services arriving in and/or departing from ports located in Italy to ports located in Italy or in the Member States of the European Union or the European Economic Area.

The Ferrobonus is an incentive measure in favour of economic operators who make transport choices in favour of combined or intermodal rail transport as an alternative to the entire road. The legal basis for the measure is Article 1 (648) to (649) of Law No 208/2015, by which the Italian Government provided for the allocation of State resources to undertakings using rail for the combined transport of goods, with origin or destination in logistics hubs in the national territory or Member States of the European Union or the European Economic Area.

Planned evolutionary lines

The Ferrobonus measure was financed by Budget Law No 2021 of 30 December 2020 (Law No 178 of) until 2026 and by additional funds provided until 2 030 in Interministerial Decree No 347/2022 among the categories of intervention of the 'Sustainable Mobility Strategy Fund'.

The Marebonus measure was financed by Budget Law 2021 (Law No 178 of 30 December 2020) until 2026. For the purposes of this calculation, it is assumed that it is extended until 2030.

Estimated energy savings achievable

It has been estimated that, as a result of the measures envisaged to promote the modal shift in freight transport (Ferrobonus and Marebonus), a cumulative savings of around 3,9 Mtoe of final energy will be achieved in 2030.

❖ **VEHICLE ECOBONUS**

The measure consists of a contribution to the purchase, with or without scrapping, of more efficient vehicles with reduced $CO2_{emissions}$. The subsidy is recognised as the lower price charged by the operator on the invoice at the time of purchase. The discount on the purchase price is then recovered in the form of a tax credit for manufacturers and importers.

The categories of vehicles promoted include:

- Electric, hybrid and thermal motor cars with an emission level of up to 135 gr/km CO_2;

- Electric and non-electric motorcycles and mopeds of a type approval class of Euro 5 or more;
- Electric commercial vehicles.

Planned evolutionary lines

The measure currently includes appropriations up to 2024 for the following amounts:

- Year 2021: EUR 1.148 million;
- Year 2022: EUR 630 million;
- Year 2023: EUR 630 million;
- Year 2 024 640 million.

In June 2024, bookings for the Ecobonus incentive were reopened following the entry into force of the new Prime Ministerial Decree of 20 May 2024, published in the Official Journal of 25 May 2024.

From that date, it was possible to include on the Ecobonus platform, managed by Invitalia, bookings for contributions for the purchase of non-polluting vehicles of category M1 (motor vehicles), L1e – L7e (motorcycles and mopeds), N1 and N2 (commercial vehicles).

Under the new decree, subsidies for the purchase of used M1 vehicles and N1 and N2 commercial vehicles may also be booked for non-electric power supplies.

The subsequent notice will also indicate the dates and procedures for the reservation of contributions for the purchase of vehicles of category M1 to be used for taxi or hire with drivers and the contributions for the installation of LPG and Metano installations on vehicles of category M1.

Below is a summary table of the measure for electric cars.

Table 43 – Automatic Ecobonus measure: new car contributions, category M1 (values in EUR)

	Electric		**Plug-in hybrids**		**Band 61-135 g CO2/km**
Plateau	*Natural and legal persons*	*Natural persons with ISEE EUR 30.000*	*Natural and legal persons*	*Natural persons with ISEE EUR 30.000*	*Individuals*
Without scrapping	6.000	7.500	4.000	5.000	0
Scrapping EUR 0, 1, 2	11.000	13.750	8.000	10.000	3.000
EUR 3 scrapping	10.000	12.500	6.000	7.500	2.000
EUR 4 scrapping	9.000	11.250	5.500	6.875	1.500
EUR 5 scrapping	0	8.000	0	5.000	0
Maximum incentive price threshold, excluding VAT	35.000		45.000		35.000

The EUR 200 million allocated to the emission band between 0 and 20 g/km ended in less than ten hours after the opening of reservations.

❖ ELECTRIFICATION OF COLD IRONING

It is a programme of infrastructure measures in ports that are mutually reinforcing and complementary to the National Recovery and Resilience Plan (NRRP) referred to in Ministerial Decree No 330 of 13 August 2021 – MIT. The objective of the measure is to electrify quays in order to increase energy efficiency, reduce dependence on oil products and reduce the emission impact within ports often located within built-up areas. The measure is in line with Directive 2014/94/EU (DAFI Directive), which establishes a common framework of measures for the deployment of alternative fuels infrastructure in the European Union. This Directive requires the establishment of a shore-side electricity supply network with the aim of completing it by 31 December 2025, preferably for ports on the TEN-T core network as well as for other ports unless there is demand and/or costs are disproportionate to the benefits, including environmental benefits. The proposed investment, in line with the national decarbonisation objectives in terms of energy efficiency in transport, is proposed to establish an electricity network with an installed electricity capacity of 682 MW divided into 34 ports, of which 32 are part of the TEN-T network. It consists of the establishment of a network of systems for the supply of electricity from shore to ships during the berth phase, so as to minimise the use of auxiliary on-board engines for self-generation of the necessary electricity, significantly reducing CO_2 emissions, nitrogen oxides and thin dust. The resources allocated to the 'Cold Ironing' measure (PNC- Inv.11) amount to a total of EUR 675.63 million, of which EUR 326.43 million was earmarked for interventions by the southern regions (around 48.32 %) and EUR 349.20 million for interventions by the regions of the Centre – North (approximately 51.68 %).

Estimated energy savings achievable

It has been estimated that, as a result of the cold ironing measure, a cumulative savings of around 1,2 Mtoe of final energy in 2030 will be achieved.

❖ SUMMARY OF MEASURES

Italy, as described in the previous paragraphs, proposes to achieve the final energy savings calculated on the basis of Article 8(1) EED by means of several key mechanisms, already activated or to be activated at national level.

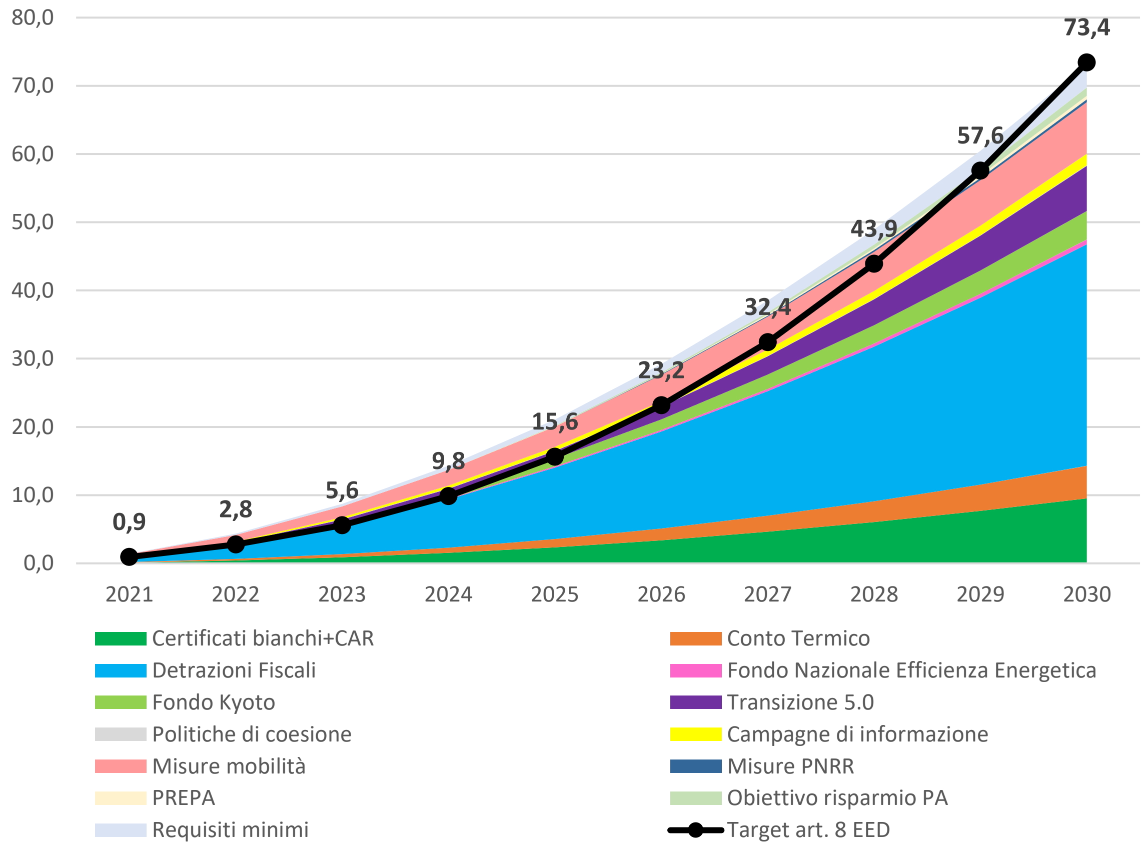
A summary table summarises the main elements of the instruments described below.

Table 44 – summary of measures to achieve the objectives of Article 8 EED and the main sectors to which they are addressed

Type of measure	Title of measure	Sectors				Energy poverty
		Residential	Tertiary	Industry	Transport	
Type of measure	**Title of measure**	**Sectors**	**Energy poverty**	**Type of measure**	**Title of measure**	**Sectors**
	Tax relief	**Residential**	**Tertiary**			**Residential**
	White Certificates	X	X	Mandatory scheme	White Certificates	X
	Tax relief	X	X	Alternative measures	Tax relief	X
	Termico account	X	X	X	Termico account	X
	National Energy Efficiency Fund	X	X		National Energy Efficiency Fund	X
Alternative measures Mandatory scheme Alternative measures	Transition Plan 4.0/5.0		X	X	Transition Plan 4.0/5.0	
	PREPA		X	X	PREPA	
	Cohesion policies	X	X	X	Cohesion policies	X
	Information plan and training	X	X		Information plan and training	X
	NRRP measures		X		NRRP measures	
	Kyoto Fund		X		Kyoto Fund	
	Saving public bodies		X		Saving public bodies	

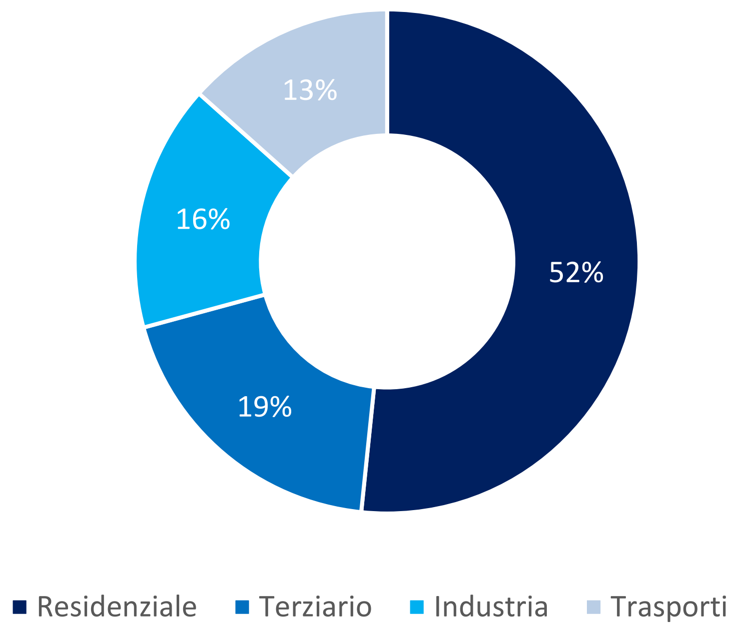
The figure below gives an overview of the cumulative savings targets allocated to the proposed mechanisms. Against a minimum target of final energy savings under Article 8 EED of 73,4 Mtoe, preliminary estimates of the impact of the proposed mechanisms lead to sufficient cumulative savings to meet the obligation. Using the annual results provided by the tested monitoring tools already used in 2014-2020, it will be possible to act if there is insufficient progression of savings to reach the targets and to propose appropriate updates where deviations between objectives and results are observed.

Figure 52 - Overview of achieving savings (Mtoe of final energy)



The graph below gives an indicative assessment of the sectoral breakdown of cumulative savings estimated to be achieved by 2030 from the measures described.

Figure 53 - Overview of expected savings 2021-2030 from energy efficiency promotion measures, by sector (percentage)



As is clear from the graph above, it will be necessary to assess the measures needed to increase savings in the transport sector, also in order to contribute to the achievement of the emissions reduction target in the Effort Sharing sector. It will therefore be important to promote measures to reduce the demand for private transport (modal shift, soft mobility), to develop and improve public infrastructure, including measures to expand and modernise rail transport networks and to optimise logistics and digitalise motorway management.

In order to strengthen the monitoring system for all active measures and to promote energy efficiency in all sectors, further national portals, including for industry and transport, will be considered alongside *the National Portal on the Energy Performance of Buildings* described in the following paragraphs. These portals could provide useful information and technical support to MASE and other public administrations, to monitor national targets for energy efficiency and renewable energy integration, and to develop strategies, programmes and measures to promote energy efficiency. With this in mind, they will also be able to provide information and promote energy efficiency by collecting best practices in the sector.

In the industrial sphere, it will be assessed to put in place all information from the ETS mechanism, white certificates, high-efficiency Cogeneration, Energy Diagnoses and other incentive measures for renewable sources, including hydrogen.

Similarly, in the field of transport, the instrument can put in place sectoral policies implemented in the various ministries (MASE, MIMIT and MIT) by creating new synergies.

II. Long-term renovation strategy to support the renovation of the national stock of residential and non-residential buildings, both public and private[74], including policies, measures and actions to stimulate deep and cost-effective renovations of buildings and

[74] In accordance with Article 2a of Directive 2010/31/EU.

policies and actions to address the segments of the national stock of worst-performing buildings, in accordance with Article 2a of Directive 2010/31/EU

At the end of November 2020, pursuant to Article 2-bis of Directive 2010/31/EU on the energy performance of buildings, as amended by Directive (EU) 2018/844, the*'Strategy for the energy retrofitting of the national building*stock' was adopted.

Pursuant to Legislative Decree No 48 of 10 June 2020 transposing Directive (EU) 2018/844 on the energy performance of buildings, the updating of the Ministerial Decree for minimum energy performance requirements for buildings (MiSE Decree of 26 June 2015).

For the purposes of dealing with these measures, reference is made to paragraph 2.2 (ii).
It is also foreseen:

- The introduction of measures to improve the quality of energy performance certificates (EPAs) and ways of encouraging the purchase of high-energy class dwellings.
- Promoting the adoption of demand response technologies, ICT and home systems enabling monitoring and monitoring of the performance of buildings, as also highlighted in the public consultation.
- Strengthening checks on compliance with regulations and standards.
- Improving the integration of energy efficiency rules and renewables in buildings. In this regard, we would like to refer to the rules on obligations for new buildings, existing buildings and buildings undergoing major renovation, laid down in Annex 3 to Legislative Decree No n.199/2021.. In particular, as regards the obligations to use renewable installations, new buildings, or buildings undergoing major renovations within the meaning of Legislative Decree No 28/2011, are expected to be designed and constructed in such a way as to ensure, through the use of renewable installations, that 60 % of the expected consumption for the production of domestic hot water and 60 % of the sum of the expected consumption for the production of domestic hot water, winter air conditioning and summer air-conditioning are met.
- The possibility of introducing energy efficiency requirements when renovating, where justified in terms of cost-effectiveness and the introduction of new limits on the use of cooling installations.
- Promoting synergies with renewables in self-consumption and energy communities, as also highlighted in the public consultation.

Particular attention will be paid to updating and integrating promotion instruments, which are planned to put in place actions to increase cost-effectiveness for beneficiaries and the country system and to stimulate deep renovations. The mechanisms for promoting measures in public administration buildings will also be strengthened, which will have to play an exemplary and leading role for the entire economic sector.

Key factors for the success of the measures mentioned are also the simplification of administrative procedures, the control and enforcement of the measures implemented, the strengthening and qualification of the ESCo model, communication and awareness-raising actions, the improvement of the monitoring and accounting system of results and support for research and innovation.

The systematisation at national level of all meteoclimatic data held in various ways by public and/or research bodies and continuous meteoclimatic data collection and certification campaigns will be considered, with a view to building a solid database for the implementation of simulation and energy certification models for dynamic buildings.

Finally, the adaptation of the duration of the heating season on the basis of updated meteoclimatic data and the introduction of a thermal season for summer cooling will be assessed.

III. Description of policies and measures to promote energy services in the public sector and measures to remove regulatory and non-regulatory barriers preventing the introduction of energy performance contracting and other energy efficiency service models[75]

Article 14 (4) of Legislative Decree No 102/2014 transposing the EED provided for the improvement of the EPC contractual model – already provided for in Legislative Decree No 192/2005 transposing the EPBD – by means of the minimum elements to be included in the energy performance contracts signed with the public sector, listed in Annex 8 to that Decree.

The recent amendments to the Code of Contracts pursuant to Article 8 (5) (c-quater) of Law No 120 of 2020 introduced the type of energy efficiency contract within the broader category of public private partnership operations. In this way, the legislator recognised that the public interest in energy efficiency, as well as having environmental benefits by reducing climate emissions and reducing energy dependency, is a driving force for economic growth. However, although the proposed model is targeted at public administrations to facilitate their contracting to promote energy efficiency in their buildings; its aim is to encourage the involvement of private operators (ESCo, credit institutions, etc.), in order to generate economies of scale, make the results to be achieved transparent and certain, there is still a low uptake of this contractual instrument today.

In order to address implementation difficulties and facilitate their dissemination, a dedicated working group has been set up at the initiative of the Ministry of Economic Affairs and Finance – Department of the General National Accounts Department, within the Inter-Institutional Table on Private Public Partnership Operations, with key institutions such as Anac, ISTAT, Anci, MASE, MIMIT and the Department for Planning and Coordination of Economic Policy of the Prime Minister's Office to define the minimum technical, economic and legal conditions that can facilitate the use by public authorities of this type of contract. In this regard, it is envisaged to publish a format for a 'Standard Energy Performance Contract for Public Buildings', capable of guiding and supporting public administrations in using this contractual instrument, which can also affect the performance of the technical services requested, but also on the economic and financial management of the administration concerned. To confirm the key role of the EPC, please note that the new standard UNI CEI EN 17669 "Energy performance contracts – Minimum requirements" has been published. As far as relevant, the above-mentioned standard is a benchmark for carrying out economic assessments of the investments needed to implement the energy performance improvement actions covered by the performance guarantee contract.

EPC evolutionary lines

A study is ongoing to assess whether it is appropriate to include an obligation for the PA to adopt the EPC contractual model as a necessary and ineliminable requirement for access to incentive measures. In this respect, public administrations which use this type of contract, minimising or even zero investment costs and transferring the risk to the private partner, will not have to record the costs of off-balance interventions. The leverage effect of the EPC is therefore capable of stimulating, with particular reference to the PA, a significant number of measures that can generate significant savings (such as the age of PA's buildings) by significantly reducing public finance costs.

In addition to the above, in view of the potential to reduce consumption in the public sector and the exemplary role that the public system should play, the inclusion of mandatory savings clauses in the energy service contracts signed by the PA will be defined.

[75] *In accordance with Article 18 of Directive 2012/27/EU.*

In addition, with regard to the legal obligations on energy efficiency, penalty and reward mechanisms will be provided to managers/officials responsible for managing the building.

It is also considered appropriate to strengthen certain enabling factors, which are key to mobilising private investment in order to achieve the energy efficiency targets:

- structure and monitor the qualification process of industry operators, with particular reference to ESCOs;
- simplify the permit-granting process for access to incentive mechanisms;
- strengthen enforcement activities with standards and regulations.

Finally, the 'CantierAmbiente' Legislative Decree is currently under discussion in Parliament, which requires all public administrations to identify a green manager, with the aim of ensuring the correct implementation of environmental legislation within their own administration and promoting energy efficiency activities.

IV. Other planned policies, measures and programmes to achieve the indicative national energy efficiency contributions for 2030 as well as other objectives referred to in point 2.2 (for example measures to promote the exemplary role of public buildings and energy-efficient public procurement, measures to promote energy audits and energy management systems[76], consumer information and training measures[77], and other measures to promote energy efficiency[78])

❖ **PUBLIC PROCUREMENT**

Public Procurement plays a leading role in the process by which public authorities acquire goods, services and works. Its proper implementation, such as the use of Green Public Procurement (GPP), the use of Energy Performance Contracts (EPC) and the digitalisation of e-procurement procedures, can make a major contribution to sustainability and efficient choices in public procurement. There is a close link between public administration procurement and the environment, sustainability and energy efficiency.

In this regard, the National Recovery and Resilience Plan provided for the reform of the Contract Code as a key objective; this revision resulted in the approval of a new contract code, Legislative Decree No 36 of 31 March 2023.

The main novelties of the new code concern: (1) the definition of a set of general principles expressing values and criteria for assessment, including the principle of result, the principle of trust and market access, which also represent the criteria for interpreting individual regulatory provisions; (2) the digitalisation of the entire life cycle of public contracts or the phases relating to the programming, design, publication, award and execution of public contracts.

In the specific area of energy efficiency, national legislation requires compliance with specific minimum requirements for purchases by central public authorities, whereas more generally for all contracting authorities and granting entities, it provides for the integration into the project and tender documentation of at least the technical specifications and contractual clauses contained in the minimum environmental criteria (CAM), adopted by decree of the Ministry of the Environment and Energy Security, in order to contribute to the achievement of the objectives of the Action Plan

[76] In application of Article 8 of Directive 2012/27/EU
[77] In accordance with Articles 12 and 17 of Directive 2012/27/EU
[78] In application of Article 19 of Directive 2012/27/EU

for the environmental sustainability of consumption in the public administration sector (the National Action Plan on Green Public Procurement – PAN GPP).

The implementation of the Green Public Procurement (GPP), which consists of the possibility of including environmental qualification criteria in the demand expressed by public authorities when purchasing goods and services, can foster the growth of a green and efficient market through:

- the inclusion of environmental preferability criteria in public administration purchasing procedures as part of the most economically advantageous tender;
- the possibility of considering environmental labelling schemes as evidence for the verification of environmental requirements;
- the possibility of considering environmental management system certifications as evidence for the verification of suppliers' technical capacities for the proper performance of the public contract.

In addition, through its demand for goods, services and works, public procurement has the capacity to influence the market, fostering the development and deployment of products and services with low environmental impact and high energy efficiency, these objectives can be achieved by updating and increasing the number of existing CAMs with clear benefits in terms of energy efficiency and saving.

Finally, through the 'Innovation Partnership' instrument provided for in Article 75 of the new Contract Code, Public Procurement can play a decisive role in promoting technological innovation by encouraging research and development for the production and marketing of new products and services, which have high environmental sustainability characteristics. For example, its use could be linked to the identification of standardised technical solutions for the energy efficiency of buildings.

In addition, the implementation of the Innovation Partnership would allow public authorities to develop innovative products and services not yet available on the market, allowing them to subsequently purchase and make the resulting equipment/services. The benefits of using the Innovation Partnership would therefore allow public administrations to choose in a competitive manner one or more partners for the development of an innovative product, service or solution adapted to their specific energy saving and consumption efficiency needs.

❖ **<u>NATIONAL PORTAL ON THE ENERGY PERFORMANCE OF BUILDINGS</u>**

With the amendments made to Legislative Decree No 192/2005 by Legislative Decree No 48/2020, the National Portal on the energy performance of buildings was introduced as a tool to promote knowledge of the national building stock, in terms of quantity, energy consumption and energy performance, and to provide support activities to citizens, businesses and the public administration, in order to stimulate the implementation of energy retrofitting measures for their buildings. The portal is also proposed as a tool to support the main stakeholders in the construction sector to meet the challenging objectives set out in 2030 of this Plan, as well as by the Long Term Strategy and the Renovation wave, which provide for full decarbonisation of the civil sector in 2050.

Ministerial Decree No 304 of 4 August 2 022 provided that the portal is to be developed and operated by ENEA and defined how it operates in terms of both the provision of the service and the management of information flows, while defining forms of cooperation and liaison between the authorities or entities holding databases, the data of which must be fed into the portal for the proper provision of the services covered by that decree.

Among the services to be provided by the Portal is the national one-stop-shop or one-stop-shop, as well as data processing services both customised on your building and in aggregated form for statistical and study purposes. In particular, the aforementioned Decree provided that the Portal should provide information and technical support to the MASE and the Unificated Conference for monitoring national targets for energy efficiency and the integration of renewable energy into buildings and for the development of energy efficiency promotion strategies and programmes in buildings.

The entry into operation of the first functionalities of the portal was also part of the reforms (under reform 1.1a) of reform 1.1 'Simplification and acceleration of procedures for energy efficiency interventions' of the NRRP M2C3 and took place in April 2022 (https://pnpe2.enea.it); the portal will be fully developed over a period of 4 years.

❖ **ENERGY AUDITS AND ENERGY MANAGEMENT SYSTEMS**

Article 8 of Legislative Decree No 102/2014 identifies as obliged entities to carry out a periodic energy audit, starting in 2015, large enterprises and energy-intensive undertakings, known as 'energy-intensive' undertakings, in accordance with Annex 2 to that decree.

ENEA establishes and manages a database of undertakings subject to energy audits and carries out the checks that will have to verify that the diagnosis complies with the requirements of the Decree, by selecting a sample of at least 3 % of the total, as well as checking all the audits carried out by in-house auditors.

In 2021, the third year of compulsory second diagnostic cycle, as was the case for 2020, the number of diagnoses received by ENEA was significantly lower than 2019, the first year in which the second cycle was required, as most companies had already carried out the diagnosis in 2019. A total of 629 energy audits were uploaded to the ENEA portal by 469 companies. Out of the 469 enterprises, 174 declared themselves as 'Large Enterprises', 271 'Energy enterprises', 24 enterprises both 'Large Enterprises' and 'Energivore Enterprises'.

There are more than 1.800 potential interventions to be carried out in the obliged entities with energy audits sent to ENEA in December 2021 and relate to 448 companies, of which 290 energy-intensive; there are 317 companies (130 companies).

The actions carried out resulted in final energy savings of 2,8 ktoe/year and primary energy savings of 19,3 ktoe/year.

❖ **CALL FOR PARKS**

The 'Parks for Climate' programme, established, involves the 23 national parks in Italy. The aim of the Programme is to achieve the objectives of$_{CO2}$ emission reduction, mitigation and adaptation and protection and enhancement of biodiversity in line with the UN 2030 Agenda, the European Biodiversity Strategy 2030 and sustainable development policies. The measures under the Programme include projects to improve the energy efficiency of the public building stock, the construction of small-scale renewable energy production installations, low ecological impact mobility services and infrastructure and sustainable forest management.

The programme is divided into three years and, as regards measures to improve the energy efficiency of the public building stock in the availability of Park bodies (Tipologgia II), a budget of EUR 27 million has been earmarked for 2019; additional resources were allocated for 2020 and 2021.

❖ **CALL "INNOVATIVE INTEGRATED PROJECTS FOR NON-CONNECTED SMALL ISLANDS"**

Directorial Decree No 340 of 14 July 2017 established the 'Minors Islands' programme, aimed at implementing integrated measures to reduce greenhouse gas emissions, promote low-emission transport modes and implement measures to adapt to the impacts of climate change on smaller non-interconnected Italian islands.

EUR 15 million has been allocated to the implementation of the programme, of which EUR 4.5 million was earmarked for the implementation of the programme for energy efficiency measures in public buildings.

To date, it is expected that the first interventions will be completed in 2023.

❖ **OBLIGATION TO INTEGRATE RENEWABLES INTO NEW OR RENOVATED BUILDINGS**

The topic, which is transversal to efficiency and renewable sources, is addressed in the sections of this chapter dedicated to electricity and thermal renewables.

❖ **HEATING AND COOLING**

In the heating and cooling sector, the provisions for air-conditioning systems will be updated with the specific aim of progressively replacing highly emitting installations (such as diesel boilers and non-efficient biomass installations) with low emission and high efficiency technologies.

Measures to ensure compliance with regulations and standards will therefore be stepped up, increasing the monitoring of the operating hours of heating systems in order to verify that there are no anomalies in the use limits.

The introduction of new limits on the use of cooling installations will then be considered, through the definition of constraints (e.g. days of use, timetables, minimum temperatures) to be adopted in relation to the reference climate zone (update of Presidential Decree No 74/2013, referred to above).

In this context, the development of efficient district heating and cooling will also be promoted in order to exploit the residual economic potential highlighted in Chapter 2. To this end, tools will be put in place to update the facilitation framework in the sector. For example, there is already provision for an implementing measure of Law No 172/2017, which provides for incentives for interventions on cogeneration plants which lead to an increase in thermal production in order to maintain or achieve an efficient district heating system within the meaning of Legislative Decree No 102 of 4 July 2014, and which are combined with an extension of the network in terms of increasing transport capacity.

Finally, it will be crucial to raise consumers' awareness and active role, for example by exploiting the technologies of home use, digitalisation of networks and smart metering, the promotion of which will be assessed by means of appropriate tools. Implementation of the provisions already laid down in Legislative Decree No 102/2014 on metering and billing systems for energy consumption in the residential sector will be completed and, where appropriate, strengthened in order to provide consumers with correct and timely information on their energy consumption, which is necessary to promote corrective or otherwise more efficient behaviour. To this end, increasing digital connectivity (ultra-wideband) and the development of applications for remote control of dwellings will be best exploited, while also fostering a different role for electricity and gas sellers, who will be able to develop commercial propositions aimed not only at the sale of the commodity, but also for the provision of consumer management services.

Finally, pursuant to Article 27 of Legislative Decree No 199/2021, an obligation to increase the renewable share of energy sold in the form of heat for heating and cooling will be introduced as of 1 January 2024 for companies selling more than 500 TEP per year.

❖ **PUBLIC LIGHTING**

In the context of the PA, it is intended to structure an energy efficiency programme starting primarily from public lighting. In this area, the programme will provide for a set of measures addressed to local administrations, aimed at accelerating a process already in the process of replacing light sources and the installation of consumption monitoring systems, together with a more efficient reprogramming of hours of use.

In this regard, the 2 018 Budget Law established that public authorities are obliged to upgrade public lighting networks by 31 December 2023, ensuring a reduction in electricity consumption of at least 50 % compared to average consumption 2015-2016. The undertakings involved in the implementation of the measures may benefit from the aid granted under the revolving fund for business support and investment in research, where EUR 300 million has been allocated to grant financing at a preferential rate.

❖ **COOPERATION BETWEEN CENTRAL GOVERNMENT AND LOCAL AUTHORITIES ON ENERGY EFFICIENCY**

A specific governance model will be put in place which, without prejudice to the centrality of the State, encourages the active contribution of all central public administrations, regions and municipalities to the achievement of national energy efficiency targets, through:

- continuous improvement of national and local energy efficiency tools, for example by reorganising energy efficiency measures to achieve greater coordination, eliminating overlaps and competitiveness (ERDF ROP instruments – FNEE – Termico);
- monitoring, valorising and supporting initiatives at central and local level and the results achieved.

A particularly useful tool in this respect has been the above-mentioned burden sharing of the renewable energy target, expressed as a share of consumption, so as to also stimulate regional and local energy efficiency interventions. The new PNIEC Observatory will focus more explicitly on energy efficiency.

v. Where applicable, a description of policies and measures to promote the role of local renewable energy communities in contributing to the implementation of policies and measures in points i, ii, iii and iv

Please refer to Section 3.1.2.

VI. Description of measures to develop the energy efficiency potential of gas and electricity infrastructure[79]

The infrastructure tariff regulation will include the energy efficiency parameter for the purpose of the remuneration of operators.

VII. Regional cooperation in this area, where appropriate

[79] *In accordance with Article 15(2) of Directive 2012/27/EU*

With the countries with which Italy has initiated the regional cooperation process, the discussion will be based mainly on the exchange of best practices on the policies already adopted in Italy which have attracted interest in other countries.

VIII. Financing measures, including Union support and the use of Union funds, in the area at national level

In the single programming of the Structural Funds for Italy for the period 2021-2027, with particular reference to the European Regional Development Fund (ERDF) and the Cohesion Fund currently under discussion, and for the subsequent period 2028-2034, the focus will be on the implementation of the INECP.

In line with the other objectives of the programming cycle, particular attention will be paid to the allocation of significant resources at local and national level for initiatives aimed at decarbonising the public and private building stock and measures to contain mobility needs and to increase collective mobility, in particular by rail, including the shift of freight from road to iron. It is recalled that the EU’s five investment priorities include those aimed at achieving a greener, carbon-free Europe.

Some of the main financing measures, including resources made available by the Union, also dedicated to the promotion of energy efficiency are described below.

❖ **<u>COHESION POLICIES</u>**

In order to increase economic and social development and to reduce disparities and disparities between territories, the Member States of the European Union and the European Commission shall promote a cohesion policy, structured through seven-year programming cycles defined in the General Approach Document (Partnership Agreement). This policy is implemented through 5 European Structural and Investment Funds (ESIF), jointly managed by the European Commission and the Member States (most of the national co-financing takes place with the National Rolling Fund for the implementation of Community policies) and through the National Development and Cohesion Fund (FSC). If resources are available from the revolving fund, these resources are committed through the Complementary Operational Programmes (CAGs), whose function is to reinforce the actions included in the programmes financed by the Structural Funds. In order to bring together the programming of FSC’s national resources for central administrations, regions and autonomous provinces and Metropolitan cities, development and cohesion plans (CSPs) have been introduced.

All of these plans and programmes at both national and regional level, under the 2014-2020 programming period, provide for specific lines of action for the promotion of energy efficiency, renewable sources and the smart transformation of electricity transmission and distribution networks.

Planned evolutionary lines

Under the ESI Funds 2014 – 2020, following the allocation of Community resources from the REACT EU programme, with reference to specific objective RA 4.1. ‘Reduction of energy consumption in public or public, residential and non-residential buildings and facilities and the integration of renewable sources’ of the Partnership Agreement 2014-2020, EUR 320 million was allocated to the National Operational Programme for Enterprise and Competitiveness 2014 – 2020. Consequently, the public notice C.S.E. 2022 ‘Municipalities for sustainability and energy efficiency’ was published, which provides for 100 % capital financing of energy efficiency measures in municipal buildings, using Consip's M.E.P.A. tool. With the Notice, 1.876 interventions were carried out for a total contribution of EUR 311 million. The estimated energy savings are around 211 GWh of primary energy.

Under the 2014-2020 CPOC, the "*Energy and Development of Territories*" programme was set up, which foresees, as regards specific objective 4.1, the implementation of energy efficiency measures on public buildings, including public lighting, on smaller islands in the regions of the midday. The resources initially allocated (EUR 16 million) were supplemented in 2020 with EUR 234 million for energy efficiency measures in public buildings and facilities located in disadvantaged areas of the midday. Projects are due to be completed by 31 December 2026. To date, the first interventions, all located in the smaller, non-interconnected islands in the areas of the midday and financed for an amount of EUR 9 million, are expected to be completed in 2023. With the reprogramming of the energy and territorial development CPOC, at the stage of CIPESS approval, additional resources amounting to EUR 234.6 million are earmarked for financing 100 % of the capital of energy efficiency measures in municipal buildings, through the purchase and supply of goods and services through the Electronic Public Administration Market (MePA). The new notice on the basis of the energy savings achieved by the ECS 2022 estimates that the energy savings achieved will be 159 GWh of primary energy.

Under the MSE PSC 2014 – 2020, the resources of the FSC Operational Plan 2014-2020 under the responsibility of the Ministry of the Environment and the Protection of Natural Resources and the Sea were pooled and, with reference to intervention area 04.01 '*Energy efficiency*', approximately EUR 94 million were allocated to finance capital up to 100 % of the eligible costs of energy efficiency projects in public and public buildings. The measure is implemented by means of CIPE Decision No 55 of 01/12/2016, which approved the FSC Operational Plan 2014-2020 under the responsibility of the Ministry of the Environment and the Protection of Natural Resources and the Sea; the measures are expected to be implemented by 2025 and will allow a reduction in annual primary energy consumption of around 11.6 GWh/year, i.e. 0,001Mtoe/year of primary energy. To date, it is expected that the first interventions will be completed in 2023.

The Partnership Agreement between Italy and the European Commission on the 2021-2027 programming cycle was approved by EC Implementing Decision on 15 July 2022. This agreement consolidated the guidelines and priorities of the new programming cycle in line with the targets set by the European Green Deal and the European Social Pillar, in the broader context set out in the UN 2030 Agenda for Sustainable Development and national and regional sustainable development strategies. The objectives to be pursued include energy efficiency in accordance with the energy efficiency first principle, to which all regional programmes and some national lines will contribute to strengthening the intensity of intervention in less developed regions. Investments in energy efficiency will therefore be supported under the 2021-2027 Community programming, including: domotics; public housing to fight energy poverty; buildings; production facilities of enterprises; public lighting networks. In particular, actions for the efficiency of public buildings will be activated, in line with STREPIN 2020. Priority will be given to interventions on highly energy-intensive buildings, supporting their deep renovation and seismic security. However, to date, detailed planning has not yet been finalised; please refer to the report of Annex III to Regulation (EU) 2018/1999 on the Governance of the Energy Union for the assumptions of interventions and financial needs for which it is responsible.

With regard to the 2021-2027 FSC, we confirm that themeasures will be implemented using the PSC instrument, through the implementation of measures relating to the 12 thematic areas that characterise the current CSPs; among these, the Theme Area 04 "Energy" includes projects related to energy efficiency, renewable energy, energy networks and energy storage.

- **KYOTO FUND**

The Kyoto Fund is a revolving fund to finance measures to implement the Kyoto Protocol. Established by Article 1 (1110) to (1115) of the 2007 Finance Law, it has been active since 2012, through 5 different programming cycles. The Fund, managed with the support of Cassa Depositi e Prestiti Spa, grants loans at a preferential rate (0.25 %) and has an initial budget of EUR 635 million. Specifically, from 2015 to 2018, EUR 350 million of the Fund was earmarked for the energy renovation of publicly owned school buildings. The 2019 Budget Law extended access to health facilities and sports facilities, with EUR 200 million still available.

As of 31 December 2021, the call for schools granted funding for the energy efficiency of more than 200 buildings (EUR 105 million of investment). Of these, 124 projects completed, totalling around EUR 50 million of investments. All funded projects achieved the minimum objective of improving two energy classes, with average savings of around 42 %.

Planned evolutionary lines

In order to respond to the 2050 and 2030 public sector targets set out in the new EED and EPBD Directives under approval and in this Plan, as well as STREPIN 2021, a reform of the Fund is expected to be implemented within the RepowerEU framework. In particular, the following are expected:

- the establishment of a fund for the decarbonisation of public buildings on the management model of the current Kyoto Fund;
- the reinforcement of the financial envelope, by complementing the remaining resources currently available (approximately EUR 250 million) with additional funds stemming from the REPowerEU programme, amounting to a total of EUR 800 million;
- the creation of a combined subsidised/non-repayable financing mechanism reserved for all public administrations (e.g. local authorities, public authorities, regions) to facilitate their energy efficiency investments.

In order to maximise the effectiveness in the use of the available resources, as well as to ensure that a certain degree of diversion of the instrument is maintained, it is envisaged to modulate the share of non-repayable funding according to the increased energy savings achieved, up to a maximum of 70/80 % of the grant and the remaining part of the investment with the soft loan.

❖ **ENERGY EFFICIENCY INVESTMENTS UNDER THE RRP**

Mission 2 'Green Revolution and Ecological Transition' was introduced as part of the RRP, specifically aimed at promoting ecological transition measures, including those under the scope of 'Energy efficiency and renovation of buildings' under component 2; this component has been allocated over EUR 15 million, plus additional investments in other Missions and Components.

♦ ***REFORM 1.1: SIMPLIFICATION AND ACCELERATION OF PROCEDURES FOR IMPLEMENTING ENERGY EFFICIENCY MEASURES***

The reform is structured around four lines of action:

- Operationalising the National Portal for Energy Efficiency of Buildings;
- Strengthen the activities of the information and training plan aimed at the civil sector;
- Update and strengthen the National Energy Efficiency Fund;
- Accelerate the implementation phase of projects financed by the PREPAC programme.

♦ ***PROMOTION OF AN EFFICIENT DISTRICT HEATING NETWORK (M2C3-I.3.1)***

The Investment (EUR 200 million) aims to promote the deployment of efficient district heating networks through the construction of new networks or the extension/modernisation of existing networks.
The measure was implemented by Ministerial Decree No 263 of 30/06/2022 and Public Notice No 94 of 28/07/2022. Following Commission Decision 2023/C 6641 final of 29 September 2023, out of the 29 projects admitted on the list No 435 of 23/12/2022 of the DGIE of MASE, 14 were found not to be compatible with the DNSH principle. However, these projects were eligible from the CO2 auction resources for 2022, pursuant to Article 10 of Decree-Law No 181 of 9 December 2023. Consequently, the NRRP resources released led to a slippage of the ranking list. To date, a total of 50 projects are eligible, generating around 0,08 Mtoe/year.

♦ ***VERDEAN ISLANDS (M2C1-I.3.1)***

The Investment (EUR 200 million), implemented by Directorial Decree No 219 of 27/09/2022 of the former Directorate-General for Climate, Energy and Air, intended for the 13 municipalities of the 19 small non-interconnected islands, aims to implement integrated projects for energy and water efficiency, sustainable mobility, waste cycle management, circular economy, renewable energy production and various end-use applications, the completion of which is planned for the first half of 2026. Specifically, projects are planned for the energy efficiency of the public building stock, amounting to EUR 17 million, as well as measures to build renewable installations (EUR 47 million) and to ensure the continuity and security of the electricity grid in order to promote the integration of energy from renewable sources (EUR 33 million).

♦ ***INTERVENTIONS FOR THE ENVIRONMENTAL SUSTAINABILITY OF PORTS – GREEN PORTS (M2C2-I.1.1)***

The objective of the investment (EUR 270 million) is to make port activities sustainable and compatible with port urban contexts by financing measures aimed at the efficiency and reduction of energy consumption of port facilities and activities.

♦ ***OTHER ENERGY EFFICIENCY MEASURES (NOT MANAGED BY MASE)***

- Plan for the replacement of school buildings and energy renovation (M2C3-I.1.1): the purpose of the investment (EUR 800 million) is to progressively replace part of the outdated school building stock, covering around 195 school buildings for a total of 410 m², with a reduction in final energy consumption of at least 50 % (3,4 Ktoe per year). The measure is currently being implemented.
- Efficiency of judicial buildings (M2C3-I.1.2): the investment (EUR 410 million) aims at the energy efficiency of 48 judicial buildings, enhancing their historical heritage, while at the same time ensuring seismic security and technological efficiency. The measure is currently being implemented and will ensure an expected savings of 0,7 ktoe/year of primary energy at the scheme.
- Improving energy efficiency in cinemas, theatres and museums (M1C3-I1.3): the Investment (EUR 300 million) aims to improve the energy efficiency of related cultural/creative buildings.
- Measures for the resilience, enhancement of the territory and energy efficiency of municipalities (M2C4-I.2.2): the aim of the investment (EUR 900 million) is to increase the resilience of the territory through a diverse set of interventions to be carried out in urban areas. The works will cover land security, building safety and retrofitting, energy efficiency and public lighting systems.

- Plan for the safety and upgrading of school buildings (M4C1-I.3.3): the purpose of the investment (EUR 3.9 million) is to secure some of the school buildings, including a gradual reduction in energy consumption.
- National Innovation Programme for Living Quality (M5C2-I2.3): the purpose of the investment (EUR 2.8 million) is to create new public housing structures, to reduce housing difficulties, with particular reference to existing public heritage, and the upgrading of degraded areas, focusing primarily on green innovation and sustainability, including energy efficiency. The investment is estimated to affect around 16.500 housing units with an expected savings of 40 %.

3.3 Dimension energy security80

I. Policies and measures related to the elements set out in point 2.3[81]

The main actions envisaged to ensure the adequacy and maintenance of the safety standards of the electricity system, gas and petroleum products can be found in the following measures:

❖ **GAS SECTOR**

♦ ***DIVERSIFICATION OF SOURCES OF SUPPLY THROUGH LNG***

Given the increased uncertainty conditions brought about by the continuing Russian-Ukrainian conflict, Italy is actively pursuing a strategy of diversification and increase of LNG supplies (currently covering around 20 % of domestic gas needs), through LNG supplies from new routes, in particular: up to 3,5 GSM^3 from Egypt, up to 1,4 GSM^3 from Qatar, up to 4,6 GSM^3 progressively from Congo, and about 3,0-3,5$^{GSM\ 3}$ from supplies under negotiation from atres countries (such as Angola, Nigeria, Mozambique, Indonesia).

The new potential of route diversification also depends on the deployment of new national regasification infrastructure, based on floating units (FSRUs) and on maximising the use of existing LNG terminals. In particular, with regard to the new infrastructure, in 2023, as a result of the emergency measures decided by the government to deal with the crisis resulting from the Russian-Ukrainian war, a fourth FRSU regasification plant in the port of Piombino entered into operation with a regasification capacity of 5 billion cubic metres per year. This will be complemented in 2025 by an additional FRSU facility off the coast of Ravenna, amounting to an additional 5 billion cubic metres per year for which the necessary permits have already been issued. With regard to the upgrading of the installations already in operation, capacity increases are expected at the Panigaglia terminal (+ 2 billion cubic metres), the Livorno terminal (+ 1 billion cubic metres) and the Rovigo terminal (up to 2 billion cubic metres). Finally, further initiatives will be considered for the construction of new regasification terminals to be located in southern Italy (Gioia Tauro and Porto Empedocle declared strategic pursuant to Article 2 (2) of Legislative Decree No 181/2023)and Sardinia.

In addition, other major projects to upgrade LNG supply infrastructure to be used directly in liquid form both for heavy road and maritime transport and for industrial users not connected to the methane pipeline network should be reported.

In particular, in addition to LNG storage facilities (15 projects authorised or advanced) and the implementation of already authorised LNG warehouses (such as Oristano, Porto Marghera and Brindisi), Panigaglia and Livorno regasification terminals are also being built to provide small Scale LNG bunkering services (Livorno for vessels with a capacity of at least 7.500 m^3 and a bunkering capacity of approximately 900 m^3m/h). It is both possible to offer reloading services.

♦ ***ADAPTATION OF TRANSMISSION NETWORK AND GAS STORAGE SYSTEM FUNCTIONS***

[80] *Policies and measures reflect the first energy efficiency principle*

[81] *Consistency should be ensured with preventive action plans and emergency plans pursuant to Regulation (EU) 2017/1938 of the European Parliament and of the Council of 25 October 2017 concerning measures to safeguard security of gas supply and repealing Regulation (EU) No 994/2010 (OJ L 280, 28.10.2017, p. 1), as well as with risk preparedness plans pursuant to Regulation (EU) 2018/2001 (as proposed by COM (2016) 862 on risk preparedness in the electricity sector and repealing Directive 2005/89/EC)*

Given the scenarios set out in this Plan and the objectives to be achieved, it is considered that natural gas will continue to play an important role in the future. The diversification of supply channels combined with the new needs for gas transit through Italy, in order to supply adjacent European markets, creates new needs for the development and maintenance of the gas infrastructure system in full efficiency.

Together with these new needs, it should also be borne in mind that the change in the global energy environment will lead to the need for greater resilience and flexibility of the absolute performance of the system in order to address, in addition to adverse events, rapid weather variations that can influence RES energy production. Since its establishment, the national natural gas system has provided a flexibility service to cover peak demand through the use of the storage system and the line-pack reserve of the transmission network. Within the scenario developed for this plan, analysing gas consumption and the current state of availability and efficiency of transmission infrastructure, LNG and gas storage, it is considered that the gas system will continue to provide flexibility, daily peak and seasonal coverage.

However, the analysis cannot be dispensed with more in-depth hourly and local adequacy assessments with a dynamic review of the related gas flows. Indeed, real gas consumption for the thermoelectric sector depends on the volatility of residual thermal demand, which is determined by:

- the actual production of the plants and any unmodelled disputes (situations of no/excess wind, temporary nuvolosity, periods of particular drought);
- the location of renewable generation facilities;
- the deployment and localisation of storage systems.

These considerations should also be made in the possible decision to build new high-efficiency open-cycle gas thermal power plants for grid balancing (peaker), where the closure of coal-fired power plants will require their presence.

As stated in paragraph 2.3, in order to implement the above, it is of paramount importance to increase the transport capacity from the entry points of southern Italy and to be able to fully exploit it through the construction of the Adriatic Line, to create the conditions for the upgrading of the Southern Corridor through TAP (Trans Adriatic Pipeline), to upgrade the storage system and to encourage the development of new renewable gas plants, in particular biomethane.

As a result of the increase in gas imports from Algeria, resulting from the reduction in Russian gas flows from Austria, and with the start of the TAP pipeline, the daily transport capacity is currently found to be a bottle neck in the network at the height of central Italy, which means that this transport capacity will need to be increased by the construction of the Adriatic Linea, which will include a new backbone to the nearby network node Minerbio, Emilia Romagna, and a thrust plant near Sulmona; similarly, the physical reverse flow capacity of the Italian network will be increased to the interconnection points with the European network (in Tarvisio towards Austria and Passo Gries to France and Germany via the Swiss network), currently amounting to 40 million Smc/g.

During 2022, TAP, which entered into operation in 2020, was used to its maximum capacity and was also crucial to compensate for the decrease in Russian gas import. In order to create the conditions for the upgrading of the Southern Corridor through TAP (Trans Adriatic Pipeline), encouraging an increase in capacity from the supply route from Azerbaijan by an additional 10 billion m³ per year, an incremental capacity process is underway to verify the interest of gas market operators in making investments in increasing transport capacity that can be achieved with limited infrastructure interventions on the national territory.

In order to ensure an adequate upgrade of the national natural gas system to the new context, it is crucial to upgrade the storage system, with the development of new installations to have a more flexible and resilient system, including in the scenarios of maximisation of withdrawals through tested injection processes that allow for higher system performance during the winter period. In particular, the measures may include the development of new fields, in some cases already technically verified, and the possibility of managing certain sites already in operation in excess of the original field pressure.

It is important to maintain the focus on the resilience of the Italian system, which has been exposed during the winter period to sharp increases in peak demand, which in the last part of the winter period could, in the event of simultaneous unavailability of the main import infrastructure (now the Transmed gas pipeline from Algeria), be exposed to rationalisation measures where peak storage capacities have already been used during the winter.

Finally, encouraging the development of new renewable gas plants, in particular biomethane, and their interconnection to the transport network would in future compensate for the decline in national fossil methane production and contribute to security of supply; the 2030 scenario for the development of sustainable biomass biomethane is estimated at around 5.7 billion cubic metres per year.

♦ ***REVISION OF THE RISK ANALYSIS DOCUMENT, THE PREVENTIVE ACTION PLAN AND THE EMERGENCY PLAN***

The risk analysis is the main document to identify the technical, economic, social and geopolitical problems most likely to occur in the Italian gas system. This document is provided for in Regulation (EU) 2017/1938 and, in view of the need to clear Russian gas supplies, is important in the assessment of a reorganisation of the energy supply mix. It was updated in 2023 considering the challenges that the national energy system will face in the short term, such as increasing renewables and phasing out of coal and fuel oil from the electricity generation mix.

On the other hand, the Preventive Action Plan (PAP), starting with the conclusion of the risk analysis, describes the national gas system and thus assesses the infrastructure and supply standards laid down in Regulation (EU) 2017/1938, including the definition of protected customers. It also describes the preventive measures put in place by the Government and the transport operator to mitigate the consequences of the risks identified. With the national dimension, the PAP also complements the European dimension, including assessments stemming also from the comparison with Member States sharing the same supply routes.

As provided for in Regulation (EU) 2017/1938, the Emergency Plan (EP) of the Italian natural gas system was also updated with the introduction of the addendum containing the consumption reduction plan of the national natural gas system (prepared pursuant to Regulation (EU) 2022/1369, a further consequence of the increased risk linked to the instability of gas supplies from Russia). The EP sets out the conditions for activating the three different levels of crisis that may occur due to adverse conditions, defines the type and modalities of implementation of the interventions to deal with crisis situations, and identifies the companies and operators in the gas and electricity sector responsible for implementation. It should be noted that the EP was initially designed to deal with short-term crises, while now, including through the Addendum on consumption reduction, measures to address longer crisis ranges, including on the demand side (e.g. voluntary reduction of industrial customers' consumption), as well as on maximising supply (LNG peak shaving and the use of strategic storage).

To further support the European system, Regulation (EU) 2017/1938 also provides for the conclusion of international 'solidarity' agreements between Member States. These agreements are measures of last resort that a State in crisis can implement if it is in desperate situations, i.e. when, having used all the options at its disposal, it fails to supply its protected customers. At present, Italy has signed a solidarity agreement with Slovenia and, today, Germany, and is in negotiations with Austria, Greece and France for the remaining agreements, with reference to the obligations of that

Regulation. Further negotiations are also ongoing with Switzerland to achieve a similar outcome, albeit outside the European legal framework.

❖ PETROLEUM PRODUCTS

The transition to an increasingly less fossil-based development will take time and while maintaining an environmentally and technologically cutting-edge domestic downstream oil industry will ensure the reliability, sustainability and security of supply needed.

In order to enhance the contribution of the oil sector to the country's energy security, a number of measures have been identified to be implemented in 2030, including:

- promote the conversion of Italian refineries to biorefineries, in line with the ever more ambitious EU targets and the increase in domestic demand for advanced biofuels used both in blends with fossil and pure products. Many of the existing refineries will be able to convert, even partially, into biorefineries for the production of biofuels to be used in purity, some overall, some in a modular way, to accompany the decarbonisation process, to zero the share of processed fossil products in favour of bio products. Specific objectives are already foreseen in this direction;
- encourage the deployment of co-processing facilities within refineries to further develop advanced biofuel production for both road and aviation transport with SAF – Sustainable Aviation Fuels. For this action, the first authorisation was issued on 25 May 2023 for the construction of a co-processing plant within the refinery located in San Martino di Trecate (NO) for the processing of vegetable oil from the processing of a waste from the production of esterified palm oil belonging to the category of 'acid oils', in order to store it and place it in place of the fuel oil mixture in the existing plant. In addition, the authorisation procedure for the construction of a plant for the processing and storage of vegetable oils, animal by-products and Used Cooking Oil (UCO), to be used for energy use for the production of HVO diesel, bio-jet, HVO naphtha and bio-LPG, to be carried out within the Livorno refinery, is currently under way;
- support the reuse of industrial sites through conversion to storage or other productive investments, including with a view to safeguarding employment levels.

Further actions to be implemented concern support for research and industrialisation of the production processes of both RFNBO and RCF synthetic fuels within refineries to complement biofuel production and to provide the market with a wide availability of carbon neutral fuels. In addition, it will be necessary to promote the development and implementation of green but above all blue hydrogen production processes, facilitating the construction of CCUS facilities in refineries. Another key action to be implemented is focused on facilities for the production of raw materials for the preparation of biofuels for biorefineries (so-called 'advanced charges' made, for example, with algae oils and waste oils), so as to create a national production chain to support a transition to advanced biofuels, supporting Community initiatives to increase the list of raw materials suitable for producing advanced biofuels and double counting, in line with the increasingly ambitious targets for the share of renewable energy for transport. Finally, it will be necessary to safeguard the Italian refinery industry in order to enable the market to dispose of environmentally friendly products produced in accordance with the highest environmental standards.

Finally, we would point out that increasing the availability of biofuels resulting from hydrogenation processes will also ensure greater availability of bioLPG that can be used as renewable gas, both in the residential sector for non-methane areas and as fuel, in order to allow for the environmentally renewal of part of the obsolete fleet currently running on petrol.

❖ ELECTRICAL SECTOR

♦ *UPDATE OF THE EMERGENCY PLAN FOR THE SAFETY OF THE ELECTRICAL SYSTEM*

The aim of the Elettrico Safety Emergency Plan (PESSE) is to avoid uncontrolled interruptions of the electricity service which would cause social and economic hardship for the community. With the evolution of the functioning of the electricity system, the current defence plans need to be updated, with new dynamic and flexible logic, with the aim of limiting disservices through protective solutions, preventive control and corrective control for effective management of emergency situations.

From a medium- to long-term perspective, it is considered necessary to adopt risk analysis methodologies at programming and operational level that take into account forecasting uncertainties to identify effective mitigation actions to avoid or limit disservices, including with a view to greater cross-border coordination of security and emergency management measures.

♦ *INCREASING RESILIENCE*

Improving the reliability of an electricity system, as well as improving its performance in the face of ordinary events, requires increasing its resilience by identifying criteria and ways to minimise disservice in the face of extreme, natural or man-made events. In this sense, a key element is risk assessment at all stages of system management, overcoming classical approaches that do not consider multiple failures.

Among the measures to be implemented to improve the resilience of the electricity system, network operators (TSOs and DSOs) aim to adopt analytical methodologies that take into account all the risks arising from the occurrence of multiple contingencies in order to identify the most useful and effective interventions to improve system resilience at all management stages and for all relevant threats, including hydrogeological threats, which are proving to be particularly critical, and which in perspective can be expected to cause significant disruptions.

The risk analysis extended to consider threats and their likelihood, already applied in the definition of the network development plans for resilience, is an element on which to work at all levels and at all stages for enhancing resilience. This requires consideration to be given to the link between causes and effects, i.e. between threats, failures, contingencies and impacts on the service of the electricity system, and thus to:

- shape the quantitative link between the causes of disorders and contingencies, through an extension of the classic risk definition;
- identify and select contingencies on the basis of environmental/meteorological conditions, in the short or long term, in order to make it possible to assess the safety of the system also in the face of possible extreme events;
- assess the impacts on the system;
- identify the most effective risk mitigation actions in the short and long term both at preventive and corrective level to improve the resilience of the system.

Accordingly, the objective to be pursued is the identification and application of:

- passive measures, aimed at improving the ability of the infrastructure not to fail in the face of threats, preventing and minimising the impact of threats through:
    1) the introduction of redundancy, which reduces the vulnerability of the network infrastructure by, for example, increasing the number of connections in order to strengthen the mesh of the network;

2) the reinforcement of components and the use of protection barriers, which reduce the vulnerability of components, preventing threats from damaging network infrastructure.

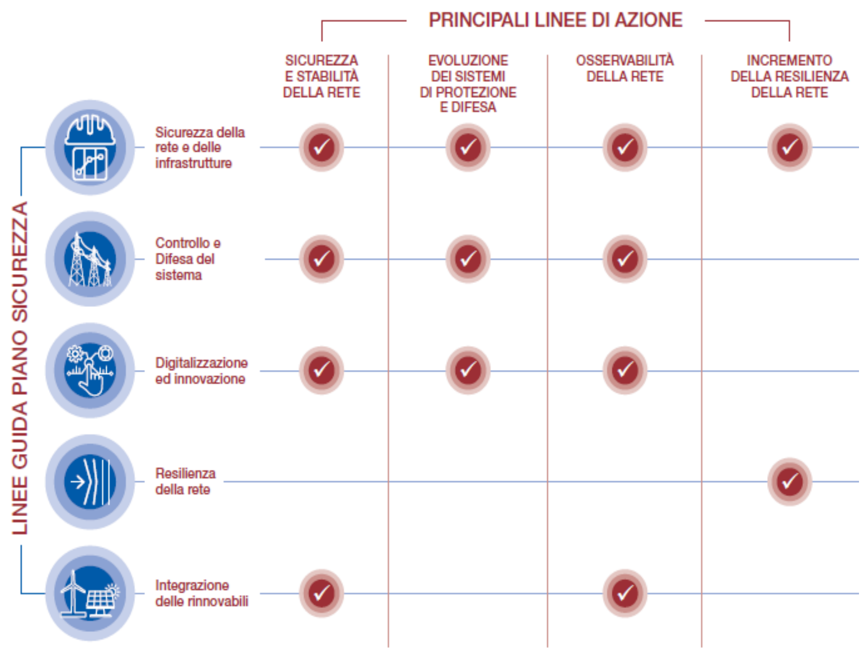
- active measures (smart), aimed at minimising disservices, improving the absorption capacity of the system and the speed of recovery.

We would point out that passive approaches, such as the deployment of new power lines, may be delayed due to the timing of authorisation processes. From this point of view, the medium-term objective is to address the problem in an integrated way by adopting both passive and active solutions for the defence of the system.

♦ ***NETWORK DEFENCE PLANS AND ADOPTION OF CONTINUOUS TECHNOLOGICAL ADAPTATION MEASURES***

The safety plan, drawn up annually by Terna and with a four-year time horizon, sets out the actions to be carried out to guide the energy transition, ensuring the security and stability of network operation. The plan identifies a number of measures to be taken to achieve the safety objectives. The four strands of action of the Plan are developed in line with the main objectives, as shown in the figure below.

Figure 54 – Security plan. Action guidelines and guidelines



The five main objectives (security, control, digitalisation, resilience and RES integration) will also have to be confirmed in the next Defence Plans, which will have to be adapted and adjusted to take into account the progressive *decommissioning* of the national coal thermal fleet and the progressive increase in production from renewable sources, the share of which will be further increased compared to that set out in the INECP 2019.

The analyses to assess possible countermeasures to be taken in cases of changes in network structures due to the increasing impact of distributed generation and the possible occurrence of situations of network degradation will need to be developed. To this end, the plans will need to be integrated and coordinated among operators in order to improve the resilience of the system, through the adoption of active measures in addition to passive ones and identifying the best mix of solutions.

The definition of the resilience of the system must also include all the activities that network operators must carry out in order to reduce service recovery times, which require coordination with the main actors involved (local and regional authorities, civil protection, road managers, etc.) and making available the available resources. Both the National Transmission Network Operator and distributors are required to submit resilience plans by identifying the areas and lines at risk and priority actions to be implemented to improve the resilience of network infrastructure. These plans should consider both passive and active solutions.

♦ *CAPACITY MARKETS*

The measure, initially approved by the EC in 2018 and then in 2 019 in the subsequent version with new emission limits for participating installations (Ministerial Decree of 28 June 2019, followed by the Decree of 9 May 2024), provides for the introduction of annual auctions by Terna, open to all technologies capable of contributing to the objective of adequacy, for the supply of resources, including foreign resources, to cover the needs expressed by Terna on the basis of a long-term *assessment* updated annually. The measure was subsequently updated in 2021 and approved by Ministerial Decree of 28 October 2021. The auctions with a delivery period of 2022 and 2023 were carried out in 2019. The auction with a delivery period of 2024 took place in 2022.

The latest Italian Adequacy Report (RAI), published in December 2023, shows that a share of the thermoelectric park is at risk of divestment due to economic unsustainability, both in the medium and long term. In more detail, Terna estimates that the thermoelectric capacity at risk of decommissioning is 14.8 GW by 2028 and 19.7 GW by 2033. If all this capacity were actually shut down, Loss Of Load Expectation (LOLE) would be hundreds of hours/year, well above the 3h adequacy standard of LOLE/year. In this context, the capacity market mechanism will continue to ensure the availability of the resources necessary for the adequacy of the Italian electricity system. Spot markets, which are necessary to provide price signals for optimal dispatching of resources close to delivery (day-ahead and intraday markets), are not sufficient to ensure the right price signals to guide market entry and/or exit choices in the medium to long term. In order to carry out competitive procedures for the supply of capacity for the delivery years 2025, 2026, 2027 and 2028, Decree No 180 of the Minister for the Environment and Energy Security of 9 May 2 024 approved the new rules governing the system of remuneration for the availability of electricity production capacity.

♦ *INSTRUMENTS FOR MAINTAINING INSTALLATIONS IN OPERATION*

The existing *capacity market* mechanism, with the new rules approved by Ministerial Decree of 9 May 2024, was supplemented to stimulate a series of technical improvements to the traditional thermoelectric sector so as to ensure its availability even under extreme climatic conditions, such as those in summer 2022 and described in paragraph 2.4.3 (high temperatures and low rainfall). Among the various technical improvements, the most effective in increasing the availability of thermoelectric power plants is to adapt their cooling systems that operate exclusively on water. This solution, for thermoelectric power plants built close to watercourses, is based on the replacement/integration of the current water cooling system with non-water systems, such as evaporative towers with air capacitors, hybrid water-air capacitors with closed loop water, thus systems that ensure the operation of thermoelectric power plants even under extreme climate conditions, characterised by heavy heat waves and low flowing into watercourses.

In parallel *to the capacity market*, Article 20 of Legislative Decree No 210 of 2021, which provides for the definition of public service obligations for electricity undertakings, with particular reference to the capacity for which operators request divestment but which is still necessary to ensure the adequacy of the electricity system, while minimising the burden on final consumers.

♦ ***NEW TOOLS FOR SYSTEM FLEXIBILITY***

Small distributed resources, such as electric vehicles, heat pumps and residential accumulations, can play a key role in the energy sector not only with a view to optimising self-consumption, but also with a view to participating in energy and service markets, providing valuable services for the operation of the electricity system.

Distributed resources can already participate in the market for dispatching services through the UVAM pilot project. However, in order to increase the use of these resources for the management of the energy system, it is necessary to identify appropriate mechanisms to stimulate the necessary technological innovation, together with the appropriate regulatory tools, to reduce the costs of participation of such resources in the market for dispatching services, allowing competition with large traditional resources. Further research is needed in this area, but the promotion of standardisation of communication processes, technologies and protocols could be the key to removing technological and economic barriers that to date have a negative impact on the effective participation of these resources in markets.

A further step will be to amend the Italian network code, making it possible for these resources to participate in the market for dispatching services in a structural manner and no longer through a pilot project. However, it should be pointed out that, to date, the dispatching services market operated by Terna in order to ensure the balancing of electricity demand and supply, as well as the security of the grid itself, is essentially a spot market, which only remunerates the activation of resources. Therefore, as explained in paragraph 2.3., this market may not provide sufficient price signals to stimulate investment in new resources needed to meet the flexibility requirements of the electricity system. The market for dispatching services should therefore evolve from a predominantly spot market to a market that also includes forward instruments.

The experience of the pilot projects launched in 2017 by ARERA with the UVAM model based on pooling of resources has made it possible to identify opportunities for their greater integration into the services market and to develop a regulatory regime in force since 2025, with the new regulation of dispatching (Integrated Text on Electrical Dispatching – TIDE). However, it should be pointed out that, to date, the dispatching services market operated by Terna in order to ensure the balancing of electricity demand and supply, as well as the security of the grid itself, is essentially a spot market, which only remunerates the activation of resources. Therefore, as explained in paragraph 2.3, this market may not provide sufficient price signals to stimulate investment in new resources needed to meet the flexibility requirements of the electricity system and to promote the participation of resources such as demand response. The market for dispatching services will therefore be subject to review, as highlighted above, by also integrating forward tools.

♦ ***MEASURES FOR THE SPREAD OF ACCUMULATIONS***

As regards the development of storage capacity, Legislative Decree No 210/2021, followed by Decision 247/2023 of the ARERA, states that the storage capacity required by the system must be developed by means of fixed-term contractualisation mechanisms operated by Terna. In December 2023, the European Commission approved (State Aid SA.104106 (2023/N)) the Accumulation Contract Mechanism (MACSE) for the development of new electricity storage capacity.

In more detail, the supply should cover newly built storage capacity, according to regular auctions and area capacity quotas. As a result of these auctions, the holders of the contracted storage capacity will be awarded annual remuneration for the entire long term period of time provided for in the auctions, against the obligation to implement the facility and to make available to Terna the new storage capacity created, in order to (i) enable it to operate to third market participants on the energy markets and (ii) make it available on the MSD.

This capacity will have to be progressively procured by sequential auctions. In this way, the needs generated through each auction will be sized in such a way as to take into account the expected evolution of new renewable capacity, both in terms of quantity and distribution between different market areas (in this way, it will be possible to express in each auction a need commensurate with the actual needs of the system and the evolution of network developments, as well as capture any reduction in the costs of electricity storage technologies that can be tested in the coming years).

♦ *CYBERSECURITY*

As regards cybersecurity measures, in implementation of Regulation (EU) 2019/941 of the European Parliament and of the Council of 5 June 2019, the Risk Preparedness Plan in the electricity sector has been updated by providing for national and regional measures to prevent and/or address possible electricity crises.

Within the Plan, a cyber attack risk cluster was dedicated, where risks such as “malicious attacks and fuel shortages”, “rare and extreme natural disasters” and “simultaneous incidents” have been identified, specifying the operational tasks related to risk preparedness planning and management, to be delegated to the National Transmission Network Operator, as well as a plan of measures to manage and address a possible system crisis. Those scenarios have been identified taking into account the risks referred to in Article 5(2) of Regulation (EU) 2019/941 of the European Parliament and of the Council of 5 June 2019 and have been developed in line with regional crisis scenarios, and have been consolidated downstream of a consultation with the Regulatory Authority, TSO, Distribution System Operators considered significant as well as with production category associations.

The plan should be updated in accordance with the terms set out in European legislation.

II. Regional cooperation in this area

❖ <u>CROSS-BORDER COORDINATION</u>

Regional cooperation arrangements and procedures have been identified in the Risk Plan to ensure collaborative coordination between Member States and TSOs for the prevention of risks on the electricity system.

In this system, the national transmission network operator Terna carries out adequacy analyses in its control area and contributes to the pan-European analysis in order to identify possible risks at European level or within its control area, providing the Regional Security Coordinator with the information necessary to carry out the Short Term Adequacy Analysis-STA (Short Term Adequacy Analysis-STA) assessments in order to identify possible risks at European level within a weekly timeframe.

In case adequacy risks are detected, a regional process is activated to find possible solutions to minimise risks through bilateral coordinated countermeasures between other TSOs, including the activation of a Critical Grid Situation (CGS).

The countermeasures used to address the critical situation may be the following: removal of maintenance of the network affecting border lines, upgrading of transfer capacity, preparing for energy emergency delivery.

If adequacy issues occur close to real time and no internal countermeasures are available, Article 21 of Commission Regulation (EU) 2017/2196 provides that Terna may request emergency energy deliveries from neighbouring TSOs for a period of time when the upward or downward reserve purchased in the markets for dispatching services is not sufficient for real time needs.

This emergency energy supply shall be governed by bilateral contracts signed with neighbouring TSOs detailing the terms and conditions of the supply. The emergency delivery price shall be described in each contract and shall be paid by the requesting TSO on the basis of market prices in D-1.

Early termination of delivery may exceptionally be required in the event of security breaches or other adequacy issues.

Mutual assistance contracts are in place between Terna ei and French, Swiss and Slovenian TSOs in the event of an emergency.

Outside the Region, these contracts were signed between Terna and TSOs from other Member States (Greece) and third countries (Montenegro).

III. Where applicable, financing measures in this area at national level, including Union support and the use of Union funds

In line with the 2014-2020 programming period, the 2021-2027 programming, as defined in the Partnership Agreement between Italy and the European Commission approved by the EC Implementing Decision on 15 July 2022, under policy objective 2, provided for an increase in the grid's capacity to absorb an increasing share of renewable energy and the smart transformation of electricity transmission and distribution networks. To this end, the National Research Innovation and Competitiveness Programme for the green and digital transition 2021-2027, with a budget of EUR 800 million. Under Objective 2, the deployment of new infrastructure is also envisaged for climate change mitigation and adaptation and adaptation of existing traditional infrastructure, through action to develop RES electricity generation.

Under the FSC 2021-2027, in addition to the areas of energy efficiency and renewable energy, networks and accumulations are also envisaged within the Energy Policy Area. In the area of networks and accumulations, in complementarity with the NRRP, the FSC also includes improving the effectiveness and performance of electricity transmission and storage systems, through: modernising networks, both distributive (smart grids) and transmissive networks, in order to increase their environmental resilience and adaptive flexibility; the development of storage capacity for electricity generated from renewable sources, in areas where the localisation of electricity generation and consumption is most acute (as is the case in particular between Sicily and mainland Mezzogiorno). The role of storage is key to stabilising transmissive networks and optimising the balance between the different electricity demand and supply time profiles. In this context, pilot projects for the use of low enthalpy geothermal energy for industrial and civil low-enthalpy heating for industrial and civil heating can be assessed and supported under the Fund.

3.4 Dimension Internal energy market82

3.4.1 Electricity infrastructure

I. Policies and measures to achieve the interconnectivity target referred to in Article 4(d)

❖ **ELECTRICAL SECTOR**

The Terna Development Plan 2023, in line with previous plans, identifies opportunities to develop interconnection capacity with the electricity systems of neighbouring countries. The examination of signals from foreign markets and the scenarios for the evolution of electricity systems in Europe and neighbouring countries shows that the development of Italy's interconnection capacity involves:

- the northern border (France, Switzerland, Austria and Slovenia);
- the border with South East Europe, in particular Greece and possibly other Balkan countries where significant renewable sources are developed and wholesale markets become more mature and integrated.

The development of interconnection capacity with North Africa can also be of strategic importance, with a view to the growing integration of Mediterranean countries with the European market. In this context, the Italy-Tunisia interconnection cable – ELMED[83] (or tunita) – provides an additional tool to optimise the use of energy resources. The project is included in the list of projects of Mutua Interest (SMEs), having shown positive effects in the medium and long term scenarios for Italy, Tunisia and other Member States of the European Union.

In order to enhance the indicators set out in Communication COM (2017) 718 final (and set out in the heading of the paragraph), account has been taken of the interconnection projects[84] listed in the table below and defined as part of ENTSO-E Ten-Year Network Development Plan (TYNDP-), i.e. projects planned by Terna in its National Transmission Network (PdS) development plans.

[82] *Policies and measures shall reflect the energy efficiency first principle.*

[83] *December 2022, the European Commission informed that the project for interconnection between Italy and Tunisia had obtained the largest amount, EUR 307.6 million, of the Connecting Europe Facility (CEF), the European Union fund for the development of projects aimed at strengthening the Community's energy infrastructure.*

[84] *For the purpose of calculating the targets, only interconnections with EU Member States and Switzerland (as a country interlinked only with EU Member States), as recommended by the Expert Group on electricity interconnection targets, should be taken into account. Therefore, interconnection projects with Montenegro and Tunisia remain excluded from the calculation.*

Table 45 – Interconnection projects planned in PDS23 and Merchat Lines Initiatives (TYNDP24)
[Source: Terna]

Frontier	Project ID PDS/TYNDP	Project name
IT-AT	—/210 *	Ml Würmlach – Somplago
	204-P/375	Power line 220 kV Interconnection Italy – Austria
	252-P/—	Interconnection AT Dobbiaco – Austria
IT – CH	—/250 *	Ml Castasegna – Monese
	—/174 *	Ml Greenconnector project (HVDC Verderio – Sils)
	167-P/1171	Valchiavenna rationalisation and Interconnection with Switzerland
IT – FR	301-P/299	HVDC SACOI3
IT – SI	200-I/150	Italy – Slovenia interconnection (removal of existing network limitation)
	—/323 *	Ml Zaule – Dekani
	—/324 *	Ml Redipuglia – Vrtojba
IT-TN	601-I/29	Italy-Tunisia interconnection (ELMED)
	—/283 *	ML TUNUR
	—/1208 *	Medlink2
IT-MT	—/1085 *	Malta-Italy ml
IT-GR	554-P/1112	HVDC GRITA 2
IT-ME	401-S/28	HVDC Italy-Montenegro (MONITA2)
IT-DZ	—/1208 *	Medlink1

** Merchant Line project not owned by Terna*

The development of additional interconnection projects, compared to those considered here, must take into account the long timescales resulting from the need to implement agreements between States and between TSOs and to complete permitting, construction and commissioning processes, including possible local oppositions.

There remains an interest in investigating further interconnection projects, provided that they are technically and economically feasible and in line with decarbonisation and market integration objectives.

II. Regional cooperation in this area85

As already pointed out in the previous paragraph, discussions and cooperation with neighbouring countries are ongoing in order to implement the energy infrastructure network, improving national and European security of supply.

[85] *Interventions other than PCIs and SMEs of regional groups established under Regulation (EU) No 869/2022.*

III. Where applicable, financing measures in this area at national level, including Union support and the use of Union funds

The development of interconnection capacity with North Africa can provide an additional tool to optimise the use of energy resources in both countries, with positive effects in medium and long-term scenarios also on other Member States, which is why the ELMED project is included in the list of projects of Mutua Interest (SMEs), in accordance with Regulation (EU) No 869/2022.

In August 2022, Terna, following the request from the Authority (ARERA) concerning the provision of appropriate financing instruments to cover investment costs in part, applied for the Italy-Tunisia interconnection project for access to EU funds under the Connecting Europe Facility (CEF Funds), the European Union fund for the development of projects aimed at strengthening the Community's energy infrastructure. In December 2022, the European Commission informed that the project for interconnection between Italy and Tunisia had obtained the largest amount, EUR 307.6 million, of the CEF Fund, compared with the EUR 850 million planned for its implementation.

As part of the NRRP contributions, EUR 150 million is allocated to Terna for measures to increase the resilience of the National Transmission Network[1]. In addition, the Council of the European Union approved on 8 December 2023 the revision of the Italian RRP, including the REPowerEU chapter. Within the latter, under the measure for Networks and Infrastructure, there are three projects submitted by Terna for an estimated total contribution of EUR 840 million. The projects submitted are: Tyrrhenian Link Ramo East, with an expected contribution of EUR 500 million, SA.CO.I3, with an expected contribution of *EUR 200 million and Smart National Transmission Grid* for EUR 140 million.

The Repower EU also allocates additional funding for the Tyrrhenian link, SACOI and the following additional projects.

- **M7 – Investment 4 "Tyrrhenian link"** with a financing of EUR 500 million, the investment contributes to the realisation of the Tyrrhenian link project, which includes two new high-voltage DC (HVDC) installations, in a bi-terminal configuration, with a capacity of 1.000 MW each. The project partly financed by the EIB is divided into two separate sections: 'West link' – Sicily – Sardinia and the Sicilian – Terraferma. Investment 4 to be completed in August 2026 supports the construction of the 'Eastern interconnection line' between Sicily and Campania, which foresees the installation of 514 km of direct current submarine cable (HVDC) installations between Eboli and Caracoli.
- **M 7 – Investment 5 "SA.COI I3".** The project included in the list of Projects of Common Interest (PIC) pursuant to Regulation (EC) No 347/2013 consists of the construction of a 200 kV High Voltage Direct Current (HVDC) cable connection connecting Sardinia, Corsica and Tuscany, with a total transport capacity of up to 400 MW. Investment 5 supports with funding of 200 million the construction by August 2026 of the casings that will host the two new converter power stations adjacent to the existing ones, one located in Sardinia in Codrongianos (province of Sassari) and one in Tuscany in Suvereto (province of Livorno).
- **M7 – Investment 7 "Smart National Transmission Grid"**. With a financing of EUR 140 million, the investment to be completed in August 2026 contributes to the digitalisation of the electricity transmission grid to improve its efficiency, security and flexibility, as well as to support the development and integration of renewable sources. The objective of the investment with a budget of EUR 140 million is to digitise the National Electricity Transmission Network and to improve the management and control system managed by the Transmission System Operator. The project covering both the transmission network and its software components aims to facilitate the integration of consumers and prosumers into the energy market, accelerating the deployment of renewable energy and increasing grid resilience. Specifically, the project provides for: the installation of the Secure

Protocol 104 in at least 250 electric stations (at the time of installation, and in synergy with the Information and Communication Technology (ICT) architecture, all data shall be fed through the central management and control system); the installation of 5G equipment or ICT architectures in at least 40 electric stations; the installation of an industrial IoT monitoring system on at least 1.500 electric traps to collect data that can be processed in the management system.

- **M7 – Investment 6 "Cross-border electricity interconnection projects between Italy and neighbouring countries".** The objective of this investment with a budget of EUR 60 million is to extend and modernise the electricity transmission infrastructure between Italy, Austria and Slovenia. The action consists of completing the following cross-border interconnectors:
    - 'Somplago (Italy) -Würmlach (Austria)', with an increase of 300 MW in the nominal capacity of existing interconnectors (target August 2026);
    - 'Zaule (Italy) -Dekani (Slovenia)' and 'Redipuglia (Italy) – Vrtojba (Slovenia)' with an increase of 250 MW (target December 2025) in the nominal capacity of existing interconnectors between Italy and Slovenia.

  The investment concerns only the completion of the part of the interconnector on the Italian side.

❖ **<u>GAS SECTOR</u>**

In view of the need to address the lack of the main source of supply for the Italian (and European) system as a result of the conflict resulting from the Russian invasion of Ukraine, a series of measures have been identified to strengthen existing interconnections, in line with the SNAM development plan, aimed at increasing the centrality of the Italian system in connecting the Mediterranean and the so-called Southern Corridor resources to European markets, which guarantee economic and security benefits for the country and simultaneously increase exports to those systems that will need gas to replace what had previously come from Russia:

- strengthening of the overall simultaneous import capacity of the entry points located in southern Italy through the implementation of the Adriatic Line with the aim of increasing imports from North Africa and Azerbaijan and possibly from new LNG regassifiers being studied in southern Italy;
- reinforcement of the transport capacity of the Melendugno Entrate Point (without increasing the total contemporary capacity of the system), which will be launched following a successful conclusion of the ongoing incremental capacity process;
- enhancing total export capacity to Austria and North Europe;
- enhancement of LNG imports through the construction of the two new regasification units in Piombino and Ravenna and the assessment of possible new terminals in southern Italy;
- creation of an export capacity to Malta;
- increase of domestic production capacity of both natural gas and biomethane;
- renewal and upgrading of the storage system.

❖ **<u>OIL SECTOR</u>**

Interconnections for the oil sector

As already highlighted in the chapter on energy security and specifically on cross-border infrastructure, for the oil sector, the Transa-Alpine Pipeline (Transa-Alpine Pipeline) is the most important strategic infrastructure for the transport of crude oil which, through the Alps, links the Port of Trieste to the city of Ingolstadt in Germany and supplies eight refineries located in Austria, Germany and the Czech Republic.

3.4.2 Energy transmission infrastructure

I. Policies and measures related to the elements set out in point 2.4.2, including, where applicable, specific measures to enable the delivery of Projects of Common Interest (PCIs) and other key infrastructure projects

❖ **ELECTRICAL SECTOR**

The measures to promote the upgrading and improvement of the electricity transmission network, to be carried out in line with the TERNA's 10-year development plan, are based on the following actions:

♦ ***INTERNAL NETWORK DEVELOPMENTS***

Terna has planned a series of measures to ensure that congestion between market areas is overcome, in order to make production more efficient and to increase the availability of resources in the dispatching services market. The 2023 Development Plan provides for the modernisation of existing power lines with interventions on the same route or adjacent to an improvement in operating performance, or to enable them to be operated on a direct current basis. This will allow for a significant increase in transport capacity through the implementation of a DC layer (Hypergrid project) which will enable an active and highly stabilising network to be built through the use of underground/submarine cable technology and innovative AC solutions.

Investments in distribution networks, which are increasingly affected by the deployment of small and medium-sized installations, should also be added to these interventions.

♦ ***PLANNING OF THE DEVELOPMENT OF THE NATIONAL TRANSMISSION NETWORK***

In order to achieve the energy policy objectives in the times planned, it is inevitable that investment in the energy sector and even more in the electricity sector should be accelerated. Investments will need to be channelled, to a large extent, in the development of new RES capacity, storage and transmission and distribution networks, to be carried out through a coordinated approach, in order to make the system more efficient as a whole. In this regard, Terna S.p.A. will make available to administrators, legislators and proposing entities the new digital portal 'TE.R.R.A.', introduced by Law 11/2024 (formerly the 'Energy Decree'), to consult strategic and relevant information on land, networks, innovators and accumulations. This institutional communication tool creates a substantial basis for efficient and sustainable spatial planning, providing transparent and accessible information on the current and future state of the facilities, connection requests and environmental, landscape and cultural constraints on national territory. The aim of the TE.R.A. Portal is to promote maximum transparency on data and information, to promote rationalisation and optimisation of electricity infrastructure planning and, finally, to support stakeholders involved, including through continuous monitoring and progress reports on the grid and the electricity system provided by Terna. In order to achieve the Community objectives, provision should also be made for speeding up and simplifying authorisation procedures for both network development works and the connection of renewable installations. The main indications contained in the conclusions on the infrastructure of the EU electricity grid, approved on 30 May 2024 by the Energy Council, highlight the need for unprecedented investments in electricity grids at both transport and distribution levels. The document also stresses the need to identify measures to speed up authorisation procedures. Finally, a development of RES consistent with policy scenarios cannot be left out of the forward contractualisation mechanisms (e.g. RES auctions), which ensure their implementation and reduce their development costs. As regards network works, it will be important to facilitate permits for repowering interventions on the primary network (RTN) which provide for ‘extra performance’ (e.g. increase in current reach values) with equal environmental impact. Further details on the simplifications of the authorisation procedures are set out in Chapter 3.3.

Taking into account the evolution of the electricity system as a whole with a view to achieving the European targets for the production of electricity from renewable sources, in the 2023 Development Plan Terna identified a new connection standard at the voltage level 36 kV for generation installations with a capacity of up to 100 MW to be connected to RTN. The new standard 36 kV connection solution allows the connection to RTN to be provided at a voltage level that is more appropriate to the average size of the production facilities requesting connection, while releasing them from the permitting complexities brought about by the construction of a 150-132 kV stall. In particular, the new standard connection solution requires each production facility to be directly connected to a voltage stall of 36 kV, which acts as a network facility for connection with conventional power of 100 MVA.

- ***DEVELOPMENT OF STORAGE SYSTEMS FOR SAFE MANAGEMENT AND EFFICIENCY OF RTN***

The accumulation will have to be seen as a compensatory element additional to the development of the network necessary for the integration of RES and will be closely dependent on the capacity and location of the RES implemented. Article 18 of Decree 210/2021, which transposes at national level Directive EU 944 of 2019, not only recognises the accumulation as essential for the integration of RES and the containment of overgeneration, but also provides for the definition of a long-term supply system based on competitive, transparent, transparent auctions conducted by Terna and aimed at minimising the burden on final customers. The Electricity Storage Capacity Supply Mechanism (MACSE) was approved by the European Community in December 2023 (State Aid SA.104106 (2023/N)).

- ***PROTOTYPING APPROACH TO FACILITATE THE DEPLOYMENT OF INNOVATIVE PROJECTS ON ENERGY NETWORKS***

Establishment of a regulatory framework enabling innovation projects, including through a dedicated fund and, where appropriate, the granting of transitional derogations from the existing rules, to enable operators to test innovative solutions on the ground and prototype, providing for appropriate cost recognition mechanisms. Network operators will be particularly involved, through the use of a new system innovation approach that also involves business parties for the development of new business models, including at the downstream stages of the strictly electricity supply chain, and their verification by means of ad hoc trials. An example of this is the pilot projects launched by ARERA to facilitate the participation of distributed resources in the dispatching services market.

- ***EVOLUTION OF THE RECOGNITION OF INFRASTRUCTURE COSTS BASED ON THE SERVICE PROVIDED TO USERS***

Progressively and gradually going beyond the current cost recognition approach, differentiated between operating costs and capital costs, in favour of an integrated approach aimed at strengthening the criteria for investment selectivity and the efficient use of infrastructure, always at the heart of the regulatory action, identified by the Regulation for Expenditure and Service Objectives (ROSS).

This approach will be adopted by ARERA on a step-by-step path with a first step to define the criteria for the recognition of costs oriented towards total expenditure, applicable to all infrastructure services in the electricity and gas sectors (ROSS-base) and integrated for the main operators with *forward-looking* logic, which are reflected in the analysis of the industrial plans to be discussed and validated with the regulator both in terms of service volumes and objectives and in terms of the cost of the same service (ROSS-full). The new recognition criteria will be first implemented, starting from the next regulatory period.

In particular, the new integrated approach focuses on: realistic forecasts and development plans based on the future and actual needs of the customers of the service; incentives to improve the level of performance, in terms of efficiency, economy and quality of service; removal of any regulatory barriers to the development of innovative solutions.

❖ GAS SECTOR

The situation since 2021, characterised by high volatility in natural gas prices and, subsequently, the tensions triggered by the Russia-Ukraine conflict, has significantly changed the way in which the Italian transmission system was used, which historically provided for a significant flow of incoming gas along the north-east direction through the Tarvisio Entry Point.

The new dynamics of infrastructure use see an increase in imports from the South with a utilisation of up to 100 % of existing capacity for limited periods of time and an increasing contribution from LNG terminals. This framework may take a structural dimension in the medium term also in view of the guidelines and decisions taken at both Community and national level, which provide for the possibility of reducing energy dependency on Russia to zero through increased gas supply from other suppliers and the progressive development of renewable gases to support the energy transition. The issues related to the new dynamics of infrastructure use are additional to those already on the gas transmission and storage system concerning the need to modernise and maintain an infrastructure which in some of its components was designed even more than 40 years ago. These considerations underpin the definition of the measures taken to promote the upgrading and improvement of the natural gas system, to be carried out in line with the operator development plans, which are described below.

♦ *DEVELOPMENT AND ADAPTATION OF THE GAS TRANSMISSION SYSTEM*

The transport system will need to be developed with a view to increasing import capacity from interconnection points with North African countries and Azerbaijan. To this end, it will be crucial to implement the Adriatic Line, which, by increasing the transport capacity of the south-north system, will make it possible to use the full capacity of the import points in South Italy. Developments in the TAP transmission system and the resulting development of the Italian infrastructure will also be of great importance to make capacity available up to about 18 billion m^3 year by Azerbaijan.

The gas transmission system will also need to increase its transmission capacity to other countries of the European Union, in particular by increasing transport capacity to the countries of Central Eastern Europe and in particular to Austria. In the context of ensuring energy security in other countries, it is also recalled that Sicily is interconnected with Malta.

In addition to new capacity building, it is necessary to plan and carry out the necessary works for the maintenance of existing gas pipelines and compression plants, in order to ensure transport service through a safe, efficient system and in line with modern construction technologies with the aim of maintaining and reducing the level of risk, improving transport continuity and quality, improving levels of environmental protection by reducing the emission of climating gases.

♦ *DEVELOPMENT AND ADAPTATION OF THE REGASIFICATION SYSTEM*

As described in the preceding paragraphs, the Ministry of the Environment and Energy Security is actively pursuing a strategy for diversification and increase LNG supplies, both through active policies of agreements with producer countries, by increasing regasification capacity through the authorisation of two floating regasification units (FSRUs), managed by SNAM and located in the port of Piombino and off the coast of Ravenna, and by authorising increases in the regasification capacity of existing terminals.

In order to increase security, diversification and competition for the Italian gas system, the development of new LNG import capacity can be the necessary tool to ensure the presence of multiple sources of spot supply and alignment with the prices of the main European hubs.

To date, the two FSRUs (one of which became operational in 2023) have been authorised and the increase in regasification capacity for the OLT terminal, while the increase for Adriatic LNG, which has studied further capacity increases, is being defined.

Small-scale LNG storage and regasification capacity (i.e. small scale and truck loading) will also be a key element for Italy in the transition period towards a fully decarbonised system, enabling the opportunities of the globalised LNG market to be seized. In this context, certain small-scale coastal storage and regasification storage projects (SSLNG) to be carried out in Sardinia and the Adriatic coast (Ravenna and Porto Marghera) are being authorised and evaluated at MASE, as well as projects for the discharge of LNG from small LNG vessels, storage and subsequent loading on bettoline vessels (bunkering) and cryogenic tankers for the refuelling of household and/or industrial customers and fuel refuelling stations.

In particular, in Sardinia, in implementation of the INECP 2019, the infrastructure configuration of gas in order to achieve the objective of the phase out of coal-fired power plants was defined in Sardinia.

In order to ensure that Sardinian consumers have the necessary level of security, fairness and continuity of supply, the possibility of linking the coastal warehouses under construction and authorisation to the regasification terminals operating in Italy that are in the process of establishing a reloading system carried out by the TSO, and the possibility of adopting a system of correlation between the raw material price and the PSV price. In this regard, we would point out the project of the OLT LNG Tuscany regasification terminal, which provides, in addition to the activities currently carried out by the terminal, for the implementation of a small scale service for the discharge of LNG into small vessels which will supply coastal and bunkering facilities in Italian ports and the Mediterranean ports, and the provision by the Panigaglia LNG terminal of a truck loading service.

In addition to projects related to the development of new regasification capacity, it is necessary to carry out maintenance and modernisation of existing terminals, in particular those that have been operating for longer periods, in order to ensure their efficient operation, in line with the latest technologies.

♦ *DEVELOPMENT AND ADAPTATION OF THE GAS STORAGE SYSTEM*

The need to increase security of supply, while ensuring adequate flexibility in the system and the necessary seasonal modulation of supply, in order to ensure the necessary support to the system during the winter season and market coverage in case of maximisation of levies, requires the development of new storage capacity, which will need to be expanded, taking into account the expansion of existing facilities and the deployment of new infrastructure.

In addition to the development of new capacity, it will be necessary to carry out the necessary works to maintain the existing infrastructure efficiency for the following purposes:

- maintain the performance of the storage system against their physiological decay resulting from use over time;
- adapt the infrastructure to the latest technical standards;

- Increase the continuity and reliability of the service;
- improve levels of environmental protection by reducing greenhouse gas emissions.

These objectives can be achieved through interventions in the storage system, for example by drilling new wells, the gas treatment system, replacing the most critical tools or enhancing their performance and, finally, on the gas compression system, for example by introducing electrocompressors that can reduce the emissions of climate gases by also ensuring a backup in the event of a malfunction of existing turbochargers.

♦ *DEVELOPMENT OF BIOMETHANE*

The fight against climate change – the consequences of which are now increasingly evident – and the growing tensions on international markets make the deployment of renewable gases increasingly urgent and strategic in light of the need to accelerate the decarbonisation path and reduce European energy dependency. In this context, the development of biomethane can play a central role, including with a view to fostering a sectorial integration approach, a more sustainable and circular resource use economy.

In this regard, the REPowerEU Commission has recently doubled the EU's biomethane production target to 35 billion cubic metres by 2030 compared to what was initially foreseen in the Fit-for-55 initiative, which by the same date indicated an overall volume of around 17 billion cubic metres. This objective implicitly sets much higher targets for Italy than hitherto considered.

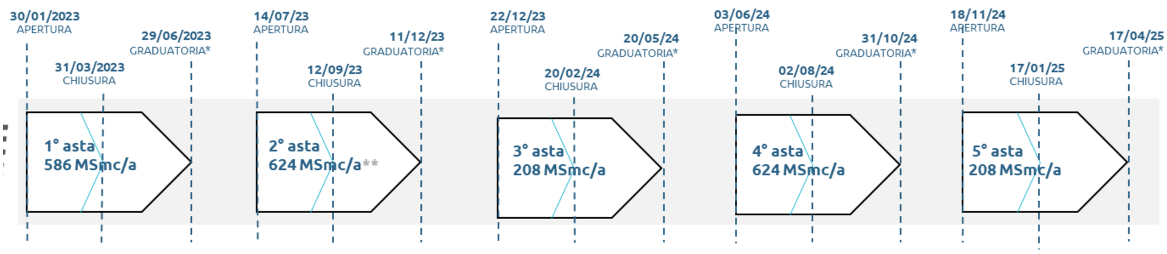
With this in mind, provision should be made for the adoption of support mechanisms to promote the establishment of biomethane production facilities and to reduce unit costs and accelerate the development of the capacity needed to achieve the targets set out above.

In this sense, the Biometano Decree published in the Official Gazette on 26 October 2022 and its implementing rules drawn up with the support of the GSE and approved by an approval decree on 13 January 2023, intend to provide support for the biomethane sector by:

- a capital contribution of 40 % on the eligible expenditure of the investment incurred, up to the maximum eligible investment cost;
- an incentive for production, with differentiated tariffs based on the cost of installations;
- annual power quotas made available to exploit the potential of reversions of existing biogas plants and the emergence of new production.

Please find below the timelines for calls for access to the forms of incentives and the respective quotas for production capacity made available through appropriate competitive procedures.

Figure 55 - Types of calls for incentives and production capacity quotas



♦ *FURTHER DEVELOPMENTS IN THE LNG NETWORK*

Article 6 of Legislative Decree No 257 of 16 December 2016 transposing the 'DAFI' Directive laying down rules for the implementation of Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure for the supply of natural gas for transport provides that an adequate number of LNG refuelling points for inland waterway vessels or seagoing vessels powered by LNG on the TEN-T core network are to be established by 31 December 2025 at the latest by 31 December 2025. accessible to the public at least along the Italian sections of the TEN-T core network to ensure the circulation of LNG powered heavy-duty vehicles, taking into account current demand and its short-term development. In Italy, the TEN-T core network has about 3.300 km of total road, divided into 3 main corridors:

- Palermo – Naples – Rome – Bologna – Modena – Milan – Verona – Brennero axis.
- Genova – Milan – Chiasso and Genoa Voltri – Alessandria – Gravellona Toce.
- Fréjus – Turin – Milan – Bergamo – Verona – Padua – Venice – Trieste axis.

In recent years, as a result of the large development of the number of LNG heavy-duty vehicles – around 2.000 vehicles in circulation on Italian roads – a large number of road distributors of liquid methane have been built and entered into operation (currently there are 59 existing installations in Italy and a further 41 in the project, according to Federmethane).

II. Regional cooperation in this area86

As regards regional cooperation in the field of energy infrastructure development, in addition to the cooperation activities already set out in paragraph 1.4., full cooperation between European electricity system operators in defining the energy scenarios (ENTSO-E/ENTSOG Scenario Report) and the Ten-Year Network Development Plan (Ten-Year Network Development Plan) is also highlighted in order to implement the shared energy security objective.

III. Where applicable, financing measures in this area at national level, including Union support and the use of Union funds

As already stated above, many cross-border infrastructure projects in both the gas and electricity sectors have been included by the European Commission in the new list of projects of common interest (PCIs), i.e. infrastructure measures with positive effects on European countries, which enable the integration of EU markets, diversify energy resources and help end energy isolation.

In addition, many projects of European relevance are being assessed to obtain funding through the EU REPOWER programme and other funding programmes that the European Union is implementing with Member States as a result of the pandemic crisis.

[86] *Interventions other than PCIs of regional groups set up under Regulation (EU) No 347/2013.*

3.4.3 Market integration

I. Policies and measures related to the elements set out in point 2.4.3

The definition of measures for the further development of integrated energy markets, with a view to accelerating the penetration of renewable sources and greater participation in the markets of different categories of resources, shall in particular include:

- the policy framework outlined by the INECP approved in 2019;
- the 2019 national transposition framework for the Clean Energy Package of the European Commission, with particular reference to Directives 2001/2018 and 944/2019 and Regulation No 943/2019 on the promotion of renewable sources and the integrated electricity market, as updated by the new provisions on the reform of the integrated electricity market recently approved by the Parliament and the Council of the EU, geared towards the development of forward negotiations and greater consumer protection so that prices better reflect the benefits of increased penetration of renewable sources;
- the new gas package recently endorsed by the Parliament and the Council of the EU promoting the development of the integrated market and gas infrastructure for the deployment and integration of hydrogen and renewable gases;
- the new Integrated Text on Electric Dispatch (TIDE), in force since 2025, reforming the dispatching activity aimed at ensuring the safety of the electricity system, in an efficient and cheap manner, in the context of the increasing uptake of non-programmable renewable sources and distributed generation, as well as the progressive reduction in the use of programmable installations.

This includes the following measures:

❖ **<u>EXCEEDING THE NATIONAL SINGLE PRICE (PUN) AND DEVELOPING *EUROPEAN MARKET COUPLING*</u>**

In order to improve the integration of the Italian market into the European market based on the full application of the *market coupling* provided for in Regulation (EU) No 1222/2015 (CACM) for day-ahead and intraday markets, in accordance with Legislative Decree No 210/21, the PUN has been exceeded as from 2025; from that date, offers to buy on the day-ahead market will be valued at zonal prices, also in line with the objective of promoting price signals to the final consumer and, looking ahead, the development of *demand response*.

However, the definition by the EMG of a benchmark for forward trading will be safeguarded, in continuity with the calculation of the PUN.

❖ **<u>DEVELOPMENT OF FORWARD MARKETS FOR THE PROMOTION OF INVESTMENTS IN RENEWABLE GENERATION CAPACITY</u>**

Measures will be taken to promote the development of PPPs by addressing entry barriers that still make it difficult to participate in such schemes; in this respect, market-based instruments will be put in place that promote both supply-side and demand-side aggregation, so as to facilitate the participation of small entities that individually would have greater resistance and/or difficulties in ensuring compliance with the requirements and commitments of the medium- to long-term agreements, and appropriate guarantee mechanisms will be assessed, including through the involvement of public entities such as GSE and CONSIP and the development of centralised trading platforms. In this regard, pursuant to Legislative Decree No 199/2021, GME has already introduced an information bullet with the aim of facilitating the meeting between the parties involved in the conclusion of these agreements, which is the starting point for the further strengthening of centralised market instruments. Finally, Article 2 of Decree-Law No 183/23, in order to promote the self-production of final energy customers and the development of new renewable generation capacity, introduced a mechanism whereby GSE is a central counterparty for fixed-term contracts with such entities, complementary to the auctions for support for renewable sources provided for in Legislative Decree No 199/2021.

Two-way or CfD contracts, understood as a tool for contracting with the renewable generation capacity system, are a crucial tool to ensure the achievement of decarbonisation objectives.

The CfD tool can bring significant benefits in terms of price stabilisation over time, providing the producer from renewable sources with certainty of revenue flows in the medium to long term that allows the project to be bankable, and for the consumer to be protected against price volatility in *spot* markets.

In order to improve the effectiveness and efficiency of this instrument, some developments in the design of the CfDs are being assessed, with particular reference to the mechanism for defining the needs to be supplied in auctions and the contractual structure.

The definition of needs must, in particular, take into account, in an integrated optimisation approach, the need to pursue decarbonisation objectives at the lowest cost to consumers and without compromising the safety of the electricity system. In that regard, it must be borne in mind that minimising costs for the system requires consideration, first, of the different market value associated with the expected production profiles of different renewable technologies; market value which, in turn, is closely linked to network developments and storage capacity.

The structure of the contract, in terms of rights and obligations for assignees, will have to evolve with the dual objective of efficiently allocating risks and responsibilities between the system and private investors and of integrating renewable capacity more closely into the dynamics of *spot markets. In*particular, the following*will be considered:*

- the introduction of automatic tariff adjustment mechanisms to address rising costs and risks related to inflation;
- the possibility of recognising the fee payable on the basis of different profiles from the actual input of the installation in order to promote efficient investment and resource management solutions, as well as a better allocation of risks among the different actors in the system. As a first step, for example, the fee payable could be recognised on the basis of the potential inputs of the installation instead of the actual net input at times of cuts to renewable production due to local constraints and/or overgeneration *situations*. In the future, as soon as the electricity system has a minimum amount of *utility scale* storage resources and the related *time shift products provided for* in Legislative Decree No 210/2021, the tariff to be charged could be recognised on the basis of *standard* profiles consistent with the needs of the electricity system (e.g. *baseload* and/or peakload*)*, providing for an obligation to place renewable energy on an annual basis equal to a share of the contracted profile; this type of contractual structure would leave private investors with responsibility for the optimal *mix* of renewable technologies to be deployed.

Finally, in order to promote the deployment of long-term renewables power purchase agreements, under the Repower chapter of the NRRP, a reform was planned, to be implemented by 2024, aimed at introducing a system of guarantees to mitigate the financial risk associated with such agreements, in particular those with a duration of at least three years, in order to reduce the barriers to their use. In particular, the reform will have to: (I) provide that each contractor ensures partial coverage of the equivalent value of the contracts by means of guarantee instruments provided for in the regulation of the electricity market; (II) introduce measures to mitigate the risk of default, including requirements and constraints for policyholders and penalties for default of the producer (iii) identify an institutional entity that assumes the role of seller/buyer of last resort, which succeeds the counterparty in default and ensures that its obligations towards the performing counterparty are fulfilled.

❖ **DEVELOPMENT AND OPENING OF THE ANCILLARY SERVICES MARKET**

The growth of intermittent renewable sources will increase the need for flexibility of the system, which can be met by ensuring the availability of an adequate amount of flexible resources ready to provide services to the transmission system operator.

It is therefore necessary to complete the process of authorising the resources distributed to the services markets, including through aggregation, in accordance with the principles of technological neutrality and cost minimisation, as provided for in the TIDE, which Terna is implementing through the updating of the network code. To this end, the main areas of intervention are:

- promote equal competition between production units and consumption units on the services market, based on the principle of technological neutrality;
- remove as far as possible and useful for the system the minimum power limits required for participation in the services market;
- provide for each resource to participate in relation to the actual capacity to provide the service, removing any performance obligations that could penalise certain resources;
- empower the provision of services on an aggregate level, considering that small units often lack sufficient skills to participate individually in organised markets.

In addition, given that the future scenario is characterised by increased daily price volatility (low during the core hours of the day, higher during the evening), it is considered appropriate to test and promote new tools and flexibility mechanisms to organise production cycles so as to maximise levies in hours of abundance of renewable production.

II. Measures to increase the flexibility of the energy system with regard to renewable energy production such as smart grids, aggregation, demand response, storage, distributed generation, mechanisms for dispatching, re-dispatching and curtailment, real-time price signals, including the roll-out of intraday market coupling and cross-border balancing markets

In a context where flexibility becomes an essential objective for the efficient and secure integration of the increasing share of energy from renewable sources, the following measures are crucial:

❖ **DEVELOPMENT OF *SCALE UTILITY ACCUMULATION* CAPACITY**

In order to integrate renewable energy expected in 2030, MACSE (further details in Section 3.3) will ensure the developmentof new storage capacity on the basis of area requirements developed by Terna and approved by the Ministry of Environment and Energy Safety (MASE), subject to the opinion of the Regulatory Authority. MACSE will finance, through competitive auctions, the supply of several GWh of new electricity storage capacity, allowing the actual development of RES to be 'followed'. The measure is also part of the reforms foreseen in the RRP. The development of accumulation systems in accordance with competitive mechanisms is linked to the reorganisation of the market design, in line with the recently adopted reform of the European Commission updating Regulation 943/2019 and Directives 944/2019 and 2001/2018, aimed, inter alia, at promoting the development of forward markets and the flexibility of the system. The new mechanism, approved by the European Commission in December 2023, is in the process of being finalised and provides for the future supply of new centralised storage capacity, which will be made available to electricity market participants interested in using it in electricity markets, through the introduction of*time shift options*; the new design will address the need for greater integration of renewable sources and promote flexibility in the system, valorising the different value of energy over time and ensuring a more efficient management of the*phenomenon* of non-programmable renewable overgeneration.

❖ **DEVELOPMENT AND SUPPORT OF COLLECTIVE SELF-CONSUMPTION CONFIGURATIONS AND IN PARTICULAR ENERGY COMMUNITIES**

In the last two years, following the specific provisions of Legislative Decree No 199/2021 and Legislative Decree No 210/2021, the regulation of collective self-consumption configurations, including energy communities, has been encouraged by the regulatory authority's most recent definition of the Integrated Text of Self-Consumption, which has streamlined the various possible schemes and regulated the use of shared energy; on this basis, measures to increase self-consumption, including widespread self-consumption, as well as the active and informed participation of consumers, through aggregation into new entities aimed at managing, for predominantly social purposes, energy consumption and generation, including through virtual *sharing* tools. To this end, a dedicated portal has also been set up to guide final customers in the context of energy sharing opportunities as *a first step* for the activation of additional support and assistance services, including for the local administrations concerned, in setting up new participatory collective actors. In this regard, as also stated in paragraph 3.1.2., measures to support the development of such configurations are also envisaged.

❖ **DEPLOYMENT OF VEHICLE AND POWER GRID INTEGRATION TECHNOLOGY: *VEHICLE TO GRID***

With the expected electrification of the sector, connected mobility could also become an important flexibility resource to support network management needs, through the development of innovative technologies such as the so-called *vehicle to grid*. In 2020, a first phase of implementation was launched on the basis of the provisions of the Ministerial Decree of 30 January 2020 and the subsequent regulation of ARERA in the context of the projects promoted under Decision 300/2017, introducing mechanisms and new rules for participation in the markets for electric vehicle charging systems services and providing for specific measures to rebalance the payment of general system charges.

Subsequently, these mechanisms will be applied extensively in order to promote the uptake of technology for integration between electric vehicles and the electricity grid; prior impact assessments will be carried out to take into account the outcomes of the experimental phase and to identify appropriate adjustments to the mechanisms.

III. Where applicable, measures to ensure the non-discriminatory participation of renewable energy, demand response and storage, including via aggregation, in all energy markets

❖ **UPDATE OF THE DISPATCHING MODEL AND ROLE OF DISTRIBUTORS (DSO)**

The energy transition will lead to an increase in resources linked to the distribution network. Examples include the growth of solar photovoltaic in the residential sector and distributed accumulations, which will play an important role in achieving the *energy and emission targets*. Similarly, consumers themselves will have an increasingly active role in the energy market, moving from *consumers* to *prosumers*. However, despite the increasing number of distributed resources, their potential for flexibility remains largely untapped to date. From a practical point of view, there are a number of technical and commercial factors which – if not properly addressed and resolved – make the participation of distributed resources in flexibility markets through aggregators technically complex and unprofitable. Among the various enabling actions, it is crucial to promote the technological standardisation needed to ensure the observability and controllability of these resources at low cost, including through the establishment of binding minimum technology standards associated, for example, with any form of incentive to purchase.

In this context, Legislative Decree No 210/21 provided, even in the context of *a central dispatch* model, for a more active role for DSOs by regulating:

- how electricity distribution system operators cooperate with the transmission system operator, with a view to extending, in an efficient and secure manner for the system, the participation of entities with generation, consumption and storage facilities connected to the distribution networks they operate, including through aggregators, in the energy, ancillary services and balancing services markets;
- the testing of a system of local self-dispatching, through a system of premiums and penalties that stimulates electricity producers and final customers to balance their positions by offsetting consumption with local production, while respecting network security constraints.

On the one hand, ARERA has put in place a mechanism that will allow local network constraints expressed by distributors dynamically and to ensure the coordinated and safe operation of energy transmission and distribution networks in the supply processes of global flexibility services in the market for dispatching services. On the other hand, ARERA also launched the first trials on the procurement of local ancillary services by DSOs, developing solutions to facilitate flexibility in distribution networks and the evolution towards *Smart-Grid*.

The experimentation is in addition to the experiment concerning the role of neutral facilitator for Terna’s procurement of global ancillary services. In the future, it is crucial to continue testing in order to improve the coordination arrangements between TSOs and DSOs. According to the approach currently prevailing in Europe and Italy, a model should be maintained in which the balancing market is managed only by the TSO, giving DSOs a “facilitator” role in dispatching resources connected to their networks. In parallel, network congestion management and stress control will have to be ensured by both the TSO and DSOs, through their respective markets for global ancillary services and, where efficient, local services.

❖ **<u>DEVELOPMENT OF AGGREGATION IN SERVICES AND BALANCING MARKETS</u>**

Legislative Decree No 210/2021 strengthened the right of consumers to create aggregations (generation facilities, including together with storage systems and demand units) for access to service markets that TSO needs to resolve any congestion, fostering better integration of energy from renewable sources and supplying the necessary reserve margins.

Distributed resources can already participate in the ancillary services market today through the UVAM pilot project. In addition, the process of enabling resources distributed to the services markets will need to be completed, including through aggregation, in accordance with the principles of technological neutrality and cost minimisation, as provided for in the provisions of the TIDE, which Terna is implementing through the updating of the network code.

To this end, the new regulation of electrical dispatching that will be in place since 2025 will define more clearly the roles of Balancing Responsible Parties (BRP) and Balancing Service Provider (BSP), so as to institutionalise the existence of the two potentially (but not necessarily) distinct roles and their operational perimeters:

- the BRP is the person responsible for marketing the amount of energy in energy markets, including responsibility for taking a balanced position, failing which economic consequences will be applied;
- the BSP is the entity responsible for carrying out movements resulting from the provision of ancillary services to which the entity has engaged with the Network Manager.

The process of opening up the services market will also be based on Terna's review of the currently defined ancillary services and the related requirements for their provision, together with the adaptation, as mentioned above, of the models currently used for resource selection.

IV. Policies and measures to protect consumers, especially vulnerable and, where applicable, energy poor consumers, and to improve the competitiveness and contestability of the retail energy market

❖ **COMPLETION OF LIBERALISATION OF RETAIL MARKETS**

The process of liberalising the retail market for electricity and natural gas has been implemented in recent years with the adoption of the legislative and regulatory acts provided for by Law 124/2017, which resulted in the end of the protection schemes for small enterprises (since 1 July 2021) and more subsequently for micro-enterprises (since 1 April 2023).

The process of liberalising the final sales market for household electricity and natural gas customers has recently been completed in implementation of the above-mentioned legal provision.

As of 10 January 2024, the regulated price regime for household customers in the natural gas sector was exceeded. Therefore, since that date, all customers have been supplied by a freely chosen sales operator on the market. For vulnerable customers, operators are required to offer them an offer on standard terms set by the Authority, in accordance with the provisions introduced by DL 176/2022.

With regard to electricity, pursuant to the Decree of the Minister for the Environment and Energy Safety of 18 May 2023 and on the basis of the regulatory authority's rules, by 10 January 2024, procedures were carried out for the selection of suppliers of the so-called gradual protection service, a means of transition to the free market so as to ensure continuity of supply to household customers other than vulnerable customers who have not chosen a supplier on the free market independently. The switching of customers to service operators to gradual protections identified for local areas as a result of the call for tenders is scheduled to take place from 1 July 2024.

As regards vulnerable customers in the electricity sector, identified individually by Legislative Decree No 210/2021 transposing Directive 944/2019, Decree-Law No 181 of 9 December 2023 provided for the right to be supplied as part of the vulnerability service provided by suppliers registered in the relevant register, selected by competitive procedure. In the coming months, ARERA will have to regulate the terms of the service and the procedures for selecting operators.

These actions will contribute to:

- prevent the exercise of market power by operators and strengthen*unbundling* rules which today have a competitive advantage for retailers integrated with distribution;
- to qualify the sales market, which is currently highly fragmented;
- promote mobility and the active role of consumers and simplify *switching* procedures;

- provide consumer certainty and reduce the proliferation of incorrect information.

❖ CONSUMER PROTECTION INSTRUMENTS AND MEASURES

There are a number of consumer measures to accompany the liberalisation process in line with the objectives set out above, which strengthen the instruments put in place in recent years:

- Consumption portal and other developments in the Integrated Information System: since 2019, the energy consumption portal has been *online* on the Single Buyer website, which makes available to each consumer, in compliance with *privacy* rules, the data of their electricity and gas users relating to the details of their supply contract and historical consumption data, thanks to the information obtained from the Integrated Information System. Data on electricity and natural gas meters will also be made available to third parties designated by the consumer as well as on the Offer Portal to allow consumers to compare the same offers on the basis of their own consumption profile. Accessibility to consumption, historical and daily data, can also be promoted through new digital solutions.
- On the digitalisation front, a further perspective concerns the deployment of *smart home tools*. *Switching*, volture and activation/decommissioning of supply, including cases of delinquency, will also be made increasingly efficient thanks to the Integrated Information System.
- Register of electricity and natural gas suppliers: all electricity sellers, in order to carry out their activities, must be registered in the list of electricity sellers, which have recently entered into operation by decree of the Ministry of the Environment and Energy Safety pursuant to Law No 124/2017 (Article 1 (80) to (81)). A reform of the list of natural gas vendors, introduced by Law No 214 of 30 December 2023, is planned to strengthen the deterrent effect of the list with regard to improper behaviour of operators and to harmonise, both in terms of requirements and management, the gas list with the similar electricity operating instrument, in order to improve the protection of final customers. Suppliers will have to comply with specific criteria, modalities, technical, financial and good repute requirements for inclusion and retention on the list.
- Regulation of the services of the Ultima Application: there is a rationalisation of the rules governing the selection of merchants, the conditions for the provision of the service and the arrangements for entering and leaving the services for final customers without a supplier on the free market, in coordination with the rules on overcoming protection schemes.
- Measures for vulnerable household consumers: tools to protect vulnerable electricity and natural gas customers will be developed. Pursuant to the provisions of Article 11 of Legislative Decree No 210/2021, as amended by Decree-Law No 181/2023, provision is made for the introduction of a vulnerability service under *standard* contractual conditions defined by ARERA provided by operators selected through tender procedures for local areas.
- Other measures: There will be checks and sanctions against misconduct, strengthening the tools for comparing tenders (already present by ARERA and the Single Buyer). An important role will be given to information campaigns with the aim of raising awareness among final customers and increasing consumer competence on the multiple tools that the market offers to promote their active role, in particular in support of the final stage of the market liberalisation process.

❖ EMERGENCY MEASURES TO ADDRESS CRISI

Several temporary emergency measures were introduced to support households and businesses during the energy crisis following the Russian-Ukrainian conflict. These measures are introduced as a matter of urgency and are the result of a more general reflection on the need to identify possible replicable measures to be taken in order to address the possible re-emergence of contingent problems. These include:

- energy bills in instalments for final customers: the measure provides that final customers may request their suppliers to charge their energy bills in instalments and, in order to support the liquidity needs of vendors resulting from these instalment plans, the latter have access to State-guaranteed credits;
- reduction of tariff charges: the measure entails zero or reduction of tariff components to cover so-called system charges which finance public policies for general users or the reduction of the value added tax on natural gas for households;
- reinforcement of energy bonuses for persons suffering from economic distress or severe health conditions that require the use of life-saving electrical equipment both in terms of compensation and increase of the ISEE threshold to access the bonus;
- electricity price cap: two separate provisions have been adopted to introduce a cap on the revenues of producers of electricity from renewable sources:
    - for renewable energy producers benefiting from incentive mechanisms, a price compensation system has been put in place to redistribute the extra profits resulting from the surge in energy prices (period from February 2022 to June 2023);
    - pursuant to Regulation (EU) 2022/1854, a maximum limit of EUR 180/MWh is to be applied to the market revenues of producers or their intermediaries from the production and sale of electricity from renewable sources as well as from the other types of sources identified by that Regulation.

❖ **MEASURE IN FAVOUR OF ENERGY-INTENSIVE ENTERPRISES**

The evolution of energy market prices has made it increasingly attractive to invest in new renewable generation capacity, although a need to stabilise revenues and reduce market risk remains (and is likely to grow in the future with the adaptation of the generation mix). This requirement can be met – in addition to CFDs – through PPPs with industrial entities or through the direct deployment of renewable energy installations by energy intensive consumers, thus also contributing to the decarbonisation of industry. This is a virtuous path that should be promoted. Energy D.L. provided for a mechanism, known as “Electricity release”, for the development of new RES capacity (over 200 kW) by energy-intensive companies, or by third parties with which they sign, including through wholesalers, fixed-term contracts for renewable energy. At the request of the company energivora, GSE may, for the first three years, anticipate the effects of the construction of these plants by selling renewable energy at a price in line with the costs of the technology. The anticipated energy will have to be returned to the same price during the next 20 years. The advance and repayment will take place on the basis of two-way CFD contracts.

The measure in favour of energy-intensive enterprises has also been reformed by Decree-Law No 131/2023 to support the competitiveness of productive sectors exposed to international competition, in accordance with the new Community guidelines on State aid for climate, environment and energy 2022, strengthening companies’ obligations towards efficient behaviour and in line with decarbonisation objectives. In this regard, in the coming months, the regulatory framework on the modalities and criteria for energy-intensive companies to meet and fulfil their obligations on improving energy efficiency, reducing the carbon footprint by covering their needs with energy from renewable sources or reducing climate emissions will be refined in the coming months.

❖ **PROSUMER INSTRUMENTS*: THE SELF-CONSUMPTION PORTAL***

To support the development of solar self-consumption, both individual and collective, as well as energy communities, GSE has developed a dedicated IT tool: the Video Video Consumption Portal. The main objective of the portal is to facilitate and support the launch of self-consumer-oriented PV projects through a simulator, self-consumption guide, FAQs, maps and good examples.

Having become aware of the benefits of self-consumption, the consumer can test their usefulness for their specific case. The portal allows for personalised simulations for private individuals, businesses and public authorities. The analysis carried out through the portal shows the correct size of the plant and the economic assessment of the initiative, assuming different financial solutions.

v. Description of measures to enable and develop demand response, including those addressing tariffs to support dynamic pricing87

❖ **ELECTRICITY AND GAS MARKET: *SMART METERS***

New *smart meters* will play an important role in providing all the useful comprehensibility and monitoring elements for consumers.

In the electricity context, the replacement of existing digital meters *with* second generation smart meters is considered indispensable for conveying products, services and offers to be included in new distributed generation and consumption models, including *demand response* and *smart grids*.

2G meters have been defined and regulated in terms of technical, functional and economic requirements by ARERA for the three-year period 2017-2019 and already have more than 4 million 2G meters put into service at low-voltage utilities. In 2019, an update of the regulation (Decision 306/2019/R/eel) was received for the three-year period 2020-2022 and in 2022 for the three-year period 2023-2025, including a planning of the timetable for the large-scale commissioning of 2G meters for all distribution companies with more than 100.000 customers (98 % of the country's sampling points), which provide for the following steps:

- the start of plans to put into service 2G *smart metering* systems shall be carried out by 2022;
- the massive replacement phase of already existing meters will have to be completed by 2026 (for 95 % of the meters, the same percentage used for the first generation). There is also a *target* of 90 % replacements in 2025.

In the context of dispatching, gradual exceedances may be carried out, in line with the plans for the activation of new 2G meters, sampling profiling mechanisms and inputs for small users and installations using the actual measures made available by the new meters for the purpose of defining the physical batches of the dispatching service.

In the gas sector, the transition to smart metering systems (*Decision* 669/2018/R/GAS) is continuing, making solutions with higher functionalities possible at an early stage where the cost differential is limited or lower than the expected benefits, with the following timeframes:

- for distribution companies with more than 200.000 final customers, 85 % in service by 31 December 2020;
- for distribution companies with a number of final customers between 100.000 and 200.000, 85 % in service by 31 December 2021;

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[87] *In accordance with Article 15(8) of Directive 2012/27/EU*

- for distribution companies with a number of final customers between 50.000 and 100.000, 85 % in service by 31 December 2023;
- progressive extension of substitution targets to smaller operators.

❖ **DISSEMINATION OF TENDERS FOR DYNAMIC PRICE ELECTRICITY SUPPLY CONTRACTS**

- In accordance with Legislative Decree No 210/2021, regulation will be introduced concerning the right of consumers who have a smart meter to conclude, upon express request, a dynamic price contract, that is to say, a contract for the supply of electricity reflecting the price variation on spot markets, upon express request, with each supplier with more than 200.000 final customers. In this regard, ARERA carried out a consultation with DCO 668/2022 with a view to reviewing the specific conditions for subsequent adoption of relevant measures. This first review revealed the need for further investigation and analysis, which is still ongoing, in order to establish obligations for suppliers consistent with the technical constraints arising from the measurement. In addition, ARERA is expected to consider, also on the basis of the results of market monitoring and offers, the adoption of mechanisms to guide the gradual pricing of supply contract components, other than electricity, in a dynamic manner, while reducing fixed quotas, taking into account the need to promote demand response and energy efficiency in end use.

3.4.4 energy poverty

I. Where applicable, policies and measures to achieve the objectives set out in point 2.4.4

In general, policies to combat energy poverty can be classified in different types:

- policies to reduce household energy expenditure (e.g. bonuses or social tariffs);
- policies to improve the energy efficiency of dwellings by reducing their energy needs (application of regulations, incentives, energy performance certificates, energy tutors, etc.);
- subsidies to households with low incomes.

In Italy, there are several instruments relating to the different types.

First, it should be noted that, in order to better coordinate existing objectives and measures between the various institutional stakeholders, the National Energy Poverty Observatory, provided for in Legislative Decree No 210/2021, has been operational since 2022.

The National Observatory is a collegiate body composed of six members: two members appointed by the Minister for the Environment and Energy Security, including the President, one by the Minister for Labour and Social Policy, one by the Minister for Infrastructure and Transport, one by the Conference of the State Regions and Autonomous Provinces and one by the Regulatory Authority for Energy Networks and Environment. For the performance of its tasks, the Observatory shall rely on the technical support of the Energy Services Operator (GSE) and the Single Buyer (AU). In addition, in order to achieve its objectives, the Observatory may take initiatives to consult, hear and cooperate with the various public and private actors affected by energy poverty.

The Centre shall have the following functions:

- submission of proposals to MASE and ARERA for measures to combat energy poverty, including through the promotion of communication, training and assistance to public actors and stakeholder representative bodies;
- carrying out studies, analysis and technical support for the design and implementation of measures addressing energy poverty, including for the purposes of the integrated reporting on energy poverty referred to in Article 24 of Regulation (EU) 2018/1999;
- monitoring energy poverty at national level;
- support for cooperation within similar European institutional bodies;
- developing criteria for identifying the number of households in energy poverty;
- promoting the exchange of experience and information with the regions, other central and local administrations concerned, with associations, statistical institutions, research organisations dealing with poverty issues in various ways and with stakeholders;
- coordination of measures to combat energy poverty at national level;
- support in the development of the National Strategy against Energy Poverty.

The Observatory therefore has the role of an interinstitutional platform for designing and monitoring the effectiveness of measures and integrating the various actions into public policies in order to combat energy poverty in a comprehensive manner, seeking to overcome the fragmented nature of the measures and dedicated resources.
The Observatory is the institutional forum in which to develop, in accordance with a comprehensive approach, the various initiatives related to analysis, measurement/monitoring, information[88] and combating energy poverty, starting with those set out in this Plan. In this regard, Legislative Decree No 210/2021 provided for the drawing up, on the basis of the Observatory's analyses, of a national

[88] The Decree provides, inter alia, that the results of the work carried out by the Observatory are to be disseminated on the Ministry's institutional website.

strategy to combat energy poverty, which is a reference policy framework, with the aim of formulating periodic indicative targets for the development, at national level, of structural and long-term measures and for the integration of ongoing and planned actions under public policies.
In addition, on the basis of the evolution of the results resulting from the EPIC Project's activities and, therefore, the identification of new indicators, the Observatory will make proposals to the Government for the transposition and implementation within the national framework of the definition of energy poverty referred to in Article 2 (52) of the Energy Efficiency Directive, also taking into account what is suggested by Commission Recommendation (EU) 2023/2407 of 20 October 2023.

❖ SOCIAL BONUSES AND MEASURES TO REDUCE THE COST OF BILLS

The main specific measure to combat energy poverty in Italy is part of the type of instruments for reducing household energy expenditure: these are the social bonuses for electricity and natural gas, aimed at households in economic distress.

Bonuses are paid by means of a discount on the bill, with an amount differentiated by the number of household components and, for gas only, depending on the type of use and the climate zone. The indicator to identify the range of beneficiaries of this measure is ISEE (Indicator of the Equivalent Economic Situation), which is used at national level to access other subsidised social benefits as well. This indicator is linked to certain subjective requirements and the economic situation of the household. In order to obtain the electricity and gas social bonuses, the ISEE value must be below EUR 9.530[89], which increases up to EUR 20,000 for households with at least 4 dependent children (thresholds subsequently amended for 2023, as shown below). In order to avoid distortive effects on consumption, and to maintain an incentive for energy savings, the discount in the bill is set uniformly for all households of a certain type, regardless of their actual consumption; the electricity bonus covers around 30 % of the annual expenditure of an average household; the gas bonus accounts for 15 % of annual expenditure.

The arrangements for the recognition of social bonuses for economic inconvenience have undergone a profound transformation since 2021 into implementation of Decree-Law No 124 of 26 October 2019 (converted, with amendments, into Law No 157 of 19 December 2019). A mechanism based on consumer demand, which required the submission of an application to the municipality of residence, has moved to an automatic mechanism which does not provide for any request from those entitled to receive the bonus, based on the interoperability of the INPS and SII databases, which enabled more households affected by energy poverty to be intercepted and resulted in a significant increase in the bonuses paid: beneficiaries rose from one third of the beneficiaries (800 thousand) to 2.5 million. In 2022, the bonuses paid increased further as a result of extraordinary government interventions.

[89] *Inflation update of the ISEE threshold valid since 2023.*

Table 46 - Electricity and gas bonuses 2019-2022 (data in millions) [Source: ARERA – AU]

Year	Electric bonus	Gas bonus	Total bonus paid	% Change annual
2019	0,8	0,6	1,4	+ 3 %
2020	0,8	0,5	1,3	— 3 %
2021	2,5	1,5	4,0	+ 198 %
2022	3,7	2,4	6,1	+ 53 %

The analyses carried out by ISTAT assessed the effectiveness of the bonus measure in reducing inequality and the risk of poverty. The largest share of households benefiting from the bonus is in the first two fifths of income, i.e. in the poorest group, reinforcing the ability of the bonus mechanism to effectively identify the target of the most economically disadvantaged households. Bonuses have a strong redistributive effect: in the fifth poorest, the benefit is maximum, accounting for up to 4 % of household income and more than 85 % of total expenditure is allocated to households with the first two fifths of equivalised income. In relation to household income, the benefit is higher in the first fifth.

In order to limit the rise in commodity prices and to protect the households most in difficulty, some extraordinary measures have been adopted since 2022. First, a total of EUR 2.81 million of public resources were allocated in 2022 to strengthen and extend the range of beneficiaries of the electricity and gas social bonuses. The range of persons entitled to the social bonus for electricity and gas for economic inconvenience has been extended, increasing the ISEE threshold (DL No 21/22), starting from the second quarter of 2022 to EUR 12,000, for all eligible families, and to EUR 15,000 for 2023 (Law No 197 of 29 December 2022) or EUR 30,000 for households with at least 4 dependent children (Decree-Law No 34 of 30 March 23).

Measures have also been put in place not specifically targeted at poor customers, but to all consumers, including zero system charges in the case of electricity supplies (reduction in the natural gas sector), the application of VAT to a lesser extent for supplies of natural gas and the provision of instalment plans for bills.

It should also be noted that, in addition to measures to combat energy poverty, Legislative Decree No 210 of 8 November 2021 also defined, for the electricity market, the regulatory framework for the protection of vulnerable and energy poor customers, identifying, for the first time in Italian law, the criteria for defining the range of vulnerable customers. Specifically, the standard identifies household customers listed in paragraph 2.4.4 as vulnerable.

The Decree also provides for the definition of a specific offer for the supply of electricity for vulnerable customers, at prices reflecting the cost of energy in the wholesale market, as part of the process of overcoming the enhanced protection service for all household customers from 2024 onwards.

By Decree-Law No 176 of 18 November 2022, converted with amendment by Law No 6 of 13 January 2023, those provisions concerning vulnerable customers were also extended to the natural gas market.

The framework thus introduced is consistent with the Commission Communication on guidance to Member States for updating their National Energy and Climate Plans 2021-2030, where access to essential services at affordable prices is expected to be ensured for all vulnerable and energy poor consumers. Moreover, the proposed European reform of the electricity market design, currently under discussion, also requires Member States to adopt additional protection to prevent the disconnection of electricity to vulnerable customers, particularly at "critical" moments (e.g. rising prices). In addition, such customers should be given a "high quality" universal service, distinct from that for other types of customers.

❖ **MEASURES TO SUPPORT ENERGY EFFICIENCY AND THE DEPLOYMENT OF RENEWABLE SOURCES**

Energy efficiency[90], in particular measures to promote the energy retrofitting of buildings, is one of the effective tools to combat energy poverty. More information can be found in Chapter 3.2; there is only one focus on energy efficiency measures that have a specific impact on reducing energy poverty.

This includes, for example:

- tax deductions for the energy retrofitting of buildings ('Ecobonus'): this instrument was first extended to households in energy poverty, by means of the power to transfer credit for those who were incaptives (Budget Law 2017), and subsequently extended to independent institutions for social housing/social housing (Budget Law 2018);
- the National Energy Efficiency Fund, which provides for subsidised or guaranteed financing by the State for energy efficiency measures carried out by companies and public authorities, also includes measures to improve the energy efficiency of public housing;
- the Termico Account, which incentivises measures for energy efficiency in the public administration and the production of thermal energy from renewable sources. This mechanism also allows support for actions to improve the energy efficiency of public residential buildings. Between 2021 and 2022, more than 3.700 social housing interventions were carried out with the Termico Account (out of a total of around 187 measures supported by the mechanism). Out of a total of more than EUR 540 million recognised by the Termico account, EUR 9.2 million was allocated to social housing.

These measures will be strengthened in line with the evolutive lines identified in Chapter 3.2, also taking into account the new EU Energy Efficiency Directive, which requires Member States to achieve a share of the required cumulative end-use energy savings among energy poor consumers, vulnerable customers and, where applicable, people living in social housing: this share must be at least equal to the share of households in energy poverty. The new Directive introduces an obligation for Member States to implement energy efficiency improvement measures as a priority among vulnerable customers, people affected by energy poverty and, where appropriate, people living in social housing, to alleviate energy poverty.

In particular, one of the most complex topics, already highlighted in the INECP 2019, is that of people living in non-owner-occupied dwellings.

Indeed, the available data show that the majority of poor households do not live in owner-occupied homes, but in third party housing (rented or in usufruct) and that the incidence of absolute poverty is higher among tenants.

In 2021, poor rented households accounted for 45.3 % of all poor households, with an absolute poverty rate of 18.5 %, compared to 4.3 % of those living in owner-occupied dwellings. In this context, the push for energy efficiency measures is very weak.

[90] *All measures in this area are described in more detail in the energy efficiency dimension section, in particular paragraph 3.2.*

Table 47 – Type of use of the dwelling of poor households – Year 2021 [Source: ISTAT]

Type of use of the dwelling	% of households in poverty
Rent	*45 %*
Properties	*41 %*
Usufruct and free use	*14 %*

In this respect, the problem arises in particular of the lack of incentives for owners to carry out structural measures: in this situation, tenants can only efficiency in their energy consumption through behavioural changes. The proposed revision of the Directive requires Member States to ensure financial and technical support for measures to reduce energy poverty among tenants, taking into account the costs of such measures and their accessibility for owners and tenants, overcoming the divergence of interests between owners and tenants.

The measures necessary for this purpose may include the provision of incentives, the repeal or amendment of legal or regulatory provisions, the simplification of administrative procedures to be combined with training and information and technical assistance in the field of energy efficiency. It is also important to support a dialogue involving stakeholders, such as owner and tenant organisations, consumer organisations, renewable energy communities and citizen energy communities if present, and local and regional authorities, as well as relevant public authorities and agencies, precisely to develop proposals for measures.

Measures for the deployment of renewable sources and energy efficiency include energy income: this is a public incentive for low-income households to install photovoltaic panels on dwellings, with a contribution of up to 100 % of expenditure, with the aim of reducing the costs of bills, thanks to self-generation of electricity. The National Energy Income Fund was established by Decision No 7 of 17 March 2020 of the Interministerial Committee on Economic Programming and Sustainable Development and a budget of EUR 200 million since 2022, transferred from the Development and Cohesion Fund to the National Energy Reddito.

Among the instruments that can help alleviate energy poverty, shared energy configurations, in particular renewable energy communities (CERs) described in paragraph 3.1.2, may also be included. CERs can bring economic and social benefits to poorer households or located in rural and remote areas.

The NRRP also takes into account this function of CERs; for example, investment 1.2 is targeted at public administrations, households and micro-enterprises in municipalities with less than 5.000 inhabitants in order to support the economy of small municipalities, often at risk of depopulation, and to strengthen social cohesion. This investment aims to ensure the necessary resources to install at least 2.000 MW of new electricity generation capacity in distributed configuration.

In the light of the above, the importance of greater institutional cooperation between the different national and local authorities responsible for the interplay between energy poverty measures, housing policies and efficiency in public and private buildings becomes even more evident and, on a case-by-case basis, the discussion at the National Energy Poverty Observatory also goes in this direction. In this context, attention will also be paid to actions to overcome the problems in collecting data and mapping local situations resulting from the incompleteness and high heterogeneity of operational, regional and local databases, and from the specificities of the different public and private construction sectors.

Finally, a measure concerning vulnerable qualified consumers as residents of isolated systems is that laid down by the Decree of the Minister for Economic Development of 14 February 2017, which defined the objectives of energy development towards a design based on renewable sources (both electric and thermal) on smaller non-interconnected islands. Specifically, provision is made for a comprehensive 'basic tariff' on the energy fed into the grid and a bonus on self-consumption, namely, for thermal RES solutions (solar heating installations, solar cooling, heat pumps, etc.) a one-off remuneration, partially reimbursing expenditure incurred and differentiated for the various types of installations. as coordinated with the conversion law of 27 April 2022, Article 1 (9b) and (2022c) provides for an update of Ministerial Decree No 14/2/2017 on the energy transition of small islands not interconnected with the aim of achieving full coverage of the energy needs of smaller islands that are not interconnected through energy from renewable sources by 31 December 2026.

❖ <u>FURTHER PLANNED EVOLUTIONARY LINES</u>

♦ *TRAINING, INFORMATION, TUTORING*

Optimising consumer behaviour in order to reduce bills, as well as energy efficiency, even more for vulnerable customers who are less aware of the opportunities available, goes through both digital licensing tools and training tools. Italy, through the European project ASSIST (Support Network for Household Energy Saving), running from 2017 to 2020 (with the participation of the Single Buyer) involving around 8.500 consumers, has defined a virtuous model to support consumers in difficulty.

The results of the project include the definition of the figure and tasks of the Tutors for Domestica Energy (TED), which is a single point of reference, with integrated skills, which consumers in energy poverty or vulnerable are able to consult on all issues related to their energy consumption, through training, networking and support for the action.

Looking ahead, further measures will be considered to promote this model of advice and technical assistance, together with the development of targeted information campaigns, including in the form of training and networking measures involving in particular consumer associations, energy operators and research organisations.

In terms of information and training, it is also important to recall the Energy Efficiency Information and Training Plan described in Chapter 3.2.

♦ *LOCAL AUTHORITIES' POLICIES TO COMBAT ENERGY POVERTY*

Experience on energy poverty shows the effectiveness of measures taken by local authorities (municipalities, regions) in national policies. Local actions, thanks to direct knowledge of the context and conditions of families in the area, can be effective and comprehensive, including through targeted initiatives. Successful initiatives, which may be more extensive, include at least the following:

- development of a free audit service for households in poverty, with energy audits and support for access to renovation incentives or Conto Termico;
- installation of photovoltaic panels in social housing owned by local governments;
- free distribution of LED bulbs and other saving devices to poorer households;
- recovery of abandoned buildings, reclassifying them from an energy point of view and allocating them with a reduced rent to the households most in need;
- subsidised loans for the installation of photovoltaic panels for shared consumption;
- communication campaigns at local level to encourage good consumption behaviour.

In addition, with regard to measures for the development of energy communities, Legislative Decree No 210/21 provided that local authorities participating in them should take initiatives to promote the participation of vulnerable customers in the communities, so that vulnerable customers can access the environmental, economic and social benefits of the community, and also entrusted GSE with the development of dedicated information services, including information guides and simulation tools, which are a tool to be strengthened to disseminate promoted participation models of local authorities.

It should be noted that some of the measures dating back to 2 022 are predominantly financial in nature in response to the energy crisis and the need to provide immediate support to vulnerable or energy poor consumers. Therefore, the positive effects on the reduction of the phenomenon cannot be regarded as a trend without taking into account the necessary new and appropriate structural measures to that end.

3.5 Dimension Research, innovation and competitiveness

I. Policies and measures related to the elements set out in point 2.5

The energy and emission scenarios of the coming years require a holistic and interdisciplinary approach to research and development in the energy sector, capable of operating selectively on the technologies available for further industrialisation.

In the short term (2024), policies and measures are aimed at promoting technologies identified as priorities for the decarbonisation of the production system and the competitiveness of the Italian system. This includes integrated projects, which are part of electricity system research, hydrogen initiatives, which directly involve businesses, cybersecurity and the implementation of Hydrogen Demo Valley at the ENEA Research Centre in Casaccia.

In the medium term 2025-2030, in addition to consolidating the most promising technologies launched in 2022-2024, it is planned to include in the R & D programme the priority technology areas set out in Chapter 2.5. Alongside research and innovation activities, more attention will be given to the transfer of new technologies to the country's economic fabric with the help of new emerging actors in the energy landscape, such as living lab and start-ups.

The priority technology areas referred to in Chapter 2.5 will therefore be implemented through the following instruments/policies:

- Mission Innovation;
- Horizon Europe programme;
- Post-2024 electrical system search;
- Innovation Fund;
- other measures and policies.

Table 48 – Technology technologies and instruments/policies

	Mission Innovation	Horizon Europe programme	Search for electrical system	Innovation Fund	Other policies
Energy storage	X	X	X	X	X
Renewable sources	X	X	X	X	X
Hydrogen	X	X	X	X	X
Renewable fuels		X	X	X	X
Nuclear	X				X
CCSU		X		X	X
Network technologies and digitalisation	X	X	X		
Critical raw materials and advanced materials;	X		X		X

❖ **<u>INSTRUMENTS/POLICIES IN THE SHORT TERM (UNTIL 2024)</u>**

♦ ***SEARCH FOR ELECTRICAL SYSTEM***

Electricity system research focuses on fundamental research for energy technologies and materials with TRL 1-4. On the basis of the strategic evaluations carried out, the discussions with key research stakeholders and the results of the public consultation, two priority objectives were identified on which to concentrate the financial resources of EUR 210 million:

- decarbonisation; and
- digitalisation and evolution of networks.

Under certain topics of strategic interest, "Integrated Projects" are planned to be carried out, with a structured scientific structure and a parallel collaboration of research organisations and universities, with the ultimate aim of accelerating the selection of technologies and processes that can contribute to achieving the emission reduction targets at competitive costs. A summary of the Integrated Projects is set out below.

- *High-efficiency photovoltaic.* Its objective is to develop new PV technologies, to be launched towards production processes that reduce the cost of energy produced by also reducing the costs of Balance of System (BoS) linked to the area occupied by the PV system, to explore possible solutions for PV integration and to develop methodologies that can maximise PV energy production.
- Electrochemical and thermal storage*technologies.* Its overall aim is to act as a driver for the development of innovative storage technologies, improving their performance, safety and sustainability. Research into electrochemical accumulation is carried out on both the current dominant technology (Advanced Li-ion batteries – Gen. 3b), both on the most attractive technologies for stationary applications, such as redox flows and Na-ione, and on the most innovative technologies, to systematically explore the possibilities of electrochemical storage technologies beyond 2030 (Gen. 4 and Gen 5).
- Hydrogen*technologies.* As part of the project, activities focus on low Technology Readiness Levels (TRL 1-4), with a particular focus on components, technologies, systems and processes within the Power to X approach, to foster the integration of the electricity grid with the natural gas grid, with a balancing function of the grid, such as long-term storage and long distance hydrogen transmission and distribution infrastructure.
- *Security of energy systems.* Potential threats may be related to the energy production and transmission-distribution chain or communication networks, or IT networks. The uptake of new IT/OT/IoT digital technologies in networks enabling flexibility services implies an evolution of cyber security measures. Three main drivers of the digital transformation of energy systems are: (I) ensuring the security of new energy communication technologies; (II) preserve the resilience of the electricity system; (III) harnessing the potential of big data technologies and artificial intelligence to support cybersecurity.

▪ ***LINES OF ELECTRICITY SYSTEM RESEARCH RELATED TO DECARBONISATION***

- *Frontier materials for energy use.* The proposed activities focus on the recovery of dispersed heat, in the form of electricity, the development of materials and technologies for building components for the energy sector through sustainable and energy-efficient *additive manufacturing* and catalysts.
- *High-efficiency buildings for the energy transition.* Research and innovation in the sector is geared towards the development of components, tools and technologies for renewables and energy efficiency, for the upgrading of the existing and new building stock.
- *Energy efficiency of industrial products and processes.* Activities are planned for the efficiency of industrial thermal processes, the development of efficient technologies for decarbonising hard-to-abated sectors *and* the efficiency of the water reuse chain.
- *Technologies for the efficient penetration of the electrical carrier into end uses.* The core aims of the project are: (a) maintaining and developing processes and technologies for the

energy transition, electric vehicle energy refuelling systems, complex heat pump systems; (b) support the introduction of organisational and management technologies, processes, systems and models through advanced IT technologies.

- *Electricity from sea. The main objective of the*project is the construction and installation at sea of a full-scale off-shore prototype capable of converting waves into electricity. The prototype, called PeWEC (Pendulum Wave Energy Converter), will be installed on the island of Pantelleria.
- *Thermodynamic solar. In*order for CSP technology to contribute effectively to the energy transition process, it is a priority to reduce generation costs, with R & D activities and technical solutions aimed at increasing performance and reducing the Levelised Cost of Energy (LCOE).

- ***LINES OF ELECTRICITY SYSTEM RESEARCH RELATED TO DIGITALISATION AND EVOLUTION OF NETWORKS***

- *Evolution, planning and operation of electricity grids. In*line with future developments in the electricity system and taking into account possible future challenges, innovative technological and architectural solutions need to be identified and developed to increase the flexibility of the electricity grid, and methodologies for designing efficient planning interventions that ensure high levels of reliability, adequacy, security and resilience.
- *Digitalisation of the integrated energy system.* Two main areas of research are identified: the first focused on advanced IT methods and techniques for the efficiency of energy systems processes, through the development of the largest amount of information available; the second dedicated to innovative processing technologies and architectures that establish widespread access to shared scalable computing resources.
- *Energy from renewable sources and integration into the territory.* The use of renewable energy sources in every possible production sector is an essential element of the energy transition. The approach to the development of technological solutions must be interdisciplinary and should cover the energy system planning and management tools, which must take into account the technical, economic, environmental and regulatory aspects of the different solutions and any possible hybridisation and integration.
- *Resilience and security of the energy system.* Given the increased frequency and severity of extreme weather and hydrogeological events due to climate change, as well as the occurrence of other natural events such as earthquakes, there is a need for tools to support institutions and operators to improve the resilience of the system.
- *Sustainable mobility and interaction with the energy system.* The scenario of rapid electrification of the circulating fleet is closely linked to the evolution of the electro-energy system and therefore innovative forms of integration need to be developed. Research activities aim at functionality and services that can deliver more sustainable cross-sectoral benefits.
- *The user at the heart of the energy transition. The Clean Energy for All Europeans Package Electricity and Renewable Market*Directives set out a new role for the end-user, which must become increasingly active not only in the production and self-consumption of energy from renewable sources, but also in the implementation of energy efficiency pathways and the provision of ancillary services to the transmission and distribution network.
- Adjustment*support: market developments; innovation in network design and operation. The following activities*will be implemented: support for changes in the regulation of electricity markets; study of new models for regulating and operating distribution networks; coordination of technical, regulatory and pre-regulatory activities at national and international level for regulatory purposes.
- *Flexibility of the integrated energy system.* The significant presence of non-programmable renewable sources, and the objective of their strong increase, pose a new challenge for all

actors in the energy system. The objective of research is to provide tools to improve technologies, economy and sustainability, develop innovative technologies, design new rules and business models.

❖ **INSTRUMENTS/POLICIES IN THE MEDIUM TERM, UNTIL 2030**

♦ ***MISSION INNOVATION***

As part of the new programming of Mission Innovation (MI 2.0), Ministerial Decree No 386 of 17 November 2 023 identified the programmes, projects and activities eligible under the initiative, allocating the resources available, amounting to more than EUR 500 million, among those activities and defined the general arrangements for implementing the measure. In particular:

a) the *Green Powered Future Mission* programme is allocated EUR 317 million (approximately 63 % of the total), of which EUR 135 million for the Nuclear Programme Agreement and EUR 182 million on the following technology areas: renewable sources, energy storage, grid technologies, data and digitalisation.
b) the *Clean Hydrogen Mission* programme is allocated EUR 118 million (approximately 23 % of the total).
c) projects and activities across the previous missions are allocated EUR 36 million (approximately 7 % of the total);
d) international projects are allocated EUR 11 million (around 2 % of the total).

♦ ***HORIZON EUROPE PROGRAMME***

Horizon Europe is the main EU funding programme for research and innovation with a budget of EUR 95.5 million over the period 21-27. Compared to previous research support programmes, Horizon Europe brings significant novelties, including:

- the establishment of the European Innovation Council, to support breakthrough innovations throughout the life cycle, from early stage research, technology transfer, financing, to the growth of start-ups and SMEs;
- the definition of 5 “Missions” to achieve greater impact through a more focused focus and a closer link between European R & I. These include:
    - “*100 climate neutral cities by 2030*”, which aims to support, promote and lead 100 European cities in their systemic transformation towards climate neutrality and turn these cities into centres of innovation, for the benefit of quality of life and sustainability in Europe;
    - *mission adaptation to climate change*aimed at supporting at least 150 European regions and communities towards climate resilience, promoting the development of innovative solutions to adapt to climate change and encouraging regions, cities and communities to lead the transformation of society.
- strengthening “Open Science Policy” policies;
- a new approach to more ambitious and strategic partnerships;
- the definition of a new contractual model that will be applied in all directly managed European programmes funded under the Multiannual Financial Framework 21-27.

In the context of these partnerships, we highlight those launched by the MUR under the *Clean Energy Transition Partnership (CETP) 2022-2027* and the *European Partnership Driving Urban Transitions (DUT) 2022-2027*. In particular, with reference to CETP 2022-2027, aimed at promoting transnational innovation ecosystems, the MUR provided for specific research calls (EUR 210 million

– co-funded also by MiMIT) for the period 2022 and 2023. These calls for tenders addressed to the electricity and heat production sector, as well as industry, shall include accompanying activities to foster the sharing of strategic knowledge and maximise the impact so as to accelerate the upscaling, replication and market uptake of cost-effective clean energy technologies. Under DUT 2022-2027, the MUR will finance (EUR 49 million of which EUR 32 million are also co-financed by MiMIT) transnational R & D projects in line with the three objectives of the programme, implemented with the following measures:

- *Positive Energy (PED) Transition Pathway districts*: the measure aims to support urban transition through innovative solutions for the design, large-scale deployment and replication of DPEs, with the mission to have at least 100 DPEs by 2025;
- *15-minute City (15minC) Transition Pathway*: the measure aims to support the transition regarding sustainable urban mobility by improving accessibility and connectivity, starting from the neighbourhood level;
- *Circular Urban Economies (SES) Transition Pathway*: the measure aims to support the transition regarding the planning and design of inclusive urban spaces and an urban economy based on regeneration and circularity.

♦ *POST-2024 ELECTRICAL SYSTEM SEARCH*

The public consultation for the new cycle 2025-2027 was concluded in May 2024. The aim of the proposal for the 2025-2027 three-year plan is to promote progress in the results of ongoing research activities, ensuring continuity with the three-year plan 2022-2024, and the development of new projects, such as bioenergy and the relationship between water resources and the energy system. The efforts to integrate the different research specialisations to optimise the effectiveness of the action to support the transition and energy security are also confirmed.

“Decarbonisation” and “Digitalisation and evolution of networks” are the two macro-objectives around which the plan is structured. For the ‘Decarbonisation’ objective, the topics of renewable energy have been identified (innovative, efficient and sustainable photovoltaic; energy from the sea; thermodynamic solar), efficiency, hydrogen technologies, electrochemical and thermal storage, materials and border devices for energy applications. For the objective ‘Digitalisation and evolution of networks’, the topics related to the evolution, digitalisation, security, flexibility and resilience of the electricity system have been identified; research on energy scenarios and market developments, the interaction between sustainable mobility and the energy system, the role of the citizen as a prosumer and the integration between renewable energy and land are also planned.

The scheme of the 2025-2027 three-year plan is aligned with the overall objectives, expressed at European level, in the SET-Plan and in the Horizon Europe programme, and is consistent with the provisions of the Fit-for-55 package and the measures identified by REPowerEU.

♦ *INNOVATION FUND*

The Fund currently supports 7 projects located in Italy, which in total will receive a contribution of around EUR151.6 million, compared to the total eligible costs of the projects ofEUR 389,8 M. These projects will contribute to the decarbonisation of industries for an overall reduction of GHG emissions of around 25.4 Mt $CO2_{equivalent}$ in the first 10 years of operation. 5 additional projects are in the process of concluding the grant agreement.

As regards the first pilot auction of the European Hydrogen Bank, aimed at financing the production of hydrogen from renewable fuels of non-biological origin (RFNBO) in the European Economic Area, no Italian project is one of the selected projects.

Table 49 - List of Innovation Fund projects selected in Italy

Acronym	Title	Sector	Start date	Project phase	Beneficiaries	Innovation Fund grant (EURmillion)	Expected GHG emission avoidance (tCO2eq)
Large Scale						**133,9**	**25,182,944**
SC-HOOP	Sustainable Chemical Recycling through HOOP technology	Chemicals	01/07/2023	Preparation	VERSALIS SPA	16,2	139,838
TANGO	Italian PV gigafactory	Solar Energy	01/01/2021	Operation	3 SUN | EGPI	117,7	25,043,106
Small Scale						**17,8**	**188,564**
DrossOne V2G Parking	Large scale vehicle to grid system with integrated static storage: hamessing EV bacteria and their fast response to deliver grid services, currently provided by highly polluting gas plants	Intra-day electricity storage	01/05/2021	Operation	F2MeS	1,6	62,336
H_2 Valcamonica	Green hydrogen for the decarbonisatio n of Valcamonica	Hydrogen	01/01/2022	Preparation	A2A | SNAM SPA | FNM	4,4	42,295
PIONEER	airport sustainability Second LIFE Battery Storage	Intra-day electricity storage	01/01/2022	Construction	ADR | ENEL X SRL | Fraunhofer	3,1	16,004
PRIMUS	First Manufacturing crystal glass Under Innovative Solution	Glass, ceramics & constructio n materials	01/09/2022	Operation	Bormioli Rocco	4,5	42,332

VITRUM	Virtous Innovative Transformation of high-quality container glass Manufacturing	Glass, ceramics & construction materials	01/06/2022	Construction	Bormioli Luigi	4,1	25,597

♦ *OTHER MEASURES AND POLICIES*

In order to promote and implement research in priority technological areas not covered by the previous instruments, specific incentive policies and measures will be defined, using both national resources and Community funding. In particular, technological areas will be:

- **HYDROGEN:** the Italian backbone from Mazara del Vallo to Tarvisio was included in the PCI list and, in the thematic area of cross-border hydrogen transport networks. The project sees the joint participation of Germany and Austria respectively and will contribute to the creation of a European hydrogen transport network as an opportunity for the decarbonisation of Italian and European industrial hubs, in line with the achievement of the 2050 climate targets. In addition, the hydrogen infrastructure planned for Hydrogen Valley in Puglia was included by the European Commission as one of the IPCEI hydrogen projects approved in February 2024 under the Hy2Intra wave. The infrastructure planned by Snam is part of the broader framework for the development of the hydrogen supply chain involving other primary industrial operators active in Puglia. The project, which is expected to run in 2028, has the ambition to transport renewable hydrogen produced in Puglia to decarbonise the region's industry and mobility in the Taranto Hub through 100 km of pure hydrogen pipeline, largely reusing an existing pipeline;
- **CCS**: the CALLISTO (Carbon liquefaction transportation and Storage) Mediterranean CO2 Network project, included in the sixth PCI list, aims to develop the largest multimodal open access CO2 hub in the Mediterranean, supported by dedicated onshore transport infrastructure, with the aim of enabling the decarbonisation of various clusters of industrial emitters through the capture, aggregation, transport and permanent storage of CO2. In its main scheme, the candidate PCI CALLISTO Mediterranean CO2 Network includes both onshore collection and transport, either through existing pipelines or new surface pipelines, or by sea by shipping CO2 from emitters in Italy and France, together with the relevant CO2 regasification and liquefaction hubs located in the two countries and then proceed with final storage at the Ravenna CCS hub from 2027 onwards. The aim of this initiative is to effectively pursue decarbonisation objectives while preserving the production levels of energy-intensive industries in the region and enabling cross-border transport. During the selection process, the project received support from both Member States involved, Italy and France. Moreover, the collaboration between Italy and France in the design of a common CCS strategy was confirmed by the issuance in March 2023 of the Mediterranean CCS Plan signed by both governments, which aims to present the plan to support the development of the first CCS project in the Mediterranean basin, namely the Callisto Mediterranean CO2 Network project, and to promote further CCS projects in the Mediterranean region;
- **Nuclear:** The landscape of national nuclear research, development and training is inherently connected and directly linked to its industrial fabric. It is important to take into account the high scientific and technological content of the sector, which encourages universities to work with local research centres to strengthen their research mission, professionalisation of young experts in the field and the development of skills. The ultimate

goal is to transfer these skills to the production chain so as to increase its technological value and competitiveness in the international landscape.

The importance of maintaining nuclear skills and its transmission to future generations has prompted universities with nuclear engineering programmes to join the InterUniversity Consortium for Nuclear Technological Research (CIRTEN). The Polytechnics of Milan and Turin together with the universities of Bologna, Padua, Palermo, Pisa and Rome 'La Sapienza' have exploited synergistic nuclear expertise to make critical mass and increase participation in various national and international research programmes. Among the main issues are the involvement of CIRTEN in the*'Research of the Electrical System*', where, within the stream dedicated to nuclear fission energy, it dealt with a variety of calculation and modelling activities to support the development of SMR and AMR systems.
For the most prominent experimental part of the research, the SIET company, which is involved in ENEA, plays a leading role. He carried out tests at a significant scale to support the qualification of pivotal components, with the help of its numerous experimental infrastructures, including the pressurised Simulator facility for safety experiments, an unicum worldwide in size and power. The most relevant collaborations and works include tests for the qualification of the steam generator for the SMR project of the American NuScale Power company and the experiments on the innovative passive safety systems of the American SMR AP600 Westinghouse in order to verify their effectiveness and enable their licensing by the US regulator. Siet is also involved in the development of LFR systems, where it has provided its infrastructure for testing innovative steam generators and self-regulating passive safety systems designed for the European demonstrator of the supply chain, ALFRED.
Finally, ENEA, which has historically acted as a national collant for nuclear research and development, has contributed to the advancement of SMR and AMR systems, both with design activities and related technological development and supporting experimentation. In the context of AMR, most of the institution's efforts over the last 30 years have been directed towards LFR (lead-cooled fast reactors), where Italy has a central role between Western countries. From the first studies on the Energy Simplificator to European *Accelerator Driven System* (ADS) developments, multiple collaborative activities in the EU on liquid metals and national ones (TRASCO programmes – Scorie I, II, and III transmutation programmes), ENEA has always become a hub for applied research and has often coordinated and directed European and national research and development activities.

In the field of fusion energy, Italy has a long tradition of research for the development of fusion energy and has developed expertise on all scientific, technological and industrial aspects, and has recognised experience in designing, implementing and using experimental fusion systems and installations. The Italian fusion school, in physics and engineering, is considered one of the best in the world, so that researchers and engineers trained in this school occupy key roles in a large number of European and international laboratories and bodies.

Thanks to the construction of the DTT *facility* at the ENEA Research Centre in Frascati, Italy confirms that it is also central to one of the largest installations for international chartering and of fundamental importance for ITER and future fusion facilities. DTT is an Italian initiative, an integral part of the European fusion *roadmap*, involving all research bodies, most of the fusion universities and ENI, the largest national energy industry. DTT is a very complex plant, which requires the integration of various innovative technologies, and draws on all skills acquired in Italy, including industrial skills, allowing the country system to be in a privileged position for the construction of a power-melting plant.

- **Wind:** with regard to wind, the objectives set out in Chapter 2.5 will be achieved through the following R & D activities:
    - *for floating wind*: (a) floating wind platforms (developing a national industry, optimising hydrodynamic loads and reducing costs), including with a view to the multi-use use of renewable technologies; (b) solutions for low-impact anchor lines; (c) new generation turbines optimised for the Mediterranean Sea context; (D) systems for controlling and optimising electricity production, also depending on the possible environmental degradation of blades; (e) digital twin and augmented reality models for increased reliability and cost reduction in design and maintenance processes; (f) floating or stationary electrical substations, as well as HVDC dynamic cables; (g) security against possible terrorist attacks; (h) study of the noise generated; (I) consolidation of the MaRELab Sea laboratory carried out in the field of System Research
    - *for on-shore wind*: (a) optimisation of aerodynamic performance of existing turbines for power maximisation with the same area of the occupied rotor; (b) development of a re-blading industry; (c) development of turbines suitable for Italian weather conditions and integration into populated areas (including mini and micro wind); (D) new recyclable materials; (e) analysis of the impact on the electricity grid in the installed power increase scenarios at 2030; (f) development of predictive maintenance strategies.

In addition, the policies and measures put in place or planned by the MUR in the field of energy research, decarbonisation and the ecological transition can also be added. Again, the identified lines of activity and energy technologies are in line with those of the SET Plan, thus complementing MASE's activities.

- *National Research Programme (NRP) 2021-2027.* Under this programme, the priority research lines are:
    - renewables: energy storage (mechanical, thermal, electrical, chemical) and European and inter-continental networks (electricity and gas); new materials and components for the exploitation of renewable sources; development of national value chains for the production and use of electricity and renewable hydrogen for energy storage, power electronics and energy management; energy communities;
    - digitalisation: smart, flexible, integrated, resilient and digitalised grids;
    - decarbonisation of industry: local production from renewable sources, efficient and sustainable use of energy and materials;
    - national energy system and land, sea and air transport systems.
- OGS 2022-2024 three-year work*plan. The main lines of activity of the Plan*include those in the field of carbon dioxide storage study and hydrogen storage. On the latter front, in particular, thanks to the expertise acquired in the field of carbon dioxide and natural gas storage, OGS participates in an innovative European HyStorIES (Hydrogen Storage In European Subsurface) project, which involves the identification of potential underground hydrogen storage sites in Europe. In addition, the Authority carries out research on the assessment of high and low enthalpy geothermal resources and the environmental impact study linked to their industrial exploitation.
- *Activities carried out with the university system.* Among the main developing or implementing activities, covering almost all of the priority technology areas referred to in Chapter 2.5, are: renewable gases and hydrogen, storage systems, grid digitalisation, CCS, electric mobility.
- *Three-year energy plans of universities, research bodies and the institutions of high artistic and musical training (AFAM)*. In the context of the RepowerEU, a reform is planned for the

drafting of 'three-year energy plans' and subsequent implementation (by 2026) by universities, research bodies and institutions of the high arts and music training (AFAM) for the energy efficiency of their buildings and the use of renewable sources.

II. Where applicable, cooperation with other Member States in this area, including, where appropriate, information on how the SET Plan objectives and policies are being translated to a national context

The responsibility for the coordination of the SET Plan in Italy lies with MASE and MUR. Italy has decided to monitor all the working groups set up for the preparation of the Implementation Plans (IP) for key actions. The national contact persons of each working group also set up 'consultation groups' composed of representatives of industry, research and academia, able to provide a qualified input to the drafting of IP. The Italian delegation operates both through plenary hearings of the main actors in the public and private R & D sector and through bilateral meetings. Until 2 021, it was also able to count on the support of the Italian "Enlarged Board" of Horizon 2020 Energia, to which around 120 members of companies, research bodies, universities, ministries and regions, usually met 2-3 times a year.

The intensive work leading to the definition of the Implementation Plans has seen Italy particularly active in cooperating with other Member States to identify priorities and indications of financial needs. This cooperation at Community level has often led to the submission of joint partnership projects under the Horizon 2020 programme. This cooperation should be consolidated and intensified, if possible also within the Horizon Europe programme.

Italy's research on energy technologies, after a period of high fragmentation, is evolving towards a more coordinated framework of initiatives, also supported by alignment with the SET Plan and the Horizon 2020 programme. The Italian research system has a good international positioning, demonstrating its readiness to capture all the most innovative ideas from international level. The ongoing development of European research can contribute positively to the process of rationalising research objectives by enhancing and finalising the various national competences in the field. However, the national research system must be able to rapidly update competitiveness priorities, guidelines and assessments in the field of energy technologies and enable the country to contribute effectively to future choices under the European SET Plan, while also safeguarding industrial competitiveness and enhancing the capacity to produce innovation.

In particular, with regard to nuclear power, Italy, through ENEA, University and National Industry, cooperates on SMR/AMR systems with major European players, including EDF, CEA, IRSN in France, SCK-CEN in Belgium, CIEMAT in Spain, KIT in Germany, RATEN-ICN in Romania, KTH, Lead-cold in Sweden, and others, sharing strategies, supply chains, R & S programmes, training and dissemination policies.

III. Where applicable, financing measures in this area at national level, including Union support and the use of Union funds

Italy, as already mentioned, considers Horizon Europe 2021-2027 as a priority instrument in supporting research projects in the field of climate and energy in the coming years.

The results achieved by the country under the Horizon 2020 programme, as set out in paragraph 4.6, have been more than satisfactory. However, during the first two years of intervention under the Horizon Europe programme, national operators have highlighted certain issues which will require a higher threshold of attention in the approach to the Programme in the coming years. In particular:

- Horizon's strong competitiveness due to the widespread reduction of national research incentives in many Member States and has led to over-demand;
- the innovation of the format, with many calls distributed during the year, and the introduction of partnerships, for which the Italian system was perhaps not prepared.

Other Community measures for which the Italian research system is of interest, as already stated in the initial part of this chapter and in Chapters 2.5 and 4.6, are Innovation Fund and IPCEI.

Italy has focused much on its participation in Mission Innovation through the mobilisation of significant resources, which can support the development of pilot and demonstration projects for the coming years, with the achievement of medium to high TRLs. Effective coordination between EU countries participating in Mission Innovation will be important in this respect, in order to pursue all possible synergies with the Community resources and programmes available to support research projects.

With regard to nuclear, ENEA coordinates and participates in a number of European projects (EURATOM) in the field of new generation nuclear fission, thus enabling it to exploit its know-how, share research infrastructures, methodologies and calculation codes, safety approach, technology, and fully integrate its R & S activities into SNETP.

In the field of nuclear fusion ENEA is the National Programme Manager of the European Fusion Programme, coordinating, as Head Research Unit (HRU), the activities of the Italian team (composed of the main industrial entities, research organisations and universities involved in the sector) in the EUROfusion consortium managing the economic resources made available by EURATOM for nuclear fusion research.

SECTION B: ANALYTICAL BASIS91

4 CURRENT SITUATION AND PROJECTIONS WITH EXISTING POLICIES AND MEASURES92 93

4.1 Projected evolution of main exogenous factors influencing energy system and GHG emission developments

This paragraph illustrates the assumptions and methodology for constructing the scenarios developed in support of this Plan.

Any scenario analysis is built around some "key variables" which briefly represent the key *drivers* of future developments, the uncertainties of which are reflected in the uncertainty of the results obtained. In particular, in the areas covered by this plan, developments in GDP and sector added values, demographic trends, as well as projections of international fossil fuel prices and CO2 emission allowances$_{on}$ the ETS market are particularly important.

In addition, the European Commission, as part of the monitoring mechanism under the Regulation on greenhouse gas projections, provided new data in March 2024 relating to the main macroeconomic and demographic drivers, on the basis of which the baseline dataset was updated, supplemented when necessary with the details made available by the European Commission in the course of 2021 as part of the update of the European Reference Scenario.

I. Macroeconomic forecasts (GDP and population growth)

The table below shows the evolution of population and GDP between 2020 and 2 040 in the scenarios carried out. In drawing up this update of the plan, with the use of the most recent drivers, it is particularly clear that the population has fallen since 2020, with more than one and a half million fewer people than initially envisaged in the plan adopted in 2020. By 2030, there are around 4.5 million fewer people and almost 7 million people in 2040.

Table 50 – Evolution of population and GDP

See Part 2 for[91] a detailed list of parameters and variables to be reported in Section B of the Plan.

[92] *Current situation shall reflect the date of submission of the national plan (or latest available date). Existing policies and measures encompass implemented and adopted policies and measures. The policies and measures adopted are those decided by official government act by the date of submission of the national plan and for which a clear commitment to implementation has been made. The policies and measures implemented shall be those measures to which, at the date of submission of the integrated national energy and climate plan or integrated national energy and climate progress reports, one or more of the following situations applies: directly applicable European legislation or national legislation is in force, one or more voluntary agreements have been concluded, financial resources have been allocated, human resources have been mobilised*

[93] *The selection of exogenous factors may be based on the assumptions made in the EU Reference Scenario 2016 or other subsequent policy scenarios for the same variables. Besides, Member States specific results of the EU Reference Scenario 2016 as well as results of subsequent policy scenarios may also be a useful source of information when developing national projections with existing policies and measures and impact assessments.*

	2020	2025	2030	2035	2040
Population (million)	59,6	58,9	58,8	58,6	58,5
GDP (million EUR 2015)	1.573.680	1.817.198	1.886.931	1.942.484	2.053.348
Average annual rate of GDP	—	2.92 %	0.76 %	0.58 %	1.12 %

The table below shows the historical value 2020 and the growth rates of the sectoral added values (VA) used for the scenarios. The historical values of sectoral VA, ISTAT source, are expressed in mlnEUR (chain-linked values, reference year 2015), while the expected annual average growth rates (%) were developed using the details provided by the European Reference Scenario, which was finalised in 2021, as well as the GDP developments recommended by the European Commission.

Table 51 – Evolution of sectoral added values [Source: historical values: Eurostat, Eurostat and PRIMES data processing]

	NACE codes	2020 (million EUR 2015)	2025	2030	2035	2040
Agriculture	A	32.832	32.697	33.633	33.574	33.795
Constructions	F	224.916	264.613	271.692	276.374	286.326
Services	GTU + AND	32.832	32.697	33.633	33.574	33.795
Energy and mining sectors	D + B + C19	224.916	264.613	271.692	276.374	286.326
Industry	C (excluding C19)	32.832	32.697	33.633	33.574	33.795

II. Sectorial changes expected to impact the energy system and GHG emissions

Different industrial sectors follow different growth dynamics. The table below shows the average annual growth rates of VA of the main industrial sectors used for the scenarios. The data has always been produced by the development of the parameters recommended by the European Commission in 2024 and the detailed data of the European Reference Scenario.

Table 52 – Evolution of Added values of the main industrial sectors [Source: the development of the parameters recommended by the European Commission in 2024 and the detailed data of the European Reference Scenario]

Sector	% 20-25	% 25-30	% 30-35	% 35-40
Iron and steel	7.6 %	0.4 %	— 0.1 %	0.0 %
Non-ferrous metals	7.9 %	0.4 %	— 0.1 %	0.0 %
Chemicals	2.4 %	0.6 %	0.0 %	0.2 %
Non-metallic minerals	3.9 %	0.7 %	0.0 %	0.2 %
Pulp, paper and printing	3.2 %	0.5 %	0.0 %	0.1 %
Food, drink and tobacco	2.7 %	0.7 %	0.0 %	0.2 %
Textiles	4.1 %	0.1 %	— 0.2 %	— 0.2 %
Engineering	3.2 %	0.6 %	0.8 %	1.4 %
Other industries	3.1 %	0.5 %	0.0 %	0.1 %

III. Global energy trends, international fossil fuel prices, EU ETS carbon price

With regard to international prices for fossil fuels and CO2 emission allowances$_{in}$ the ETS market, reference was also made to the benchmarks recommended by the European Commission under the monitoring mechanism set out in the Regulation on the Governance of Greenhouse Gas Proposals.

Table 53 – Evolution of international prices of energy commodities and ETS allowances [Source: European Commission]

Year	Petroleum	Gases (NCV)	Coal	ETS1 emission allowances
	EUR 38 500 – 52 2023/GJ	EUR 38 500 – 52 2023/GJ	EUR 38 500 – 52 2023/GJ	EUR 2023/tCO_2
2020 *	7,6	3,7	1,9	29
2021 *	12,5	18,1	4,5	65
2022 *	16,7	35,1	10,9	90
2023 *	12,5	10,9	4,4	92
2024	13,1	8,3	4,1	95
2025	12,4	9,4	4,1	95
2030	13,9	9,0	4,0	95
2035	15,4	8,2	3,8	100
2040	15,8	10,1	3,8	100

** Annual average of daily value*

The policy scenario also introduced the so-called ETS2, the new system that will cover CO2 emissionsfrom combustion in road transport, buildings and energy and manufacturing industries not covered by the current ETS as of 2027.

Table 54 Evolution of emission allowance prices ETS2 [Source: European Commission and subsequent processing]

Year	ETS2 emission allowances
	EUR 2023/tCO_2
2027	30
2028	50
2029	55
2030	55
2035	58
2040	58

With regard to the years after 2030, in the absence of any more robust assumptions, it was assumed that the price of emission allowances will grow at a rate similar to the ETS1 emission allowance price.

IV. Technology cost developments

Already in 2016, a Technical Working Group was set up under the Presidency of the Council, which brought together different skills and professionalism in order to put the different knowledge in an interactive and flexible way into the system and exploit the different knowledge in an interactive and flexible manner. This technical working group was attended by actors such as MASE, MEF, MIT, RSE, ENEA, ISPRA, CNR, Banca d'Italia, Istat, Centro Studi Confindustria, University, Terna, Snam, GSE. One of the results of this working group was, for example, the creation of a catalogue containing a technical and economic analysis of the available energy technologies, both supply and end-use, which are useful for advancing the decarbonisation process of the Italian energy system. This continuously updated database contains some of the data with which the scenarios are developed.

In general, updating knowledge on cost scenarios is facilitated by the participation of public companies such as RSE, ISPRA, ENEA, GSE in various international working groups (EC, IEA, IRENA, etc.).

From the point of view of monitoring the current situation of technology costs, an important role is played by GSE, which, under Article 48 of Legislative Decree No 199/2021, is required to 'take over the current costs of technologies and the production costs of energy carriers, to be shared with RSE, ENEA and ISPRA for their research and scenarial activities'.

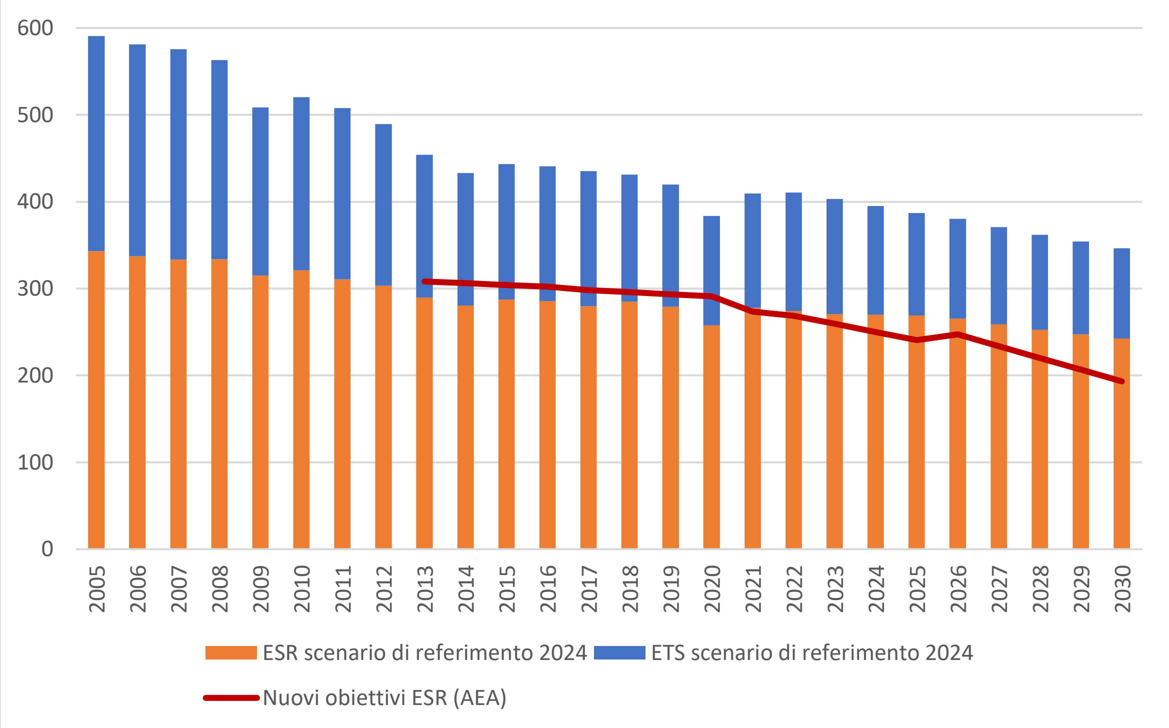
4.2 Decarbonisation dimension

4.2.1 Greenhouse gas emissions and removals

I. Trends in current GHG emissions and removals in the EU ETS, effort sharing and LULUCF sectors and different energy sectors

The graph below summarises the projections of GHG emissions until 2030 separately between ETS and ESR, according to the baseline emissions scenario of current policies (i.e. considering the effect of policies adopted throughout 2021). The graph shows the higher reduction for ETS sectors. In the face of an expected reduction in total emissions from 2005 to 2030 of around 244MtCO_2eq, ETS emissions are expected to decrease by around 144 MtCO 2eq (above 58 %) and ESR emissions by 100 MtCO_2eq (around 29 %).

Figure 56 – ETS and ESR greenhouse gas emissions (Mt CO2eq), historical years and baseline [Source: ISPRA]



Note: to avoid overlaps and simplify the display, the chart shows the breakdown before the amendments to Directive 2003/87/EC introduced by Directive (EU) 2023/959.

The current measures therefore appear to be more effective in terms of reducing ETS emissions, mainly due to increased renewables in the electricity generation mix. However, in order to promote a reduction of climating emissions in the sectors covered by the ESR *(transport and civil sector in the first place)*, a change in generation unless accompanied by a change in consumption in terms of the amount or carriers used, leads to limited benefits.

Indeed, for the sectors included in the ESR, the baseline shows that, even following the changed post-COVID-19 situation linked to the economic recovery and behavioural change following the pandemic, and the important and profound changes in the geopolitical environment that occurred, despite the adoption of the measures foreseen in the NRRP, emissions do not reach the previous -

33 % reduction target in 2030 compared to 2005 levels. Much more challenging and ambitious is therefore the reduction effort in the light of the update of the target, which, according to the recent Council Regulation (EU) 2023/857 of 19 April 2023, increases to -43.7 %.

It will be necessary to adopt additional policies and measures, which will have to be particularly strong in the civil and transport sectors, as already shown in 2021 and 2022, the last year for which final statistical data are available: the Italian emissions were higher than the annual allocations (AEAs) defined under the ESR Regulation by 4,6 and 5,5 MtCO2eq respectively.

The table below summarises the projections of greenhouse gas emissions up to 2030, with the related European ETS and ESR emissions targets, according to the baseline current policy scenario (i.e. considering the effect of policies adopted throughout 2021).

Table 55 – National GHG emissions and European targets (Mt CO_2eq), historical and baseline [Source: ISPRA]

	1990	2005	2021	2022	2023	2024	2025	2030	2040
Total GHG emissions excluding LULUCF	522	596	411	413	406	398	390	349	308
ETS emissions *	—	248	131	136	133	125	118	104	86
ESR emissions	—	343	278	274	270	270	269	243	n.a.
ESR objectives * *	—	—	274	269	259	250	241	193	n.a.
Difference from ESR targets	—	—	5	6	11	20	28	49	n.a.
LULUCF	— 4	— 34	— 25	— 21	— 23	— 26	— 28	— 28	— 31
Total GHG emissions including LULUCF	519	562	386	392	383	372	362	321	278

** Considering the scope of the Directive before the adoption of Directive (EU) 2023/959. Aviation and national navigation emissions are not included.*
** * indicative targets, the objectives will be specified by specific rules to be adopted at European level. The criteria set out in Regulation (EU) 2023/857 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 were used for the estimation.*

For the period 2021-2025, the LULUCF Regulation provides for the reporting of removals and emissions from the LULUCF sector and the accounting rules for[94] LULUCF categories. Data for 2021-2022 show that emission neutrality for the period 2021-2025, as shown in Table 47, should be achieved and, under the ESR Regulation, the use of a limited amount of LULUCF credits to contribute to the achievement of the ESR targets (the so-called LULUCF flexibility) of 5,75 MtCO_2eq. for the period 2021-2025.

[94] *Managed forest land (Forest land maining forest land), Afforested land (land converted to forest land), Deforested land (Forest land converted to other land uses), Managed cropland (Cropland maining cropland, land converted to other land uses), Managed grassland (Grassland remaining grassland, Cropland converted to fatland, Wetland converted to fatland, Settlements converted to fatland, Other land converted to fatland, Grassland converted to wetland, Grassland converted to settlement, Grassland converted to other land)*

Table 56 – National LULUCF greenhouse gas emissions and European targets (Mt CO_2eq), historical and baseline [Source: ISPRA]

	1990	2005	2021	2022	2025	2030	2035	2040	2021-2025
	— 3,6	— 33,7	— 24,8	— 21,2	— 28,0	— 28,4	— 24,6	— 30,8	
	n.a.	n.a.	n.a.		n.a.	n.a.	n.a.	n.a.	— 82
									0
									82

** For the period 2021-2025, the LULUCF Regulation provides for the reporting of removals and emissions from the LULUCF sector and the accounting of[95] LULUCF categories*

For the period 2026-2030, the scenario shows that the 2030 target, as shown in Table 48, will not be met.

Table 57 - The emission situation of the LULUCF sector for 2026-2030 (Mt CO2 eq.) [Source: ISPRA]

	2026	2027	2028	2029	2030
	MT CO_2 eq				
Emissions-LULUCF Assorption	— 28.0	— 27.6	— 25.9	— 30.7	— 28.4
LULUCF targets *	— 34.6	— 34.6	— 34.6	— 34.6	— 35.8
Distance to LULUCF targets	**— 6.6**	**— 7.0**	**— 8.8**	**— 4.0**	**— 7.4**

** The final trajectory 2026-2029, and consequently the LULUCF targets, will take place in 2025, following the revision of the data reported with the GHG emissions inventory in the same year.*

Finally, it should be noted that, if the annual target is exceeded, the LULUCF Regulation also provides for a penalty to be applied (in addition to the greenhouse gas emissions of the following year, a quantity equal to the amount, in tonnes of CO_2 equivalent, of excess emissions multiplied by a factor of 1.08).

In conclusion, for the LULUCF sector, the current policy scenario foresees the achievement of the 2025 target of neutrality, as set out in Regulation (EU) 2023/839; the sector's removals as at 2030, according to the scenario of-28,4 MtCO 2eq, remain quite distant from the LULUCF target of -35,8 $MtCO_2$eq contained in the Fit for 55 package.

[95] *Managed forest land (Forest land maining forest land), Afforested land (land converted to forest land), Deforested land (Forest land converted to other land uses), Managed cropland (Cropland maining cropland, land converted to other land uses), Managed grassland (Grassland remaining grassland, Cropland converted to fatland, Wetland converted to fatland, Settlements converted to fatland, Other land converted to fatland, Grassland converted to wetland, Grassland converted to settlement, Grassland converted to other land)*

II. Projections of sectoral developments with existing national and Union policies and measures at least until 2040 (including for the year 2030)

Data show a strong reduction in emissions from 2005 until 2015 and a subsequent decrease at lower reduction rates. There is a clear reduction in 2020, due to the COVID-19 pandemic, and the subsequent rise in 2021 and 2022 due to the resumption of activity. This is due to many factors, some structural and other quotas. The most important are:

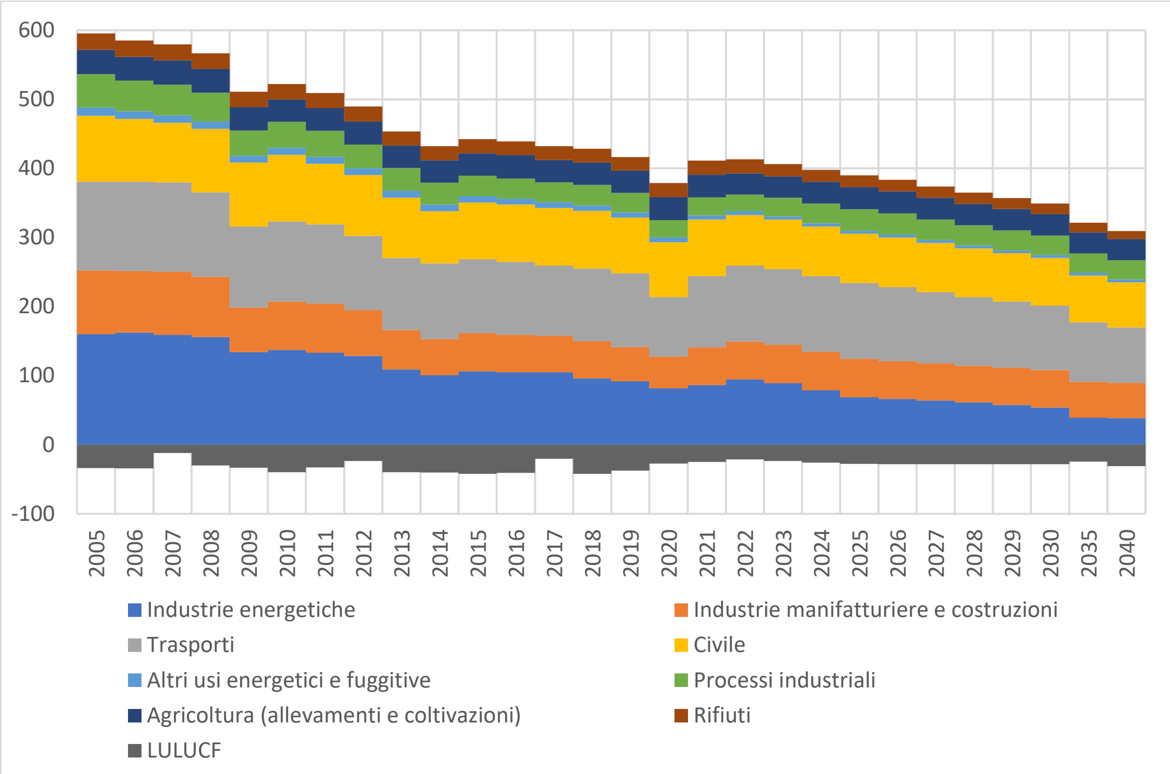
- share of renewable energy in primary consumption higher than expected as a result of the strong development of photovoltaic production and the uptake of biomass for heating;
- increased efficiency of electricity generation, with many combined cycle natural gas-fired plants entering into operation, in many cases co-generative, accompanied by a progressive decommissioning of obsolete steam plants fuelled with fuel oil;
- reduction in transport consumption for joint action to raise fuel prices and low activity levels;
- a rapid reduction in final consumption in the industrial sector as a result of the economic crisis and the structural change in production activities;
- increased efficiency of energy end-use appliances.

The table and graph below show the projections of the baseline until 2040. Emissions are broken down by sector.

Table 58 – Greenhouse gas emissions broken down by sector (Mt CO2eq), historical and baseline [Source: ISPRA]

GHG emissions, Mt CO_2eq.	2005	2015	2020	2021	2022	2025	2030	2035	2040
By ENERGY USI, of which:	**488**	**360**	**300**	**332**	**338**	**310**	**274**	**249**	**239**
Energy industries	160	106	82	86	95	68	54	39	39
Manufacturing industries and construction	92	56	46	55	55	56	54	52	51
Transport	128	107	87	103	110	110	93	86	80
Civil	96	82	79	82	73	72	69	67	66
Other energy and fugitive uses	12	9	7	6	6	4	4	4	4
FONTI ALTRE, of which:	**107**	**83**	**79**	**79**	**75**	**80**	**75**	**72**	**69**
Industrial processes	48	30	25	26	24	31	28	27	27
Agriculture (livestock and crops)	35	32	34	33	31	32	31	31	31
Waste	24	20	20	20	20	17	15	14	12
Total (excluding LULUCF)	**596**	**443**	**379**	**411**	**413**	**390**	**349**	**320**	**308**
LULUCF	— 34	— 42	— 27	— 25	— 21	— 28	— 28	— 25	— 31

Figure 57 – Greenhouse gas emissions broken down by sector (Mt CO_2eq), historical and baseline (Source: ISPRA]



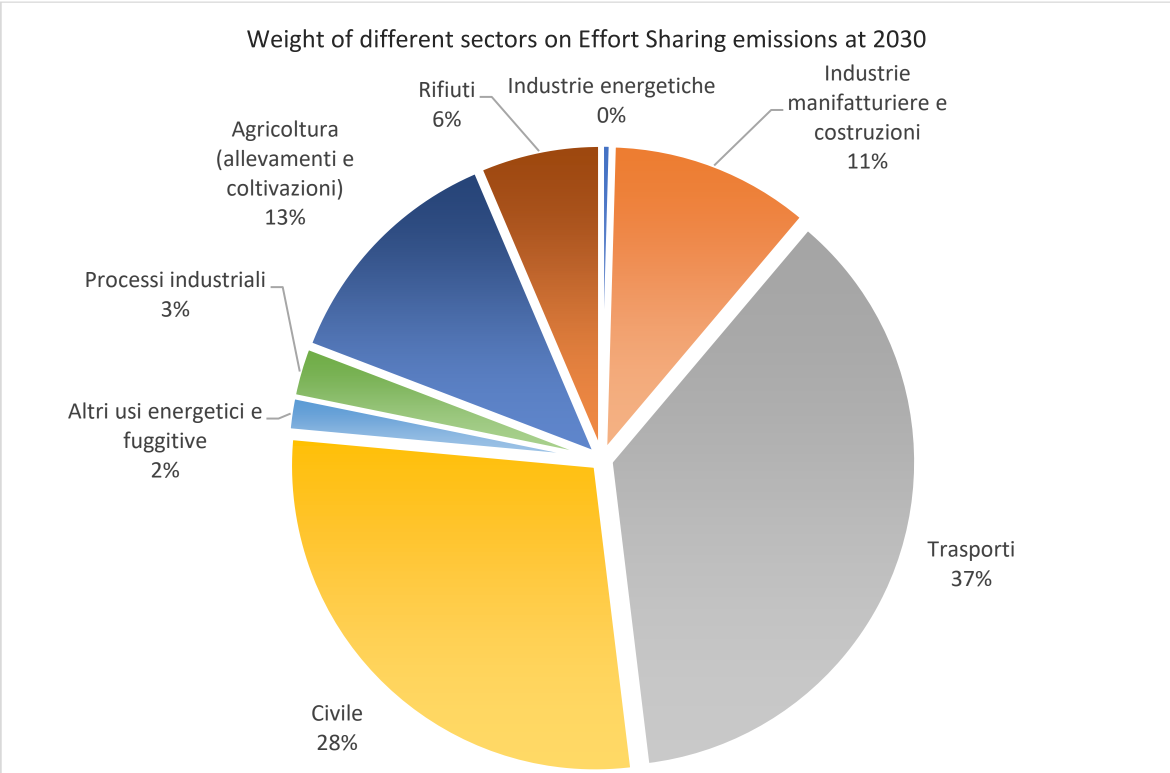
The 2021-2030 sectoral analysis shows that:

- there is a very significant reduction in emissions in energy industries (-38 %), mainly due to the reduction of emissions from the electricity sector. Emissions in this sector are directly linked to fossil fuel electricity production. The significant growth in renewable electricity production and increased thermoelectric efficiency since 2008 have contributed to the reduction of emissions in historical years. The reduction of emissions in the projection years is due to the further increase in thermoelectric efficiency, the share of renewables and the phasing out of higher carbon fuels;
- in the transport sector, emissions are projected to decrease by 10 %, due to the increase in transport demand and the implementation of weak policies on the modal shift;
- in the civil sector, emissions decreased by 16 % mainly due to efficiency gains and phasing out the most polluting fuels; lifestyles and temperature developments, especially winter, also play a decisive role;
- emissions from industry, as regards energy consumption, show a significant contraction over the period 2005-2015 (around -40 %) partly due to the economic crisis and partly due to structural change in activity and increased efficiency of production processes. In the period 2021-2030, emissions from the industry sector remain almost constant amid a very strong recovery in production according to the projections of the drivers used for scenario development; this implies continuous efficiency of production and a gradual shift towards less emitting energy carriers;
- for industrial processes and F-gases there is a slight increase in emissions in the face of a production recovery due to the lack of effective technological solutions that can contain non-energy emissions in the short term;

- emissions from waste show a high reduction rate from 2021 to 2030 (-23 %) mainly due to the decrease in landfilling;
- agriculture has a rather stable trend over the period 2021-2030, the measures already in place do not have a significant impact on the sector whose total emissions are not significantly reduced;
- for the LULUCF sector, the year 2022 is characterised by a very low level of removals; however, the baseline scenario returns a framework with downward net removals. This reflects an emissive increase due to the increase in the incidence of fires, both in forested and other wooded land.

The figure below shows a focus on the weight of the different sectors covered by the ESR in the baseline scenario. It is clear from the graph that transport and civil continue to be the predominant sectors in terms of emissions (together accounting for almost two-thirds of emissions) and for which additional policies and measures will need to be adopted.

Figure 58 – Greenhouse gas emissions by sector as a percentage of total Effort Sharing as at 2 030 in the baseline [Source: ISPRA]



The table below shows national emissions (without LULUCF), by type of gas, in terms of CO_2eq. CO_2 accounts for more than 80 % of total emissions. It is worth noting, however, that while other gases also contribute to reducing the total emission level, their role tends to grow progressively over time. Methane reduction is mainly due to the waste sector. The reduction of fluorinated gases is mainly due to the implementation of the specific European regulation governing their use.

Table 59 – Greenhouse gas emissions from 2005 to 2040, disaggregated by gas (Mt CO2eq), historical until 2022 and baseline [Source: ISPRA]

GHG emissions, MT CO_2eq.	2005	2015	2020	2021	2022	2025	2030	2035	2040
Carbon dioxide	502	362	303	337	342	324	288	264	255
Methane	55	49	47	47	46	41	39	37	35
Nitrous oxide	26	17	18	17	16	17	17	17	16
F-Gas (HFCs, PFCs, SF6, NF3)	12	14	11	10	10	8	5	3	2
TOTAL	596	443	379	411	413	390	349	320	308

4.2.2 Renewable energy

I. Current share of renewable energy in gross final energy consumption and in different sectors (heating and cooling, electricity and transport) as well as per technology in each of these sectors

Renewable energy sources have played a major role in the Italian energy system for several years and have been widely deployed in all sectors of use (electricity, heat, transport). The evolution of the share of gross final consumption of energy covered by renewable sources, in particular, is shown in the table below; the data shall be calculated by applying the RED I methodology for the years until 2020 and the RED II methodology, as amended by RED III, for 2021 and 2022. In2 022, RES energy amounted to around 22,6 Mtoe, representing a share of total gross final consumption of more than 19 %; the share of the heat sector in the total RES amounts to 47 %, that of the electricity and transport sectors at 46 % and 7 % respectively.

Table 60 - Total ERF share (ktoe) (*) [Source: GSE]

	2017	2018	2019	2020	2021	2022
Numerator – RES energy	**22.000**	**21.605**	**21.877**	**21.900**	**22.819**	**22.568**
Gross electricity production from RES	9.729	9.683	9.927	10.176	10.207	10.370
Final RES consumption for heating and cooling	11.211	10.673	10.633	10.378	11.061	10.626
Final consumption of RES in transport	1.060	1.250	1.317	1.346	1.552	1.573
Denominator – Total gross final consumption	**120.435**	**121.406**	**120.330**	**107.572**	**120.340**	**117.448**
Total RES share (%)	**18.3 %**	**17.8 %**	**18.2 %**	**20.4 %**	**19.0 %**	**19.2 %**

(*) Data for the period 2017-2020 shall be calculated using the methodology set out in RED I; they are therefore not perfectly comparable with the data for 2021 and 2022, calculated using the methodology set out in RED II, as amended by RED III.

❖ **ELECTRICAL SECTOR**

In 2022, RES electricity production, calculated using the calculation criteria set out in RED I (until 2020) and RED II as amended by RED III (since 2021), stood at around 120.6 TWh; the impact on Lord domestic electricity consumption is 37.1 %.

Table 61 - Electricity RES share (TWh) (Source: GSE]

	2017	2018	2019	2020	2021	2022
Numerator – Gross production of RES electricity	**113,1**	**112,6**	**115,5**	**118,4**	**118,7**	**120,6**
Water (normalised)	46,0	46,8	47,1	48,0	48,5	48,1
Wind (normalised)	17,2	17,9	19,1	19,8	20,3	21,0
Geothermal	6,2	6,1	6,1	6,0	5,9	5,8
Solar	24,4	22,7	23,7	24,9	25,0	28,1
Bioenergy (sustainable)	19,3	19,1	19,5	19,6	19,0	17,5
Denominator – Internal consumption Lords of electricity	**331,8**	**331,9**	**330,2**	**310,8**	**329,8**	**325,1**
FER-E share (%)	**34.1 %**	**33.9 %**	**35.0 %**	**38.1 %**	**36.0 %**	**37.1 %**

❖ THERMAL SECTOR

The table below shows the data necessary for the calculation of the RES share in the thermal sector; again, the data are calculated by applying the RED I methodology for the years up to 2020 and the RED II methodology, as amended by RED III, for 2021 and 2022. In2022, RES consumption in the thermal sector amounted to around 10,6 Mtoe; annual variations are mainly linked to changes in temperatures and changes in plant equipment. Inrecent years, the share of RES in overall national heat consumption has always been around 20 %; the largest contribution is from solid biomass uses (mainly firewood and pellets used in the residential sector) and heat pumps.

Table 62 - RES share of heat sector (ktoe) (Source: GSE]

	2017	2018	2019	2020	2021	2022
Numerator – RES energy	**11.211**	**10.673**	**10.633**	**10.378**	**11.061**	**10.626**
Gross production of RES heat	957	950	997	983	373	373
Final RES consumption for heating	10.254	9.723	9.636	9.395	10.688	10.252
of which bioenergy (sustainable)	7.265	6.780	6.779	6.564	7.477	6.827
of which solar	209	218	228	236	247	263
of which geothermal	131	128	131	120	115	110
— of which space energy for heating and ACS	2.650	2.596	2.498	2.475	2.588	2.744
— of which ambient energy for cooling	—	—	—	—	261	308
Denominator – Gross final consumption in the thermal sector	**55.823**	**55.359**	**53.979**	**52.023**	**57.068**	**51.538**
FER-C share (%) *	**20.08 %**	**19.28 %**	**19.70 %**	**19.95 %**	**19.38 %**	**20.62 %**
Waste heat used through district heating networks	—	—	—	—	9	10
FER-C share with waste heat (%)	—	—	—	—	**19.40 %**	**20.64 %**

** Data for the period 2017-2020 shall be calculated by applying the methodology set out in RED I; they are therefore not perfectly comparable with the data for 2021 and 2022, calculated using the methodology set out in RED II, as amended by RED III. For greater certainty, the FER-H share calculated for 2020 applying the RED II criteria is 20.09 % without considering waste heat and 20.10 % when considered; this value is the basic level against which the targets for the heat sector are assessed.*

❖ TRANSPORT SECTOR

The evolution of the transport RES target, as shown in the table below, is also developed in this case by applying the calculation criteria set out in RED I (until 2020) and RED II, as amended by RED III. In 2022, sectoral consumption of RES energy amounted to 3,5 Mtoe; the relative impact on total consumption, calculated by applying the premium coefficients shown in the table (including denominator, precautionary), is 8.0 %.

Table 63 - ERF share transport sector (ktoe) (Source: GSE)

	coeff. RED I	2017	2018	2019	2020	coeff. RED III	2021	2022

Numerator – RES energy		**1.992**	**2.434**	**2.890**	**2.810**		**3.283**	**3.477**
Advanced double counting biofuels	2	7	65	403	408	2	538	613
Non-advanced double counting biofuels	2	350	520	571	536	2	800	858
Single counting biofuels	1	703	665	343	402	1	214	102
Share of electricity on the road	5	2	3	4	6	4	14	19
Share number of rail electricity	2,5	159	167	163	135	1,5	163	178
Share of electricity on other modes	1	166	168	172	154	1	93	90
Denominator – Gross final consumption in transport *		**30.728**	**31.774**	**31.946**	**26.178**		**40.454**	**43.642**
FER-T share (%)		**6.5 %**	**7.7 %**	**9.0 %**	**10.7 %**		**8.1 %**	**8.0 %**

**Data for the period 2017-2020 shall be calculated by applying the methodology set out in RED I; they are therefore not perfectly comparable with the data for 2021 and 2022, calculated using the methodology set out in RED II, as amended by RED III. The criteria for calculating RED are, in this case, significantly different: RED I considered only petrol, diesel and electricity in all forms of transport, while RED II, as amended by RED III, considers the entire transport sector including international shipping and international aviation.*

II. Indicative development projections with existing policies for 2030 (with a perspective until 2040)

In terms of RES development in 2025-2040, the following tables show, respectively, the evolution of overall RES shares in current policies and in the electricity, thermal and transport sectors. In the trend of 2030, RES contribute to 26.2 % of gross final energy consumption, an increase of around eight percentage points compared to 19.2 % in 2022 (historical figures). Looking ahead to 2040, the RES share is growing further to 31.4 %.

Table 64 – Total RES share 2025-2040 with existing policies and comparison with 2022 (ktoe) (Source: RSE]

	2022	2025	2030	2040
Numerator – RES energy	**22.568**	**25.770**	**30.632**	**36.985**
Gross electricity production from RES	10.370	12.255	15.066	20.088
Final RES consumption for heating and cooling	10.626	11.394	12.545	13.394
Final consumption of RES in transport	1.573	2.122	3.021	3.503
Denominator – Total gross final consumption	**117.448**	**117.343**	**116.987**	**117.751**
Total RES share (%)	**19.2 %**	**22.0 %**	**26.2 %**	**31.4 %**

❖ **ELECTRICAL SECTOR**

Under current policies, the contribution in the electricity sector is expected to reach 15,1 Mtoe per 2030 gross RES generation, i.e. 175 TWh (less the share of around 1 TWh dedicated to the production of green hydrogen). In 2030, 53.2 % of gross domestic electricity consumption with renewable energy is covered compared to 37.1 % in 2022 (historical figure). Analysing individual sources, the significant technical and economically exploitable residual potential and the reduction of PV and wind costs also imply growth for these technologies under current policies. Also over the same time horizon, geothermal production growth and stabilisation of hydropower production is considered to be a significant reduction in bioenergy, both because of the absence of specific incentive schemes for these types of fins in the current policy scenario and for competition with the production of biomethane promoted by the NRRP. Looking ahead to 2040, the share of electric RES is growing to 68.8 %.

Table 65 - ERF share in the electricity sector 2025-2040 with existing policies and comparison with 2022 (TWh) (Source: RSE]

	2022	2025	2030	2040
Gross renewable production[(1)]	**120,6**	**142,5**	**175,2**	**233,6**
Water (normalised)	48,1	47,5	46,9	46,9
Wind (normalised)	21,0	27,8	43,4	69,8
Geothermal	5,8	7,3	7,7	7,7
Bioenergy[(2)]	17,5	13,9	10,1	9,7
Solar	28,1	46,0	67,2	99,6
Denominator – Internal consumption Lords of electricity	**325,1**	**327,0**	**329,6**	**339,5**
FER-E share (%)	**37.1 %**	**43.6 %**	**53.2 %**	**68.8 %**

[(1)]net of share for the production of green hydrogen with electrolysers
[(2)] including the RES share from waste. Only production from raw materials that comply with sustainability requirements shall be considered.

❖ THERMAL SECTOR

The thermal sector also plays an important role in the evolution of current renewable energy policies: in absolute terms, it is expected to reach around 12,5 Mtoe of RES by 2030. Growth is linked to the increase in the renewable component of annual heat pumps and increased use of solar thermal, geothermal and bioenergy installations96. By 2030, the share of thermal RES reached 24.3 % compared to 20.6 % in 2022 (historical figure). Looking ahead to 2040, the share of thermal RES is growing to 26.1 %.

Table 66 - RES share in the heat sector 2025-2040 with existing policies and comparison with 2022 (ktoe) (Source: RSE]

	2022	2025	2030	2040
Numerator	**10.626**	**11.394**	**12.545**	**13.394**
Gross production of RES heat	373	410	416	476
Final RES consumption for heating	10.252	10.984	12.129	12.919
of which bioenergy[(1)]	6.827	7.410	7.939	7.937
of which solar	263	348	503	503
of which geothermal	110	137	137	137
of which ambient energy from pdc	3.052	3.078	3.539	4.329
of which hydrogen	0	12	12	12
Denominator – Final Lord consumption in the thermal sector	**51.538**	**52.489**	**51.598**	**51.382**
FER-C share (%)	**20.6 %**	**21.7 %**	**24.3 %**	**26.1 %**

(1) Including biomethane consumption

[96] *Including biomethane and biogas*

❖ **TRANSPORT SECTOR**

RED III, approved at Community level in 2023, but not yet transposed into national legislation, changes the methods for calculating the RES share of transport compared to the criteria set out in the previous RED II Directive. More weight is attributed to hydrogen, but overall makes it more difficult to achieve the targets, as gross final consumption includes consumption in all transport segments, including shipping and international aviation. The share of RES in transport according to RED III stands at 15.4 % in 2030, mainly due to the growth of advanced biomethane, biofuels and electricity by road, and grows up to 19.2 % in 2040, which also complicates greater hydrogen penetration.

Table 67 – ERF share in transport 2025-2040 with existing policies and comparison with 2022 – calculation criteria set in accordance with the rules of RED III (ktoe) [Source: RSE]

	coeff. RED III	**2022**	**2025**	**2030**	**2040**
Numerator – RES energy		**3.477**	**4.751**	**6.868**	**8.964**
Advanced double counting biofuels	2	433	514	770	871
Non-advanced double counting biofuels	2	858	948	1.118	1.165
Single counting biofuels	1	98	172	335	466
Biomethane single counting	1	5	—	—	—
Advanced double counting biomethane	2	180	478	759	887
Renewable share of electricity on the road	4	19	59	140	387
Renewable share of rail electricity	1,5	178	208	265	373
Share of electricity on other modes	1	90	96	122	156
Hydrogen from renewables	2	0	9	40	114
Denominator – Gross final consumption in transport *		**43.642**	**43.105**	**44.712**	**46.602**
FER-T share (%)		**8.0 %**	**11.0 %**	**15.4 %**	**19.2 %**

(*) *RED III considers the entire transport sector including international shipping and international aviation*.

4.3 Dimension energy efficiency

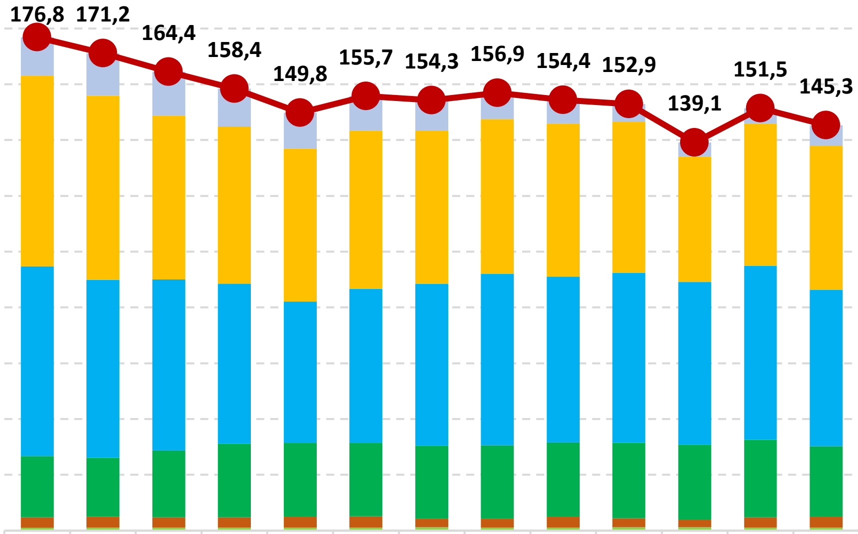
I. Current primary and final energy consumption in the economy and per sector (including industry, residential, service and transport)

In recent decades, the Italian energy system has changed profoundly; the development of natural gas in the early 2000s was followed, especially since 2010 (Figura 59), by rapid growth in renewable energy sources and a gradual reduction in oil and coal products, with significant effects both in terms of tackling climate change risks and security and diversification in energy supplies.

In 2022, according to Eurostat data, the gross domestic energy consumption in Italy amounted to around 145 Mtoe[97], a significant contraction compared to 2021, in line with the trend observed since 2010. Compared to 2017, in particular, there is a significant decrease in the uses of natural gas (-8.8 %), petroleum products (-7.0 %) and solid fuels (-20.7 %), while the consumption of renewable sources is slightly reduced (-2.9 % dynamic mainly associated with the significant contraction in hydropower production), and the use of electricity increased (+ 13.8 %).

[97] *Gross domestic consumption is the sum of primary energy consumption and non-energy uses.*

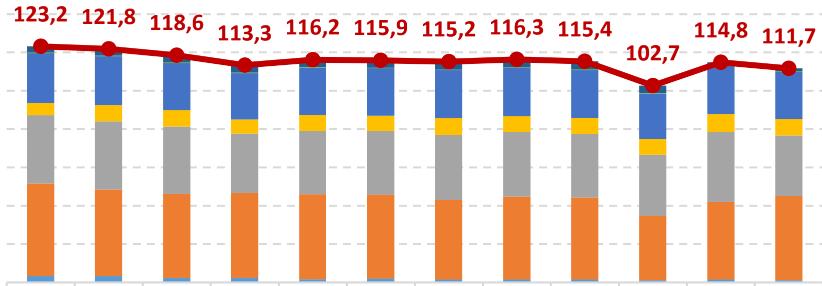
Figure 59 - Evolution of Gross Domestic Consumption by Source (Mtoe) [Source: Eurostat]



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Solidi fossili	13,7	15,3	15,7	13,5	13,1	12,3	11,0	9,3	8,5	6,5	5,1	5,5	7,4
Petrolio	68,4	66,0	58,6	56,3	54,7	56,7	54,8	55,4	54,7	54,0	44,9	51,0	51,5
Gas	68,1	63,8	61,4	57,4	50,7	55,3	58,1	61,5	59,5	60,9	58,3	62,4	56,1
Rinnovabili	21,9	21,0	23,9	26,4	26,5	26,3	26,0	26,2	26,7	27,0	26,9	27,7	25,4
Energia elettrica	3,8	3,9	3,7	3,6	3,8	4,0	3,2	3,2	3,8	3,3	2,8	3,7	3,7
Rifiuti non rinnovabili	1,0	1,1	1,1	1,1	1,2	1,1	1,2	1,1	1,1	1,2	1,2	1,2	1,2
Totale	176,8	171,2	164,4	158,4	149,8	155,7	154,3	156,9	154,4	152,9	139,1	151,5	145,3

Final energy consumption has developed in recent years similar to those of Gross Domestic Consumption. Figure 2022 (111,7 Mtoe) is down (by 3-4 percentage points) compared to the previous five-year period, with the exception of 2020. Again, the contraction concerns mainly natural gas and solid fuels, while oil products are growing.

Figure 60 – Evolution of final consumption by source (Mtoe) [Source: Eurostat][98]



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Calore derivato	3,2	3,4	3,7	3,7	3,9	4,0	4,1	4,1	4,2	3,9	1,5	1,5
Rifiuti non rinnovabili	0,2	0,3	0,3	0,3	0,3	0,3	0,2	0,3	0,3	0,3	0,3	0,3
Energia elettrica	26,0	25,5	24,7	24,2	24,7	24,6	25,1	25,2	25,1	23,7	25,1	24,7
Rinnovabili	6,5	8,6	8,5	7,5	8,4	8,0	8,7	8,4	8,4	8,2	9,3	8,6
Gas	35,5	35,5	35,2	30,9	33,0	33,2	33,9	33,6	33,0	31,8	36,6	31,6
Petrolio	48,3	45,2	43,8	44,3	44,3	43,8	41,7	43,2	42,9	33,7	40,5	43,8
Solidi fossili	3,4	3,3	2,4	2,4	1,7	2,0	1,5	1,5	1,5	1,2	1,5	1,2
Totale	123,2	121,8	118,6	113,3	116,2	115,9	115,2	116,3	115,4	102,7	114,8	111,7

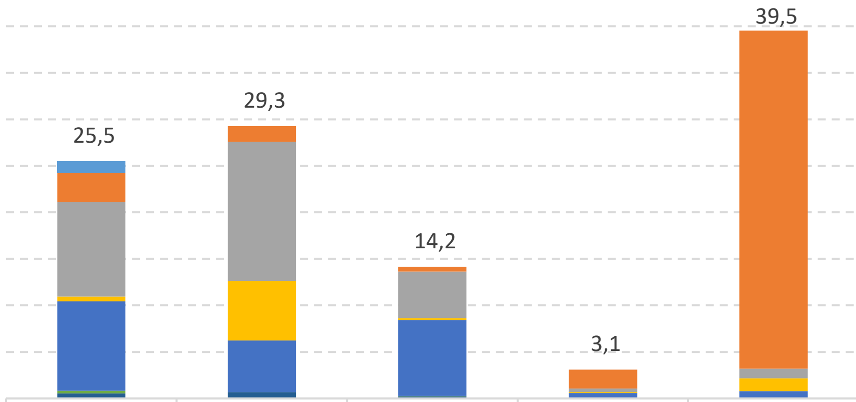
Solidi fossili ■ Petrolio ■ Gas ■ Rinnovabili ■ Energia elettrica ■ Rifiuti non rinnovabili ■ Calore derivato

The figure below shows the sectoral final consumption recorded in 2022 broken down by energy source. It is noted that most final consumption is concentrated in the transport sector (39,5 Mtoe, 35 % of total final consumption); residential (29,3 Mtoe, 26 %) and industry (25,5 Mtoe, 23 %).

Gas and electricity remain the predominant energy sources in the industrial sector (around 78 % of total consumption), residential (70 %) and mainly tertiary (93 %). The use of petroleum products is mainly concentrated in the transport sector (where 83 % of total consumption of petroleum products is concentrated), while the role of renewable sources (biofuels) increases progressively.

[98] Reference is made to finalC onsumes of energy calculated by applying the criteria established for the monitoring of energy efficiency targets. It should also be noted that the renewable heading includes biofuels blended with fossil fuels, while it does not include biomethane fed into the grid or energy from heat pumps.

Figure 61 – Final energy consumption by source and sector, 2022 (Mtoe) [Source: Eurostat]



	Industria	Residenziale	Terziario	Agricoltura	Trasporti
TOTALE	25,5	29,3	14,2	3,1	39,5
Solidi fossili	1,2	-	-	-	-
Petrolio	3,1	1,7	0,5	2,0	36,3
Gas	10,2	15,0	5,0	0,4	1,0
Rinnovabili	0,5	6,4	0,2	0,1	1,4
Energia elettrica	9,6	5,6	8,2	0,6	0,8
Rifiuti non rinnovabili	0,3	-	0,0	-	-
Calore derivato	0,6	0,7	0,2	0,0	-

With regard to the energy efficiency of final consumption, the combined energy savings achieved by active policies (within the meaning of Article 7 EED, subsequently amended by Article 8 EED III) in the period 2014-2 020 are reconstructed by ENEA at around 23 Mtoe; these savings are mainly associated with tax deductions (45 % of the total) and the White Certificates mechanism (36 %). Looking at 2021 and 2022, it should be noted that the weight of deductions from overall savings gradually increases (up to 54 % in 2022), as well as initiatives to promote sustainable mobility (to 27 % on average), while that of Bianchi Certificates (on average 11 %) falls.

Table 68 - Energy savings from active policies within the meaning of Article 7 EED, as amended by Article 8 EED III (Mtoe) [Source: ENEA]

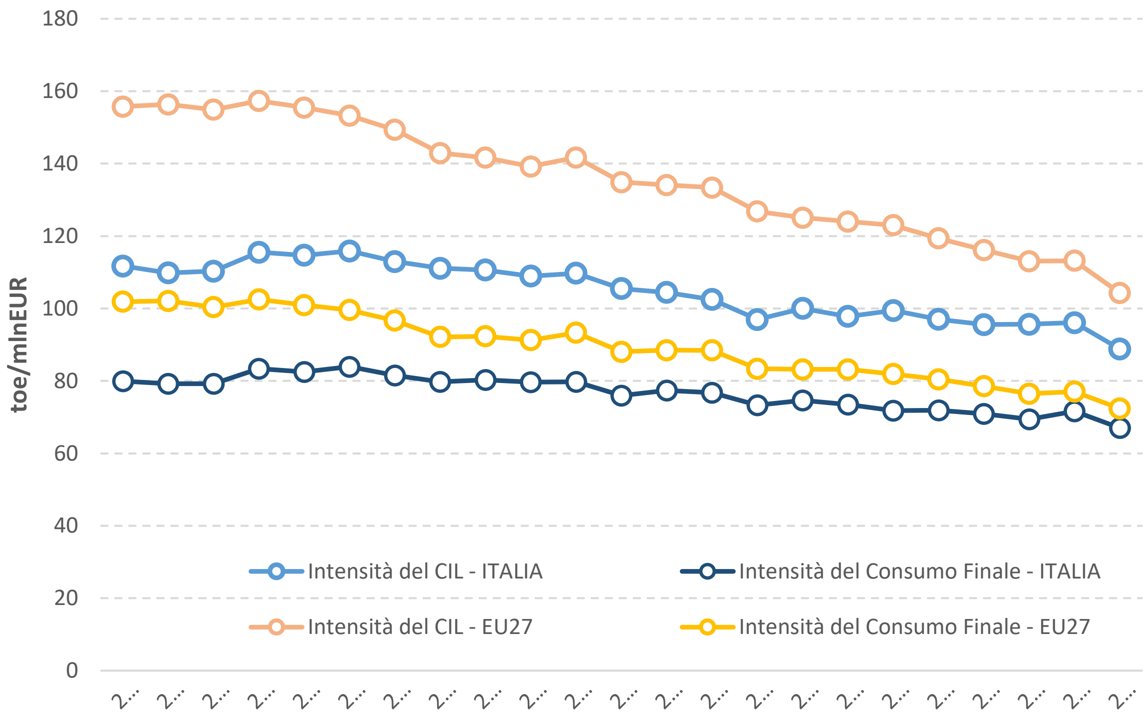
	2014-2020	**2021**	**2022**
White certificates	8,39	0,11	0,32
Heat account	0,62	0,09	0,15
Tax relief	10,40	0,52	1,36
National Energy Efficiency Fund	0,00	0,01	0,01
Transition Plan 4.0	1,83	0,07	0,14
Cohesion policies	1,11	0,01	0,01
Information campaigns	0,41	0,00	0,10
Sustainable mobility	0,48	0,47	0,42
Total	**23,24**	**1,3**	**2,5**

❖ **ENERGY INTENSITY AND ENERGY EFFICIENCY**

Energy intensity, assessed in terms of energy consumed per unit of economic wealth produced (GDP, chain-linked values, reference year 2010), is a robust indicator of economic and energy efficiency. Eurostat data show that Italy is characterised by energy intensity per wealth produced among the lowest in the main European countries.

The intensity calculated by reference to primary energy and the intensity calculated for final consumption follow rather similar trends. The figure below shows, in particular, how the average intensity calculated following both approaches decreased significantly between 2000 and 2022 for both Italy and the EU countries as a whole.

Figure 62 – Final consumption and gross domestic consumption per unit of GDP – Years 2000-2022 [Source: Eurostat]

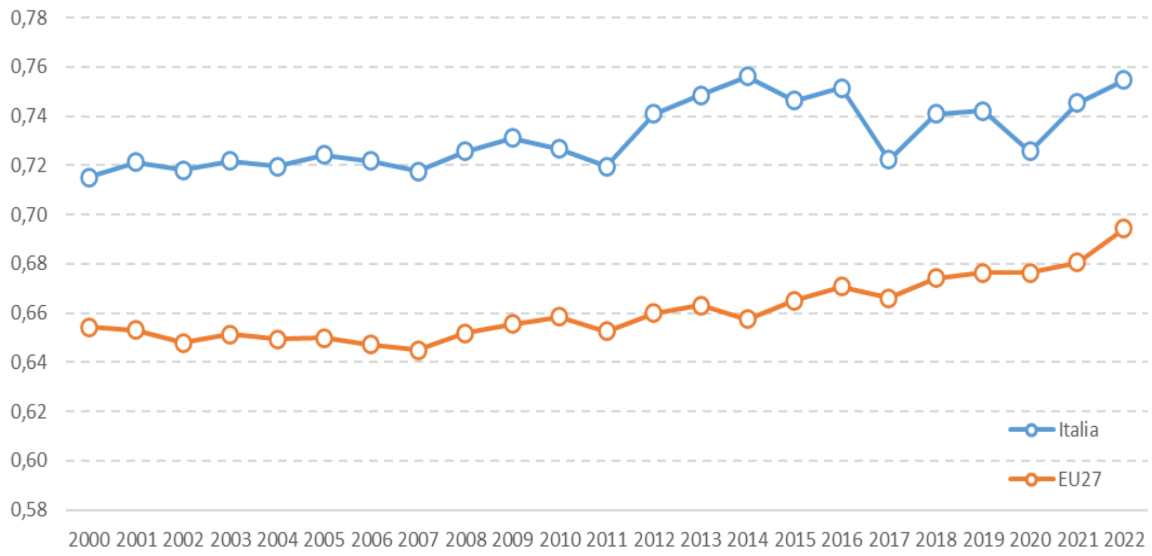


With regard to energy efficiency, Italy historically shows higher values than the average in other European countries, resulting in a greater effort to achieve significant energy savings than in other economies where specific consumption is historically higher and compryable.

The ratio of final energy consumption to primary energy consumption is an indicator of the overall energy conversion efficiency of primary sources; in Italy, this ratio has always been significantly higher than the European average (Figure below). Until 2011, the relative stability of the indicator is linked to the fact that the efficiency gain, also due to the increase in gross electricity production from cogeneration plants, is partly offset by the increasing weight of secondary energy sources (electricity, oil derivatives) in final energy consumption; on the other hand, a trend increase in the ratio is observed in the following years, due both to the increase in the share of final electricity consumption and to the increase in fossil fuel transformation efficiency.

Since 2000, the ratio of final and primary energy consumption in Italy has been around 0,715 (figure 2000) to 0,756 (figure 2014, just above that recorded in 2022, of 0,755), averaging around 0,73, while in EU27 the average figure observed over the period 2000-2022 is 0,66.

Figure 63 – Final consumption per Gross Domestic Consumption Unit, Years 2000-2022 [Source: Eurostat]

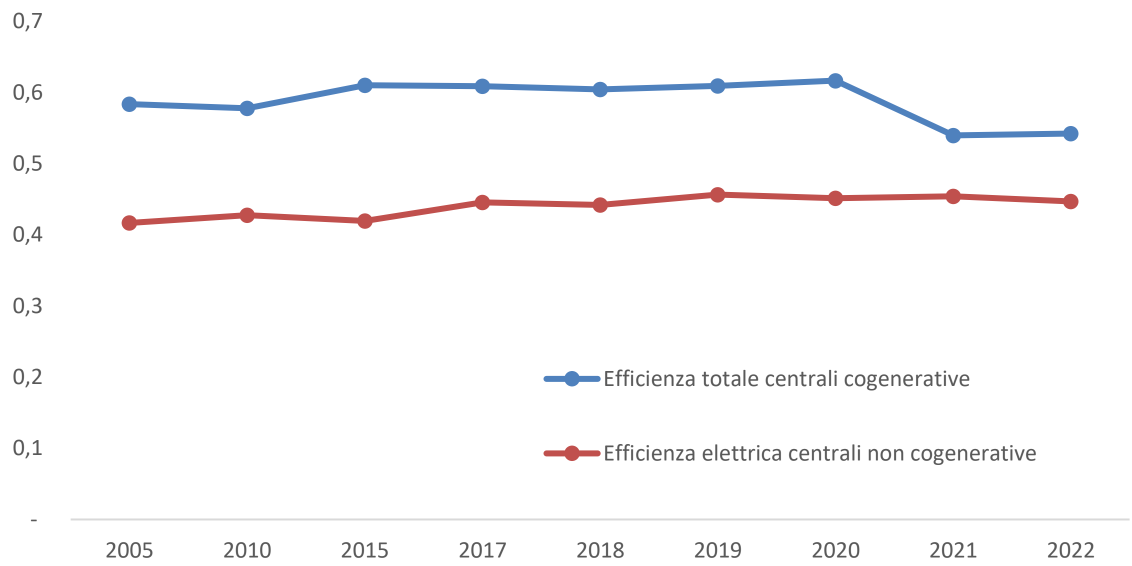


❖ **ELECTRICAL TRANSFORMATION EFFICIENCY**

Data on energy consumption and electricity and useful heat production of thermal power plants make it possible to calculate the efficiency of the thermal power park in terms of the ratio of energy produced to the energy content of the fuels used.

The figure below shows the evolution of the efficiency of the national thermoelectric park for cogenerative and non-cogenerative power plants. In particular, in 2 022, the electricity efficiency of cogenerative power plants, including heat production, was 54 %, that of non-cogenerative power plants at 45 %. For a correct interpretation of the figure, it should be noted that, from 2021 onwards, the consumption associated with the self-generated heat consumed by auto-producers is separated, in accordance with Eurostat's request, from cogeneration data and are counted as end uses in the sector belonging to self-producers. This explains the apparent fall in average yield compared to previous years.

Figure 64 – Efficiency of the national thermal power park * [Source: Eurostat]
(*Ratio* of the nergy*produced to the energy content of the fuels used*)



(*) It should be noted that from 2021 onwards the data are collected using a different methodology than in the past, transposing Eurostat's indications. Values are therefore not fully comparable with those of previous years.

The efficiency gains observed for cogenerative power plants between 2010 and 2 015 are of particular importance, mainly linked to the predominant operation of the combined cycle and condensing cogenerative sections of significant size and efficiency.

Notes that the conversion efficiencies recorded in the most recent years are higher than in the period 2005-2010; the efficiency gains are particularly relevant for cogeneration plants in the period 2015-2020, for non-co-generative plants in the period 2017-2021.

II. Current potential for application of High Performance Cogeneration and efficient district heating and cooling[99]

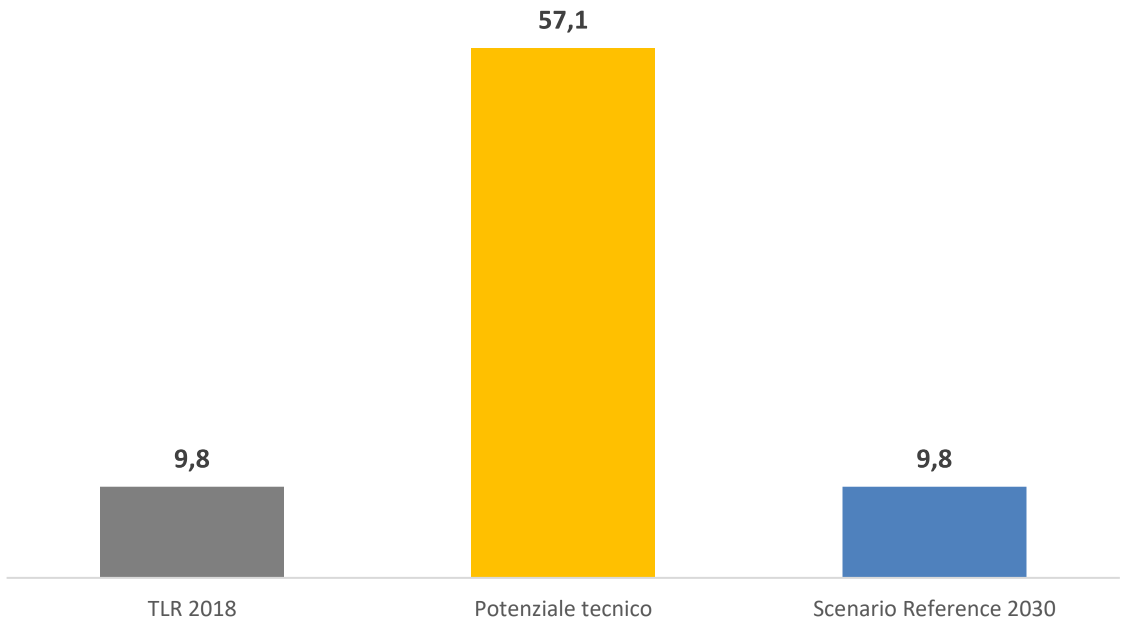
In 2021, as required by Article 14 of the EED, GSE updated its assessment of the development potential of efficient district heating and high-efficiency cogeneration originally developed in 2016.

With regard to efficient district heating, the 2018 heat demand analyses showed a technical potential to exploit district heating of around 57 TWh (around 6 times the current levels of development), mainly concentrated in the northern parts of the country.

Projections in the Reference scenario show that, under existing policies, heat from efficient district heating networks would be 2 030 TWh in 10.

[99] *In accordance with Article 14(1) of Directive 2012/27/EU*

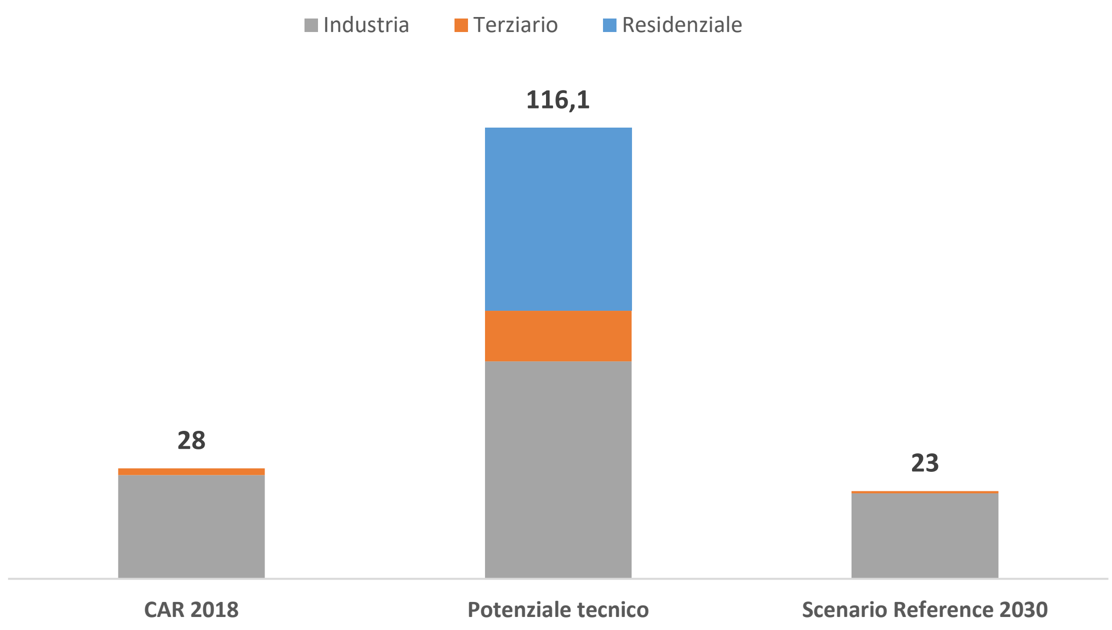
Figure 65 – Comparison of current DH level, technical potential and Reference scenario at 2030 (TWh)



With regard to high-efficiency cogeneration, a total of 2 018 TWh of CHP heat was 35.5 TWh, largely attributable to industry (75 %), followed by cogenerated heat for district heating (20 %) and tertiary (5 %), while residential is negligible. In terms of sources, gas is largely prevalent in consumption (95 %). The technical potential, to be understood as a theoretical maximum demand for cogenerable heat based on purely technical conditions, was 116 TWh (excluding district heating network installations), of which 56 TWh in industry, 47 TWh in residential and 13 TWh in the tertiary sector.

According to the Reference scenario, as of 2030, under existing policies, the useful heat from CAR would amount to 23 TWh.

Figure 66 – Comparison of current CAR level (excluding CAR-TLR installations), technical potential and reference scenario (TWh)



III. Projections considering existing energy efficiency policies, measures and programmes as described in point 1.2. (ii) for primary and final energy consumption for each sector at least until 2040 (including for the year 2030)100

Table 5.1 shows historical data for 2022 and policy projections for the period 2025-2 040 in terms of Gross Domestic Consumption (CIL), primary and final energy consumption, broken down by sector and source. In addition, the projection of non-energy consumption is reported.

There is a gradual reduction in energy intensity[101] (Figure 5.1), as well as an increasingly important role played by renewables at the expense of fossil sources.

100This reference business as usual projection shall be the basis for the 2030 final and primary energy consumption target which is described in 2.3 and conversion factors.

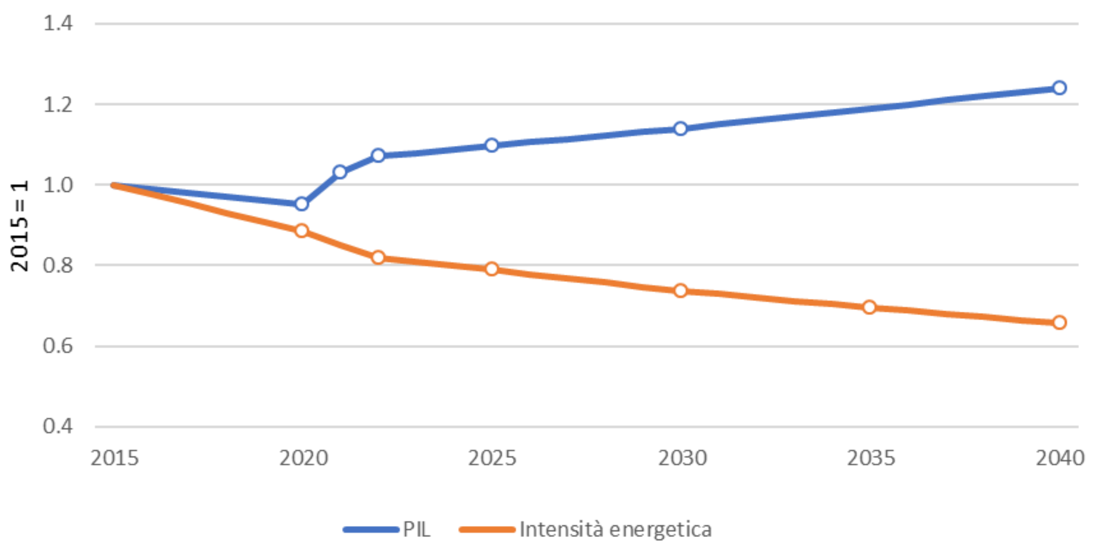
[101] Energy efficiencymeasure of the economic system, understood as the amount of energy needed to produce a unit of GDP. It is calculated as the ratio of CIL to GDP.

Table 69 - Primary and final energy consumption (for each sector); projections 2025-2 040 in the baseline scenario, historical data 2021 and 2022 EUROSTAT (Mtoe)

Baseline scenario	2021	2022	2025	2030	2040
Gross inland consumption [1]	**151.5**	**145.3**	**143.4**	**139.1**	**134.7**
Solids [2]	6.7	8.6	4.4	3.7	3.5
Petroleum products	51.0	51.5	49.5	47.7	46.7
Natural gas	62.4	56.1	56.2	50.4	43.4
Renewables	27.7	25.4	29.5	33.6	38.8
Electricity	3.7	3.7	3.7	3.7	2.3
Primary energy consumption [3]	**145.6**	**139.6**	**137.2**	**133.1**	**128.8**
Final energy consumption [4]	**114.8**	**111.7**	**111.8**	**111.1**	**111.2**
detail by sector	**114.8**	**111.7**	**111.8**	**111.1**	**111.2**
Industry	27.5	25.5	26.4	26.3	26.1
Residential	32.7	29.3	29.3	28.3	27.9
Tertiary	14.9	14.2	14.4	14.0	14.3
Transport	36.4	39.5	38.5	39.1	39.7
Agriculture	3.3	3.3	3.2	3.3	3.3
details by source	**114.8**	**111.7**	**111.8**	**111.1**	**111.2**
Solids [2]	1.8	1.5	1.7	2.0	2.0
Petroleum products	40.5	43.8	41.0	40.0	39.3
Natural gas	36.6	31.6	32.5	30.7	30.0
Electricity	25.1	24.7	24.9	25.3	26.3
Heat	1.5	1.5	1.7	1.8	1.9
Renewable[5]	9.3	8.6	9.9	11.5	11.9
Final non-energy consumption	**5.9**	**5.7**	**6.2**	**5.9**	**6.0**

[1] *indicator 'Gross inland consumption (Europe 2020-2030)', which includes international aviation and excludes environmental heat and international shipping.*
[2] *including share of non-renewable waste and steel gases.*
[3] *primary consumption does not include non-energy uses included in Gross Domestic Consumption.*
[4] *indicator "Final energy consumption (Europe 2020-2030)".*
[5] *includes biofuels and biomethane*

Figure 67 Comparison between the projection of energy intensity and GDP[102] over the period 2015-2040

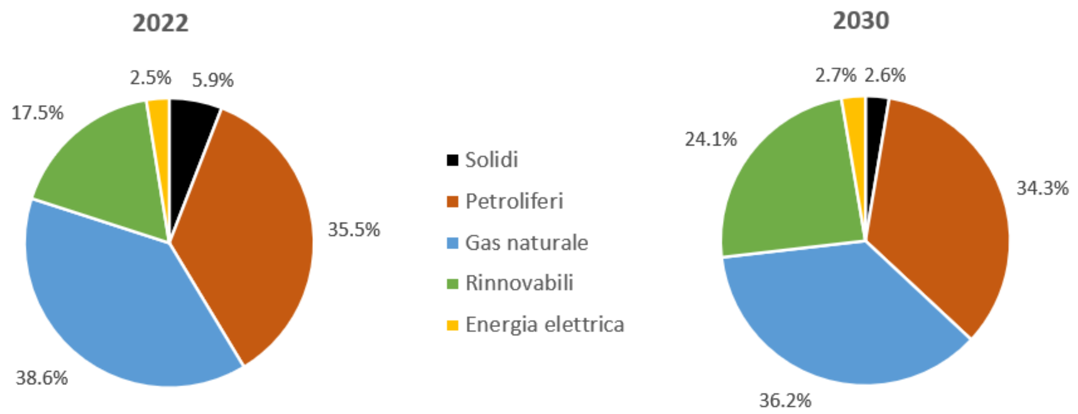


The evolution of primary energy needs is the result of some processes relating to different topics:

- The progressive energy efficiency and technological innovation of new devices progressively replacing the most outdated ones;
- The largest share in terms of consumption of renewable thermal energy, electricity (electrification) and biofuels and thus a different fuel mix in end uses;
- The gradual decarbonisation process in terms of increased RES penetration in the consumption (e.g. ETS sectors) and generation sectors (e.g. electricity generation)

In terms of primary energy mix in 2030 compared to 2022, it is noted that the weight of fossil fuels decreases, with particular reference to natural gas, which still remains the main source, while increasing the consumption of renewable sources (Figura 68).

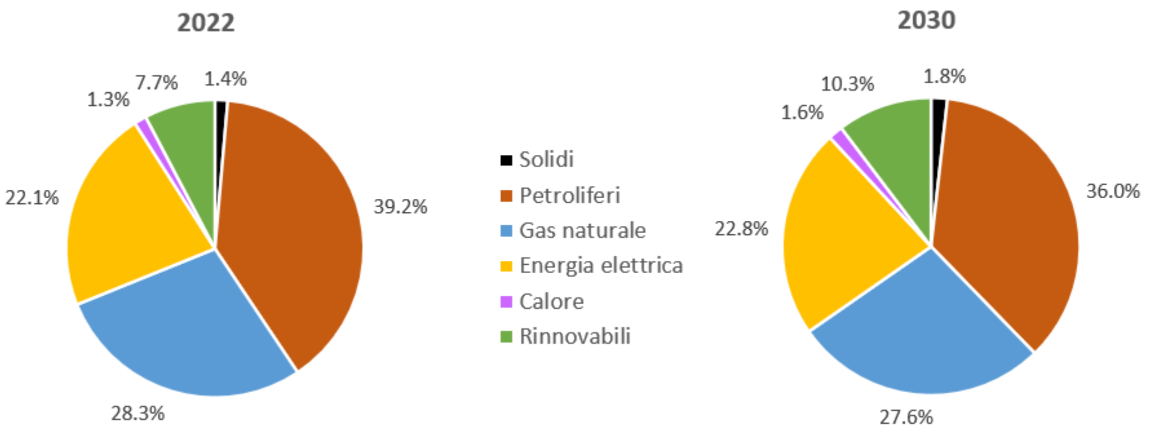
Figure 68 Comparison of primary energy mix 2022 and 2030 (Reference scenario).



The general considerations already expressed for the dynamics of primary energy mixes also apply to the final consumption mix (Figura 69). The trend is a contraction for the share of gas and petroleum products to the benefit of renewables and electricity.

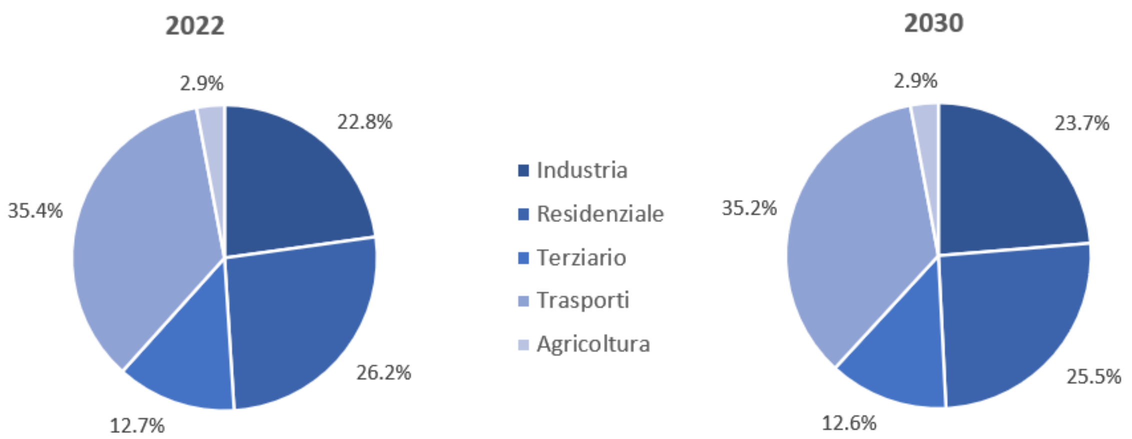
[102] *Chain-linked values 2015*

Figure 69 Comparison of the final energy mix 2022 and 2030 (Reference scenario).



On theFigura 70other hand, at sectoral level, the final energy consumption mix remains similar to 2030 compared with the last year at the end of the year (2022). There is a slight decrease in the energy weight of the residential sector and a moderate increase in industry. In fact, industry's final consumption was particularly low in 2022 due to the energy price crisis.

Figure 70 Comparison of consumption breakdown of end-use sectors 2022 and 2030 (Reference scenario).



IV. Cost-optimal levels of minimum energy performance requirements resulting from national calculations, in accordance with Article 5 of Directive 2010/31/EU

The Energy Performance of Buildings Directive (EPBD) 2002/91/EC and the subsequent Directive 2010/31/EU (EPBD Recast) define the principles for improving the energy performance of buildings. The recast EPBD required the Member States to define the minimum energy performance requirements for buildings on the basis of cost-optimal levels. To this end, the Directive introduced a method of comparative analysis for determining the reference requirements for national standards.

The Delegated Regulation (EU) No N.244/2012 and the subsequent Commission Guidelines of 19 April 2012 set out a methodology framework for calculating the optimal energy requirements of buildings, from both a technical and an economic point of view.

The application in Italy of the method proposed by the Commission has made it possible to identify minimum energy performance requirements based on cost-optimal levels for new buildings and for existing buildings undergoing major or minor renovation of structures and installations.

The report entitled 'Methodology for calculating cost-optimal levels of minimum energy performance requirements (Article 5 of Directive 2010/31/EU)'[103] sent to the Commission in August 2013 presented the results of these calculations and compared them with the requirements in force. As required by Article 5 of Directive 2010/31/EU, the comparative methodology was updated in 2018, five years after it was drawn up in 2013. The new features introduced in the update are set out in the following section[104], while a detailed description of the comparative methodology can be found in the 2013 report mentioned above.

Main changes and calculation assumptions underlying the 2018 methodology

To better understand the results obtained with the 2018 update of the comparative methodology, it is necessary to highlight some of the main points underlying the approach taken. The main changes in relation to the assessments carried out in 2013 and the main calculation assumptions made when applying the methodology are set out below.

- Introduction and assessment of a no-action scenario for existing buildings. In the technical/economic assessments of energy efficiency measures (EEM), the overall costs of measures have been taken into consideration for existing buildings, not the reduced costs if work were done in a 'window of opportunity'. Therefore, the costs of scaffolding and all ancillary works have also been considered in this updated methodology. When applying the 2013 methodology, only costs related to energy efficiency measures were considered, under the assumption that they were conducted at the same time as extraordinary maintenance works, which had to be carried out anyway. This additional assessment enables a much more realistic estimate of the investment needed and offers costs that are higher but much closer to common practice.
- Establishing a new intended use for the reference buildings. The assessments were carried out for the reference buildings previously examined and also for a school building representative of the period 1946-1976, located in Italian climate zones B (601-900 degree days) and E (2101-3 000 degree days).
- Assessment of the energy performance of the reference buildings using the semi-stationary calculation method according to Italian standard UNI/TS 11300. Compared to the previous application of the benchmarking methodology, the most recently published technical specifications (years 2014/16) are used in the 2018 update. Some of the main changes are outlined below:
    - the climate data refers to the new technical standard UNI 10349-1: 2016;
    - new method for calculating the heating and cooling period;
    - analytical calculation of heat bridges for both new and existing buildings;

[103] *https://ec.europa.eu/energy/en/content/eu-countries-2013-cost-optimal-reports-part-2*
[104] *More information can be found in the report published by the Commission https://ec.europa.eu/energy/en/content/eu-countries-2018-cost-optimal-reports*

  - new methods for calculating the efficiency and losses of generation subsystems for energy carriers other than fossil fuels (introduction of UNI TS 11300-part 4: 2016).

- Change in levels of energy efficiency measures (EEM). The types of action/measure considered are the same as those used in the 2013 assessment, although in some cases the number of levels examined and/or their intensity (scale of values) has been changed.
- Updating of overall costs:
  - the main changes concern the cost values of energy carriers (methane gas and electricity) and of investment in energy efficiency measures (EEM);
  - no form of incentive or subsidy is considered due to the continuing evolution of the legislative framework in this field and the short time span of some of the measures, in accordance with the Regulation, which allows the Member States to freely choose.
- Use of renewable sources. Availability of space and optimal positioning was always assumed regarding the installation of photovoltaics on various reference buildings, without considering the potential constraints and obstructions that are often present in real life.

Results obtained from the application of the comparative cost-optimal methodology

Given the varied characteristics of the building stock, it was necessary to find a way of describing it that illustrated its specific features and gave it meaningful representation. Building categories were therefore defined, on the basis of which a clustering model representative of the national building stock was generated.

Specifically, considering the buildings in climate zone B (climate dominated by summer needs) and E (prevalence of winter needs), the methodology analysed the following building types:

- RMF (Monofamiliar Residential): dating back to two times of construction, 1946-1976 and 1977-1990, consisting of buildings of 1 and 2 floors;
- PRC (Residential Piccolo Condominio): dating back to two times of construction, 1946-1976 and 1977-1990, consisting of buildings of 3 floors;
- RGC (Residential Grand Condominio): dating back to two times of construction, 1946-1976 and 1977-1990, consisting of buildings of 4, 6 and 8 floors;
- Uff (Office buildings): dating back to two times of construction, 1946-1976 and 1977-1990, consisting of buildings of 2 floors and buildings of 4-5 floors;
- SCU (Schools): dating back to the construction period 1946-1976 and developed on 4 floors.

For each type, both the new building (NO) and an intervention for two different existing buildings (E1 and E2[105]) were considered: the results are shown in Table 22 (residential), Table 23 (offices) and Table 24 (schools) presenting the cost-optimal values updated to 2018. The optimal values are determined through the technical and economical optimisation of the various possible configurations examined. Please note that the codes representing the buildings also differentiate them for certain typological/construction characteristics: for example, the PRC code defines a residential building with a 'small multi-apartment' type (PRC) but the PRC E1 and the E2 building differs per year of construction, S/V ratio, dispersive surface, heated volume and other factors leading to the assessments given in Table 22, Table 23 and Table 24[106].

[105] *E1 indicates a building from the period of construction 1946-1976 and E2 a building from the period 1977-1990.*

[106] *For further details, please see: STREPIN, Annex 1 to the Italian Energy Efficiency Action Plan June 2017, http://enerweb.casaccia.enea.it/enearegioni/UserFiles/PAEE-2017.pdf*

Table 70 - Global cost, relative optimal annual primary energy value, global non-renewable primary energy STATE, global non-renewable primary energy scenario COST-OPTIMAL and $_{CO2\ COST\text{-}OPTIMAL}$ emissions savings of reference residential buildings

	BUILDING CODE	*Overall cost*	*Ottimal EP value*	*Current overall non-renewable primary energy consumption*	*Overall non-renewable primary energy consumption in the COST-OPTIMAL scenario*	*Cost-optimal CO2 emissions reduction*
		[EUR/m²]	**[kWh/m²]**	**[kWh/m²]**	**[kWh/m²]**	**[KgCO₂/m²]**
CLIMATE ZONE E	**RMF_E1**	498	90,6	500	79	84,2
	RMF_E2	311	89,5	290	79,2	42,2
	RMF_N0	575	97,7	—	26,9	—
	RPC_E1	335	127	325	106	21
	RPC_E2	243	103	160	55,2	16,2
	RPC_N0	419	102	—	42,6	—
	RGC_E1	355	118	295	101	18,6
	RGC_E2	212	73,5	140	59,6	13,1
	RGC_N0	363	75,3	—	40	—
CLIMATE ZONE B	**RMF_E1**	310	102	225	90,2	27
	RMF_E2	270	92,8	105	82,2	4,6
	RMF_N0	477	120	—	34,8	—
	RPC_E1	242	79	160	55,2	21
	RPC_E2	185	54,3	118	37,2	16,2
	RPC_N0	359	100	—	43,9	—
	RGC_E1	257	82,8	155	62,2	18,6
	RGC_E2	187	55,2	105	39,3	13,1
	RGC_N0	320	85	—	45,2	—

Source: STREPIN March 2021

Table 71 - Global cost, relative optimal annual primary energy value, global non-renewable primary energy STATE, global non-renewable primary energy scenario COST-OPTIMAL and$_{CO2\ COST\text{-}OPTIMAL}$ emissions savings of reference office buildings

	BUILDING CODE	*Overall cost* [EUR/m²]	*Best value EP* [kWh/m²]	*Current overall non-renewable primary energy consumption* [kWh/m²]	*Overall non-renewable primary energy consumption in the COST-OPTIMAL scenario* [kWh/m²]	*Cost-optimal CO2 emissions reduction* [$KgCO_2/m^2$]
CLIMATE ZONE E	**UFF_E1**	452	120	320	93,6	45,3
	UFF_E2	384	94,7	230	76,2	30,8
	UFF_N0	514	89,9	—	55,4	—
CLIMATE ZONE B	**UFF_E1**	394	115	230	85,5	29
	UFF_E2	372	98,1	190	76,8	22,6
	UFF_N0	468	112	—	69,9	—

Source: STREPIN March 2021

Table 72 - Global cost, relative optimal annual primary energy value, global non-renewable primary energy STATE, global non-renewable primary energy scenario COST-OPTIMAL$_{scenario}$ and CO2 COST-OPTIMAL emissions savings of reference school buildings

	BUILDING CODE	*Overall cost* [EUR/m²]	*Best value EP* [kWh/m²]	*Current overall non-renewable primary energy consumption* [kWh/m²]	*Overall non-renewable primary energy consumption in the COST-OPTIMAL scenario* [kWh/m²]	*Cost-optimal CO2 emissions reduction* [$KgCO_2/m^2$]
CLIMATE ZONE E	**SCU_E1**	330	115	240	101	27,8
CLIMATE ZONE B	**SCU_E1**	190	55,5	95	41,7	10,7

Source: STREPIN March 2021

Evaluating the results set out in the tables above, several general considerations emerge relating to the building envelope, technical systems and costs associated with the configurations obtained using the cost-optimal methodology.

Considering the building envelope (e.g.: capping insulation, replacement of locks), the intervention is an optimal solution according to the methodology used, only for new buildings and only in a few cases for existing buildings, mainly from the time of construction between 1946 and 1976. In other cases, given the high costs of the civil works required to build or restore the building envelope, the optimal solution focuses on carrying out other measures, in particular relating to systems.

As far as systems are concerned, the full use of heat pumps for heating and cooling and domestic hot water (Full Electric Building) is optimal only for new single-family homes. For the other building categories, the optimal system solution is the combination of heat pump, gas boiler (condensing and three-star) and multi-split system. Photovoltaic modules are used in all building types. In the residential sector, the percentage of energy consumption from renewable sources ranges from 50-70 % for new buildings to 10-20 % for existing ones. By contrast, offices have coverage of 40-50 % for new buildings and 15-20 % for existing ones. Lastly, school buildings have a significantly different consumption profile as they do not require air conditioning in the summer. In this case, all heating and domestic hot water is provided by a condensing boiler, while photovoltaics provide around 20 % of energy.

Analysing the cost structure of the cost-optimal solutions, the biggest differences relate to the period of construction of the building (new and existing), whereas the cost discrepancy between climate zones B and E is less significant.

A report has been drawn up by ENEA and the Polytechnic of Turin as part of the activities relating to research into the Electrical System – Project 1.5 Technologies, Techniques and Materials for Energy Efficiency and Energy Savings in Electrical End Use of New and Existing Buildings, which is a study to describe and test the new calculation methods that are being followed for the second update of the Italian application of the benchmarking methodology.

In particular, the report sent by the Ministry of Environment and Energy Security to the European Commission analysed the differences between the optimal solutions resulting from the application of the simplified hourly method of standard UNI EN ISO 52016-1 and those resulting from the quasi-steady-state monthly method adopted in the previous update of the methodology.

The comparison of the results obtained by the two methods of calculation, which differ essentially in the heat transmission model through building components, does not reveal significant differences in the combination of energy efficiency measures and in the calculation of the overall cost. However, the analysis of sensitivity to economic parameters showed variations in the optimal level to varying costs of energy efficiency interventions/measures (EEM) and energy carriers: it also points out that the economic parameter with the greatest influence on the overall cost is the discount (or discount rate).

The results of this study cannot be considered to be consolidated for the purpose of updating the methodology since, although the approach followed is technically correct, the costs of the technologies applied, as well as the other economic and financial parameters used in the calculation process, have been left unaltered compared to the analyses carried out in 2018, in order to further elaborate on the necessary updates.

Over the last two years, due to the effects of national post-pandemic measures and for obvious international geopolitical reasons, significant changes in energy supply costs have occurred and uncertainty about their evolution over time has increased; changes in the costs of energy efficiency technologies and interventions were equally significant, in particular as a result of the energy efficiency measures introduced and the difficulties in the distribution of goods globally.

In view of the current new price balance situation, commodity and processing price variables are being updated in order to take them into account in the new methodology set out in the attached report.

Refining the results on the basis of the above price update, which is being finalised, will include 2018 building models (of which 16 for residential use, 8 for office use and 2 for school use) and 16 energy efficiency measures (EEM), but will differ from the previous one for the following main aspects:

- Assessment of the energy performance of reference buildings with the hourly calculation model of heat energy demand for heating and cooling introduced by UNI EN ISO 52016-1;
- Revision of the levels of EEM energy efficiency measures to take into account the performance evolution of plant technologies and the update of the legal requirements in force since 2021 (since 2019 for public buildings);

- Update of electricity and methane gas costs, including carbon emissions, and estimate of possible price developments in the long run;
- Update of investment costs for EEM energy efficiency measures;
- Update of the discount rate to be used in the calculation of global costs in macroeconomic and financial analyses.

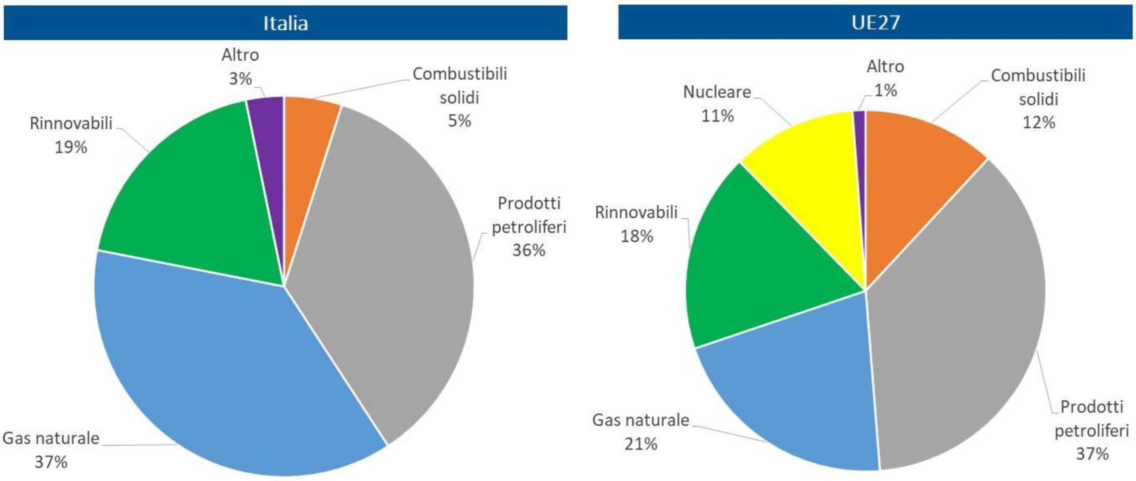
The result of this refinement will be completed and sent with a specific report by 2024.

4.4 Dimension energy security

I. Current energy mix, domestic energy resources, import dependency, including relevant risks

The Italian energy mix, understood here as the distribution of the various sources used to meet the energy needs of an area (represented by gross energy availability[107]), is shown – with reference to 2022 – in the graph below, together with a comparison with the EU27 average (Eurostat data).

Figure 71 – Energy Mix – 2022 [Source: Eurostat]



There are significant differences between the Italian energy mix and the average EU27 energy mix. In Italy, natural gas plays a relatively significant role (37 % of the total compared to an EU27 average of 21 %), while the use of petroleum products is in line with the European average. The use of solid fuels is significantly lower than the use of slightly higher renewables.

These characteristics are, of course, linked to the domestic production and import dynamics of the various sources. After a five-year period of relative stability, Italy's total production of energy sources was 34,7 Mtoe in 2022, a significant decrease compared to the previous year (-6.4 %). All sources were affected by this dynamic: natural gas production decreased by 2.5 %, renewable production by 6.5 %, and production of petroleum products by 7.7 %.

[107] *According to the Eurostat conventions, the energy dependency on imports is calculated by reference to* Gross availablle energy */Gross energy availability, slightly different from other items referred to in the preceding paragraphs (e.g.* Gross Inland Consumption/Gross *Domestic Consumption).*

Table 73 - Internal energy resources 2017-2022 (ktoe) [Source: Eurostat]

	2017	2018	2019	2020	2021	2022
National production	**36.667**	**37.342**	**36.910**	**37.480**	**37.078**	**34.710**
Solids	—	—	—	—	—	**—**
Petroleum products	4.456	5.091	4.708	5.856	5.228	**4.824**
Natural gas	4.536	4.462	3.931	3.287	2.608	**2.544**
Renewable *	27.675	27.790	28.271	28.336	29.242	**27.342**

** Includes biofuels for transport, biomethane, environmental energy and the share of non-renewable waste.*

Imports developed in 2022 as opposed to domestic production: the overall figure is around 119 Mtoe, an increase of 3.8 % compared to 2021. In this case, the differences between the different sources are relevant: the annual change is positive for electricity (+ 0.5 %), petroleum products (+ 11.2 %) and solid fuels (+ 41.2 %), negative for natural gas (-4.9 %) and renewable (-6.0 %).

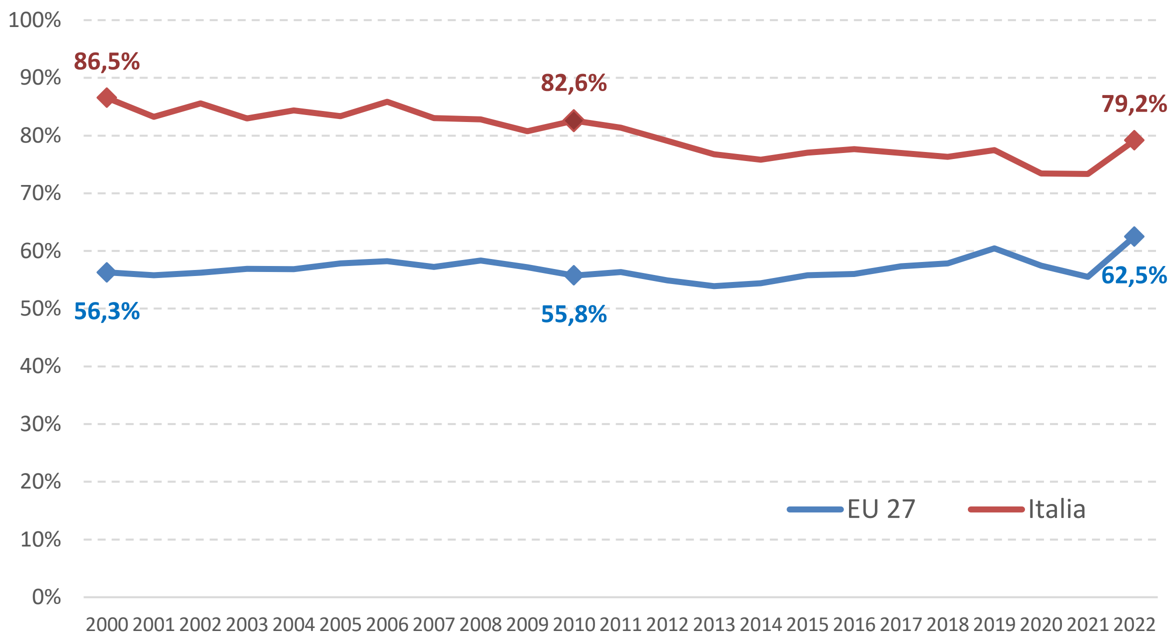
Table 74 – Net imports 2017-2022 (ktoe) [Source: Eurostat]

	2017	2018	2019	2020	2021	2022
Net imports	**124.564**	**121.920**	**122.492**	**105.799**	**114.850**	**119.168**
Solids	9.360	8.622	6.387	4.739	5.374	7.591
Crude oil and petroleum products	52.824	51.634	52.437	42.008	45.121	50.179
Natural gas	56.820	55.268	57.936	54.117	58.519	55.674
Electricity	3.247	3.775	3.280	2.769	3.679	3.696
Renewable *	2.312	2.622	2.452	2.165	2.156	2.027

** Includes biofuels for transport.*

Finally, with reference to the indicator of Italy's degree of dependence on imports of energy products, it should be noted that the figure recorded in 2022, which is an increase compared to the previous year, is high both in absolute terms (more than 79 % of the needs are covered by imports) and in relative terms (the figure is around 17 percentage points above the EU27 average); this condition may expose the Italian energy system to security of supply risks, as evidenced, for example, by recent geopolitical and market turbulence.

Figure 72 – Energy dependency on imports index (%) [Source: Eurostat]



On the other hand, extending the analysis to developments over the past two decades, it can be seen that some relatively recent phenomena (in particular the progressive growth of RES and the decrease in energy intensity) have led to a gradual and significant decrease in Italy's dependence on imports of energy products from foreign countries.

II. Projections of development with existing policies and measures at least until 2040 (including for the year 2030)

The following tables show the projections for production, net imports of energy products and energy dependency over the period 2025-2040 on current policies.

In the medium to long term, in terms of energy mix, RES play the most significant role at the expense of contributions from other sources, which is combined with a decrease in gross energy availability[108].

With regard to domestic production, there is an overall increase due exclusively to RES input (+ 33 % in 2040 compared to 2025 levels, i.e. + 10 Mtoe produced, mainly as a result of photovoltaic and wind technologies).

As regards imports, the contraction is confirmed in the medium to long term for all types of energy products, with the exception of RES, which in any case represent a residual part of total net imports. In particular, there is a significant decrease in natural gas volumes (-11 Mtoe imported in 2040 compared to 2025, corresponding to a negative change of 20 %).

As a result of domestic import and production dynamics by type of source and product, energy dependency decreases in the long term from 74.5 % in 2025, to 71.2 % in 2030 and 68.0 % in 2040.

[108] *Gross energy availability is calculated as the sum of domestic production, net imports, stock changes and products subject to recycling and recovery.*

Table 75 - Internal energy resources, projections 2025-2040, baseline scenario (ktoe)

	2025	2030	2040
National production	**37.664**	**41.438**	**45.074**
Solids	—	—	—
Petroleum products	3.961	3.530	2.803
Natural gas	2.548	2.299	803
Renewable *	31.155	35.609	41.468

**Includes biofuels for transport, biomethane, environmental energy and the share of non-renewable waste*

Table 76 – Net imports, projections 2025-2040, baseline scenario (ktoe)

	2025	2030	2040
Net imports	**110.112**	**102.506**	**95.642**
Solids	3.410	2.647	2.648
Crude oil and petroleum products	47.884	46.403	45.992
Natural gas	53.691	48.197	42.938
Electricity	3.712	3.715	2.260
Renewable *	1.415	1.544	1.804

** Includes biofuels for transport.*

Table 77 - Energy slope, projections 2025-2040, baseline scenario (%)

	2025	2030	2040
Energy dependence	74.5 %	71.2 %	68.0 %

4.5 Dimension Internal energy market

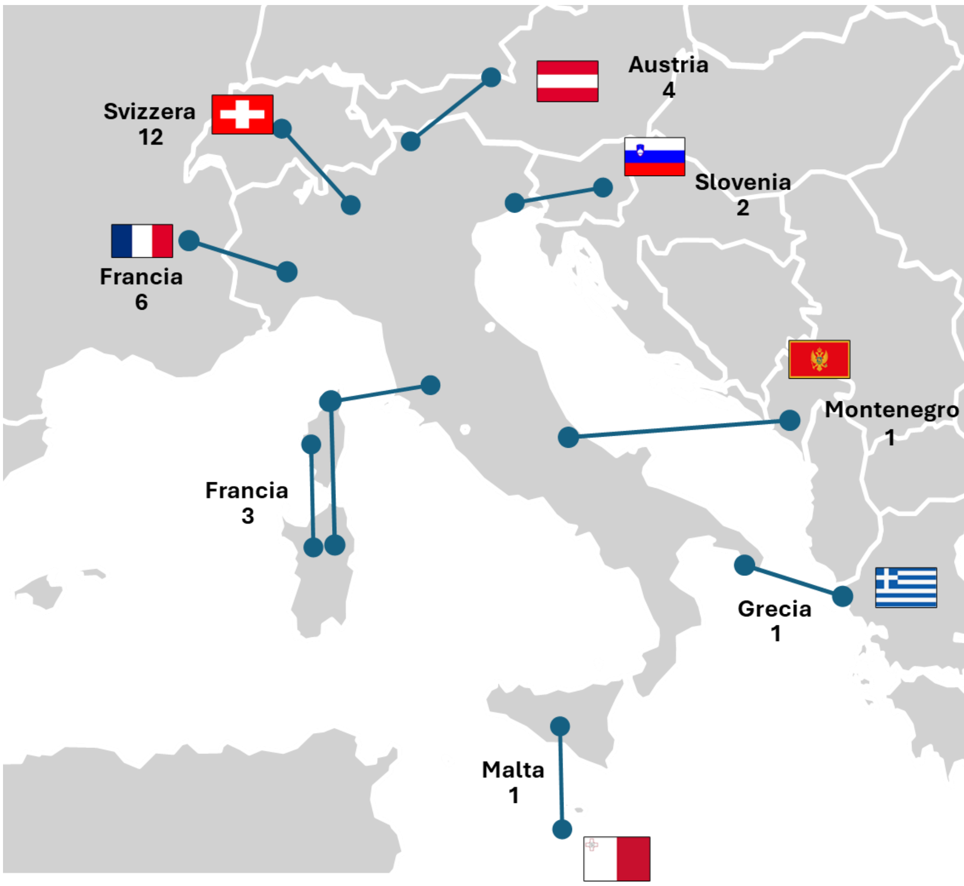
4.5.1 Electricity interconnectivity

I. Current interconnection level and main interconnectors[109]

Currently, interconnection capacity is mainly located on the northern border of France (6 lines with France, 12 with Switzerland, 4 with Austria, 2 with Slovenia). The total on the northern border is 9 tanks at 380 kV, 9 tanks at 220 kV, 4 150/132 kV tanks and a double 320 kV HVDC connection to France.

There are also a direct current connection with Greece, one connecting the peninsula with Montenegro and a tri-terminal linking Sardinia and the Italian peninsula with Corsica (SACOI2). In addition, Sardinia is also connected to Corsica by means of an alternating current cable of 150 kV (Sarco). Finally, a 220 kV double tank cable connects Sicily with Malta.

Figure 73 - Map of existing interconnections [Source: Terna]



[109] *With reference to existing transmission infrastructure prospectuses of transmission system operators (TSOs)*

The total value of the trading capacity at the northern border for the year 2024 is between 8.300 MW and 10.435 MW in import and between 4.110 MW and 4.995 MW in export[110].

78 Table – Existence of external interconnection lines

Station Italy	Foreign station	Voltage (kV)	CA/DC
Camporosso	Trinité Victor (FR)	220	CA
Venaus	Villarodin (FR)	380	CA
Rondissone	Albertville (FR)	380	CA
Rondissone	Albertville (FR)	380	CA
Piossasco (* *)	Grand'Ile (FR)	320	DC
Piossasco	Grand'Ile (FR)	320	DC
Pallanzeno	Greenhouse (CH)	220	CA
Bridge	derivaz. To Water (CH)	220	CA
Valpelline	Riddes (CH)	220	CA
Avise	Riddes (CH)	220	CA
Bulciago	Soazza (CH)	380	CA
Musignano	Lavorgo (CH)	380	CA
Cagno	Mendrisio (CH)	380	CA
Month	Gorduno (CH)	220	CA
Gorlago	Robbia (CH)	380	CA
S. Fiorano	Robbia (CH)	380	CA
Tirano	Campocologno (CH)	150	CA
Villa di Tirano	Campocologno (CH)	132	CA
Soverzene	Lienz (AT)	220	CA
Tarvisio (*)	Greuth (AT)	132	CA
Gross (* *)	Nauders (AT)	220	CA
Vizze meadows	Steinach (AT)	132	CA
Redipuglia	Divaccia (SI)	380	CA
Padriciano	Divaccia (SI)	220	CA
Galatina	Arachthos (GR)	400	DC
Codrongianos/Suvereto	Lucciana (Corsica)	200	DC
Codrongianos/Suvereto	Lucciana (Corsica)	200	DC
S. Teresa di Gallura	Bonifacio (Corsica)	150	CA
Ragusa	¨ tab (Malta)	220	CA
Villanova (* *)	Lastva (ME)	500	DC

(*) Merchant Line
(*) interconnector L. 99\ 09*

[110] *Source: NTC values in import direction on the Italian borders – YEAR 2024; NTC values in export direction on the Italian borders – YEAR 2024*

Table 79 – Interconnection capacity [Terna data processing]

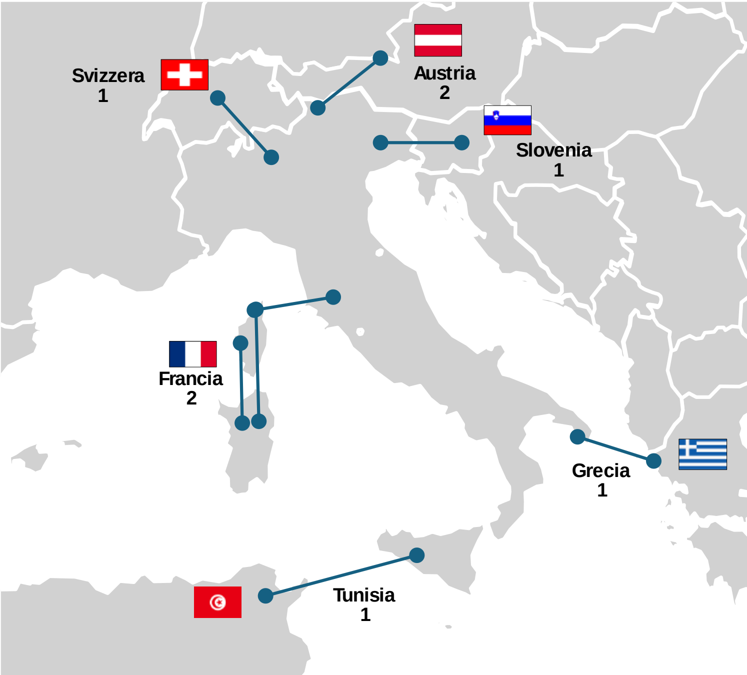
Period	Frontier	Winter [MW]		Summer [MW]	
		Peak 7h-23h	Off Peak 23h-7h	Peak 7h-23h	Off Peak 23h-7h
		Import			
Monday – Saturday	France	4.485	4.338	4.044	3.817
	Switzerland	4.572	4.036	3.747	3.424
	Austria	625	605	580	565
	Slovenia	753	641	534	494
	Total Northern border	**10.435**	**9.620**	**8.905**	**8.300**
	Greece	500	500	500	500
	Montenegro	600	600	600	600
	Malta	200	200	200	200
Sunday and festivals	France	4.338	4.338	3.817	3.817
	Switzerland	4.036	4.036	3.424	3.424
	Austria	605	605	565	565
	Slovenia	641	641	494	494
	Total Northern border	**9.620**	**9.620**	**8.300**	**8.300**
	Greece	500	500	500	500
	Montenegro	600	600	600	600
	Malta	200	200	200	200
		Export			
Monday – Saturday	France	1.995	2.160	1.870	2.055
	Switzerland	1.810	1.910	1.440	1.660
	Austria	200	245	180	200
	Slovenia	660	680	620	645
	Total Northern border	**4.665**	**4.995**	**4.110**	**4.560**
	Greece	500	500	500	500
	Montenegro	600	600	600	600
	Malta	200	200	200	200
Sunday and festivals	France	2.160	2.160	2.055	2.055
	Switzerland	1910	1910	1660	1660
	Austria	245	245	200	200
	Slovenia	680	680	654	645
	Total Northern border	**4.995**	**4.995**	**4.560**	**4.560**
	Greece	500	500	500	500
	Montenegro	600	600	600	600
	Malta	200	200	200	200

II. Needs to increase transmission capacity abroad (including for 2030)[111]

Between the planned interconnection measures, the full rebuilding of the Sardegna-Corsica-Italy Continental SACOI 3 link (replacing the current SACOI 2) was authorised in September 2024 and the Italy-Tunisia submarine connection in May 2023; on the other hand, the new interconnection between Italy and Greece (Grita 2) is at the conciliation stage.

[111] *With reference to TSOs' national network development plans and regional investment plans*

Figure 74 – Connectivity projects planned by Terna [Source: Terna]



In December 2023, the Interconnector Italy-Austria entered into operation with an NTC of 300 MW. In addition, the entry into operation of the private bipole was achieved in November 2022 and in August 2023 of the public bipole of the Piossasco-Grande Île HVDC project with an overall trading capacity of 1.200 MW. The new Italy-Montenegro HVDC interconnection with an exchange capacity of 2 019 MW entered into operation in 600.

The status of the main projects for the development of external interconnection identified by Terna in the 2023 Development Plan is set out below.

Authorised:

- link between Italy and France, SACOI 3 "Sardegna-Corsica-Italia Continentale" replacing the current SACOI 2, which has now reached the end of its useful life;
- the link between Italy and Tunisia is of strategic importance for the transmission electricity system of the Mediterranean basin, which will provide an additional tool to optimise the use of energy resources between Europe and North Africa.

At design/consultation stage:

- power line 220 kV Interconnection Italy – Austria: reconstruction of the current 220 kV pipeline between Italy (Soverzene) and Austria (Lienz);
- new interconnection with Greece (Grita 2): new HVDC connection to increase the trading capacity between the two countries;

At the planning stage:

- new interconnection with Switzerland associated with the wider project for the nationalisation of Valchiavenna.

In addition to the first hub of the Piossasco-Grand'Ile HVDC interconnection (on the Italy-France border), to the first hub of the HVDC interconnection MON.ITA. (on the Italy-Montenegro border) and 220 kV Nauders (AT) – Glorenza (IT) interconnection, the project is currently foreseen on the Italy-Slovenia border in accordance with the objectives of Law 99/2009:

- interconnection – Italy-Slovenia – Existing network 380/220 kV on the Italy-Slovenia border.

The above projects planned by Terna are further accompanied by private initiatives (reg./14/2009), known as merchant lines, and of which Terna must take into account, in order not to overestimate interconnections and to avoid overburdening the territory.

However, in the light of the authorisations granted, there are few merchant products made, which is a factor of uncertainty. Among the merchant lines, there are projects on the northern border between Italy and Switzerland, France and Austria, while projects with Malta, Tunisia and Algeria are present in the south of the peninsula.

4.5.2 Energy transmission infrastructure

I. Main characteristics of the current electricity transmission infrastructure (RTN)

The national transmission network on 31 December 2 023 has a network extension of more than 68.000 km of lines and cables and around 910 stations.[112] The network is characterised by a predominantly longitudinal development. The structure in zones, the corresponding transit limits and the details of the connection lines between zones are shown in the figures below.

In recent years, the north-west area has seen an increase in production relative to regional needs, owing to the simultaneous effect of the spread of distributed generation and the contraction in consumption. This leads to an aggravation of transport problems from north-west to north-east, as it is combined with the high import of power from the border (Switzerland and France) and hydropower production.

The high and very high voltage network in the north-east of the country has problems linked to seasonality (periods of high water) and low level of interconnection and mesh. The 400 kV network consists of a wide loop closing to the west at Dugale Station (VR) and East at Redipuglia Station (GO). As structured, the electricity grid in question is highly unbalanced on the Node of Redipuglia, to which power flows from the Slovenian border are channelled.

In the south, the large production from renewable sources concentrated in the area between Foggia, Benevento and Avellino, as well as the significant conventional generation installed in some areas of Apulia and Calabria, lead to high transit flows in the southern primary transmission network, creating congestion on primary networks and dynamic instability under certain operating conditions. There are particular problems with the 380 kV connections of the Adriatica backbone and along the 380 kV lines from Calabria to the north.

As regards the territory of the two major islands, in Sicily the electricity system is supplied by a partly wired thermal park, mainly concentrated in the east and south-west of the island and numerous RES installations located mainly in the south-west and Centro-Oriental (mainly wind) areas; in particular, the distribution of the power park module makes the Sicilian system unbalanced and is indeed a challenge for the full integration of the new renewable generation.

In Sardinia, the electricity system is very sensitive to grid disruptions caused by budgetary imbalances, which poses a risk to the security of the system, as the state of the power park in the island and the lack of inertia of the system (also linked to the reduced interconnection with the Continente's electricity system) exposes the Sardinian grid to be disrupted at a higher frequency than in the continental system.

[112] *Source: Terna, Annual Financial Report – Integrated Report 2023*

Figure75: Values of transit limits between market zones, winter case [Source: Terna, Value of transit limits between market zones, Rev. 30, December 2023]

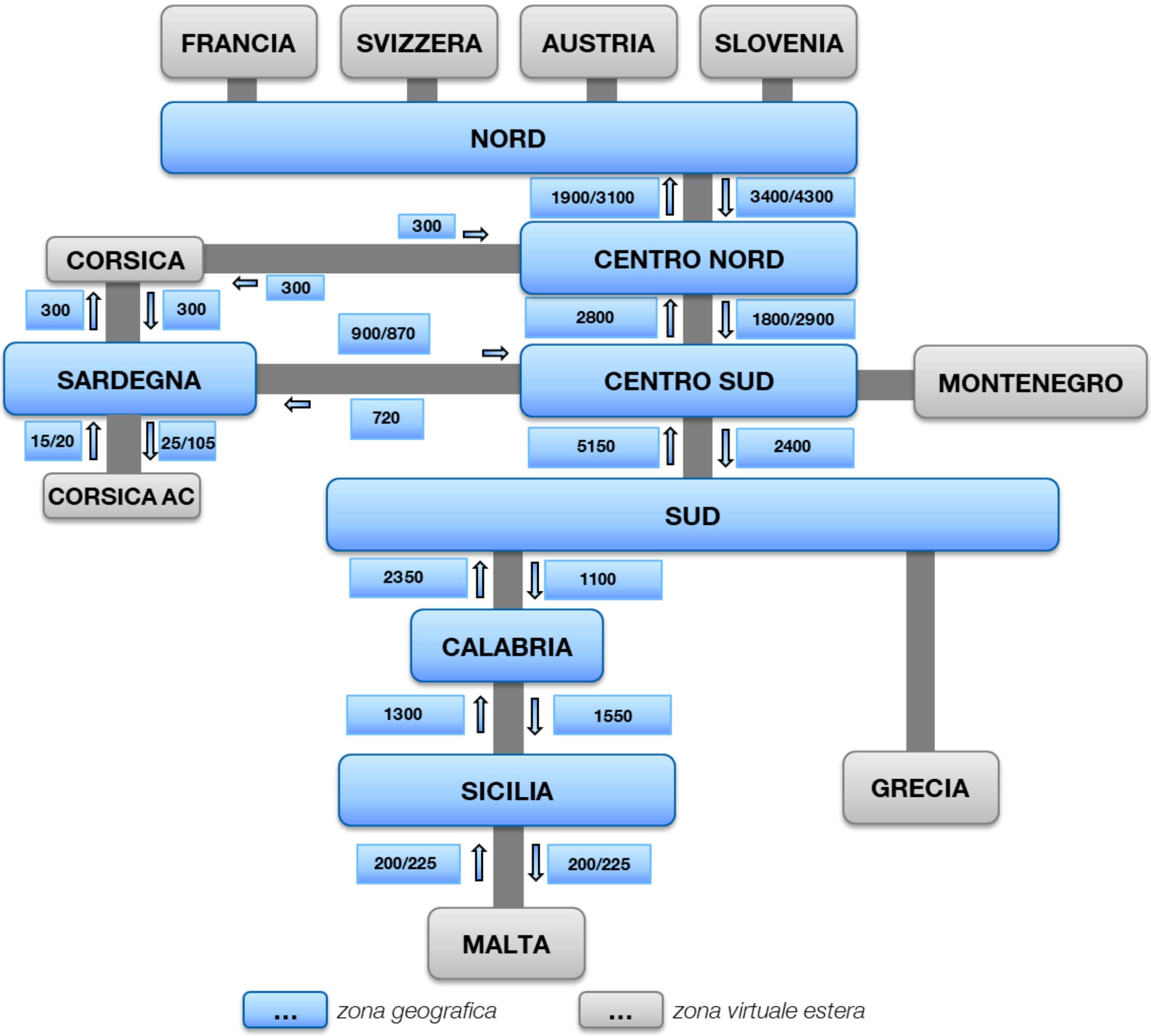
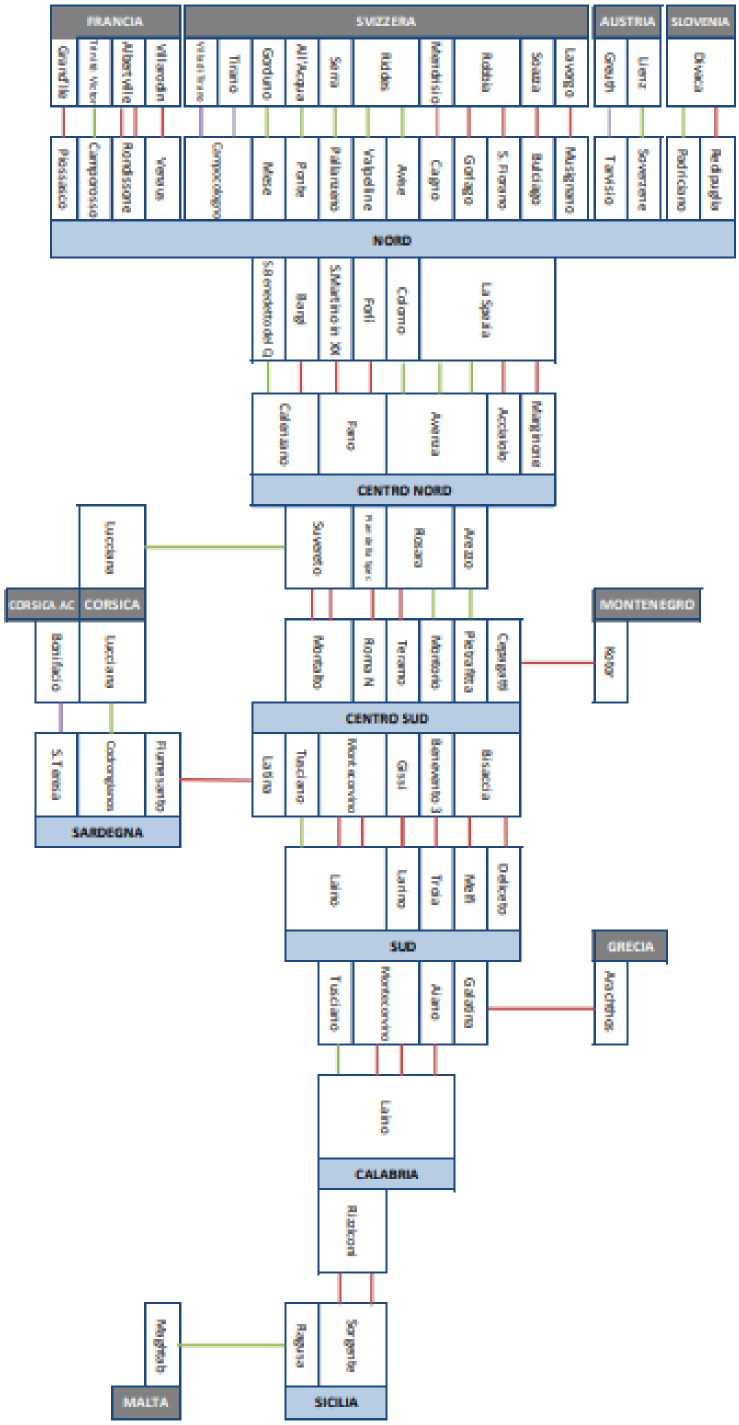


Figure76: Outline of connecting lines between zones [Source: Terna, Identification of relevant network areas, Annex A.24 to the network code, Rev. 05, January 2021]



II. Main features of the current electricity distribution infrastructure

As regards the electricity distribution network, as of 31 December 2021 there were 399,099 medium-voltage network km (MT) and 879.837 km of low voltage network (BT), as well as primary and secondary cabins, operated by 125 operators distributing a total of around 263.7 TWh of energy at 36.933.000 withdrawal points, of which 29.776.000 households and 7.1 million non-households (source ARERA, Annual Report on the state of services and activity carried out, 2021).

The largest Italian e-distribution operator (which operates around 90 % of the lines) in its development plan at 31 December 2020 declares 2.336 primary cabins and 447.250 secondary cabins for a conversion power of 110.353 MVA and 85.066 MVA respectively[113].

The main drivers that determine (and above all will determine) the evolution of the distribution network are identifiable in the following:

- distributed generation (power generating facilities connected to MT and BT networks);
- deployment of electric heat pumps for heating and cooling;
- electric vehicle charging infrastructure.

From the Authority's monitoring[114] to 31 December 2020, around 952.000 distributed generation facilities, of which approximately 935.000 photovoltaic generation installations are connected. The total gross efficient power is 34.1 GW, of which around 20 GW of photovoltaic generation and about 7 GW of thermoelectric generation. Total gross production is 70.95 TWh, of which 53.6 TWh from renewable sources with 22.8 TWh of photovoltaic. As of 31 December 2021,[115] there are more than 1 million photovoltaic installations with a capacity of less than 5 MW (below 6 MW, installations are usually connected in distribution[116]) with a total capacity of 20.3 GW; there are 205 installations above 5 MW (of which part is connected in distribution), with a total capacity of 2.3 GW.

As of 2021, there are around 20.3 million heat pumps[117] for heating with an installed heat output of around 120.3 GW. For space cooling, there are around 22.0 million installations with an installed thermal input of 136.3 GW.

For electric vehicles, as of 31 December 2021, 136.754 vehicles are registered, of which 49 % BEV and 51 % PHEV are registered, while there are around 26 thousand public recharging points distributed over 13.223 charging infrastructure. 17 % of recharging points shall have a power of up to 7 kW alternating current, 77 % to 43 kW alternating current and the remaining higher direct current power[118].

It is clear from these figures that consumption for heating and cooling already today makes a significant contribution to load and typically peak days correspond to warmer or colder days[119].

The interventions planned by distributors are limited to the future evolution of the system. The plans are three years and therefore do not cover the full timeframe. In addition, only the most economically relevant interventions are included in the plans, typically primary cabins and medium voltage network portions. However, new distributed generation and load facilities have significant impacts mainly on the low-voltage grid, which is not analysed in detail. For example, for the three-year period 2021-2023, 253 interventions on primary cabins [120] are included in the e-distribution development plan 2021 (SOPs), of which around 90 for the construction of new primary cabins. In

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[113] *https://www.e-distribuzione.it/content/dam/e-distribuzione/documenti/e-distribuzione/Piano_di_Sviluppo_delle_infrastrutture_di_EDistribuzione_2021_2023.pdf*
[114] *https://www.arera.it/it/docs/22/703-22.htm*
[115] *https://www.gse.it/documenti_site/Documenti%20GSE/Rapporti%20statistici/Rapporto%20Statistico%20GSE%20-%20FER%202021.pdf*
[116] *https://www.ceinorme.it/strumenti-online/norme-cei-0-16-e-0-21/*
[117] *https://www.gse.it/documenti_site/Documenti%20GSE/Rapporti%20statistici/Rapporto%20Statistico%20GSE%20-%20FER%202021.pdf*
[118] *https://www.motus-e.org/analisi-di-mercato/dicembre-2021-le-auto-elettriche-raddoppiano-nel-21-il-governo-le-abbandonera-aspettando-infrastrutture-che-gia-ci-sono/*
[119] *https://www.terna.it/it/sistema-elettrico/dispacciamento/dati-esercizio*
[120] *https://www.e-distribuzione.it/content/dam/e-distribuzione/documenti/e-distribuzione/Piano_di_Sviluppo_delle_infrastrutture_di_EDistribuzione_2021_2023.pdf*

addition, the request for connection to the National Transmission Network of approximately 75 primary installations was formalised, mainly for the newly distributed connection. The e-distribution PdS is particularly significant in this respect, as it serves the areas with the highest penetration of distributed generation (the other operators serve, with some exceptions, mainly urban centres). Turning to the next three main distributed energy operators (Arete, Unareti and IRETI), a total of 17 new primary cabins are expected in their SPs, not including the upgrading of AT/MT transformers. The development plans show that the planned interventions are driven by several drivers: load growth, generation connection, telecontrol needs, resilience, loss reduction and voltage quality.

III. Projections of RTN extension needs until at least 2040 (including for 2030)[121]

The Terna Development Plan 2023 identifies a number of priority development measures, including two external connections (new Italy-Greece HVDC and new Italy-Tunisia interconnection). Internal connections shall be identified on the basis of the following main needs:

- reduction of congestion between market areas;
- reduction of intra-zonal congestions and constraints on production capacity;
- increased safety and reliability in metropolitan areas;
- improvement of quality and safety.

Please find below the details of the main interventions by type of benefit.

❖ **REDUCTION OF CONGESTION BETWEEN MARKET AREAS**

- 400 kV 'Calenzano – Colunga' pipeline for increasing the trading limits on the north – centre north;
- 400 kV 'Foggia – Villanova' pipeline to increase the trading limits in the south – centre south and to support the production of plants from renewable sources in the south;
- Pipeline 400 kV 'Montecorvino – Avellino – Benevento' to increase the trading limits on the southern – south-south and south – Calabria sections, as well as to promote the production of plants from renewable sources;
- network upgrading Nord Calabria for increasing the trading limits on the southern – Calabria section, as well as to encourage production from renewable sources in Calabria;
- HVDC Centro Sud – North Centre (Adriatic Link) to increase the security of operation of the electricity system between the market areas south-centre-North and North-North Centre, ensuring increased regulatory capacity, as well as for further expected renewable generation;
- HVDC Continente-Sicily – Sardinia (Tyrrhenian Link) connection to increase the trading limits on the southern – Sicily and Sicily – Sardinia sections, as well as to promote the safe operation of the islands' electricity system by connecting them directly with the Continent, ensuring greater regulatory capacity, and the integration of the new generation expected from renewable sources on the islands;
- Hypergrid: five new electric backbone to increase transport capacity between areas and support the integration of the new RES quota. The five backbone are:
    - Central Link
    - HVDC Milan – Montalto
    - Ionian dorsal – Tyrrhenian: HVDC Priolo – Rossano – Montecorvino – Latina

[121] *With reference to TSOs' national network development plans and regional investment plans*

- Adriatica dorsal: HVDC Foggia – Villanova – Fano – Forlì
- Sarda dorsal: HVDC Fiumesanto – Montalto (Sapei 2) and Sardinian Link

❖ **INTRA-ZONAL CONGESTION REDUCTION AND PRODUCTION CAPACITY CONSTRAINTS**

- 400 kV pipeline between Milan and Brescia is used to reduce congestion on the section between the north – west and north – east of the country;
- rationalisation of the average Valle del Piave network in order to reduce congestion and favour production from renewable sources (mainly hydropower plants) and the transport of the energy fed into the grid during periods of high hydropower;
- 400 kV 'Paternò – Pantano – Priolo', 'Chiaramonte Gulfi – Ciminna' and 'Partanna – Ciminna' pipelines for greater fungibility of resources in Sicily and between Sicily and the Continent, also in order to increase operational safety and encourage production from renewable sources;
- 150 kV SE S. Teresa – Buddusò power line in order to reduce congestion and increase the safety and quality of the electricity transmission service.

❖ **INCREASED SAFETY AND RELIABILITY IN METROPOLITAN AREAS**

- rationalisation of AAT and AT Turin, Genoa, Florence, Rome and Naples networks in order to reduce congestion affecting the safety and reliability of primary networks feeding areas with high concentration of users.

❖ **IMPROVEMENT OF QUALITY AND SAFETY**

- redevelopment of the 150 kV network in the Sorrentine Peninsula, due to the quality and continuity of the supply service of the local AT network, characterised by high load density;
- interventions on the AT network in the Ragusa area and in the Catania area to improve the supply safety of the loads of the areas, characterised by many primary cabins in antennas and industrial loads sensitive to the phenmenology of voltage/microinterruptions.

In addition to the above, please find below the preliminary updated representation of the planned European transport capacity in [122]ENTSO-E's Ten-Year Network Development Plan (TYNDP) 2024, currently under preparation. The final representation will be available with the publication of the TYNDP 2024.

Table 80 – Trading values according to ENTSO-E Ten-Year Network Development Plan (TYNDP) 2024

[122] *https://tyndp.entsoe.eu/*

	ENTSO-E TYNDP 2024	Transfer capacity increase (NTC) 2025		Transfer capacity increase (NTC) 2035	
	Border	**= >**	**< =**	**= >**	**< =**
Inter-national	FR-ITn	4485	2160	4485	2160
	CH-ITn	4572	1910	5772	3110
	AT-ITn	725	545	1375	1195
	ITn-SI	680	753	1080	1153
	ITcs-ME	600	600	1200	1200
	GR-Its	500	500	1500	1500
	ITsic-MT	225	225	450	450
	ITsic-TN	0	0	600	600
Corsica	FRc-ITCO	70	130	120	150
	ITcn-ITCO	300	300	400	400
	ITsar-ITCO	380	320	480	420
Intra-national	ITcn-ITcs	3050	2950	4650	5350
	ITcn-ITn	3500	4700	4500	5300
	ITcs-ITs	2400	5000	5600	8200
	ITcs-ITsar	720	900	720	900
	ITsic-ITsar	0	0	1000	1000
	ITcs-ITsic	0	0	1000	1000
	ITs-ITca	1100	2350	4000	5250
	ITsic-ITca	1500	1500	4000	4000
	ITcs-ITn	0	0	2000	2000

IV. Projections of needs for extension of distribution networks until at least 2040 (including for 2030)

In the scenarios for the development of the national energy system, the growth of both some types of load and distributed generation is of particular importance: of course, both phenomena affect distribution networks. With regard to the resulting impacts on distribution, general considerations can be expressed, although specific interventions may change depending on the characteristics of each network, the area served and the scenario under consideration. Indeed, one of the main problems in determining the evolution of distribution networks is to apply global scenarios to local realities with a high geographical detail.

In this context, networks can be divided into two main types: urban networks and rural networks, which differ both by their intrinsic characteristics and by the expected evolution of users.
For urban distribution networks, the increase in load, especially in terms of grid connected power, is particularly relevant due to the high load density already present. The increase in the power peak taken is mainly linked to summer conditioning, winter heating, electric vehicle charging and to a lesser extent to electrification of other end uses (e.g. electric cooking plans). These networks are expected to have an impact on all network components and especially those with lower voltage (MT/BT secondary cabins and BT lines). The impacts on primary cabins and MT lines are generally

lower, as these network components are planned with fairly large margins and are highly telecontrolled, as a result they can better withstand an increase in load[123]. Moreover, the contemporary factors of the different loads tend to be contained and the network components close to the primary cab do not suffer significantly from localised load increases. Other network components, such as MT/BT secondary cabins[124] and BT lines, are more likely to increase the load, especially if caused by electrification of end uses which is often characterised by high powers (e.g. electric vehicles), high load concentrations (e.g. renovation of a multi-apartment building with full electrification) or high contemporary factors (e.g. summer conditioning).
Considering, for example, secondary cabins, the three distribution companies that mainly serve urban areas (Arete, Unareti and IRETI) in their development plans include interventions in the coming years on around 3.500 secondary booths out of a total of around 23.200. In such cases, the most critical conditions are mostly reached during summer heat waves: high temperatures and the contribution of the load from air-conditioning plants lead to greater problems of overload and reliability. It is therefore clear that the increase in the number of heat pumps for summer conditioning and electric vehicles will lead to a worsening of the existing conditions (even on a level playing field). In addition, even during winter periods, although the operation of the networks is facilitated by low temperatures, the use of electric heating systems combined with the increase in electric vehicles may lead to new problems.

Finally, measures to upgrade networks in urban areas are particularly difficult: the laying of lines requires complex and costly excavation processes, especially in historical centres, and the construction or upgrading of secondary cabins may in some cases be impracticable due to the lack of physical spaces for new premises or limitations on the number of permits available to set up construction sites (in this respect, synergy with the planning of other infrastructure).

On the contrary, in industrial or rural areas, distribution networks are more affected by the increase in distributed generation, in particular photovoltaic. Generation in such cases results in different impacts compared to load: generation facilities are very often of significant size and connected on medium voltage, including through dedicated lines directly connected in the primary cab. In these cases, the main interventions are linked to the construction of new primary cabins in order to accommodate generation and transmit it to the transmission network (as is apparent from the e-distribution PdS). In the case of medium load density networks (e.g. residential areas with many single-family dwellings), high penetration of distributed generation may cause problems at all voltage levels due to higher power density of distributed generation than BT load. Finally, in high load density areas, local generation usually brings benefits by reducing load peaks, while production peaks are also compensated for in low load situations. It is therefore clear that there is a potential synergy between load and production in urban networks called for as a result of heat waves. Storage systems installed to increase self-consumption will also play an important role in networks with high penetration of distributed generation and new loads.

As regards electrification of end uses, some general considerations can be conducted for heat pumps and electric vehicles.

Heat pump conditioning systems for cooling are already a significant load on the grid, with around 50 % of households equipped with a air-conditioning system[125]. This is also demonstrated by the fact that the peak load of the electricity system is recorded at the warmer days of the year. The increase in the number of air-conditioning systems will certainly exacerbate these problems, especially in urban areas characterised by heat islands.

[123] *https://innovation.ukpowernetworks.co.uk/wp-content/uploads/2021/04/LCL-DNO-Report-B2-Impact-of-Electric-Vehicle-and-Heat-Pump-loads-on-Network-demand-profiles.pdf*
[124] *https://orca.cardiff.ac.uk/id/eprint/146419/1/IMRJ_7308_20211230_V1.pdf*
[125] *https://www.istat.it/it/files/2022/06/REPORT-CONSUMI-ENERGETICI-FAMIGLIE-2021-DEF.pdf*

Heat pumps used as the main heating system are currently much less widespread than summer air conditioners[126]. Although the absorption profile of these users does not overlap with the existing peak of the distribution network, which, as mentioned above, usually takes place in summer, their impact on the grid in the future will not be negligible. Especially in cases of replacement of existing high-size thermal installations (e.g. multi-apartment buildings), their impact on the grid, especially of low voltage, could be significant.

The estimation of the impact of electric vehicle charging infrastructure is uncertain due to the low experience of network operators on the behaviour of these systems, mainly due to the fact that many of their consumption *are behind the meter* and thus not directly monitored by distributors, which also affects heat pumps. In addition, the trend in mobility is very uncertain, understood not only as the level of deployment and energy carrier used, but also as a territorial distribution, types of charging infrastructure and user habits. Scenario surveys identified the most significant aspects: with regard to slow recharges for non-household users, the expected problems are mainly linked to the overlap of the morning *baseline* peak with the peak charging of cars travelling to jobs[127]. For domestic recharges, however, the problems are caused by the overlap of the evening peak with the recharging peak of vehicles of those who return home in the same time slot[128]. Recharges for other types of users (e.g. Local public transport, charging hubs for light and heavy goods vehicles) are more dependent on the specific location on the network (e.g. close to an already unsaturated primary cab) and on recharging needs[129] (e.g. in storage and through *unity chargers*). The impacts increase as the nominal power of recharging points grows, especially for medium and high-power public infrastructure[130]. However, charging electric vehicles also has a considerable advantage of being controlled relatively easily, allowing absorption to be modulated also according to the needs of the system[131]. This makes it possible to implement a number of strategies to reduce the impact on the electricity system and in particular on the distribution network[132]. As regards recharges at workplaces, they can be coordinated, including with the pre-existing load, so as to minimise the impact on the network[133]. Workplace charging and, more generally, daytime charging have the advantage of being coupled with photovoltaic generation, achieving the benefit of reducing the impact on the network (reciprocal compensation between load and generation)[134]. As regards domestic charging, a simple solution is to defer or postpone charging at night, when the load has its minimum daily load[135][136]. Another interesting solution is to install storage systems, even coupled to distributed generation installations, which could allow for less grid upgrades[137]. As regards

[126] *https://www.assoclima.it/downloads/2256/73/Libro_Bianco_sulle_pdc_quarta_edizione__versione_web.pdf*
[127]*https://www.researchgate.net/publication/341454431_Cross-Country_Comparison_of_Hourly_Electricity_Mixes_for_EV_Charging_Profiles*
[128] *https://www.sciencedirect.com/science/article/pii/S014206152100140X*
[129] *https://open-research-europe.ec.europa.eu/articles/1-156*
[130]*https://www.rse-web.it/rapporti/evoluzione-del-sistema-energetico-urbano-e-impatti-attesi-sulle-infrastrutture-risultati-e-raccomandazioni/*
[131] *IEA Grid Integration of Electric Vehicles A manual for policy makers.*
[132] *Rancilio, G.; Cortazzi, A.; Viganò, G.; Bovera, F. Assessing the Nationwide Benefits of Sakle-Grid Integration during Distribution Network Planning and Power System Dispatching.* World Electr. VEH. J. ***2024**, 15, 134. https://doi.org/10.3390/wevj15040134*
[133] *Zachary Needell, Wei Wei, Jessika E. Trancik, 'Strategies for benefiting electric vehicle charging to reduce peak electricity demand and store solar energy,' Cell Reports Physical Science, Volume 4, Issue 3, 2023, 101287, ISSN 2666-3864,*
[134] *Bosisio, Alessandro & Iannarelli, Gaetano & Greco, Bartolomeo & Morotti, Andrea & Pegoiani, Andrea & Cirocco, Alessandro & Cavalletto, Luca. (2023). Urban e-hubs for electric vehicle charging. 108 – number 11/12. 20-28.*
[135]*https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Sep/IRENA_EV_Smart_Charging_2019.pdf?rev=ce97a59bf5314e1dafce7bdcaa72fa88*
[136] *https://www.arera.it/atti-e-provvedimenti/dettaglio/20/541-20*
[137] *https://www.mdpi.com/1996-1073/16/1/557*

recharges in publicly accessible infrastructure, systems for coordinating charging processes[138] (especially for longer stops) or, again, the installation of storage systems are relevant[139], which would also have the advantage of reducing the rated power of stations and thus avoiding the installation of a user cab for connections in MT. Finally, coordination for the planning of the location of recharging points with network operators should be mentioned[140].

In order to enable distribution networks to manage the connection of additional loads and generators, smart control solutions (e.g. reactive power control of generators), the installation of dedicated equipment (e.g. reconnecting desks, storage systems) or the use of flexibility made available by users may be assessed[141]. There are many solutions proposed in the literature[142], but it is often difficult to quantify their benefits. Indeed, a comprehensive analysis[143] of the latter in relation to their costs must take into account multiple factors (e.g. remuneration and cost of flexibility made available by users) and the uncertainty of the evolution of the scenario. In such cases, it is also important to characterise the local market in detail by considering the coordination between TSOs and DSOs for the provision of ancillary services[144].

There are few studies available in the literature that can reliably quantify the investments needed in decarbonisation scenarios, mainly due to the lack of data to model the system, the difficulty of conducting analyses on large and complex systems and the difficulty of scaling up national or regional scenarios to the level of distribution networks. In an Eurelectric study[145], Italy estimates around 30 billion investments in distribution networks between 2020 and 2 030 in a scenario with an increase of 42 GW of generation and 6 million electric vehicles. Of these EUR 30 billion, around 6 are driven by electric vehicles and 3.3 billion by generation. The rest relates mainly to investments related to digitalisation and modernisation of the network: the latter expenditure item is particularly significant, mainly due to the ageing of infrastructure. Indeed, the same study estimates that around 50 % of BT lines will be more than 40 years old in 2030: the need to modernise the network can therefore be an opportunity to rethink planning according to the new scenarios. A sharp increase in investment globally, almost 100 %, is also foreseen by the IEA[146], but data are not broken down by geographical area and therefore it is not possible to extract the specific information for Italy.

In one RSE study, the additional costs related to a scenario that considered around 50 GW of installed PV generation capacity and 6 million electric vehicles[147] were assessed: the largest investments were estimated at around EUR 7.2 billion, of which EUR 1 billion was due to electric vehicles, EUR 600 million to heat pumps and EUR 5.6 billion to photovoltaic generation. However, costs could vary between 3,3 and almost 11 billion depending on scenario assumptions and penetration of *smart grid* technologies. These values are to be seen as additional to investments in network infrastructure already included in the historical performance of distributors (usually more than 1.2 billion per year[148]), so the estimated value, albeit lower, is of the same order of magnitude as the Eurelectric ratio. However, uncertainties in the local scenario need to be taken into account: for example, if the penetration of charging infrastructure is greater in more urbanised areas, where

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[138] *https://www.rse-web.it/rapporti/fornitura-di-servizi-alla-rete-tramite-veicoli-elettrici-in-ricarica-soluzioni-tecniche-gestione-e-remunerabilita-nel-caso-applicativo-di-flotte-aziendali/*
[139] *https://www.mdpi.com/2079-9292/9/6/939*
[140] *https://www.arera.it/it/docs/23/173-23.htm*
[141] *https://www.arera.it/atti-e-provvedimenti/dettaglio/23/296-23*
[142] *https://bridge-smart-grid-storage-systems-digital-projects.ec.europa.eu/*
[143] *https://ses.jrc.ec.europa.eu/smart-grid-cost-benefit-analysis*
[144] *https://www.arera.it/allegati/docs/21/352-21.pdf*
[145] *https://www.eurelectric.org/connecting-the-dots/*
[146] *https://iea.blob.core.windows.net/assets/a72d8abf-de08-4385-8711-b8a062d6124a/WEO2020.pdf*
[147] *https://www.rse-web.it/rapporti/confronto-tecnico-economico-delle-alternative-di-sviluppo-al-2030-della-rete-di-distribuzione/*
[148] *https://ieeexplore.ieee.org/document/9241121*

the load is already high and will increase at the same time due to the deployment of heat pumps, the impact may also be significant locally.

❖ **SMART GRID REINFORCEMENT (NRRP M2C2-I2.1)**

As part of the NRRP, Mission 2 ‘*Green Reform and Ecological Transition*’, Mission 2 ‘*Strengthening and digitalising network infrastructure*’ was planned for Investment 2.1 ‘*Strengthening smart grid*’ to increase the grid capacity to host and integrate further distributed generation from renewable sources (Hosting Capacity) and to increase the power available to users to support the electrification of energy consumption (e.g. electric mobility, heating with heat pumps). For the implementation of the measure, approximately EUR 3,6 mldEUR has been allocated with the incremental objective *of Hosting capacity* for distributed generation of 4.000 MW and to increase the capacity and power available to at least 1.500.000 users to support electrification of energy consumption.

Ministerial Decree No 146 of 6 April 2022 defined the essential elements of the procedures for selecting proposals for the measure. In particular, the Decree allocates EUR 3.6 million (EUR 1 million to increase the grid capacity to host and integrate further distributed generation from renewable sources; EUR 2,6 MLDEUR to increase the power available to utilities and to promote electrification) to public electricity distribution service concessionaires, in the form of a non-repayable contribution of up to 100 % of the eligible costs, for the implementation of interventions on both the electricity grid and its software components.

On 22 June 2022, public notice No 119 for the submission of project proposals was published on the website of the Ministry of Environment and Energy Security, providing that interested parties may submit project proposals under the two abovementioned quotas (capacity hosting and electrification of consumption).

As of 3 October 2022, the deadline for submitting applications for funding, 25 integrated projects and two projects aimed at electrification of consumption were submitted. On the basis of the total financial envelope of the Notice, 22 projects were eligible for funding, with the implementation of which on 30 June 2 026 the increase in Hosting Capacity will be around 9.800 MW and the number of inhabitants involved in electrification measures will be 8.5 million.

The investment is increased with additional resources of EUR 450 million from REPowerEU M7-Investment 1, with the aim of implementing projects already selected under measure M2C2.1 of the RRP eligible but not financed by exhaustion of the financial envelope and interventions on low and medium-voltage network parts for electrification of consumption of an additional 230.000 inhabitants.

❖ **INTERVENTIONS ON NETWORK CLIMATE RESILIENCE (NRRP M2C2-I2.2)**

Mission 2 ‘Green Revolution and Ecological Transition’, Mission 2 ‘Strengthening and digitalising network infrastructure’ was introduced under the NRRP, Investment 2.2 ‘Interventions on climate resilience networks’ aimed at increasing the resilience of the distribution network, extreme weather events (wind/fall of trees, ice, heat waves, floods and hydrogeological risks), as well as reducing the likelihood of prolonged electricity supply disruptions and limiting the negative social and economic consequences for the areas concerned.

For the implementation of the measure, around EUR 0.5 billion has been allocated with the aim of improving the resilience of at least 4.000 km of the electricity system network in order to reduce the frequency and duration of supply disruptions due to extreme weather conditions.

Ministerial Decree No 150 of 7 April 2022 defined the essential elements of the procedures for selecting proposals for the measure. The Decree allocates EUR 500 million (EUR 150 million for the implementation of measures affecting at least 1 500 km of the transmission network; EUR 350 million for the implementation of interventions on the distribution network), in the form of a non-repayable contribution, up to 100 % of the eligible costs, to the transmission electricity network concessionaire and the concessionaires of the distribution electricity network to carry out measures aimed at increasing the resilience of at least 4 000 km of the electricity grid to extreme weather events, as well as reducing the likelihood of prolonged electricity supply disruptions and limiting the negative social and economic consequences for the areas concerned.

On 20 June 2022, public Notice No 117 was published to acquire expressions of interest in carrying out measures to improve the resilience of the transmission electricity network to extreme weather events and Public Notice No 118 for the presentation of proposals for action aimed at improving the resilience of electricity distribution networks.

According to Notice No 117, 10 projects were submitted by the TSO for a total amount of approximately EUR 173 million and 9 projects affecting 1.700 km of the network were eligible for funding.
Under Notice No 118, 27 projects were submitted by Distributors for a total amount of approximately EUR 440 million and 22 projects affecting approximately 6.593 km of network were eligible for aid.

The investment was increased with additional resources of EUR 63.2 million from REPowerEU M7-Investment 2. With the increase in the budget, operations already selected under measure M2C2.2 of the RRP, which are eligible but not financed by exhaustion of the financial envelope, will be implemented, with an increase in resilience for a further 648 km of the electricity grid.

4.5.3 Electricity and gas markets, energy prices

I. Current situation of electricity and gas markets, including energy prices

❖ **<u>ORGANISED WHOLESALE ELECTRICITY MARKETS</u>**

The architecture of the Italian wholesale electricity market is currently focused on the following three segments:

- energy markets, broken down between spot and forward markets, where operators exchange electricity among themselves;
- the dispatching or MSD market divided between ex-ante MSD and Balance Market or MB, where the system operator purchases the services necessary to ensure the safety of the electricity system in real time;
- the capacity market referred to in Article 2 of Legislative Decree No 379 of 19 December 2003, in which the system operator supplies the capacity necessary to ensure the adequacy of the electricity system in the long term.

♦ ***ENERGY MARKETS***

In Italy, the Energetic Market Operator (GME) is the entity which, under Legislative Decree No 79/1999, is responsible for organising and managing the energy markets, broken down between the market in Fit for Energy (MPE) – which is part of the day-ahead market (MGP) and the internal market (MI) – and the electricity market at Terminal (MTE).

The purpose of the MGP is to negotiate energy for 24 hours on the day of delivery: it is managed by means of hourly auctions where accepted bids are valued at the marginal*system price*. The MGP is a zonal organised market, where market areas represent parts of the transmission network with limited trading capacity between them. If flows exceed the maximum transit limit allowed by cross-zonal interconnections, the price is recalculated in each area as if each were a*market splitting market*. While offers accepted for sale are valued at the relevant zonal price each hour, bids accepted for purchase and relating to consumption units are valued at each hour at the National Single Price (PUN), defined as the average of zonal prices weighted by the value of zonal purchases, net of purchases of pumping and foreign areas. In this market, GME acts as a central counterparty for market participants.

The MI is also a zonal market consisting of a continuous trading session (XBID), organised *in* zonal order books, divided by three auctions at marginal equilibrium prices with progressive closing times, where both offers for sale and buying-in are valued at the zonal price; in this market too, GME acts as a central counterparty for market participants.

GME is also the entity identified as Nominated Electricity Market Operator (NEMO) pursuant to Commission Regulation (EC) No 2015/1222 (the CACM Regulation). As part of the integrated market design developed in recent years under the aforementioned CACM Regulation, on the border between Italy and Slovenia, between Italy and France, Italy and Austria and between Italy and Greece, daily interconnection capacities are now allocated, both in relation to the day-ahead market and the Infragiornian market, through the *market coupling* mechanism. This mechanism simultaneously carries out the implicit allocation of daily physical transmission rights and *the clearing* of bids to buy and sell energy. In 2 021, Italy joined the interconnected European Infragiornian Market project with continuous negotiations with complementary auctions for capacity valorisation, allowing negotiations up to one hour before the actual delivery of energy to the benefit, in particular, of producers from non-programmable renewable sources, who can now better adjust their positions on the basis of more up-to-date production forecasts.

GME is also involved, together with ARERA, Terna and MASE in the WB6 Western Balcan project to promote the launch of regional *coupling* in the Balkan area based on experience.

As regards the forward market, the MTE consists of the negotiation of forward contracts with an obligation to deliver and withdraw energy. The negotiations take place on a continuous basis and cover two types of contracts*, baseload and* peakload, negotiable with monthly delivery periods (three products quoted simultaneously), quarterly (four products listed simultaneously) and annual (one product).

Operators can sell and purchase energy not only through the organised GME market, but also by entering into sales contracts concluded outside the bidding system. However, the latter are registered on a specific platform, the Energy Accounts Platform (ECP), which allows wide flexibility for operators to optimise their portfolio of contracts, including bilateral contracts concluded on brokering platforms.

♦ *DISPATCHING SERVICE MARKET*

The MSD, organised on the basis of the criteria and conditions set by ARERA, concerns the provision by Terna of the services necessary for the safe operation of the electricity system, such as: the resolution of intra-zonal congestions, the establishment and use of reserve capacity and real-time balancing. The MSD consists of a programming phase (ex-ante MSD) and the Balance Market (MB). The ex ante MSD consists of six programming sub-phases, while the MB provides for the continuous submission of tenders, up to 60' before the start of the time to which those tenders relate. The method of negotiating in the MSD is that of a discriminatory auction, where the bids accepted are each valued at their own price (*pay as bid*). Since 2025, the new regulation of dispatching activity to ensure the safety of the electricity system has entered into force in an efficient manner, including in the current rapidly and constantly evolving context, characterised by the increasing uptake of non-programmable renewable sources and distributed generation, as well as the progressive reduction in the use of programmable installations.

With reference to MSD, Italy is also involved in the ongoing European integration process. Since 2021, a platform for the integration of balancing markets and, specifically, for the exchange of reserve services, in EU countries has been in place. In addition, in order to implement the new methods of negotiation resulting from Italy's accession to the European *intraday*market, in a manner consistent with the centralised dispatch by Terna, changes have been introduced to the organisation of the services market in order to coordinate the market more closely with the results of the *intraday*market, with specific constraints on the units authorised to provide services to remain within specific dispatched power ranges defined by Terna.

♦ *CAPACITY MARKET*

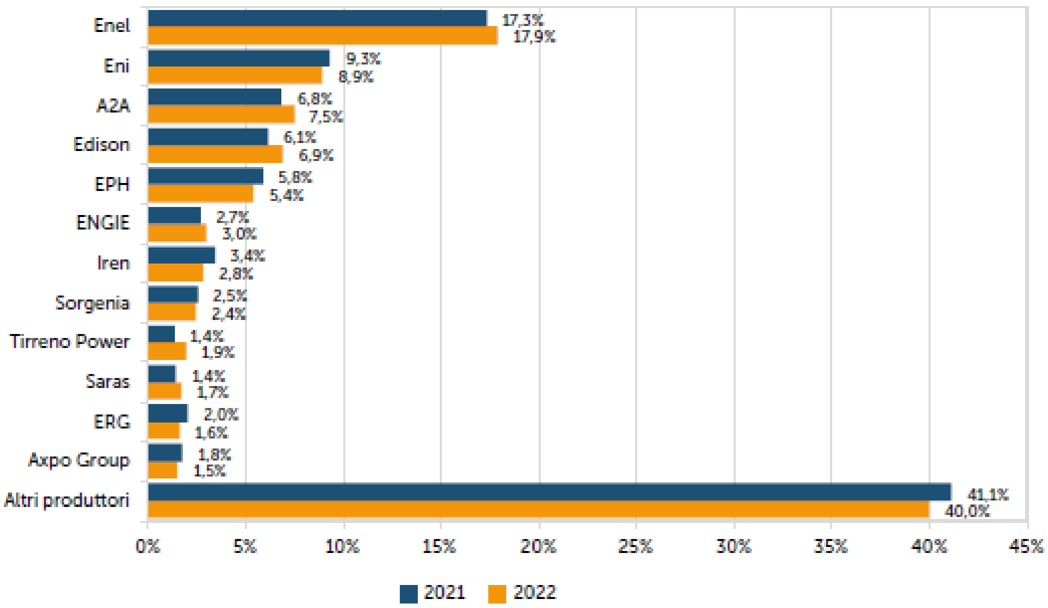
In addition to the electricity and dispatching services markets, a capacity market is also in place in Italy, in order to ensure, with a view to technological neutrality, the adequacy of the system in relation to a target set, by creating new capacity and maintaining the full efficiency of existing capacity: not only generation but also *demand response* and storage systems. 'Adequacy' means the ability of the system to meet the electricity demand in accordance with the safety and quality of service requirements. An electricity system can be considered adequate if it has sufficient resources in terms of generation, *storage, demand response* and transport capacity to meet expected electricity demand with a reasonable degree of confidence.

This market is managed by Terna, which regularly organises auctions with different delivery periods of contracted capacity (1 year for existing capacity and 15 years for newly built capacity), on the basis of rules laid down by Terna itself. The framework is based on criteria and conditions laid down by ARERA and approved by the MASE, in compliance with Community legislation. The conduct of the auctions is based on the mid-term and long-term adequacy analysis carried out annually by Terna. The bidders of capacity contracts following the auctions, in return for a premium, must ensure that this capacity is offered on the electricity and dispatching services markets for the duration of the delivery obligation and are required to return to the system any positive difference between the prices obtained on those markets and a predefined *strike* price.

♦ ***QUALITATIVE SUMMARY DATA ON GENERATION AND WHOLESALE MARKETS***

Compared with gross production of 284 TWh, the contribution of the main producers is shown in the chart below.

Figure77: Contribution of the largest groups to gross national production: comparison 2021-2022



Fonte: ARERA, Indagine annuale sui settori regolati.

The Herfindahal – Hirschman (HHI) index for gross generation of 576 is higher than in 2021, when it was 552 and already increasing compared to 2020 (496).

In 2022, there was a reduction in electricity consumption, as a result of energy market conditions in conjunction with the outbreak of the Russian-Ukrainian war, which led to a contraction in trade in the organised market compared to 2021, standing at 289,2 level, also affecting the level of liquidity (72.9 %). In 2023, the contraction in negotiated volumes continues, accompanied by a fall in prices.

The PUN, like other European *day-ahead* market prices, has experienced increases never observed earlier, mainly fuelled by generation costs (in particular: the cost of natural gas PSV).

The average annual Italian electricity price in 2 022 thus reached a record record of EUR 303,95/MWh. It is interesting to note that, in the near vertical growth recorded in 2022, there was also a rise in *the clean spark spread* (CSS).

Figure78: Development of the PUN and its determinants [Source: GME]

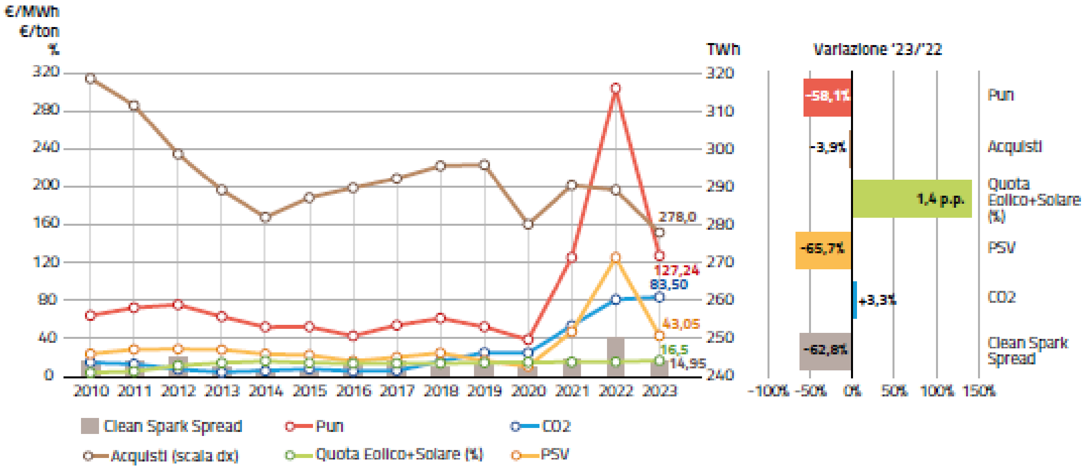
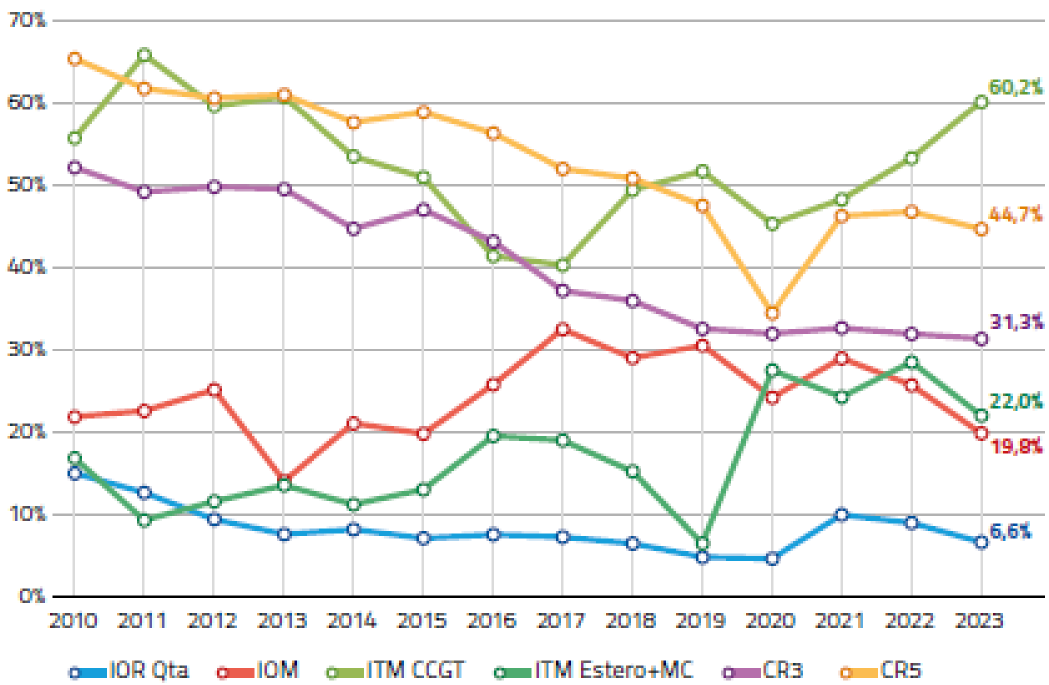


Figure79: Competitiveness indicators at aggregate level [Source: GME]



As regards the capacity market, three auctions have been carried out to date, two at the end of 2019 and one in 2021, covering the delivery periods 2022, 2023, 2024. New auctions are planned for the delivery years 2025, 2027, 2026 and 2028. Please find below the summary data on the supply of capacity that is functional to the adequacy that has been carried out so far.

Table 81 – Summary of the results of the auctions for the supply of capacity

	2022	2023	2024
Capacity in the national territory	36.5 GW	39 GW	37.9 GW
Foreign border capacity	4.4 GW	4.4 GW	3.6 GW
Non-programmable renewable generation capacity (wind, photovoltaic and flowing water hydro)	1 GW	1.3 GW	1.5 GW
Capacity from storage systems	0	0.1 GW	1.1 GW
Existing capacity: volume	34.8 GW	35 GW	34.2 GW
Existing capacity: Prize	EUR 33.000/MW/year	EUR 33.000/MW/year	EUR 33.000/MW/year
Newly built capacity: volume	1.8 GW	4 GW *	3.8 GW * *
Newly built capacity: Prize	EUR 75.000/MW/year	EUR 75.000/MW/year	EUR 70.000/MW/year

* Of which 3.1 GW authorised and 0.9 GW of terminated contracts (source Terna)

* * of which 3.2 GW authorised and 0.6 GW of terminated contracts (source Terna)

❖ WHOLESALE NATURAL GAS MARKETS

Imports and purchases at the Virtual Exchange Point (PSV) were found to be the most frequent way in which gas wholesalers source the material before they sell.

PSV is a virtual *hub* operated by Snam Rete Gas, that is to say, a conceptually localised point between the entry points and the exit points of the national pipeline network, where it is possible to trade and sell gas injected into the network, resulting both from OTC trading and from trading on centralised markets.

With regard to the latter, since 2010, the gas exchange was launched in Italy where GME acts as a central counterparty to transactions concluded by operators. In this market, now referred to as MGAS, licensed operators can purchase and sell quantities of natural gas on a spot basis.

The MGAS consists of:

- Spot gas market (MPGAS), consisting of all of the following markets:
  - Day-ahead gas market (MGP-GAS). MGP-GAS trading takes place in a continuous trading manner and, for the system gas supply sector alone (AGS compartment), the session of which takes place on the G-1 gas day, in accordance with the auction trading arrangements. For MGP-GAS trading, which take place in a continuous trading manner, bids to buy and sell gas for the three gas days following the opening of the trading session are selected. For trading in the AGS compartment, which take place according to the auction trading arrangements, bids to buy and sell gas relating to the gas day after the trading session takes place shall be selected.
  - Intraday gas market (MI-GAS). MI-GAS trading takes place according to the modalities of continuous trading and, for the system gas supply sector alone (AGS compartment), the session of which takes place on day G, in accordance with the auction trading arrangements. For MI-GAS trading, which take place in a continuous trading manner, bids to buy and sell gas for the gas day corresponding to the one in which the trading session is opened are selected. For trading in the AGS compartment, which take place according to the auction trading

arrangements, bids to buy and sell gas for the same gas day as the trading session is held shall be selected.

- Market for Locational Products (MPL). The MPL shall be conducted in the manner of auction trading. MPL sessions are held only at the request of Snam Rete Gas. On that market, Snam Rete Gas obtains from authorised users the quantities of gas needed to manage physical needs located within the balancing zone or any planned deviations between total network inputs and off-takes.
- Organised Gas Trading Market in Storage (MGS). The MGS shall be conducted in the manner of auction trading. MGS may be negotiated by licensed users and Snam Rete Gas offers for the purchase and sale of gas in storage.
- Gas Term Market (MT-GAS). The MT-GAS shall be conducted in the manner of continuous trading. A large number of order *books* are organised on the MT-GAS, each for each type of tradable product, covering different delivery periods, during which bids to buy and sell gas are selected.

Compared with Italy's gross consumption in 2022 of almost 68.500 million sm^3, down to around 61.500 in 2023 as a result of the price crisis and the policies adopted to curb consumption, around 3.300 million sm^3 relate to national production thus distributed among the various operators.

Table 82 – National natural gas producers

Group	Quantity	Share
ENI	2.177	66.3 %
Royal Dutch Shell	540	16.4 %
Energean PLC	249	7.6 %
Gas Plus	90	2.8 %
Others	226	6.9 %
TOTAL	3.282	100 %

Source: ARERA, Annual Energy Sector Survey

Imports in 2022 amounted to around SM3 million and SM3 million in 2023 61.600.

Table 83 – Main importers (2022)

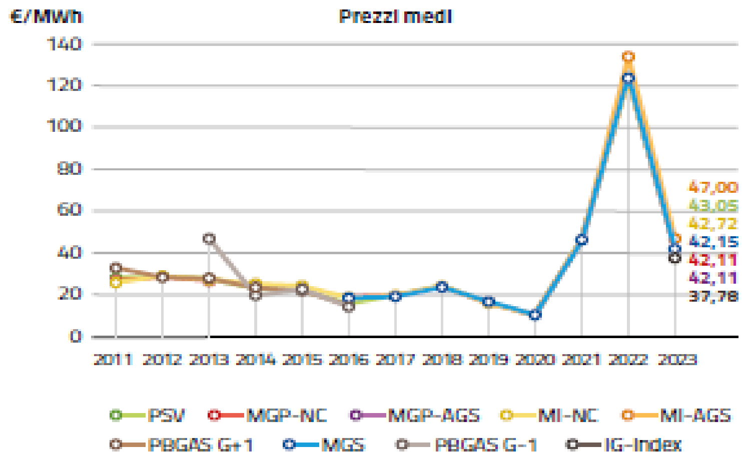
Company name	Quantity	Share	Rank in 2021
ENI	28.470	41.9 %	1TH
Edison	11.337	16.7 %	2TH
Azerbaijan Gas Supply Company Limited	7.789	11.5 %	3TH
ENEL Global Trading	4.276	6.3 %	4TH
Shell Energy Europe Limited	4.179	6.2 %	5TH
Gunvor International	2.710	4.0 %	6TH
Vitol	1.775	2.6 %	13TH
Engie Italia	1.130	1.7 %	9TH
ExxonMobil Gas Marketing Europe	1.053	1.5 %	—
DACommodities	987	1.5 %	7TH
Axpo Solutions	938	1.4 %	8TH
A2A	791	1.2 %	11TH
BP Gas Marketing	719	1.1 %	32TH
Gazprom Italy	323	0.5 %	10TH
ENET Energy	296	0.4 %	18TH
HERA Trading	276	0.4 %	16TH
RWE Supply & Trading	268	0.4 %	26TH
Centrica Energy Trading	142	0.2 %	23TH
Axpo Italia	81	0.1 %	33TH
Repower italia	66	0.1 %	22TH
Others	320	0.5 %	—
TOTAL	**67.926**	**100 %**	**—**
of which: imports from European stock exchanges	4.326	6.5 %	—
Imports (Ministry of Environment and Energy Security	72.583	—	—

Source: ARERA, Annual Energy Sector Survey

Negotiations in the MP-GAS consolidate the growth recorded in the previous four years in 2022, rising to an all-time high of 175 TWh (an increase of 35 % compared to 2021), corresponding to 24 % of total demand on an annual basis, and then stalled in 2023, with a gas system falling by a general drop in demand to 155 TWh.

With regard to price dynamics in 2022 and 2 023 in the gas markets operated by GME, the relationship between volumes and prices in the various sectors is shown below.

Figure 80 – Gas market prices



❖ **RETAIL ELECTRICITY AND NATURAL GAS MARKET**

For evidence on the retail market, please refer to the data contained in the ARERA report, as set out in the following link https://www.arera.it/atti-e-provvedimenti/dettaglio/23/343-23 and the subsequent update https://www.arera.it/atti-e-provvedimenti/dettaglio/24/59-24.

With regard to the final market for electricity and natural gas, the process of exceeding the regulated electricity and natural gas price regime has been completed. In the electricity sector, the transition to the free market has been improved, following the allocation of the service to Tutele Gradali (a transition tool identified by the legislator for the transition to the free market), for the following categories of final customers:

- for small and micro enterprises with a committed power exceeding 15 kW, with effect from 1 July 2021;
- for micro-enterprises and all final customers other than household customers, from 1 April 2023;
- for household customers other than vulnerable customers as from 1 July 2024.

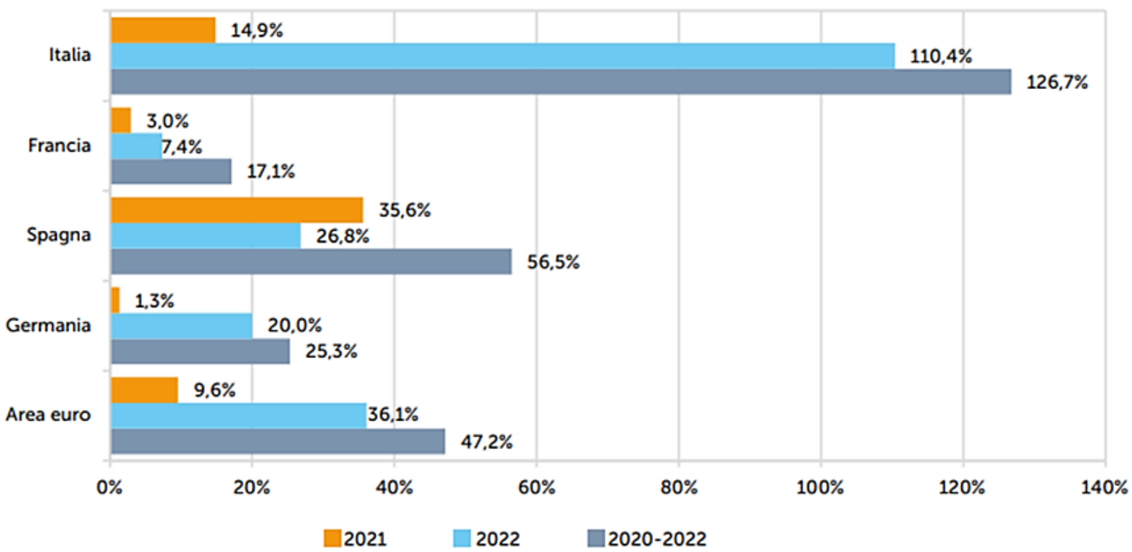
At the beginning of 2024, the overrun of regulated natural gas price price regimes also for household customers ended.

Vulnerable customers have also been identified, not only on the basis of economic conditions but also on the basis of health, age, special housing conditions, with regard to both electricity and natural gas sectors. As a form of protection, for the natural gas sector, the regulatory authority will define the contractual and economic conditions reserved to them, based on market prices, which all sellers are required to offer to vulnerable persons. For the electricity sector, vulnerable household customers who did not make an independent choice of supplier on the free market on 1 July 2024 will continue to apply the most protective service on a transitional basis. Subsequently, for these customers, there is provision for vulnerable services to be provided by identified operators through tender procedures conducted for territorial areas under contractual conditions defined by the Authority. The modalities for conducting the auctions and the provision of the service will be regulated by the regulatory authority.

Despite the improvement and measures taken in recent years, Italy still maintains a *gap* with other European countries in terms of both gas and electricity prices, with a direct impact on the competitiveness of companies and the purchasing power of households, especially those affected by energy poverty.

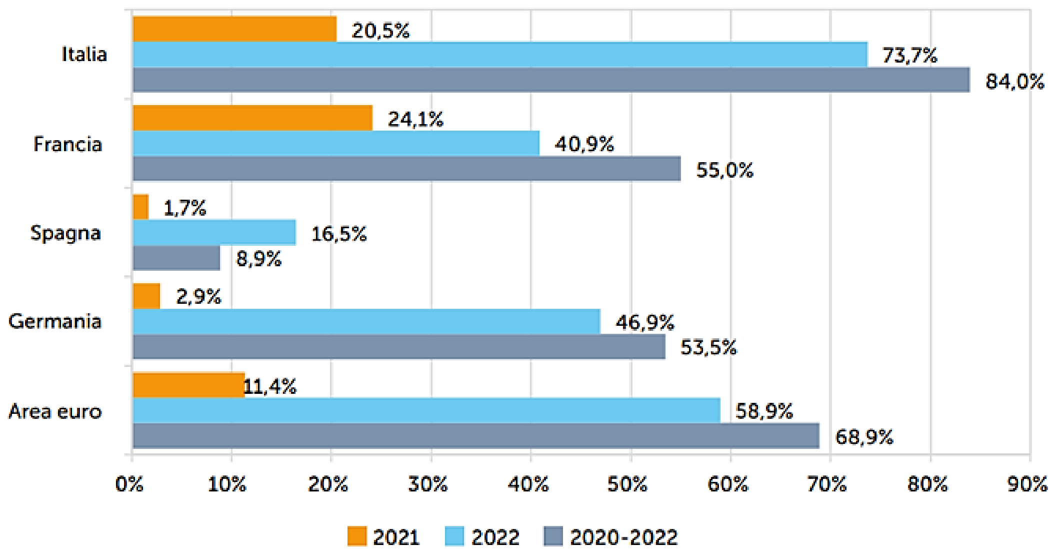
This trend is also confirmed in recent developments: looking at the following figure, it can be noted that the increase in electricity prices for households in 2 022 in Italy compared to 2021 is more pronounced than the euro area average, where there are very different situations.

Figure 81 Changes in electricity prices for households in major European countries [Source: ARERA Annual Report and Eurostat – Harmonised Index Number of Consumer Prices]



As with the electricity price, gas price developments for Italian households can be assessed in comparison with the main European countries, using the harmonised consumer price indices collected by Eurostat. This analysis shows that in 2022 gas increased in Italy (73.7 %) above both the euro area average (58.9 %) and the other three main countries.

Figure 82 – Changes in natural gas prices for households in major European countries [Source: ARERA Annual Report and Eurostat – Harmonised Index Number of Consumer Prices]



This *gap* was even more severe with the effects of the energy crisis that started in the last months of 2021 (then exacerbated by the Russian war in Ukraine that erupted in 2022): in this regard, during 2022, several emergency measures were taken to counter the effects of rising energy prices on bills in order to support households and businesses that also applied for most of 2023.

II. Projections of development with existing policies and measures at least until 2040 (including for the year 2030)

The pursuit of *decarbonisation*, energy security and renewable energy integration targets shall be realistically achievable only by taking into account the need for reinforcement both on the transmission and distribution grid, with a view as integrated and coordinated as possible.

As regards the national transmission grid, the Development Plan presented by Terna in 2023 identifies priority actions for the integration of renewable energy sources needed to achieve European targets, in particular for the electricity system.

First of all, the increase in production from renewable sources, the greatest incidence of which is in southern regions, leading to an increase in power flows from south to north, requires reinforcement of the sections involved. It is therefore necessary to develop a system capable of supporting progressive decarbonisation, increased integration of renewables, and interconnection capacity with electricity systems in neighbouring countries to ensure increasing energy security through the possibility of mutual assistance between interconnected systems.

In addition to existing works such as the Continente-Sicilia-Sardinia HVDC connection (Tyrrhenian Link) and the HVDC Centro Sud and Centro Nord (Adriatic Link), the Development Plan foresees the new Hypergrid project, composed of five electric backbone, which will use direct current transmission (HVDC) technologies to safeguard the objectives of energy transition and security. Among the main expected benefits are the doubling of trading capacity between market areas.

In order to achieve the energy and climate policy objectives in the times planned, it is inevitable that investment in the energy sector must be accelerated significantly, through a coordinated approach between all the actors involved, so as to make the system more efficient as a whole.

4.6 Dimension Research, innovation and competitiveness

I. Current situation of the low-carbon-technologies sector and, to the extent possible, its position on the global market (that analysis is to be carried out at Union or global level)

All current R & D lines in Italy have developed as a matter of priority under the following instruments:

- Mission Innovation;
- Horizon 2020;
- Electrical system research 2019-2021;
- Important Projects of Common European Interest;
- NRRPS.

❖ **MISSION INNOVATION**

Italy has joined the multilateral *Mission Innovation* (MI) initiative aimed at accelerating clean technology innovation processes, both in the public and private sectors.

During the first 5 years of the agreement, 8 *Innovation Challenges* (IC) were launched, representing the main technology areas on which it was decided to focus investments. Italy joined all JUs, with a co-leader role, with China and India, for IC # 1, focusing on *smart grids*. Italy's involvement in the activities of the JUs has involved the main public actors in energy research.

In 2020, the new phase of the initiative, *Mission Innovation 2.0*, was launched. A major novelty is the creation of 7 new *missions*, which will replace the 8 *Innovation Challenges*, through mergers and top-ups of thematic research areas. Italy is co-leader with China and the UK in the *Green Powered Future Mission*, bringing together the activities on *smart grids* (IC # 1) and the entire RES and accumulations sector. Italy also joined the *Clean Hydrogen Mission*, in light of the growing role played by the hydrogen carrier at national and global level.

The first available funds of EUR 35.8 million were allocated, through a programme agreement between the then Ministry of Economic Development and ENEA, with co-beneficiaries CNR, RSE and IIT, on the following projects:

- *IEMAP (Italian Energy Materials Acceleration Platform)* – the platform, designed, developed and implemented by integrating existing technologies, identifies itself as an advanced tool for the identification, analysis and synthesis of new materials for the energy sector. The Operational Plan of Activities consists of three research lines: (a) batteries, (b) electrolysers; (c) photovoltaic;
- *Hydrogen Demo Valley*– the investment aims to create a research hub for the development of the Italian hydrogen supply chain. *Hydrogen Demo Valley* at ENEA Casaccia Research Centre is designed to become an experimental centre for hydrogen production, transport, accumulation and use, to accelerate research and innovation and close the gap between laboratory scale and industrial level. The experimental centre will be made available to universities, research institutes and businesses to test innovations and monitor their subsequent steps towards industrialisation;
- *MISSION Smart Grid project – the project aims to develop, implement and test advanced conceptual models for* the operation of multi-vector distributed energy systems (thermico-electric) in a *smart grid* and in a real and representative environment, in order to tap into the potential for network integration across sectors.

MIs research projects are characterised by average TRLs (5-8), the implementation of which is planned for close cooperation with businesses, at different operational stages. Among the instruments used, the implementation of Pilot and Demo has a priority role to play, with the aim of creating innovative and experimental facilities to validate technological solutions developed at previous stages of research.

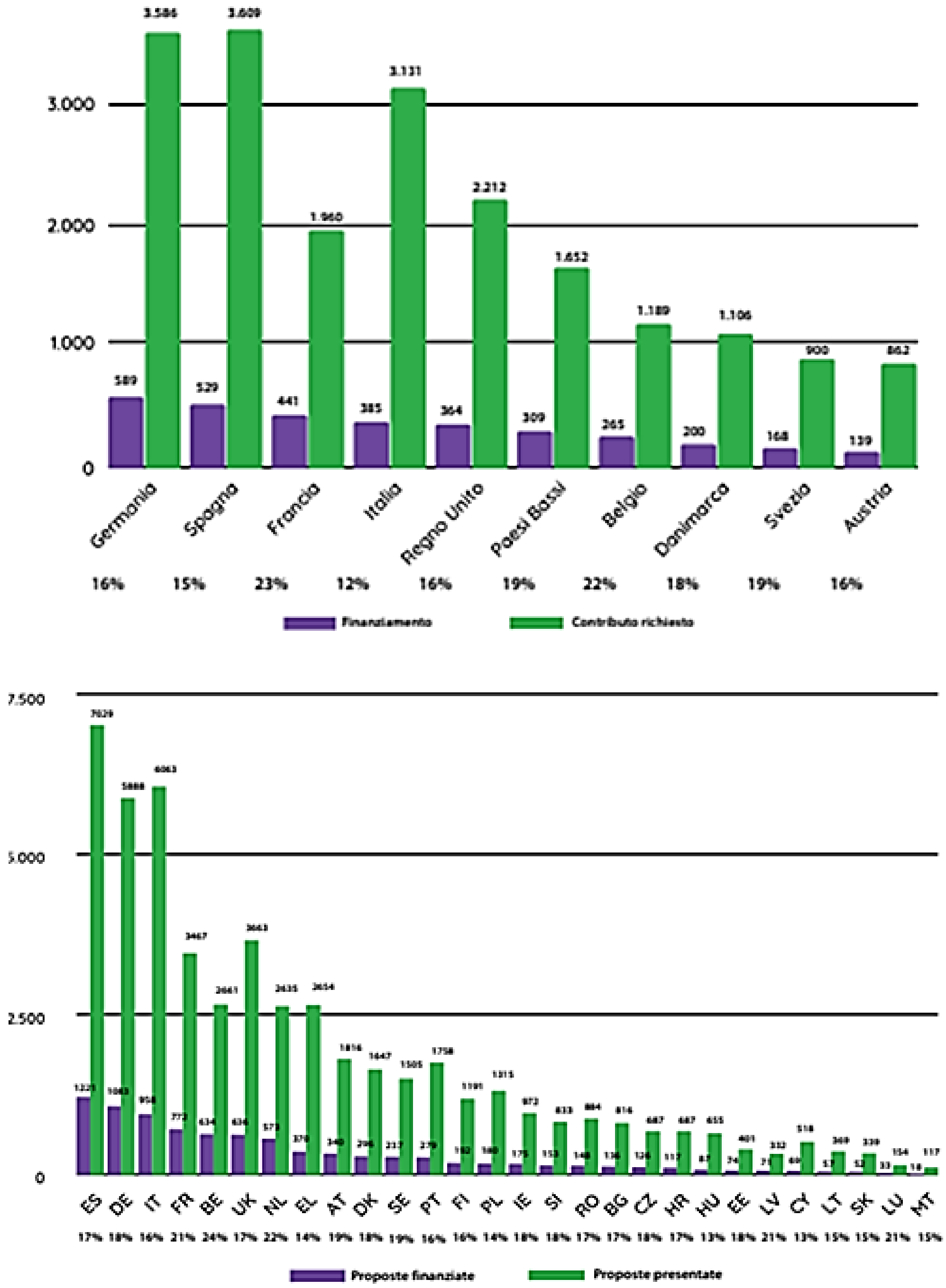
In support of initiatives in the field of MI, the 2017 Budget Law established the Fund for Investment and Infrastructure Development, refinanced by the 2018 Budget Law and Law No 58 of 28 June 2019, which authorises expenditure of EUR 10 million for each of the years 2019 and 2020 and EUR 20 million for 2021.

- **HORIZON 2020**

Horizon 2020 is the European Commission’s funding instrument for scientific research and innovation, with a budget of around EUR 80 million and a duration of 7 years (2014 to 2020). The funds allocated are managed directly and aimed at financing research projects or actions aimed at scientific and technological innovation that have a significant impact on the lives of European citizens. The instrument is structured around three pillars (Excellent Science, Industrial Leadership and Societal Challenges), which have specific research programmes and themes within them, and six cross-cutting programmes.

Italian participation in the previous Horizon 2020 calls for energy was effective, with the presence of Italian actors both as partners and coordinators, in over 6 proposals, obtaining funding with a success rate of around 16 % and ranking as a third European country for the number of proposals funded after Spain and Germany and the fourth place for the total funding obtained with around EUR 385 million. This good result has been achieved through a major project effort, in terms of quality human resources and intensive cooperation between research bodies and companies, with constant alignment with the EETS Plan’s technological priorities, allowing Italian partners to compete adequately with the other research consortia established in Europe in recent years. In the light of the results achieved, the conditions for further improvement of Italian funding participation are outlined.

Figure 83 – Results of Italian participation in Horizon 2020 calls



At national level, further measures implemented and integrated with Horizon 2 020 are:

- *Innovation agreements*: encourages projects involving industrial research and experimental development activities aimed at the realisation of new products, processes or services or the significant improvement of existing products, processes or services, through the development of one or more of the technologies identified in Horizon 2020;
- *Sustainable Growth Fund*: it stimulates research and development projects aimed at introducing significant technological advances through the development of knowledge-intensive and associated R & D intensive technologies (identified in Horizon 2020) or technologies to address the 'societal challenges' defined in accordance with the Europe 2020 strategy.

❖ **ELECTRICAL SYSTEM RESEARCH 2019-2021**

The "Electricity System Research" (RdS) is the instrument, promoted by MASE, to support research and development activities aimed at technological innovation of general interest in the electricity sector. The Facility sets out the priorities, objectives and resources of R & D activities of general interest for the national electricity system for the three-year reference period.

The Decree of 9 August 2019 approved the three-year National Electricity System Research Plan for the three-year period 2019-2021, with an estimated budget of EUR 210 million.

The activities took place under the two general objectives, related to electricity technologies and systems, set in line with the SET Plan and participation in Mission Innovation.

Technology research projects have helped develop and maintain product and process technologies and services needed for the energy transition; in relation to the electricity system, research projects have been developed to support the introduction of technologies, systems and organisational and management models that serve the energy transition and security.

❖ **IMPORTANT PROJECTS OF COMMON EUROPEAN INTEREST (IPCEI)**

TheIPCEI *Important Projects of Common European Interest* Fund was established by Article 1 (203) of Law No 145/2018 and operates through facilities to support activities carried out in Italy in the context of projects approved at European level pursuant to Article 107(3)(b) of the Treaty on the Functioning of the European Union. The objective of the Fund is to support large-scale industrial collaboration initiatives, to promote the sharing of knowledge, expertise, financial resources and economic actors in the European Union in order to achieve radical, technological and productive innovation objectives, with a shared effort by the private and public sector in the Member States to deploy interventions of common interest in strategic value chains for European industry.

Italy has joined the following IPCEI programmes: (1) batteries; (2) hydrogen; (3) CIS (Cloud Infrastructure and Services).

♦ ***IPCEI BATTERIE***

The initiative was supported by the awareness that the battery market is growing strongly, driven by the automotive sector, increasingly oriented towards power supply solutions, and by the stationary accumulation sector, with the growing need for flexibility and security of the electricity system to increase the share of non-programmable renewables connected to the grid. The overall framework, also in view of the decarbonisation objectives of the European Green Deal, entails a high strategic risk for all Member States: without a European battery production and a European value chain, the energy and mobility sectors would become dependent on technologies and components from outside Europe.

The two IPCEI projects on batteries ('IPCEI on Batteries' and 'IPCEI European Battery Innovation EuBatIn') operate in a synergy and complementarity relationship aimed at developing the battery value chain at European level. Both include projects and activities ranging from raw material extraction to battery cells and packs manufacturing to final application and recycling and disposal in accordance with the circular economy and sustainability principle.

As part of these projects, national companies are located in the different WPs covering the entire value chain.

IPCEI on Batteries: it provides for the involvement of 8 countries and funding of EUR 3,2 MLDs. For Italy, 5 companies are involved along the entire upstream-midstream-downstream production chain and total resources of EUR 473.35 million are activated.

IPCEI EuBatIn: it provides for the involvement of 12 countries and funding of EUR 2,9 MLDs. In Italy, ENEA and Fondazione Bruno Kessler participate on the research front, as well as 12 companies along the entire upstream-midstream-downstream production chain; a total of EUR 533.6 million is mobilised.

♦ *IPCEI HYDROGEN*

The aim of joining the initiative is to contribute to the decarbonisation of the national economy by supporting the replacement of fossil fuels with hydrogen, through the development of a whole set of innovations in hydrogen production technologies and along the entire value chain.

Hy2Tech: in July 2022, the Hy2Tech project was approved by the European Commission, bringing together 35 partners from 15 Member States, with a total funding of EUR 5.4 million and national funding of around EUR 1.0 million. Italy participates with 6 industrial projects and 2 R & D projects submitted by research organisations (ENEA and Fondazione Bruno Kessler). The participation of Italian partners in the IPCEI Hy2Tech project will allow Italy to take advantage of the considerable opportunities arising from the use of hydrogen in different application sectors, such as industry, transport, civil and residential, in relation to hydrogen in blending with natural gas.

Hy2Use: on 21 September, the European Commission announced the approval of the second IPCEI on Hy2Use hydrogen, which brings together 35 projects from 13 Member States. The total public support is EUR 5.2 million; the national budget amounts to approximately EUR 500 million. Hy2Use includes the construction of large-scale infrastructure for the production, storage and transport of renewable and low-carbon hydrogen and the development of innovative products and more sustainable technologies for integrating hydrogen into industrial processes in multiple Hard to Abate sectors. There are 4 Italian companies involved with their own projects.

In addition, the designs relating to two other hydrogen IPCEI are in the process of pre-notification: *Hy2Intra* and *Hy2Move*, respectively on infrastructure and transport, with a total of four Italian initiatives.

Further initiatives under the RepowerEU and MIMIT management, concerning Hy2Intra, are *highlighted*. In particular, the initiatives are to finalise the deployment of renewable hydrogen production systems in specific geographical areas, as well as the deployment and/or potential deployment of hydrogen transport infrastructure to build interconnected hydrogen clusters at European level (hydrogen backbone). The projects of the companies concerned (SNAM, Energie salentine, SAIPEM) were among the IPCEI projects by the European Commission in February 2024. The measure provides for EUR 1.4 million of public funds and EUR 3.6 million of private funding, with an expected revenue in operation in 2030.

♦ *IPCEI-CIS*

The objective of IPCEI-CIS (Cloud Infrastructure and Services) is to design and deploy the first open, secure, multi-provider, scalable and highly energy-efficient cloud-edge infrastructure in which to increase the innovation potential of digitalisation and data valorisation. The cloud infrastructure will enable industries and research organisations to access, use seamless, process and store data by connecting centralised cloud services with those where data is generated, at so-called edge borders. Interoperable platforms, distributed software environments and specialised interconnecting services will make infrastructure transparent and enable the resilience and technological leadership of European industries to be promoted, paving the way for digital innovation and helping to accelerate the implementation of the European Data Strategy in accordance with the Green Deal and the European Industrial Strategy.

The first CIS project is in the pre-notification phase and has 12 participating countries. For Italy, two research organisations (ENEA, FBK) and 5 industries are involved.

♦ ***IPCEI-NUCLEARE***

A Nuclear Working Group was set up to assess possible IPCEI funding on "*SMR and state-of-the-art borders of sustainable nuclear technology*". Through the National Platform for a Sustainable Nuclear, an overview of the entire national landscape of businesses, utilities, research and academies was carried out. In the coming months, Community assessments of the possible activation of IPCEI in the nuclear field are expected.

❖ **THE NRRP – INVESTMENT 3.5 HYDROGEN RESEARCH AND DEVELOPMENT (M2C2)**

Under the NRRP (M2C2), Investment 3.5 "*Research and Development on Hydrogen*" was introduced to support hydrogen-centred R & D activities in four strands: (1) green hydrogen production; (2) innovative hydrogen technologies for storage, transport, transformation into derivatives and *e-fuels*; (3) fuel cells for stationary and mobility applications; (4) smart integrated management systems to improve the resilience and reliability of smart hydrogen infrastructure. The measure was implemented in general by Ministerial Decree No 545 of 23 December 2021, in which:

- an agreement was concluded with ENEA (EUR 110 million) for ENEA to carry out the research activities detailed in the 'Operational Research Plan' (ROP) in 2022-2025;
- two calls (public notices Nos 4 and 5 of 23 March 2022) were published for the selection of projects on fundamental research activities carried out by research organisations and universities (EUR 20 million) and on research and development activities in the hydrogen sector carried out by private entities (EUR 30 million).

In particular, the ROP was prepared and approved in 2022. The plan is divided into four macro-areas, in line with the strands set out above, developed as follows:

- *Hydrogen production*. Research activities aim to improve the performance of the electrolytic technologies currently available and to support the development of emerging technologies (reforming processes integrated with biomass and solar source, biomass gasification, biological processes, photoelectrochemical splitting of water).
- *Innovative hydrogen* technologies. Research activities shall focus on optimising existing technologies and developing innovative solutions in the following strands: (I) hydrogen injection into the gas network; (II) hydrogen refuelling stations; (III) storage of hydrogen at high pressures; (IV) accumulation in the form of other fuels.
- *Fuel cells*. Research activities shall aim at the development and optimisation of new *stack* materials, components and architectures to reduce their cost and increase their durability, efficiency and reliability.
- *Smart systems*. Activities shall focus on the development of control strategies and management algorithms aimed at improving the interoperability of technologies for the generation, accumulation and use of the hydrogen carrier, as well as its integration into the energy system as a whole.
- Compared to the above-mentioned calls, concluded in June 2022, MASE received 39 proposals (EUR 116 million) for fundamental research for the call for tenders for research organisations and universities and 56 industrial research projects (EUR 126 million).

The investment is increased with additional resources of EUR 140 million from REPowerEU, with the aim of implementing projects already selected under the measure in question but not financed by exhaustion of the financial envelope.

❖ **OTHER MEASURES**

Further policies and instruments implemented by Italy and already implemented in the field of research are set out below.

- *Iper and super depreciation:* measure (MIMIT management) aimed at supporting and incentivising companies investing in new capital goods, tangible and intangible assets (software and IT systems) that serve the technological and digital transformation of production processes;
- *Capital goods (New Sabatini):* measure (MIMIT management) aimed at facilitating access to finance for businesses and increasing the competitiveness of the production system. The measure supports investments to purchase, including leasing, machinery, equipment, plant, capital goods for productive use and hardware, as well as digital software and technologies. The 2020 Budget Law provides for the allocation of a specific financial envelope as part of resources for investments with low environmental impact by SMEs;
- *Tax credit:* measure covered by the National Industry 4.0 Plan and aimed at stimulating private spending in R & D to innovate processes and products and ensure the competitiveness of businesses. The measure grants a tax credit of 50 % on incremental expenditure in R & D, up to a maximum annual of EUR 20 million per year, per beneficiary. The instrument was from 2023 to 2025 with a budget of EUR 55.2 million per year;
- *Energy cluster:* measure (MUR management) approved in 2017 and aimed at setting up public-private research partnerships (approximately 90 public and private entities) to pursue priority technological trajectories at European, national, regional level, to support the achievement of the research planning targets set out in the SET-Plan, PNIEC 2019, the National Research Plan, Smart Specialisation Strategy (S3), Industry 4.0 and Mission Innovation;
- *Auction revenues CO_2 (Legislative Decree No 30/2013):* measure to finance experimental development activities, in particular through first-of-a-kind demonstration projects, for the transfer of results to the production system. In particular, there is a cooperation agreement between research centres and public administrations for the development of the production and use of biofuels in the aviation sector and an ENAC research project for the production of alternative fuel from microcellular algae;
- National Innovation*Fund:* the measure (Cassa Depositi e Prestiti), with a budget under the 2019 Budget Law of approximately EUR 1 million, aims to pool and multiply public and private resources dedicated to the strategic theme of innovation (artificial intelligence, new materials, health, agritech and Foodtech, mobility, fintech, made in Italy, design and sustainable industry). The intervention instrument is venture capital, i.e. direct and indirect investments in qualified minorities in the capital of innovative enterprises with generalist, vertical or fund funds, to support start-ups, scaleups and innovative SMEs;
- *Prototyping approach to facilitate innovative projects on energy networks:* measure (ARERA management) aimed at establishing an enabling regulatory framework for innovative projects. Network operators will be particularly involved, who are called upon to adopt a new system innovation approach involving also business partners for the development of new business models in the downstream stages of the chain and trials of multi-service offers at urban or local level. An example is provided by the pilot projects launched by ARERA to facilitate the participation of distributed resources in the dispatching services market;
- *Support for research and development projects for the conversion of production processes within the circular economy*: measure (MIMIT management), implemented through the Ministerial Decree of 11 June 2020, aimed at facilitating the transition of economic activities towards a circular economy model through the productive conversion of the

industrial fabric. The measure encourages development projects aimed at a more efficient and sustainable use of resources, recognising tax relief;

- Guarantee*Fund: the*measure aims at increasing credit opportunities, supporting companies and professionals who have difficulties in accessing bank credit because they lack sufficient guarantees;
- South Growth*Fund:* measure (Invitalia management) with a duration of 12 years, established by the 2020 Budget Law and aimed at supporting the competitiveness and size growth of southern SMEs. The provisioning of the Fund shall be financed from the resources of the Development and Cohesion Fund;
- *Fund for financing innovative investment programmes and projects:* measure aimed at boosting investment by central state administrations and developing the country through investment programmes and innovative projects in the following areas: circular economy, decarbonisation, energy saving and environmental sustainability. In particular, the 2 020 Budget Law provided for the establishment of a fund of approximately EUR 22.5 million from 2020 to 2034;
- Cohesion*Funds: a number of metropolitan/regional pilot projects aimed at achieving national priorities have been implemented*under these Funds, in line with the objectives of the SET Plan;
- *Support to start-ups and venture capital active in the ecological transition (NRRP M2C2-I.5.4):* measure (Cassa Depositi e Prestiti) aims to boost the growth of the Italian innovative ecosystem through direct and indirect risk capital investments in the ecological transition sector. The investment involves the creation of a Green Transition Fund (GTF) of 3 March 2022, managed by CDP Venture Capital SGR S.p.A., with EUR 250 million. The GTF investment strategy targets renewable, circular economy, mobility, energy efficiency, waste disposal, energy storage and related sectors;
- *Renewables and batteries (NRRP M2C2-5.1):* measure to support industrial programmes suitable for developing, consolidating and strengthening the national value chain, including with a view to preserving security and continuity of supply and supply. Although it is a measure that mainly supports industry, it does not depend on research: research, development and innovation activities are assessed among the award criteria. A dedicated helpdesk, with a budget of EUR 500 million for the Batterie sector, was opened in April 2022 and closed in July 2022; a second session, with a budget of approximately EUR 360 million, was opened in November 2022 and closed in February 2023.

Further measures planned but not yet implemented are set out below:

- *Fund for operations and measures for technological and industrial development:* measure (CSEA management) established by Legislative Decree No 28/2011 (EUR 100 MEUR/year from electricity and gas tariff) to support measures and measures for technological and industrial development in the field of renewable sources and energy efficiency. The fund may be activated, where appropriate, to support demonstration projects;
- Intangible Capital Development*Fund:* measure (MEF management, in agreement with MIMIT and MUR) established by the 2018 Budget Law (EUR 250 MEUR over the three-year period 2018-2020) for the development of intangible capital, competitiveness and productivity, which may also be used for funding technological research under Mission Innovation.

II. Current level of public and, where available, private research and innovation spending on low-carbon-technologies, current number of patents, and current number of researchers

The resources allocated to energy research for demonstration projects carried out by public bodies and publicly controlled enterprises and public contributions for demonstration projects show a trend of steady growth over time as shown in the table below.

Table 84 - Energy R & D expenditure (in thousands of current euro)

	Public sector (A)	Public undertakings (B)	Private companies (C)	Total Companies (D)	Total (A + D)
2007	152.748			359.085	**511.833**
2008	176.412			370.146	**546.558**
2009	241.544			474.385	**715.929**
2010	204.460	226.034	282.112	508.146	**712.606**
2011	234.470	218.800	226.731	445.531	**680.001**
2012	272.142	203.754	244.542	448.296	**720.438**
2013	279.596	199.653	306.306	505.959	**785.555**
2014	263.400	292.762	369.732	662.494	**925.894**
2015	268.959	217.645	1.044.232	1.261.877	**1.530.836**
2016	251.480	174.684	1.082.099	1.256.783	**1.508.263**
2017	275.065	232.009	1.106.889	1.338.898	**1.613.963**

❖ **PATENTS**

Since 2005, patents in low-carbon technologies have seen substantial growth with further momentum after 2015. The share of these patents in total environmental technologies increased during this period by almost 15 percentage points, stabilising at around 45 % over the four-year period 2017-2020. At sectoral level, there is a significant differentiation between the trend of declining share of photovoltaic patents (which peaked by more than 11 % after 2010 almost half), solar thermal (which is reduced to just over 1 %) and to a lesser extent for electric cars (from 4 % to 3 %), and the sustained increase in the share of wind patents (reaching 6 % close to that of photovoltaic), electric storage technologies (accounting for more than a quarter of environmental technologies) and electric vehicle charging systems, which throughout the period quintuple their consistency, reaching almost 5 %.

Moreover, the clear and accelerated expansion of innovative activity in most enabling technologies is reinforced more recently by the increase in hydrogen technology patents, which goes hand in hand with a substantial setback and subsequently shrinking fuel cell patents. It is also important to note that in the growing innovation of hydrogen technologies, the non-fossil hydrogen production component plays a central role, with a share of patents that, after 2017, exceeds half of the total patents for decarbonised hydrogen technologies.

Figure 84 – Share of patents in low-carbon technologies in total environmental patents

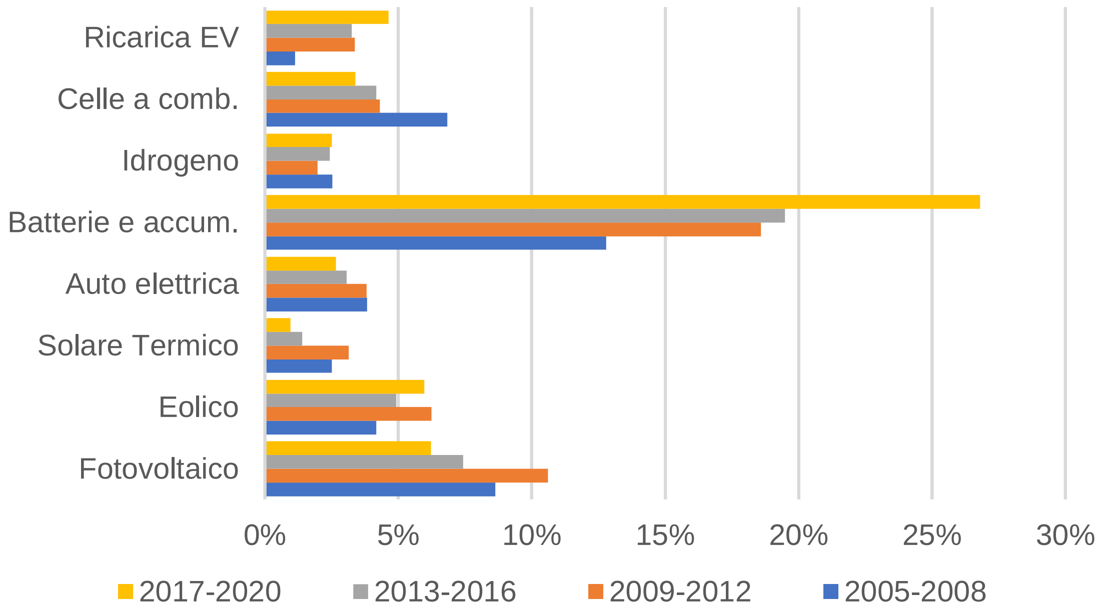
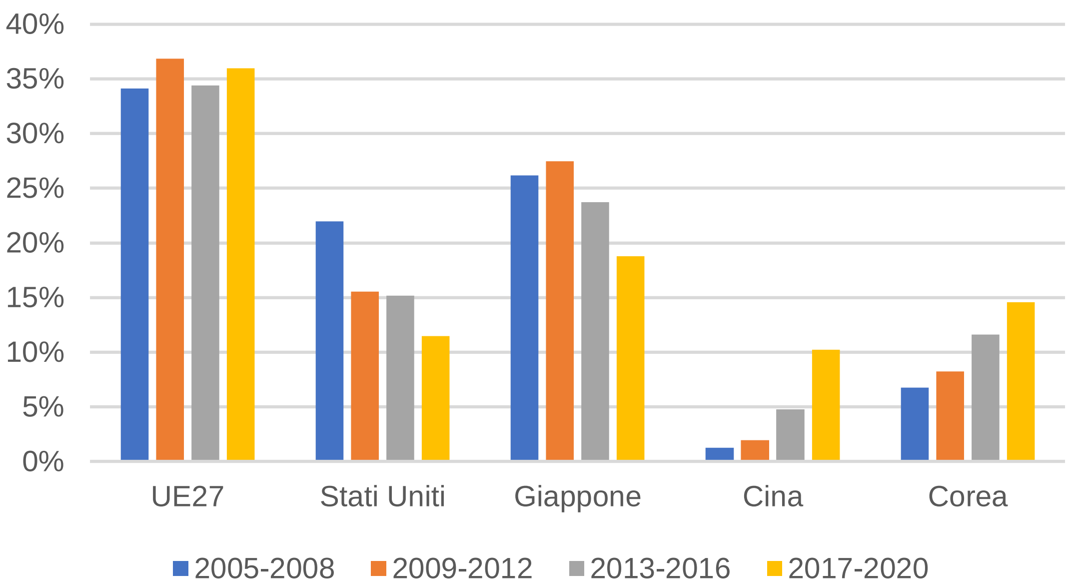


Figure 85 – Share of the largest countries and areas of patents in low-carbon technologies



Source: ENEA processing on OECD data, REGPAT database August 2022

The momentum of innovative activity in low-carbon technologies and the strong push in this activity from the enabling technology sectors is reflected at country level in an increasing "protagonism" of Asian economies, with significant growth in China, particularly significant after 2017. Over the period 2017-2020, China's share of the total low-carbon patents exceeds 10 %, which is more than twice as high as in the previous four-year period. Over the same period, the share of the Asian area as a whole (including Japan, Korea and China) increased by 4 %, reaching around 45 %, despite the significant decline in Japan, which nevertheless continues to hold almost a fifth of patents in all low-carbon technologies. China's position is distinguished by the acquisition of a technological specialisation[149] in electric storage technologies as a whole, in those applied to electric vehicle mobility and charging systems (with specialisation indices of 1,5 and 1 respectively in the last two cases) – sectors where Korea and Japan were already present (the latter leading in all electric mobility) – but equally significant is the further progress made in the photovoltaic sector, with a specialisation index of more than 1,5. On the other hand, the Chinese position in fuel cells and hydrogen technologies is still marginal, unlike Korea and Japan, which show a strong and high specialisation in the former (of 1,6 and 2,5 respectively) and tend to gain ground in the latter, with a significant specialisation in mobility applications (with specialisation index values of 1,3 and 2,3 respectively) and, limited to Japan, there is an increasingly widespread technological advantage within the hydrogen sector, as shown by the increasing specialisation in non-fossil production technologies since the four-year period 2013-2016 (with a specialisation index from 1,2 to 1,8) and even earlier in storage technologies (with a specialisation index of 2009 to 1,9).

On the other hand, the position of the United States, which, in the period 2017-2020, has just a higher share of low-carbon technology patents than China and which also lose its specialisation in hydrogen technologies from 2013-2016.

The EU27 shows as a whole some signs of recovery over the last four years, deepening wind specialisation (specialisation index up to 1,8) and strengthening the specialisation, most recently acquired, in the area of electric mobility, with a slight specialisation in mobility oriented enabling technologies (electrical and hydrogen accumulation, specialisation index of 1.1 in both cases). The figure for hydrogen technologies is, however, combined with specialisation in the sector, which has been appreciable since 2013-2016, and is also significant as regards the production of hydrogen from non-fossil sources and storage technologies.

European progress in low-carbon technologies is also the result of innovative dynamics where polarisation around a small number of countries tends to increase. In the case of wind, the technological specialisation characterising the profile of Germany and Denmark (specialisation index in 2017-2020 of 1,6 and 27 respectively) is strengthened. In the area of e-mobility, Germany's specialisation is strongly consolidated, while in Italy the specialisation is still at its birth (in 2017-2020, the specialisation index just above the unit for electric vehicles, 1.3 in hybrid vehicles).

In the context of electric mobility, Germany and France are increasingly specialised in enabling technologies (electric storage technologies applied to mobility, charging systems for electric vehicles, hydrogen technologies applied to mobility). Net of mobility, specialisation in hydrogen technologies is growing considerably in Germany and France, both in the case of non-fossil production technologies and storage technologies. In the case of photovoltaic, however, the EU27 has a specialisation index of 1, with a slight despecialisation in Germany.

In view of the recent significant increase in specialisation in the EU in the area of e-mobility, Italy's position is relatively lagging behind the largest countries, but it also seems to be the start of a new phase of innovation activity, aimed at overcoming the only anchor so far represented by the specialisation in solar thermal (which has a specialisation index of 1.7 in 2017-2020). With an emerging specialisation in electric cars showing clear signs of improvement, although currently more significant in hybrid vehicles, in the most recent period (2017-2020) there is also a significant reduction in despecialisation in electric storage technologies applied to mobility and electric vehicle charging systems (with a specialisation index from 0,5 to 0.8 in the first case and from 0,6 to 0.8 in the second case). Moreover, the figure appears to be consistent both with the positive trend in trade in electric vehicles in the most recent period and with the still high weight of batteries in imports.

[149] *The specialisation index of a country in a given technology class is the ratio between the country's share of world patents in that class and the share of global patents for the entire patenting activity. A country will therefore be specialised in a given technology class for index values above one.*

On the other hand, Germany and France point to a marked despecialisation in hydrogen technologies, which is particularly strong in the case of mobility technologies. But also in the case of non-fossil hydrogen production technologies, the specialisation index is steadily declining over the years, with the latest data significantly lower than unit.

85 Table – Low-carbon technology specialisation index, geopolitical framework

	2005 2008	2009 2012	2013 2016	2017 2020	2005 2008	2009 2012	2013 2016	2017 2020
	Photovoltaics				**Solar Termico**			
EU27	0,83	0,89	0,94	0,99	1,54	1,52	1,41	1,4
DE	*1,07*	*1,06*	*0,97*	*0,9*	*1,53*	*1,59*	*1,17*	*0,79*
FR	*0,56*	*0,88*	*1,22*	*1,26*	*0,96*	*1,25*	*1,6*	*1,61*
IT	*0,69*	*0,89*	*0,83*	*0,69*	*2,03*	*2,16*	*1,17*	*1,65*
WHO	0,67	0,63	1,12	1,51	0,61	0,52	0,68	0,69
JPN	1,32	1,41	1,16	0,89	0,24	0,42	0,5	0,25
KOR	1,62	2,32	2,96	2,72	0,19	0,36	0,31	0,24
USA	1,08	0,84	0,64	0,6	0,73	0,61	0,59	0,71
	Electrical storage technologies				**Hydrogen technologies for decarbonisation**			
EU27	0,62	0,76	0,74	0,71	0,91	0,94	1,07	1,22
DE	*0,71*	*1,01*	*0,88*	*0,89*	*1*	*0,92*	*1,15*	*1,36*
FR	*0,87*	*0,92*	*1,03*	*0,8*	*1,51*	*1,47*	*1,51*	*1,96*
IT	*0,38*	*0,35*	*0,39*	*0,44*	*0,77*	*0,76*	*0,72*	*0,3*
WHO	1,26	0,64	0,96	1,48	0,14	0,16	0,46	0,25
JPN	2,24	2,32	2,05	1,82	1,38	1,46	1,63	1,92
KOR	2,92	2,93	3,35	3,92	0,76	0,62	0,7	0,76
USA	0,76	0,55	0,6	0,46	1,03	0,9	0,68	0,53

	2005 2008	2009 2012	2013 2016	2017 2020	2005 2008	2009 2012	2013 2016	2017 2020
	Wind				**Electric car**			
EU27	1,57	1,62	1,69	1,77	0,83	0,92	1,13	1,24
DE	*1,34*	*1,37*	*1,45*	*1,63*	*1,07*	*1,14*	*1,23*	*1,65*
FR	*0,39*	*0,42*	*0,44*	*0,34*	*1*	*1*	*1,48*	*1,46*
IT	*0,7*	*0,73*	*0,59*	*0,26*	*0,57*	*0,76*	*1,04*	*1,13*
WHO	0,79	0,63	0,48	0,53	1,02	0,23	1,04	0,64
JPN	0,36	0,54	0,68	0,21	2,68	3,04	2,41	2,29
KOR	0,19	0,24	0,3	0,04	0,14	0,29	0,6	0,7
USA	0,62	0,53	0,5	0,66	0,68	0,35	0,39	0,39
	Fuel cells				**Electric vehicle charging systems**			
EU27	0,67	0,72	0,69	0,85	0,57	0,85	1,03	1,19
DE	*0,82*	*0,72*	*0,73*	*1,05*	*0,64*	*1,08*	*1,27*	*1,63*
FR	*0,67*	*1,1*	*1,1*	*1,22*	*0,89*	*1,19*	*1,08*	*0,86*
IT	*0,52*	*0,42*	*0,25*	*0,34*	*0,34*	*0,32*	*0,55*	*0,8*
WHO	0,36	0,28	0,25	0,24	0,63	0,46	0,84	1,02

JPN	2,18	2,41	2,65	2,52	2,6	2,73	2,01	1,39
KOR	1,93	1,18	1,69	1,62	0,16	0,78	1,35	1,06
USA	0,83	0,7	0,68	0,66	1,08	0,57	0,53	0,54

Source: ENEA processing on OECD data, REGPAT database August 2022

❖ **START-UPS**

Lombardy remains the most fertile ground for setting up new innovative business activities (almost one in four energy start-up is active on the Lombardy soil). Energy start-ups are also more prevalent in the northern regions and Lazio, and it is interesting to note that, as can be seen throughout Italy, these sectors are also on average more active on the patent front than in other sectors. The size of the undertaking remains certainly the main issue: the vast majority of Italian start-ups invoice less than EUR 500,000 – both in the energy sector (over 90 %) and others – and few cases where the workforce employed exceeds ten employees (around 5 %). In this respect, the main difficulty, in addition to organisational constraints, is to find sources of funding.

The most obvious delay for Italy to be discounted at this point in time is the lack of a mature market for Venture Capital. However, given the steady growth that this sector is experiencing, the impact of these companies on the national economy, which can be estimated at an added value of around EUR 3.3 million in total, of which around 15 % comes from the energy sector, is starting to be important. The employment impact remains marginal, which can be assessed in around 60.000 jobs (more than half in northern Italy), of which only 8.000 in the energy sector is expected to grow in the near future, given the prospects and increasing attention to this type of entrepreneurial activity.

III. Breakdown of the current price elements constituting the three main components of the price (energy, grid, taxes/taxes)

❖ **ELECTRICITY**

In 2022, the total expenditure incurred by the Italian system for electricity consumption is estimated at around EUR 131.5 million (an increase of 73 % compared to 2021 for which expenditure amounted to EUR 76 million), broken down as follows:

- 72.7 % for sales services (expenditure on supply of energy on the market[150], marketing and retail expenditure, expenditure on the supply of dispatching services);
- 5.3 % for network services (expenditure on transmission, distribution and measurement services);
- 6.8 % for general system charges for the proper functioning and economic and environmental sustainability of the country system (components of A_{SOS} and A_{RIM});
- 15.2 % for taxes (excise duty, VAT).

It should be noted that for 2022, the general burden expenditure item is null and void as a result of the government provisions introduced to limit the impact on final consumers of the sharp increases in the energy price; however, this item was taken into account by reference to the sum of approximately EUR 9 million which the Government charged to the State budget to compensate for

[150] *The cost of purchasing energy, borne by final customers on the free market, is estimated on the assumption that over-the-counter sales (around 27 % of the total) refer to the stock exchange prices.*

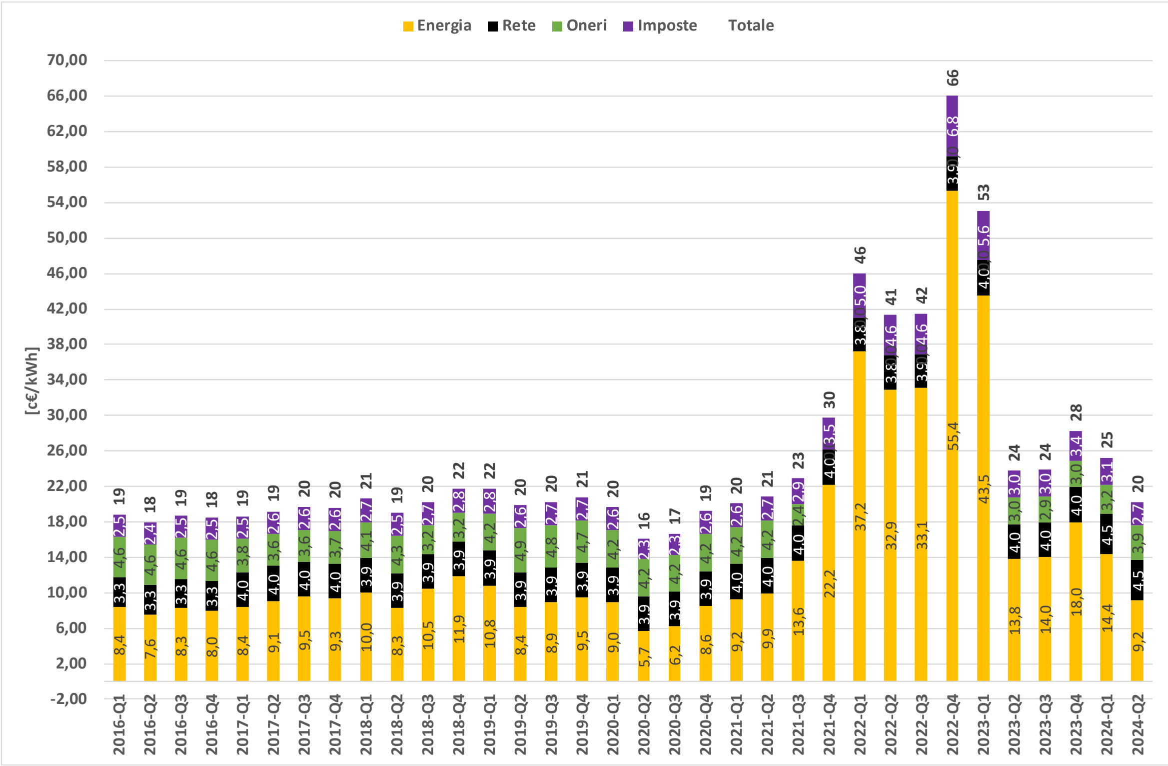
the loss of revenue. On the other hand, the expenditure on network services is 26 % to be allocated to the transmission network and the remaining 74 % to the distribution network.

For 2023, a first pre-outturn figure is around EUR 70,9 mldEUR (58.9 % for sales services, 10.3 % for network services, 14.0 % for general charges, 16.8 % for tax charges), which is close to the figure calculated for the year 2021 but always slightly higher than the amount of expenditure calculated for the pre-COVID-19 period (around 1,3 times the average annual expenditure over the period 2012-2019). Compared to 2022, the contraction in 2023 was due to a partial adjustment of the natural gas market as a result of some measures taken at both European and national level.

By dividing the total cost by the national consumption level (295.9 TWh), an estimate of the unit cost of electricity for the consumer community is obtained. In particular, in 2022 this unit cost (before tax) is estimated at EUR 44,47c/kWh, around 77 % more than in 2021; for the year 2023, however, an estimated value of EUR 23,86c/kWh is estimated, which is closer to the average unit cost in 2021 but slightly higher than in the pre-COVID-19 period (around 1,3 times).

The quarterly historical series of the unit cost of electricity in the protected market for a typical household (resident, power 3 kW, consumption 2 700 kWh) shows a significant gap in absolute values and its tariff components from the last quarter of 2021 until the first quarter of 2023. During this period, as a result of an unprecedented increase in the price of wholesale commodities, the final unit cost has tripled its value. In terms of tariff components, the share of energy reached more than 80 % of the final price, system charges were cancelled due to extraordinary regulatory measures to mitigate increases in bills, while taxes are increased due to higher VAT revenues. Since the second quarter of 2023, the unit cost of household electricity has almost realigned with historical prices up to 2021, with a final price in the range of 20,24-28,29 cEUR/kWh (45,5-63.4 % energy, 14,1-22.4 % grid, 10,5-19.1 % charges, 11,9-13.1 % taxes).

Figure 86 Evolution of the price of electricity for the most protected household consumer and its tariff components (source: ARERA)



❖ NATURAL GAS

In 2022, the Italian system spent a total of around EUR 124.7 billion on natural gas consumption (around 66 bcm) (an increase of 145 % compared to 2021 for which expenditure amounted to EUR 51 million), broken down as follows:

- 75.7 % for sales services151 (expenditure on supply of energy to the market, marketing and retail expenditure);
- 5.2 % for network services (expenditure on transmission, distribution and measurement services);
- 2.6 % for general system charges;
- 16.4 % for taxes (excise duty, VAT).

It should be noted that the expenditure item on general charges does not take into account the effect of the measures taken by the Authority in 2022 (QII-IV) with regard to the introduction of negative values in the component 'UG2' (compensation for marketing costs) applied to users with consumption bands of up to 5.000 Smc/y, in order to limit the impact of increases in energy costs; however, a first calculation of the revenue from the UG2 component would give rise to a negative figure in general costs estimated at around EUR 0.6 million.

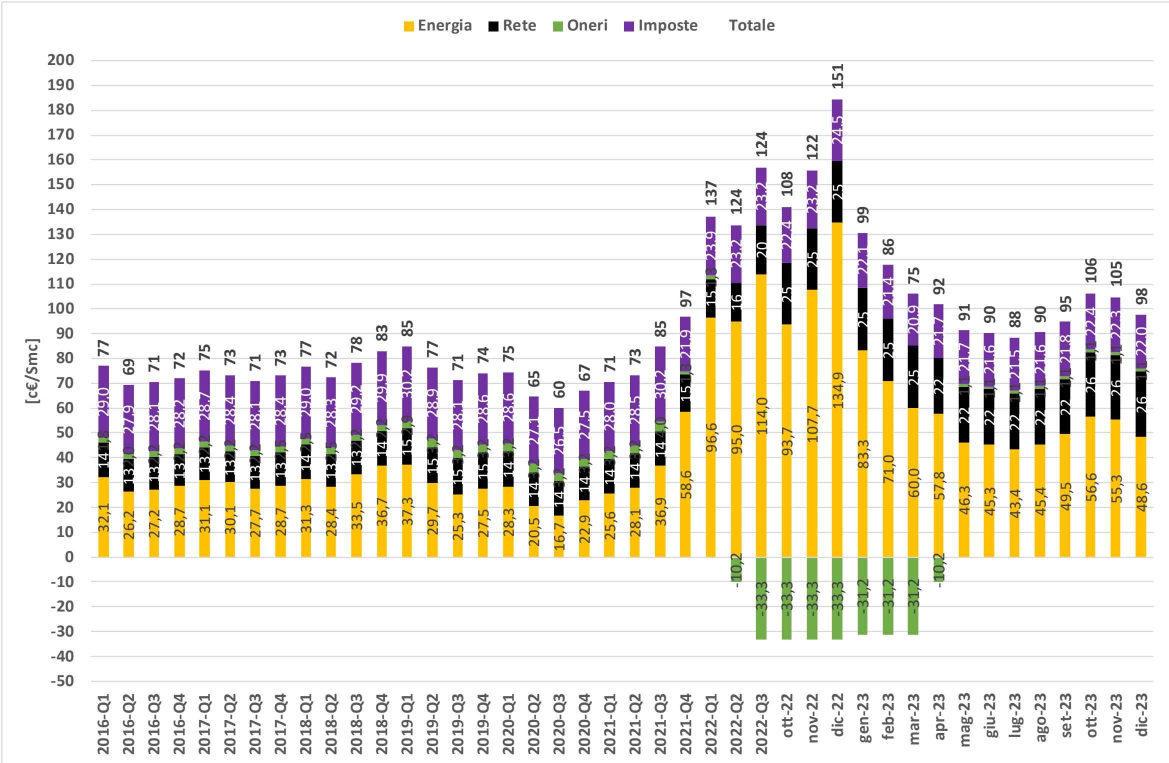
For 2023, a first pre-outturn figure is around EUR 48,7 mldEUR (60.9 % for sales services, 13.7 % for network services, 4.4 % for general charges, 21.0 % for tax charges), slightly lower than in 2021 (-22 %) but still slightly higher than the pre-COVID-19 expenditure (around 1,4 times the average annual expenditure over the period 2014-2019). Compared to 2022, the contraction in 2023 was

[151] *The cost of purchasing gas, borne by final customers, is estimated using the average annual exchange prices (MGP Gas) and the PSV platform (Virtual Exchange Point), as indicated in the Authority's Annual Report 2023.*

due to the effects on the natural gas market of some measures taken both at European and national level. In terms of average unit cost, the national network gas withdrawal amounts to around EUR 189,85/Smc (i.e. EUR 17,74c/kWh) before tax, around 131 % more than in 2021; for 2023, however, an estimated value of EUR 78,15c/Smc (i.e. EUR 7,3/kWh) is estimated to be just below the average unit cost in 2021 but slightly higher than in the pre-COVID-19 period (around 1,6 times).

The quarterly historical series of the unit cost of natural gas in the protected market for a typical household (1400 Smc) also shows a significant increase from the last quarter of 2021 until January 2023. During this period, the final unit cost doubled its value, the share of energy increased by 4 times, weighing more than 80 % of the final price. Through a number of regulatory provisions aimed at mitigating the final costs of bills, system charges have been rendered negative and reduced rates. Another regulatory intervention that proved to be particularly effective in mitigating prices during the winter season was the shift from an indexation of the gas energy component from quarterly forward TTF to monthly to outright PSV, which made it possible to quickly capture the drop in gas prices in the spot market during winter months. In the third quarter of 2021, i.e. the last quarter before this period for several anomalous aspects, the gas price was EUR 85/Smc or around EUR 8c/kWh of which (44 % energy, 16 % grid, 5 % charges, 36 % taxes). Since May 2023, the unit cost of natural gas consumed by households has been somewhat higher than historical prices up to 2021, with average final price valor in the range of 8,26-EUR 9,92c/kWh (49,1-53.3 % energy, 23,6-26.7 % grid, 1,1-1.3 % charges, 21,1-24.3 % taxes).

Figure 87 Evolution of the price of natural gas for a protected household consumer and its tariff components (source: ARERA)



❖ FUELS

Oil fuels account for 94 % of final energy consumption in road transport in 2022, which accounts for 93 % of the final consumption of the total transport sector. In 2022, Italy spent a total of EUR 71 million on the consumption of petroleum fuels for road transport (34,2 Mtoe, including the share of blended biofuels)[152], before excise duty and VAT (an increase of 26 % compared to 2021 for which expenditure amounted to EUR 57 million). Comparing the trend in the historical series of pump prices of different fuels shows that petrol and diesel prices increased from 2021 until the first half of 2022 by 39 % and 47 % respectively. These increases were partly dampened through some extraordinary measures continued in the course of 2022 aimed at temporarily reducing taxes on petroleum products which constitute the predominant share of the final price. LPG with price developments related to other petroleum products increased by 35 % in the course of 2021 and then stabilised in 2022 at a price of around EUR 80c/l. Methane for transport is the fuel that was most affected by the unfavourable conditions and also tripled its historical value at the pump in the summer months of 2022. Electricity to power public charging vehicles, assuming costs for the share of energy indexed to the PUN, has been significantly increased by the cancellation of charges applied in 2022 (particularly relevant for this type of use).

In 2023, the national average price at the petrol pump was EUR 1,87/l (41 % industrial price for energy and network, 2 % charges linked to the obligation to introduce biofuels, 57 % taxes), in line with the price of car diesel amounting to EUR 1,79/l (46 % industrial energy and grid price, 2 % mandatory biofuels, 52 % taxes), while LPG is sold on average at EUR 0,75/l (62 % industrial energy and grid price, 38 % taxes).

[152] The estimate of the system cost of oil fuels to be considered as indicative shall be made by applying to final consumption of petroleum products in road transport the national average prices at the oil pump.

Figure 88 Price evolution at Benzina, Gasolio auto, Metano, Public Charging Electricity (source: MASE calculations)

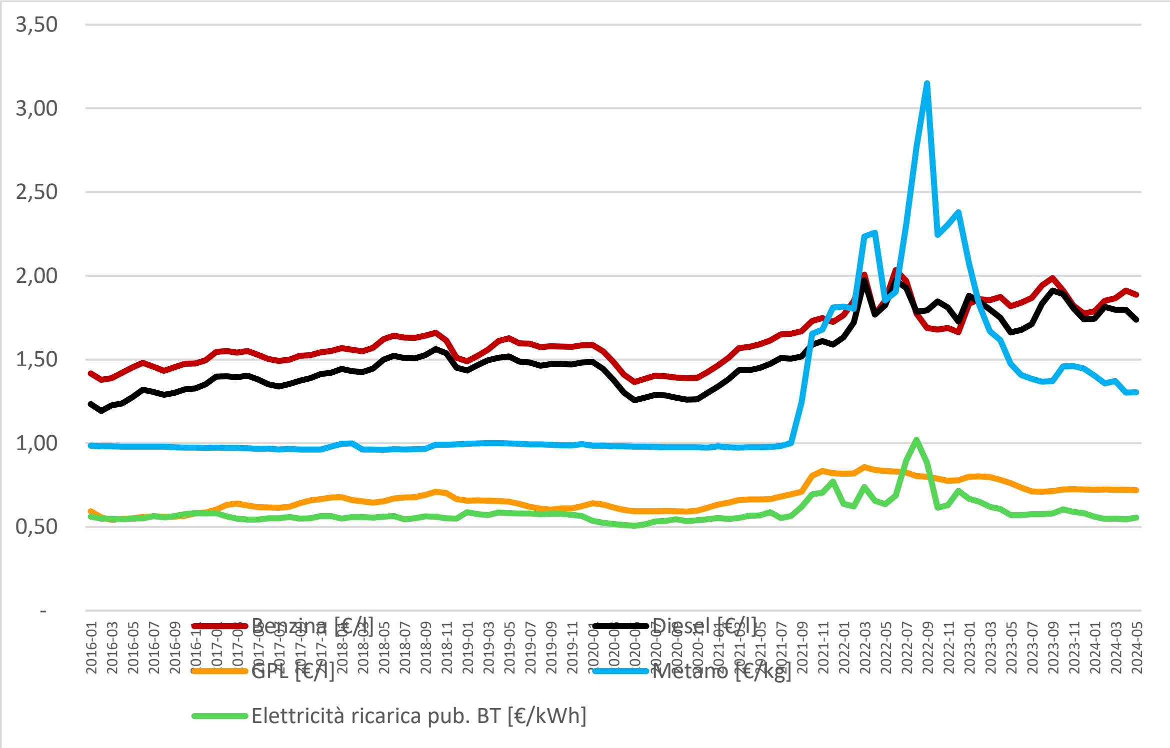


Figure 89 Evolution of the price (EUR/l) to the Benzina pump and its components (source: MASE calculations)

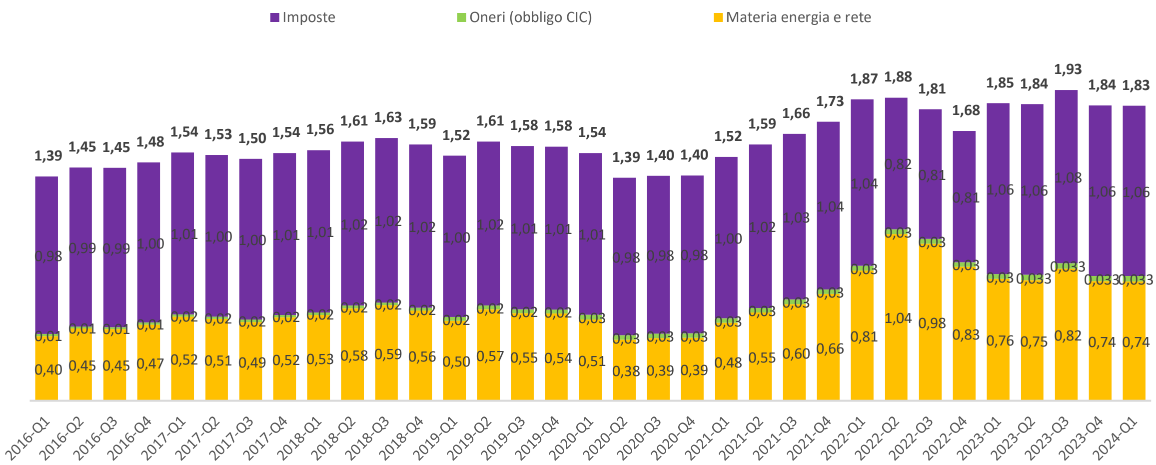
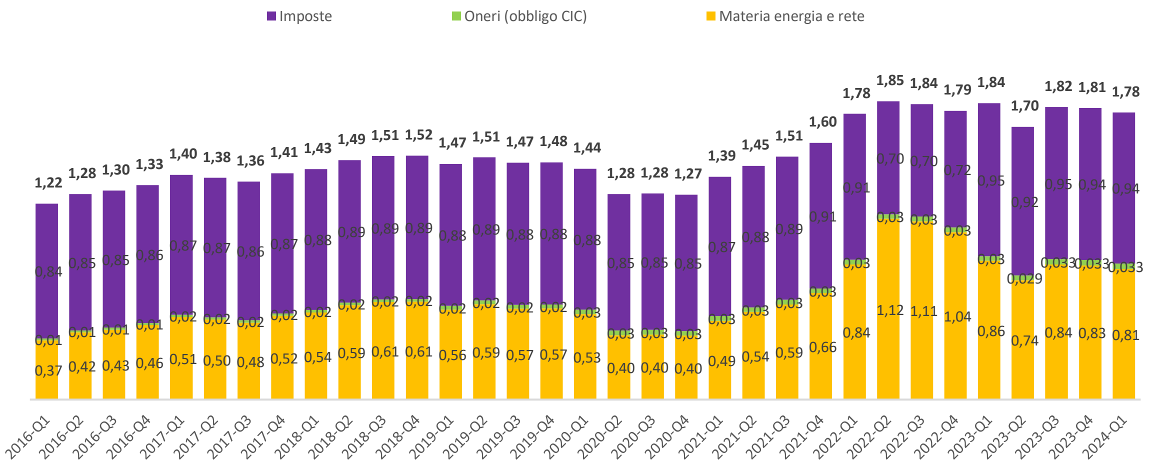


Figure 90 Evolution of the price (EUR/l) at the pump of the automotive gas oil and its components (source: MASE calculations)



IV. Description of energy subsidies, including for fossil fuels

Parliament gave MASE the task of drawing up a 'Catalogue of environmentally harmful and environmentally harmful Sussides' (as provided for in Article 68 of Law No 221 of 28 December 2015, containing measures for the green economy and the efficient use of resources). This is an inventory that allows for an overview of existing subsidies in Italy with a particular focus on their impact on the environment. As provided for in the legislation, the term 'subsidy' was understood by the Parliament in its broader definition, including, inter alia, direct incentives, exemptions, reductions and rebates in taxes, allowances and implicit subsidies.

The Grant Catalogue is a useful tool:

- to identify the policy area for a possible reform of general taxation, in application of the PPP (the 'polluter pays principle') that improves the functioning of the market;
- to identify measures that contribute to environmental tax reform (reducing the tax burden on labour inputs and businesses, while recovering revenues through forms of environmental taxation that affect pollution, natural resources, consumption and production that are harmful to the environment);
- and, above all, to identify areas of reduction of "tax expenditures" in general.

In recent times, the energy transition of European countries has become even more urgent, driven not only by the climate crisis but also by the need to make the EU independent from fossil fuels. Between 2021 and 2022, at national level, a number of measures in the form of State aid were authorised in agreement with the EU to compensate for the increase in gas and electricity prices. These are extraordinary rules whose financial effects have not been included in the estimation of subsidies monitored by the Catalogue, precisely because of their transitional nature.

However, the instability of the energy market has led to an acceleration of decision-making processes across Europe, giving new impetus to several implementing instruments, including energy taxation and the Union's energy independence.

In 2021, the European Commission presented the *Fit for 55* package and in 2022 the *REPowerEU* plan to strengthen the renewable energy targets already enshrined in the Green Deal.

In particular, in addition to the environmental tax measures already approved as part of the *Fit for 55* package (reform of the ETS*)*, a revision of the Energy Taxation Directive (ETD) (Directive 2003/96/EC) was also proposed, which, inter alia, governs the system of exemptions and tax advantages applied by Member States (excise exemptions and facilities are classified as subsidies from the Catalogue). In the Commission's view, the current ETD is no longer in a position to align with the latest EU climate and energy targets, which would seem to favour the use of fossil fuels and the malfunctioning of the internal market. The effectiveness of the existing Directive is further limited by obsolete coverage of energy products, in particular biofuels, and by a number of tax differentiations, reductions and exemptions.

Among the objectives of the proposed revision of the ETD, in addition to the main objective of overcoming the current diversity of the criteria for the taxation of energy products used by the Member States, is to eliminate outdated exemptions and preferential rates compared to standard rates, which in fact encourage the use of fossil fuels.

Furthermore, according to the Commission's third annual report on monitoring Member States' progress towards phasing out energy*subsidies (COM (2022) 642 final)*, which adopts a partially different definition of subsidies from the National Catalogue, inefficient subsidies affecting the objectives of the clean energy transition amounted to EUR 173 billion in the EU in 2020 and reached EUR 184 billion in 2021. According to the Climate Pact adopted by the Glasgow COP implementing the Paris Agreement[153], the Parties should phase out inefficient fossil subsidies, while providing targeted support to the poorest and most vulnerable countries in line with national circumstances and a just transition. According to the Commission report, Italy's energy subsidies exceed 1.6 % of GDP in 2020, of which 0.3 % of GDP for fossil fuel subsidies and around 1 % of GDP for renewable energy subsidies.

At national level, as a result of the reform carried out with the establishment of the Cite (Article 4 of Decree-Law No 1 of 2021 March 22) and the measures provided for in Article 18 of Decree-Law No 4 of 27 January 2022, five SADs, listed in the Energy category of the Environmental Subsidies Catalogue and classified as fossil subsidies, will end from 2022 onwards, which are:

- Reduction of excise duty for fuels used in the transport of persons and goods by rail (EN.SI.06).
- Exemption from excise duty on energy products used for the production of magnesium from seawater (EN.SI.14).
- Reduction of excise duties on energy products for ships handling exclusively within the port of tranship (EN.SI.25).
- Research, development and demonstration funds for hydrocarbons (oil and gas) (EN.SI.27).
- Coal Research, Development and Demonstration Funds (EN.SI.28).

The following tables are listed:

- the 7 grants cancelled or terminated;
- the 3 grants to be reformed at Community or global level;
- the 11 environmentally favourable energy subsidies (Incentivation of electricity produced from renewable energy sources and Incentivation of biogas power plants with an electrical power not exceeding 300 kW have been aggregated with electricity production from renewable sources other than photovoltaic);
- Estimates of the annual financial effects of grants cover the period 2018-2022.

[153] https://unfccc.int/sites/default/files/resource/cma2021_10_add1_adv.pdf.

Table 86 - List of grants/grants eliminated or terminated

N	Name	Reference standard	Financial effect (million EUR)				
			2018	2019	2020	2021	2022
1	Research and demonstration funds for hydrocarbons (oil and gas)	Article 23 (2) (a) of Decree-Law No 83 of 22 June 2012 converted with amendments into Law No 134 of 7 August 2012. Deleted by Article 18 c 3 of Decree-Law No 4 of 27 January 2022	74,5	74,5	74,5	—	—
2	Reduction of excise duty for fuels used in the transport of persons and goods by rail	Table A point 4 TUA (Legislative Decree No 504 of 26 October 1995). Deleted by Article 18 c 1 of Decree-Law No 4 of 27 January 2022	22,9	25,8	22,4	19,0	—
3	Coal Research Development and Demonstration Funds	Article 23 (2) (a) of Decree-Law No 83 of 22 June 2012 converted with amendments into Law No 134 of 7 August 2012. Deleted by Article 18 c 3 of Decree-Law No 4 of 27 January 2022	6,6	6,6	6,6	—	—
4	Reduction of excise duty on energy products for ships handling exclusively within the port of transhipment	Article 1 (367) to (2b) of Law No 208 of 28 December 2015. Deleted by Article 18 c 2 of Decree-Law No 4 of 27 January 2022	1,8	1,8	1,8	1,8	—
5	Exemption from excise duty on energy products used for the production of magnesium from seawater	Table A point 14 TUA (Legislative Decree No 504 of 26 October 1995). Deleted by Article 18 c 1 of Decree-Law No 4 of 27 January 2022	0,5	0,5	0,5	0,5	—
6	Reduction of excise duty on emulsions of gas oil or fuel oil in water used as fuel or fuel	Article 21-bis of Legislative Decree No 504 of 26 October 1995	0,3	0,2	—	—	—

		(Programme for a duration of six years, starting on 1 January 2014 and ending on 31 December 2019)					
7	Decision No 6/92 of the Interministerial Committee on Prices ('CIP6')	Annulled by decision of 31 January 2022, 35/2022/R/EEL, in implementation of the provisions of the 2022 Budget Law (Law No 234 of 30 December 2021) and by later 'Sostegni-ter Decree' (Decree-Law No 4 of 27 January 2022);	577,4	407,2	308,7	82,0	0,0
	Total environmentally harmful energy subsidies eliminated and terminated		684	516,7	414,6	103,3	—

Table 87 - List of environmentally harmful energy subsidies/subsidies to be reformed at European or international level

N	**Name**	**Reference standard**	**Financial effect (million EUR)**				
			2018	**2019**	**2020**	**2021**	**2022**
1	Issuance of free allocation of ETS allowances	Articles 20-23 of Legislative Decree No 30 of 13 March 2013	980,0	1.581,9	1.402,0	2.412,3	3.712,7
2	Exemption from excise duty on energy products used as fuels for air navigation other than private pleasure flying and for educational flights	Table A point 2 TUA (Legislative Decree No 504 of 26 October 1995)	1.912,2	2.014,2	682,3	878,3	1.523,8
3	Exemption from excise duty on energy products used as marine fuels	Table A point 3 TUA (Legislative Decree No 504 of 26 October 1995)	435,7	490,2	513,5	618,7	453,9
	Total environmentally harmful energy subsidies to be reformed at European and international level		3.327,9	4.086,3	2.597,8	3.909,3	5.690,40

Table 88 - List of energy subsidies with favourable environmental impact (SAF)

N	Name	Reference standard	Financial effect (million EUR)				
			2018	2019	2020	2021	2022
1	Energy account: incentive scheme dedicated to solar photovoltaic installations (2005 to 2012)	DD.MM. 28/07/2005 and 06/02/2006 (I Energy account); Ministerial Decree No 19/02/2007 (Second Energy Account); Ministerial Decree No 06/08/2010 (III Energy account); Ministerial Decree No 05/05/2011 (IV Energy Account); Ministerial Decree 05/07/2012 (V Energy account)	5.979,0	5.945,0	6.187,0	5.750,0	5.906,0
2	Incentivising electricity produced from renewable sources other than photovoltaic	Ministerial Decree of 23 June 2016	5.700,0	5.641,0	5.800,2	4.918,0	640,0
3	Deduction of 50 % or 65 % or 110 % for various energy retrofitting of existing buildings in any cadastral category, including rural, owned or held	Article 1 (175) of Law No 160/2019; Article 119 of Legislative Decree No 34 of 19 May 2020 (Rilancio)	1.634,2	1.828,9	2.008,0	2.292,1	4.513,2
4	Deduction for the purchase of furniture and large household appliances of a class not less than A + (uncertain impact)	Article 16 (2) of Decree-Law No 63/2013; Article 7 (c) of Decree-Law No 47 of 28 March 2014; Article 1 (3) (b) (3) of Law No 205/2017	283,7	352,2	419,6	484,0	639,5
5	Exemption from excise duty for electricity produced from renewable installations with an available capacity exceeding 20 kW consumed by self-generation companies in premises and places other than dwellings	December 2015 No. 208; Article 52 (3) (b) TUA (Legislative Decree No 504 of 26 October 1995)	59,6	123,3	54,2	59,6	74,5
6	Tax credit for district heating networks powered by biomass and geothermal energy	Article 8 (10) (f) of Law No 448/1998	29,6	31,3	30,9	24,2	52,6
7	Production, directly or indirectly, of electricity with installations	Annex I to Legislative Decree No 504 of 26 October 1995	0,5	0,5	0,5	0,5	0,5

N	Name	Reference standard	Financial effect (million EUR)				
			2018	2019	2020	2021	2022
	obliged to report under the provisions governing the consumption tax on electricity. Exemption for vegetable oils not chemically modified.						
8	Tax credit for the purchase of vehicles fuelled with methane or LPG or electric traction or for the installation of methane and LPG fuelling systems	Article 1 (2) of Decree-Law No 324/1997; Article 1 (54) of Law No 239/04; Article 5-sexies of Decree-Law No 203/2005; Prime Ministerial Decree No 20/02/2014 (see Article 1, 577 of Law No 147/2013)	0,2	0,1	0,0	0,1	0,02
9	Special scheme for [...] self-generation electricity systems with an ORC cycle	Article 12 of Law No 221 of 28 December 2015	d.q.	d.q.	d.q.	d.q.	d.q.
10	Promotion of energy efficiency and energy production from thermal RES (Cogeneration and CAR)	Legislative Decree No 102/2014; D. M. 5 September 2011; Interministerial Decree of 28 December 2012 and Legislative Decree No 102/2014 and Interministerial Decree of 16 February 2016 (Conto Termico 2.0)	d.q.	d.q.	302,7	364,0	382,0
11	Encouragement of measures to promote technological and industrial development	Article 32 of Legislative Decree No 28/2011	d.q.	d.q.	d.q.	d.q.	d.q.
	Total energy subsidies with favourable environmental impact		13.686,8	13.922,3	14.803,1	13.892,5	12.208,3

to be quantified Source: MASE

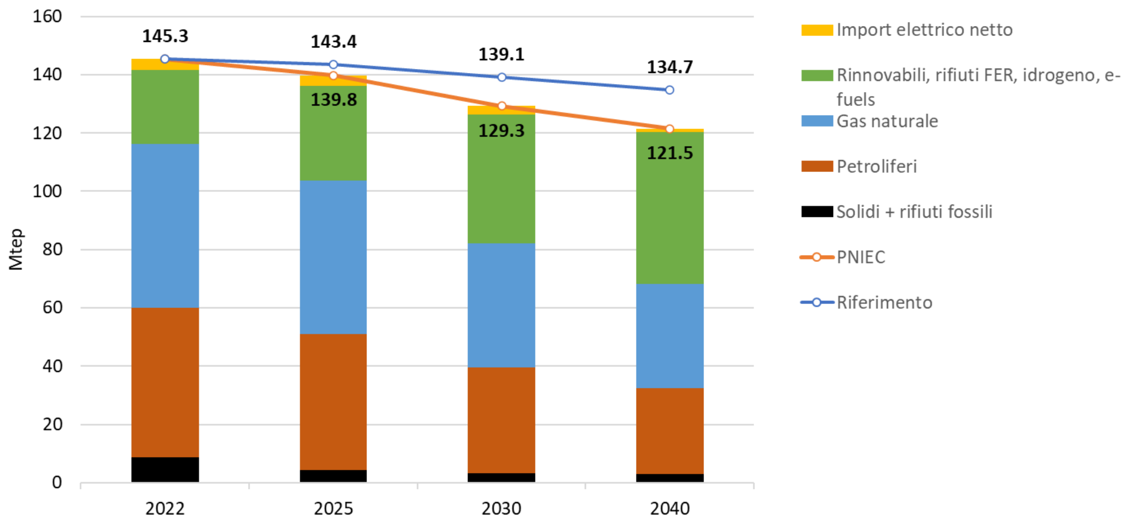
5 IMPACT ASSESSMENT OF PLANNED POLICIES AND MEASURES154

5.1 Impacts of planned policies and measures described in section 3 on energy system and GHG emissions and removals, including comparison to projections with existing policies and measures (as described in section 4).

I. Projections of the development of the energy system and GHG emissions and removals as well as, where relevant of emissions of air pollutants in accordance with Directive (EU) 2016/2284 under the planned policies and measures at least until ten years after the period covered by the plan (including for the last year of the period covered by the plan), including relevant Union policies and measures.

As stated in the previous chapters, the National Energy and Climate Plan promotes the decarbonisation of the national energy system through two main levers: technological change and the resulting efficiency processes and the progressive replacement of fossil sources with renewable sources. The graph and table below, showing the projections up to 2040[155] of the PNIEC scenario compared to the Reference scenario, show the results of this process.

Figure 91 – Evolution of gross inland consumption (including non-energy uses) in reference scenarios and PNIEC [Source: RSE]



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[154] *Planned policies and measures are options under discussion and having a realistic chance of being adopted and implemented after the date of submission of the national plan. The resulting projections under section 5.1.i shall therefore include not only implemented and adopted policies and measures (projections with existing policies and measures), but also planned policies and measures.*

[155] *The emission energy scenario in 2040 only takes into account the deadweight of the measures included to safeguard the 2030 INECP targets that are not bound by the 2050 climate neutrality targets and will be further refined in the course of the Long Term Strategy (LTS) update work.*

Table 89 – Primary and final energy consumption (for each sector), projections 2020-2 040 in the PNIEC scenario (Mtoe) [Source: RSE]

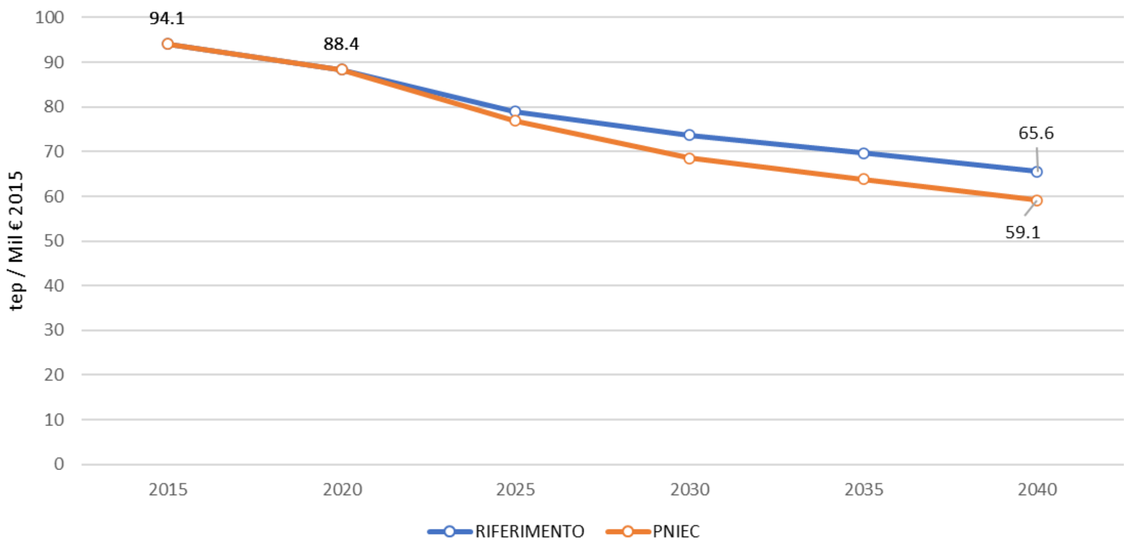
PNIEC scenario	2022	2025	2030	2040
Gross inland consumption[1]	**145.3**	**139.8**	**129.3**	**121.5**
Solids[2]	8.6	4.3	3.2	3.1
Petroleum products	51.5	46.8	36.3	29.3
Natural gas[3]	56.1	52.5	42.6	35.7
Renewable[6]	25.4	32.5	44.3	52.2
Electricity	3.7	3.7	2.9	1.2
Primary energy consumption[4]	**139.6**	**133.6**	**123.3**	**115.4**
Final energy consumption[5]	**111.7**	**109.1**	**101.7**	**99.7**
detail by sector	**111.7**	**109.1**	**101.7**	**99.7**
Industry	25.5	25.8	25.8	25.5
Residential	29.3	29.0	26.6	25.1
Tertiary	14.2	14.0	13.0	12.7
Transport	39.5	37.3	33.1	33.3
Agriculture	3.3	3.1	3.1	3.1
details by source	**111.7**	**109.1**	**101.7**	**99.7**
Solids	1.5	1.6	1.5	1.5
Petroleum products	43.8	38.2	28.4	27.0
Natural gas	31.6	30.4	24.5	21.5
Electricity	24.7	25.5	27.5	28.2
Heat	1.5	1.9	2.1	2.4
Renewables	8.6	11.6	17.7	19.1
Final non-energy consumption	**5.7**	**6.2**	**6.0**	**6.0**

[1] *indicator 'Gross inland consumption (Europe 2020-2030)', which includes international aviation and excludes environmental heat and international shipping.*
[2] *including share of non-renewable waste and steel gases.*
[3] *does not include international bunkering.*
[4] *primary consumption does not include non-energy uses included in Gross Domestic Consumption.*
[5] *indicator "Final energy consumption (Europe 2020-2030)".*
[6] *includes biofuels and biomethane*

It should be pointed out that the fall in gross domestic consumption is due solely to the above-mentioned dynamics of efficiency and decarbonisation of the energy system. GDP developments are expected to increase from 2022 onwards, with rates higher than expected last year for the medium and long term. Higher GDP growth makes the process of decarbonisation of the energy system even more challenging by 2030.

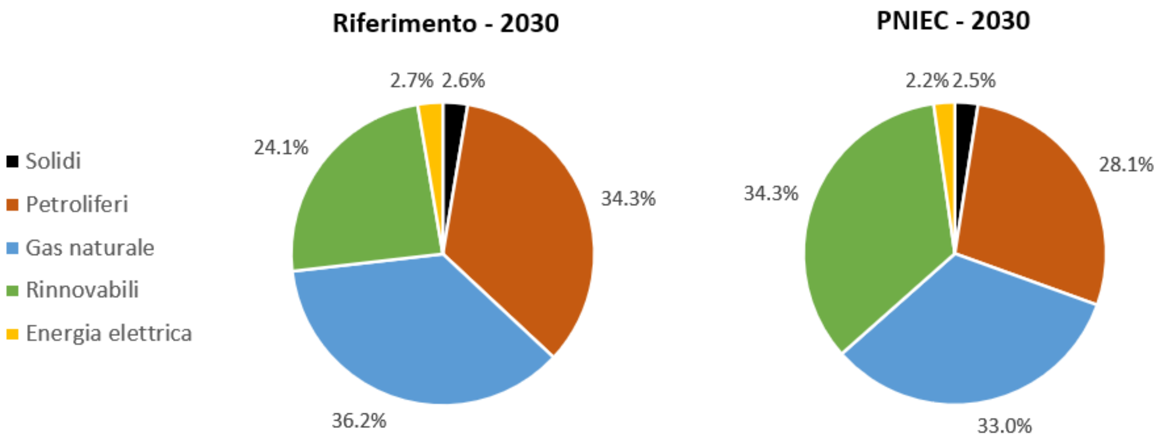
The effect of technological efficiency processes, resulting from policy implementation, is illustrated by the evolution of the energy intensity parameter of economic activities, which is continuing to decline in the short, medium and long term.

Figure 92 – Evolution of energy intensity at 2040



In both the Reference and the INECP scenarios, there are energy efficiency gains that outweigh the relative sectoral consumption. In the INECP scenario, additional policies and measures contribute to higher efficiency rates: indeed, energy intensity is reduced by 1.7 % average per year over the period 2020-2040 (1.3 % in the Reference scenario).

Figure 93 - Mix of primary needs at 2030



** Including biogas for biomethane production*

There is an increasing contribution from renewable sources to the detriment of fossil sources, with a share of the primary energy mix increasing from 17.5 % in 2022 to 34.3 % in 2 030 in the PNIEC scenario, while in the Reference scenario it reaches a share of 24.1 %.

Petroleum products continue to be used in long-distance passenger and freight transport, but their use decreases significantly already considering 2030 (around 28 % of the primary mix, compared to 34 % in the Reference scenario), as oil in transport is heavily replaced by biofuels and electrically powered vehicles, both for passenger and freight transport. In addition, sectoral consumption also decreases thanks to modal shift measures that favour rail freight transport and public transport of passengers.

Both the Reference and the INECP scenarios point to a contraction in the contribution of natural gas to the primary energy mix already in 2030; however, the processes of renewables substitution and efficiency are more demanding in the PNIEC scenario. Therefore, the use of fossil natural gas decreases from 38.6 % in 2022 to 33 % in 2030 (in the 36.2 % reference scenario in 2030).

With regard to energy security, there is a gradual increase in terms of national energy production mainly related to renewable sources. This, together with the decrease in consumption, translates into a sharp reduction in energy dependency (rather than in the reference scenario).

Table 90 – Internal energy resources, projections 2025-2040 – PNIEC scenario (ktoe)

	2025	2030	2040
National production	39.599	52.807	59.983
Solids	—	—	—
Crude oil	3.961	3.530	2.803
Natural gas	2.691	3.037	1.253
Renewable *	32.947	46.241	55.927

** Includes biofuels for transport, biomethane, environmental energy and the share of non-renewable waste.*

Table 91 – Net imports, projections 2025-2040 – PNIEC scenario (ktoe)

	2025	2030	2040
Net imports	104.747	82.635	70.814
Solids	3.239	1.765	1.766
Crude oil and petroleum products	45.057	34.903	28.301
Natural gas	49.888	39.707	34.799
Electricity * *	3.735	2.912	1.152
Renewable *	2.828	3.348	4.796

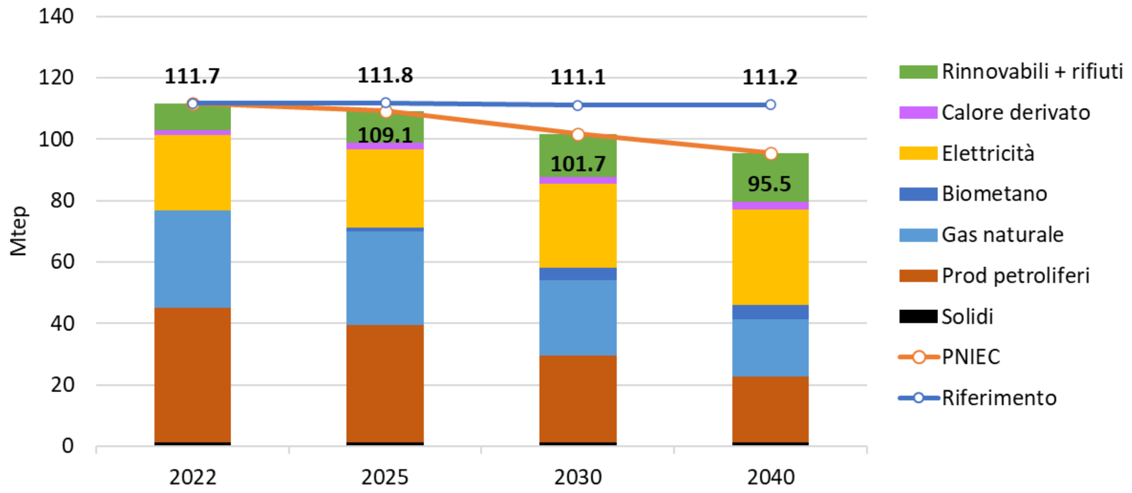
** Includes biofuels for transport.*
** * the considered electricity import values at 2030 and 2 040 are those of the EC EUref2020 scenario*

Table 92 – Energy slope, projections 2025-2040 – PNIEC scenario

	2025	2030	2040
Energy dependence	72.6 %	61.0 %	54.2 %

The measures and policies considered in the INECP scenario make it possible to reduce final energy consumption by around 9 Mtoe by 2030 compared to the Reference scenario, for a total of 102 Mtoe.

Figure 94 – Evolution of final consumption by source at 2040 (Source: RSE]



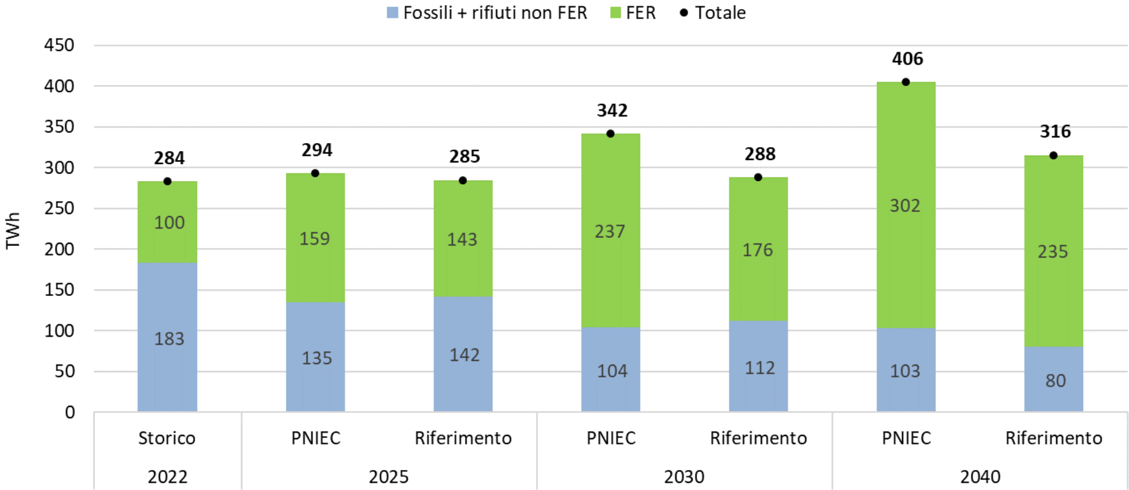
One of the main levers through which the objectives of decarbonising the energy system are to be achieved is electrification of final consumption accompanied by an increasing penetration of renewables in the electricity generation sector.

Therefore, in the PNIEC scenario, there is an increase in electricity generation that allows the electrification of end-use sectors: gross production amounts to 342 TWh in 2030 and 406 TWh in 2040 (representing an increase of 20 % and 43 % respectively compared to the 2022 historical data). At the same time, the contribution of renewable sources in the generation sector is increasing from 35 % in 2022 to 69 % in 2030 and 75 % in 2040; this increase is mainly due to non-programmable renewable sources (photovoltaic and wind), the uptake of which is triggered by ever lower investment costs.

Net electricity import contributes less significantly in the Policy scenario than the reference scenario. In the PNIEC scenario, the import at 2030 is considered to be 34 TWh corresponding to the value of the European Commission's EUref2020 scenario. Instead, in the Reference scenario, the net import value is set at 43 TWh in line with current import levels.

The*overgeneration* of electricity resulting from the increase in non-programmable renewable sources can be managed both through adequate development of electricity infrastructure and through the development of electricity storage systems, as zero overgeneration is neither economically rational nor beneficial.

Figure 95 - Evolution of gross electricity production at 2040 (including electricity for electrolysers and excluding pumped electricity production) (Source: RSE]



With regard to emissions, the historical evolution of national emissions and the expected evolution in the scenario with the additional policies identified so far are shown below.

Table 93 – National GHG emissions and European targets (Mt CO_2eq) – scenario with additional policies [Source: ISPRA]

	1990	2005	2021	2022	2023	2024	2025	2030	2040
Total GHG emissions excluding LULUCF	**522**	**596**	**411**	**413**	**406**	**389**	**368**	**291**	**240**
ETS emissions *	**—**	**248**	**131**	**136**	**133**	**122**	**112**	**84**	**n.a.**
ESR emissions	**—**	**343**	**278**	**274**	**270**	**264**	**253**	**204**	**n.a.**
ESR objectives * *	**—**	**—**	**274**	**269**	**259**	**250**	**241**	**193**	**n.a.**
Difference from ESR targets	**—**	**—**	**+ 5**	**+ 6**	**+ 11**	**+ 14**	**+ 12**	**+ 11**	**n.a.**
LULUCF	**— 4**	**— 34**	**— 25**	**— 21**	**— 23**	**— 26**	**— 28**	**— 28**	**— 31**
Total GHG emissions including LULUCF	**519**	**562**	**386**	**392**	**383**	**363**	**340**	**262**	**209**

** Considering the scope of the Directive before the adoption of Directive (EU) 2023/959. National aviation and navigation emissions are not included.*

** * indicative targets, the objectives will be specified by specific rules to be adopted at European level. The criteria set out in Regulation (EU) 2023/857 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 were used for the estimation.*

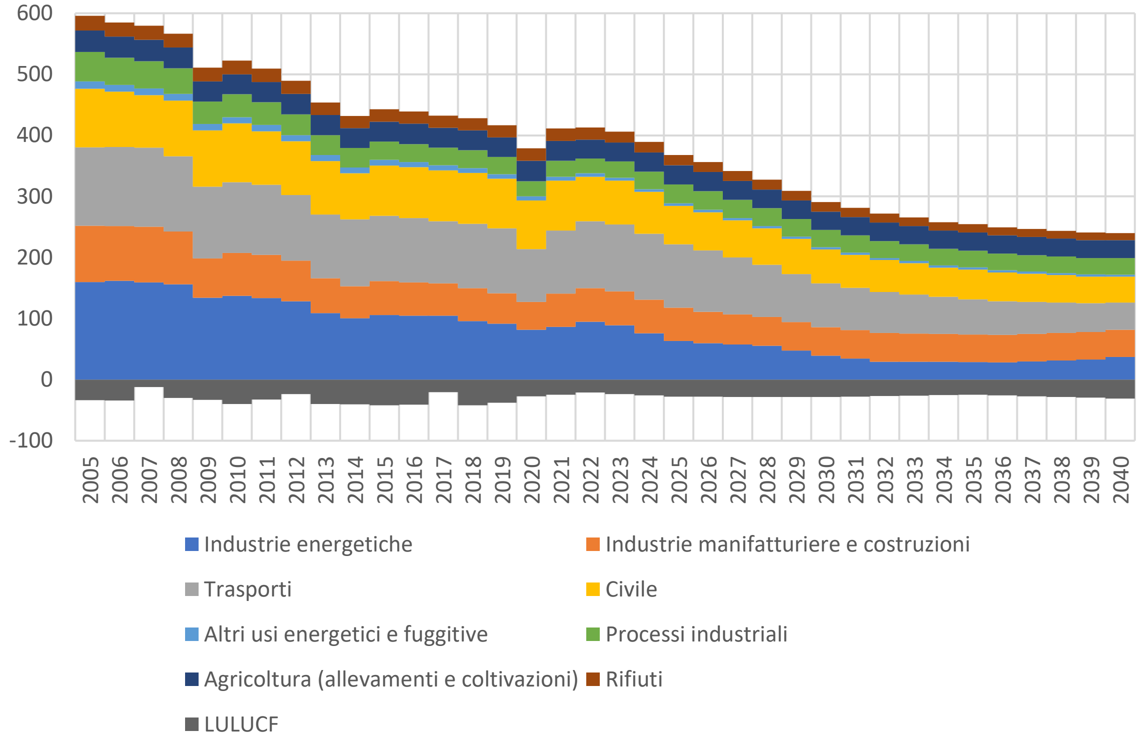
The table below shows the disaggregated emissions at sectoral level under the assumption of maximum emission reductions as a result of the implementation of the additional policies. Additional policies for the LULUCF sector are not available at the time of drafting this document, so for LULUCF the scenario with additional policies is the same as the baseline scenario.

Table 94 - Historical GHG emissions up to 2015 and according to PNIEC scenario broken down by sector ($MtCO_2$eq) [Source: ISPRA]

GHG emissions, Mt CO_2eq.	**2005**	**2015**	**2020**	**2021**	**2022**	**2025**	**2030**	**2040**
By ENERGY USI, of which:	**488**	**360**	**300**	**332**	**338**	**289**	**217**	**172**
Energy industries	160	106	82	86	95	63	39	37
Manufacturing industries and construction	92	56	46	55	55	54	47	45
Transport	128	107	87	103	110	104	72	44
Civil	96	82	79	82	73	63	56	42
Other energy and fugitive uses	12	9	7	6	6	4	4	3
FONTI ALTRE, of which:	**107**	**83**	**79**	**79**	**75**	**79**	**74**	**67**
Industrial processes	48	30	25	26	24	31	28	26
Agriculture (livestock and crops)	35	32	34	33	31	31	30	30
Waste	24	20	20	20	20	17	15	12
Total (excluding LULUCF)	**596**	**443**	**379**	**411**	**413**	**368**	**290.7**	**239**
LULUCF	— 34	— 42	— 27	— 25	— 21	— 28	— 28	— 31

** With regard to navigation, the figure refers to domestic vessels and movements in ports, international vessels are not included*

Figure 96 – Historical GHG emissions up to 2022 and according to the scenario to additional policies broken down by sector (MtCO₂eq) [Source: ISPRA]



In the light of the above table and graph, the sectoral analysis over the period 2021-2030 shows:

- a very significant reduction in emissions in energy industries (-41 %), mainly due to the reduction of emissions from the electricity sector. Emissions in this sector are directly linked to fossil fuel electricity production. The significant growth in electricity production from renewable sources is the determining factor, in addition to the contribution from the phase out of coal production;
- in the transport sector, a 26 % reduction in emissions due to the massive electrification of car transport and, to a lesser extent, the penetration of biofuels, as well as a limited reduction in the growth in demand for private transport;
- in the residential sector, emissions are reduced by 32 % due to the significant renovation rate of buildings, the continued efficiency and progressive electrification of the sector mainly due to the massive penetration of heat pumps;
- a smaller (-14 %) reduction in emissions from industry, taking together energy uses, industrial processes and fluorinated gases; for this sector there have been very large reductions in historical years (-39 % from 2005 to 2021), partly due to the economic crisis and partly due to the structural change in activity and increased efficiency of production processes, the effects of which are also evident in the reduction in emissions from the projection years, despite the assumption of a major recovery in production. The conversion of the Taranto steel production hub is also contributing to this sector, and to a lesser extent the use of CCS and the increase in the use of renewable gases.

II. Assessment of policy interactions (between existing policies and measures and planned policies and measures within a policy dimension and between existing policies and measures and planned policies and measures of different dimensions) at least until the last year of the period covered by the plan, in particular to establish a robust understanding of the impact of energy efficiency/energy savings policies on the sizing of the energy system and to reduce the risk of stranded investment in energy supply

III. Assessment of interactions between existing policies and measures and planned policies and measures, and between those policies and measures and Union climate and energy policy measures

5.2 Macroeconomic and, to the extent feasible, the health, environmental, employment and education, skills and social impacts, including just transition aspects (in terms of costs and benefits as well as cost-effectiveness) of the planned policies and measures described in section 3 at least until the last year of the period covered by the plan, including comparison to projections with existing policies and measures

The PNIEC scenario can be analysed from the point of view of its macroeconomic impacts compared to the current policy scenario. This analysis was carried out using a standard input/output model based on the sectoral interdependencies matrices published by the National Statistical Institute (GSE calculations). These matrices represent an accounting framework that schematises the economic structure of a country over a given period of time, briefly and immediately highlighting the interdependencies between the various sectors that make up the economy. The matrices, properly transformed through specific processes, make it possible to estimate the macroeconomic impacts (value added, employment) due to changes in final demand in a given sector in a given year. The matrices are constructed from the supply and use tables published by the Istituto Nazionale di Statistica (ISTAT) on an annual basis. The latest tables, available at the time of writing, refer to the year 2020 and are broken down into 63 economic sectors.

One of the methodological obstacles presented by this type of analysis is that the 63 economic sectors in the matrices are, in some cases, not fully associated with the measures assessed in the scenarios of this Plan (current and policy policies). This is the case, for example, for plants for the production of energy from renewable sources. In order to overcome the problem, expenditure on implementing the measures (and operating and maintenance costs – O & M – in the case of electricity and heat plants) has been broken down so as to bring them back to the 63 economic sectors covered by the matrices. For example, expenditure on investment in new photovoltaic plants has been broken down and partly attributed to the manufacturing sector of electrical equipment (inverters, cables, etc.), partly to the manufacturing of metal products (support structures) and so forth, allocating to each cost item a variable weight depending on the specific impact on total expenditure. This has been able to simulate the impact on the national economic system of demand for new measures, linked to renewable sources or energy efficiency, included in the scenarios of the Plan.

As regards the appropriateness of using an input-output model constructed from variables populated in a given (recent) year, including for scenario analyses, as well as monitoring analysis, it should be noted that while the value of transactions in the IO table changes from one year to the next, the structure of interrelations between sectors of the economy tends to be relatively stable over time. For example, while the output of a given good may vary substantially from year to year, it is reasonable to expect that the need for raw materials per unit of output produced will evolve fairly slowly.

Another element of attention concerns the share of imports of products needed to carry out the measures assessed in the scenarios of the Plan, which in some cases has a significant weight. The matrices already include values and coefficients within them which take into account the share of imports in the various sectors, however, it cannot be excluded that, in particular sectors of economic activity (for example, those which, combined, rebuild the photovoltaic sector), this share, although already taken into account, may be underestimated. Data collected by ISTAT as part of the PRODCOM survey[156] on international trade were used to address this problem.

The results obtained with the application of the input/output model relate to the economic impact, in terms of added value and employment, temporary and permanent, direct and indirect. The permanent spillovers relate to employment related to the use and maintenance of goods throughout their life cycle, while the temporary effects concern employment limited to the design, development, installation and realisation phase of the asset. The employment effects are distinguished directly, relating to employment directly attributable to the sector under analysis, and indirect, relating to the sectors providing the activity analysed both downstream and upstream. The estimated employment is not to be understood in terms of employees physically employed in the various sectors, but of AWU (Labour Unit), which indicate the amount of work performed by a full-time employee in the year. Consequently, it is important to bear in mind that the apparent variations that may occur between years do not necessarily correspond to an increase or decrease in "jobs", but to a greater or lesser amount of work required to carry out the investments or to carry out the specific operation and maintenance activities of a given year.

The input/output model assessed the gross economic and employment impacts (i.e. without considering any negative effects in sectors that could be considered as competitors) of investments in the interventions envisaged in the PNIEC scenario. These spillovers were subtracted from those obtained for investment in the same interventions, but according to the current policy scenario; this makes it possible to appreciate the impacts of the increased investments activated in the INECP scenario, amounting to around EUR 25 mldEUR per year over the period 2024-2030.

In summary:

- the average annual additional contribution over the period 2024-2030 to the creation of added value is estimated at over EUR 12 billion compared to what would be the case in the current policy scenario;
- annual average temporary employment (direct and indirect AWU) is estimated to be around 168, additional to those calculated for the current policy scenario in 2024-2030.

Table 95 - Summary of the main results obtained from the application of the input model – output [Source: RSE, GSE]

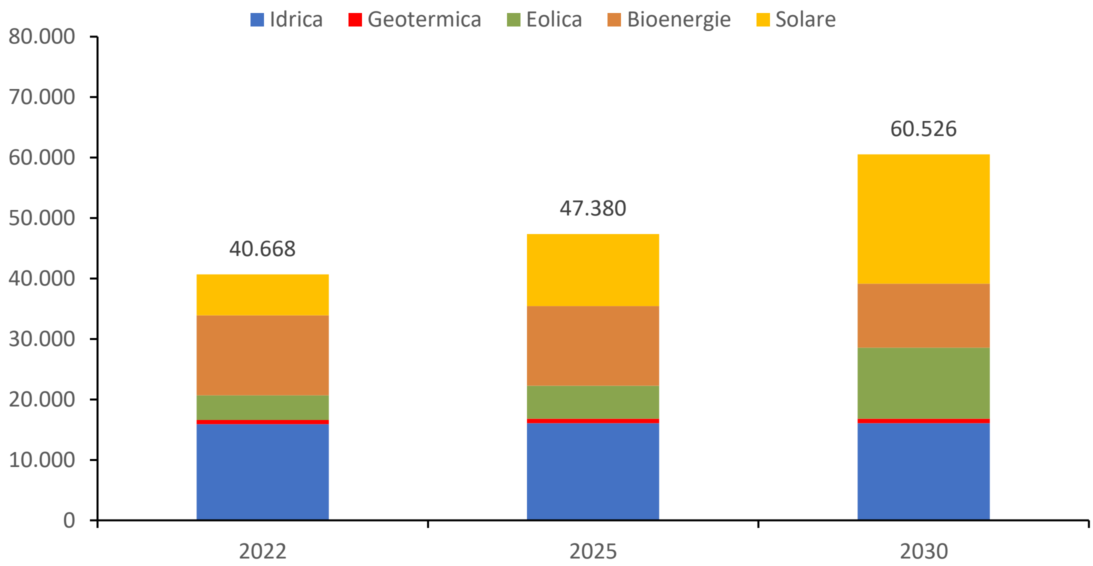
SECTOR		Δ annual investments mldEUR (2024-2030)	ΔVA average annual mldEUR (2024-2030)	Δ temporary average annual AWU (2024-2030)
Residential	Refurbishment of buildings	1,1	0,8	14.000
	Heat pumps (heating and cooling)	4,1	2,3	32.000
	Heating and domestic hot water	— 0,2	— 0,1	— 1.000
District heating	Distribution	0,0	0,0	0
Tertiary	Refurbishment of buildings	3,1	2,1	39.000
	Heat pumps (heating and cooling)	0,3	0,2	2.000
	Electrical and Lumination Equipment	0,1	0,1	1.000
Industry	Energy efficiency	0,3	0,2	4.000

[156] *The PRODCOM survey provides information on around 4000 industrial products (sales, imports and exports), providing a comprehensive picture of industrial production using harmonised statistical methods at Community level. Through the PRODCOM survey, it is possible to acquire data on the market for certain components of the expenditure carriers (e.g.: photovoltaic cells), which are not available on supply and use tables because they are not sufficiently disaggregated.*

	Steel (DRI) and CCS (capture and compression only)	0,3	0,2	2.000
Transport	Cars, motorcycles, vans, buses, trucks	8,6	2,7	26.000
Electrical sector	Bioenergy	0,2	0,1	2.000
	Geothermal energy	0,1	0,0	1.000
	Photovoltaics	2,8	1,2	17.000
	Shore wind	1,2	0,7	9.000
	Offshore wind	0,8	0,5	7.000
	Fossils	0,0	0,0	0
Power system	National transmission network development	0,3	0,2	2.000
	Upgrading and deployment of distribution networks	0,8	0,5	5.000
Storage systems	Pumping and electrochemical storage systems	0,6	0,4	4.000
	Electrolysers	0,3	0,2	2.000
Total		**24,9**	**12,3**	**168.000**

The following histogram shows the evolution by source of permanent employment (direct and indirect AWU) resulting from the installation of new FER-E installations between 2022 and 2030 under the PNIEC scenario. Estimates show that, in terms of AWU, employment grew from over 40 in 2022 to over 60 in 2030, with a positive balance of around 20 AWU (+ around 56 %).

Figure 97 – Evolution by source of permanent employment as a result of the evolution of the FER-E plant fleet according to the PNIEC scenario [Source: GSE]]



Taking into account the evolution of the fossil fuel plant fleet, the overall employment balance of the electricity production sector, in terms of AWU, is positive and around 17 units. In the fossil sector, there is a decrease in employment between 2030 and 2021 of around 2.500 AWU, in particular due to the phase out of coal.

Table 96 - Permanent occupation by source in 2022 and 2030 following the evolution of the electricity generation plant fleet according to the PNIEC scenario [Source: GSE]

Technology	Permanent AWU 2021	Permanent AWU 2030	Δ permanent AWU 2030-2021
FER	**40.668**	**60.526**	**19.858**
Hydropower	15.925	16.044	120
Wind (onshore and off shore)	4.088	11.707	7.619
Solar	6.764	21.388	14.624
Geothermal	645	789	144
Bioenergy	13.246	10.597	— 2.649
Fossils	**15.072**	**12.549**	**— 2.523**
Coal	1.924	—	— 1.924
Christmas gas	11.940	11.792	— 148
Petroliferi products	1.208	757	— 451
Total	**55.740**	**73.075**	**17.335**

❖ **SOCIAL IMPACTS AND FAIR TRANSITION ASPECTS**

The Just Transition Fund is a financial instrument under cohesion policy, which aims to provide support to territories facing serious socio-economic challenges resulting from the transition to climate neutrality.

The Fund aims to ensure that the ambitious climate targets under the*European Green Deal*, aimed at making the EU climate-neutral by 2050, are met in a fair manner and leave no one behind.

The JTF supports regions and territories through grants in sectors that are considered to be more sensitive and exposed to the consequences of the transition towards climate neutrality, also due to their connection and dependence on fossil fuels, including coal, peat and oil shale, and greenhouse gas intensive industrial processes.

Access to the Fund is ensured through the definition by the Member States of the so-called territorial just transition plans (as provided for in Article 11 of Regulation (EU) 2021/1056), which must include all the types of intervention needed to address the transition challenges in the short and long term in a given territory, with a time horizon of 2030, with a particular focus on measures for the economic diversification and modernisation of the territories concerned, as well as measures for the retraining and active inclusion of workers and jobseekers.

The main investment sectors are those that have the greatest impact on the transformation of territories and their competitiveness and social, economic and environmental sustainability in the medium to long term. These will include: clean energy technologies, emission reduction, industrial site recovery, reskilling of workers.

In Annex D to the Country Report[157] published in the context of the 2020 European Semester, the European Commission identified the territories most severely affected by the transition to a climate-neutral economy in each Member State.

For Italy, the areas of the Province of Taranto and Sulcis Iglesiente have been indicated. The JTF investments for Italy are therefore concentrated in these two areas of the country through the implementation of a national JTF programme, the managing authority of which is the Agency for Territorial Cohesion.

For each area, the relevant territorial plans, as provided for in Article 11 of Regulation (EU) 2021/1056, are drawn up in accordance with the INECP and the Ecological Transition Plan (PTE) drawn up by the MASE. In order to define the territorial plans, the European Commission launched in 2021 a process of close discussions with stakeholders, led by the Cohesion Policy Department and the Agency for Territorial Cohesion, aimed at identifying the intervention logic and highlighting any coherent projects already present in the regions. Negotiations with the European Commission took place in 2022 and, after a first proposal was sent on 20 June, concluded by Decision C (2022) 9764 of 16 December 2022 approving the National Programme and the two Territorial Plans[158].

The Territorial Plans, designed with strong coherence and synergy with the regional programmes financed by the ERDF and ESF + Funds and other territorial programmes (e.g. Sulcis Plan, CIS Taranto), contains a description of the transition process at national level, an assessment of the challenges to be addressed and their social, economic and environmental impacts and a description of the types of intervention to be financed.

Specifically, the identified challenges focus on three main areas:

- Energy and the environment, for which the plan provides for a significant increase in RES production in the identified areas, to mitigate the effects of the transition, to combat energy poverty, to contribute to the economic diversification of the areas and to create

[157] *https://www.agenziacoesione.gov.it/wp-content/uploads/2022/06/Allegato-D-2020-1.pdf*
[158] *https://www.agenziacoesione.gov.it/wp-content/uploads/2022/12/sfc2021-PRG-2021IT16JTPR001-1.1.pdf*

new jobs. In addition, preparatory action to recover widely existing environmental damage situations with targeted land remediation measures will be supported.
- Economic diversification, which means that, in the areas identified, which will be affected by a contraction in industrial activities, a shift towards a sustainable economy with significant development opportunities linked to the growth of activities linked to the green economy, agriculture, sustainable tourism and the sustainable economy of the sea. Increased demand for RES will create market space for euro area SMEs.
- Social and employment effects, for which the development of new economic sectors and activities will lead to an increase in demand for staff with green skills. The JTF PN will seize this potential demand for employment to develop job opportunities for those who lost it and those who are at risk of losing it as a result of the transition. These training and retraining actions, in order to meet the objective set out above, will be based on the outcomes of a profiling of the skills and characteristics of the entities described, which will form the basis for formulating educational and learning pathways.

At European level, the JTF provides EUR 17.5 million. With national co-financing, an amount of EUR 1.211 million is allocated to Italy: the programme allocates EUR 367.2 million to Sulcis Iglesiente and EUR 795.6 million in Taranto, while EUR 48.4 million was reserved for technical assistance as provided for in Regulation (EC) No 2021/1060. Resources allocated to territories shall be shared among challenges, with 30 % dedicated to energy and the environment, 38 % for economic diversification, and 32 % for measures to mitigate the social and employment effects of the transition.

❖ **PHASE OUT OF COAL**

Currently, there are six coal-fired thermal power plants operating in Italy, which are generally located in a prominent industrial area:

- Power plant in Fiumesanto (SS): 2 units with a total power of 534 MW[159].
- Torrevaldaliga North (RM) plant: 3 units with a total power of 1 865 MW.
- Brindisi South Central: 3 units with a total power of 1 815 MW.
- Sulcis Centre (CA): 2 units with a total power of 432 MW.

The phase out of coal will be accompanied, with a view to ensuring a fair energy transition, by measures to protect workers for the development and upgrading of employment, the fight against poverty and inequalities, and the preservation of their territories.

To effectively respond to these challenges, action is being taken on several fronts:

- legislation, by means of laws protecting the workers affected by the phase out of coal;
- institutional, strengthening dialogue between national and local institutions and between institutions and workers' representations;
- company, through the involvement of employers and workers in retraining projects also supported by public policies.

From a regulatory point of view, Decree-Law No 101 of 3 September 2019 established that the share in excess of EUR 1.000 million of the revenues from the auctions for the allocation of EU-ETS allowances, up to a maximum of EUR 20 million per year, from 2020 to 2024 is addressed to the 'Fund for the conversion of employment in the territories in which coal-fired power stations are located' to be set up at the Ministry of Economic Development (now the Ministry of Enterprise and Made in Italy).

[159] *Is the maximum applicable power as reported in the Gaudi system*

The enabling actions for the full decommissioning of coal-fired power plants are set out in Section 3.1.3.

Finally, an interesting project integrating private and public policies and dialogue between employers and social partners has been put in place by Enel S.p.A. (former national sole operator of electricity generation, processing, transmission and distribution activities). This is the 'Futur – E' project, which involves the decommissioning of 23 old thermoelectric plants that are no longer economically profitable and environmentally sustainable with a capacity of 13 GW, including some coal-fired plants. The project includes:

- retraining and relocation of surplus workers through agreements and negotiations, based on a comparison between the undertaking, workers and their representatives and on the integration between company and public policies;
- the reconversion and regeneration of brownfield sites with a focus on the preservation of ancillary services.

❖ **<u>THE EUROPEAN SOCIAL CLIMATE FUND</u>**

As part of the Fit for 55 legislative package implementing the reforms needed to achieve the objectives set by the European *Green Deal*, it was planned to allocate part of the revenues generated by the new ETS for the buildings and road transport sectors to stimulate innovation, economic growth and investment in clean technologies and to compensate for the potential effect of increasing energy costs on final consumers, with particular reference to the most vulnerable social classes and micro-enterprises.

To this end, Regulation (EU) 2023/955 of 10 May 2023 established a new financial mechanism, the so-called 'Social Climate Fund' (SCF),for the period 2025-2032, the objective of which is to allocate specific funding to Member States to address the socio-economic impacts resulting from the extension of the ETS to these two sectors, so that their decarbonisation can be supported.

More specifically, the main purpose of the Fund is to support households, micro-enterprises and transport users of the most vulnerable groups by providing – albeit temporarily – direct income support to reduce energy poverty, while financing national measures and investments aimed at reducing dependence on fossil fuels in the medium and long term through increased energy efficiency of buildings, decarbonisation of heating and cooling of buildings, including the integration of energy from renewable sources, and the granting of better access to zero- and low-emission mobility and transport.

Italy intends to use the Fund proposed by the Commission. More details on the policies intended to be implemented using the economic resources made available through the Fund will be provided in the Italian Social Climate Plan necessary for access to the Fund's aid, which is expected to be officially presented, as in the European Regulation, by the end of June 2025.

❖ **<u>POSSIBLE IMPACTS ON EMPLOYMENT, EDUCATION AND SKILLS AT SOCIAL LEVEL INCLUDING ASPECTS OF FAIR TRANSITION</u>**

The National Institute for Public Policy Analysis (INAPP), under the terms of reference of the Ministry of Labour and Social Policy, has set up an information system on professions, employment and professional needs, which has linked the economic and productive system and the vocational education and training system. This information system is designed to ensure a dual level of time reading of the data: short-term recruitment forecasts and contingent professional needs; medium-term employment forecasts and anticipation of employment needs to five years. In this framework, INAPP analysed future needs [160]in the electricity, gas, water and steam supply sector (ATECO 35), in the light of today's institutional and regulatory guidelines, with particular reference to the INECP. The purpose of the analysis is[161]to:

- identify the most involved and most transformed professionals between now and 5 years;
- identify new skills and innovative skills;
- update and implement the INAPP Professions database;
- provide suggestions on curriculum elements that should be innovated/included in order to adapt the professional unit to change.

In order to carry out this analysis, the following steps were necessary:

- sector statistical definition and mapping of products/services and production processes that characterise the current scenario and analysis of key economic and employment dynamics;
- identification of trends and drivers that will mark the near future and their combination with the key drivers of change;
- identification, in relation to these changes, of changes in professional roles and tasks;
- reconnaissance, in relation to changes in role and tasks, of emerging professional skills;
- analysis of the impact and implications of these changes for professionals working in the sector;
- drawing and representation of the change in professional characteristics.

The sector under study is contained within Section D 'Supply of electricity, gas, steam and air conditioning' of the ATECO 2007 classification and is fully covered by Division 35, which includes all activities ranging from generation to supply, transmission and marketing of electricity, natural gas, steam and air conditioning (hot or cold). Analysis of ISTAT data shows that it is an *intensive capital* sector, where a turnover of around EUR 160 million is made with a workforce of around 83. Companies with more than 250 employees account for 64 % of the workforce, compared to 23 % in Italy as a whole.

The drivers of change that could have a significant impact in terms of demand for skills and professionals have been identified:

- climate change and extreme weather phenomena;
- energy transition: decarbonisation, renewable sources and energy efficiency;
- switch from a multive-fed supply system to a predominantly electricity-driven monear supply system;
- continuous research and new digital technologies;
- liberalisation and increasing competition not only on energy produced but also on a number of services of a secondary nature and quality, understood as traceability, eco-sustainability and CSR;
- growing importance of marketing and development of online sales activities;
- redistribution of energy production and growing importance of the territory as a place of comparison with local authorities and populations;
- population growth worldwide and consequent growth in consumption.

On the basis of the factors listed above, it has been assumed which may be the most significant changes in the occupations typical of the sector and the skills that may be associated with them, namely:

[160] *This is a study to anticipate professional needs carried out using scenario methodologies in the context of the National Operational Plan on Active Employment Policy Systems (NOP SPAO) ESF Programming 2013-2020*
[161] *The Panel of Experts was invited to attend: MiSE, GSE, trade unions, businesses and industry associations.*

- be able to develop approaches geared towards self-diagnosis, self-correction and continuous improvement;
- be able to take decisions in relation to the tasks under supervision and in support of their professional autonomy;
- be able to promote and participate effectively in activities based on the interaction between different nodes in the chain of responsibilities and vertical and horizontal collaboration;
- be able to manage the processes of changing company organisational structures with a view to increasing the value of human capital;
- be able to transpose customer needs for the development of products and services;
- be able to safeguard the distribution strategy for the purchase and sale of goods and services;
- be able to effectively communicate relevant information on processes, products, services and solutions;
- be able to identify and monitor the logistical processes, both internal and external to the company, which enable the product/service to be distributed from the place of production to the final customer;
- be able to interact positively within intercultural and multidisciplinary contexts;
- be able to take decisions in relation to its context of reference through the acquisition of relevant information sets in good time;
- be able to promote risk analysis within business processes;
- be able to constantly transfer innovative know-how within production, organisation and research processes;
- be able to interpret and apply general and specific regulations in relation to the relevant local, national (and international) business/organisation system;
- be able to select the most appropriate technologies in the management and development of business production processes;
- be able to use information systems and web-based communication tools in the day-to-day management of business processes.

The skills listed above were cross-checked with the professional units (SPUs) considered most involved in the energy transition scenario. Please find below the list of selected professional units.

Table97: List of selected professional units.

Nomenclature and classification of selected professional units (ISTAT)	Description of the selected professional units
1.2.1.2.0	Entrepreneurs and directors of large companies active in mineral extraction, manufacturing, production and distribution of electricity, gas and water and waste management
1.3.1.2.0	Entrepreneurs and managers of small companies involved in mining, manufacturing, production and distribution of electricity, gas and water and waste management activities (producers and distributors)
2.2.1.1.1	Mechanical engineers
2.2.1.1.4	Energy and nuclear engineers
2.2.1.3.0	Electrotechnical engineers and industrial automation
2.2.1.4.1	Electronics engineers
2.2.1.6.1	Environmental engineer
2.5.1.5.1	Specialists in acquiring goods and services
2.5.1.5.2	Specialists in the marketing of goods and services (excluding ICT)
3.1.3.3.0	Electrical engineering technicians
3.1.3.6.0	Energy saving and renewable energy technicians
3.1.4.2.1	Thermal and electricity production technicians
3.1.4.2.3	Technicians for the operation of electricity distribution networks
3.1.8.3.1	Environmental control technicians
6.2.4.1.1	Installers and repairers of industrial electrical installations
6.2.4.1.4	Installers and repairers of electrical energy production and storage equipment

In addition, the study shows that the energy transition will lead to an increasing involvement of professionals in statisticians, mathematics and meteorologists. These are so-called data scientists that contribute to the creation of new jobs within the energy sector, where industry 4.0 enabling technologies (Internet of Things, Artificial Intelligence, Big Data, Robotics, etc.) find forms of development and applications that are more binding than in other sectors. This requires the presence of professionals able to analyse a large amount of relevant data needed for production activities and processes.

In the table below, it has been determined what importance it may have in the future of a certain competence within the specific professional units selected, in accordance with the following criteria:

- high level of importance (red), in order to address changes in the professional tasks and objectives required by the profession, the person cannot do so unless he possesses these skills in depth;
- the level of intermediate importance (green colour), in order to address changes in the tasks associated with the UP and the objectives required by the profession, the person needs to have immediately the basic elements of these skills, the acquisition and full command of which may be deferred over time, but must nevertheless be acquired;
- level of sufficient importance (yellow), in order to address changes in the tasks associated with the UP and the objectives required by the profession, the person needs to have the

basic elements that characterise professional competence, in particular for better understanding and opportunities for interaction within and outside the workplace;

- the level of low importance (white) was considered not to be sufficiently relevant for that particular profession.
-

Table 98 – Link between the identified competencies and the selected professional units

Very important (red) | Important (green) | Not important (yellow) | Irrelevant (white)

Selected Competences	Selected professional units												
	1.2.1.2.0	1.3.1.2.0	2.2.1.1	2.2.1.6.1	2.5.1.5.1	2.5.1.5.2	3.1.3.3.0	3.1.3.6.0	3.1.4.2.1	3.1.4.2.3	3.1.8.3.1	6.2.4.1.1	6.2.4.1.4.
Be able to develop approaches geared towards self-diagnosis, self-correction and continuous improvement	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Be able to take decisions in relation to the tasks under supervision and in support of their work autonomy	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Be able to promote and participate effectively in activities based on the interaction between different nodes in the chain of responsibilities and vertical and horizontal collaboration	Green	Red	Red	Red	Red	Red	Green	Green	Green	Green	Red	Red	Red
Be able to manage the processes of changing company organisational structures with a view to increasing the value of human capital	Yellow	Red	Red	Red	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
Be able to transpose customer needs for the development of products and services	Green	Red	Yellow	Red	Red	Red	Green	Green	Green	Green	Yellow	Yellow	Yellow
Be able to oversee the strategy for buying and selling products and services	Green	Red	Yellow	Yellow	Red	Red	Red	Red	Red	Red	Yellow	Yellow	Yellow
Be able to effectively communicate relevant information on processes, products, services and solutions	Red	Red	Red	Red	Red	Red	Yellow	Yellow	Yellow	Yellow	Green	Yellow	Yellow
Be able to take decisions in relation to their context of reference through the acquisition of relevant information sets in good time	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Be able to identify and monitor the logistical processes, both internal and external to the company, which enable the product/service to be distributed from the place of production to the final customer	White	Yellow	Green	Red	Green	Green	Red	Red	Red	Red	Yellow	Yellow	Yellow
Be able to interact positively within intercultural and multidisciplinary contexts	Red	Yellow	Red	Red	Red	Red	Green	Green	Green	Green	Green	Green	Green
Be able to promote risk analysis of business processes	Red	Yellow	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red

Be able to constantly transfer new knowledge sets within production, organisation and research processes													
Be able to interpret and apply general and specific regulations in relation to the local, national (and international) business/organisation system of reference													
Be able to select the most appropriate technologies in the management and development of business production processes													
Be able to use information systems and web-based communication tools in the day-to-day management of business processes													

Finally, the study shows that the current supply from Italian vocational education and training (VET) only partially responds to the demand for skills for the future, while the demand for new skills appears to be very advanced. The identification of future skills needs shows that the greatest demand, as could be expected, concerns technological and digital skills as well as transversal skills. They follow those relating to marketing, specialisations and, finally, managerial skills and related to plant operation and maintenance.

The current VET offer does not yet seem to adequately include these new skills sets in education and training programmes. Indeed, the survey for VET providers highlighted the weakness of supply in relation to the professionals most relevant for the future by drawing the distance between the supply already available and the one needed for a balanced development of the sector.

5.3 Overview of investment needs

I. existing investment flows and forward investment assumptions with regard to the planned policies and measures

The achievement of the new and ambitious decarbonisation targets stemming from the European framework represents a very ambitious challenge for Italy and its economy, with economic but also social impacts, which require significant commitment in terms of both public and private investment.

This green transformation will be the challenge that will define the economic development of EU countries and will require major investments in energy infrastructure, the efficiency of the building stock (both public and private) and in the transport sector, to support its modernisation and sustainability.

From a first preparation, which will then be further elaborated in the final version of the Plan (once the extensive SEA consultation process has been completed), taking into account the national energy system (without considering transport infrastructure), it is estimated that over the period 2024-2030 more than EUR 174 million of additional investment combined compared to the current policy scenario (an increase of 27 % over the period considered) is needed. Such investments would be directed towards high-tech and innovation solutions, which should affect both the transformation and supply of energy and its end-use.

Table 99 - Investments in technologies, processes and infrastructure necessary for the evolution of the energy system[162] [Source: RSE]]

Sector	Evolution of current policies Cumulative costs (2024-2030) [MLDEUR]	Investments for the INECP Cumulative costs (2024-2030) [MLDEUR]	Delta [MLDEUR]
Residential	59,0	93,6	34,6
Tertiary	37,2	62,3	25,1
Industry	8,2	13,1	4,8
District heating (distribution only)	0,04	0,06	0,02
Transport (vehicles only)	468,7	528,8	60,1
Electricity sector (generating installations)	46,1	81,8	35,7
Electricity system (networks)	22,6	30,0	7,4
Storage systems (batteries, pumping) (1)	7,5	12,0	4,5
Electrolysers	1,0	3,0	2,0
Total	**650,3**	**824,7**	**174,4**

(1) Accumulations coupled to small PV installations are excluded, as such investments are already in the cost of PV installations.

Significant amounts are additional investments in the development of renewable sources: in the PV sector alone, it is estimated that around EUR 20 million of additional investments are needed in the period 2024-2030 to achieve the objectives of the INECP scenario compared to what is foreseen in the current policy scenario.

[162] *Investments are accounted for in the energy scenarios carried out under the TIMES model by RSE.*

Table 100 - Investments in RES electricity generation technologies necessary for the evolution of the energy system [Source: RSE]

Sources	Evolution of current policies Cumulative costs (2024-2030) [MLDEUR]	Investments for the INECP Cumulative costs (2024-2030) [MLDEUR]	Delta [MLDEUR]
Bioenergy	0,7	2,1	1,4
Hydropower	0,3	0,3	—
Geothermal energy	1,6	1,1	0,5
Photovoltaics	26,1	45,9	19,8
Concentrated solar power	—	0,3	0,3
Shore wind	15,8	24,1	8,3
Offshore wind	0,1	5,5	5,4
Fossils	2,0	2,0	—
Total	**46,1**	**81,8**	**35,7**

For cumulated investments in the transmission network to current policies, reference was made to TERNA's PdS 2021 considering the period 2024-2030 alone (approximately EUR 13 million). For the Policy scenario, reference was made to the investments of TERNA's PDS 2023, always taking into account the share for the period 2024-2030 alone (approximately EUR 15 million). In the case of distribution networks, investments in the PNIEC scenario are expected to amount to EUR 15 million over the period 2024-2030 (+ EUR 5 mldEUR compared to the current policy scenario). Investments are also expected to amount to around EUR 12 billion to build new accumulation systems (+ 4,5 bcm compared to the reference). This estimate could increase by an additional EUR 5 billion if the distribution of new investments in new renewable electricity plants is very concentrated in the southern regions of the country.

II. Sector or market risk factors or barriers in the national or regional context

III. Analysis of additional public support or financial resources to address the gaps identified in point (ii)

With regard to renewable energy in the electricity sector, most of the support measures outlined for the construction of new installations provide, following the approach of the previous measures, operating incentives, granted over the lifetime of the installations on the basis of actual production. This is the case, for example, for the planned measure for mature technologies (FER-X) and innovative technologies (FER-2). In such cases, incentive charges are typically financed through consumers' electricity bills, through certain components of general system charges. On the other hand, investments in the construction of the incentivised installations are typically entirely borne by operators, except for some measures providing for partial contributions to the investment, including through NRRP resources, such as the measure to support agrevoltaic support, the measure for photovoltaic on agricultural rooftops (Parco Agrisolare), and the measure for collective self-consumption configurations and energy communities. In such cases, the operating support, where provided, shall be reduced accordingly.

In the electricity sector, there is also a strand of infrastructure investment measures, such as networks and flexibility services, which typically benefit from financing through specific items of electricity bills network services, although some specific measures of strategic importance also benefit from supranational resources such as REPower EU and NRRPs.

As regards thermal renewable energy and efficiency measures on buildings, the measures envisaged provide for different sources of funding: on the one hand, measures (such as the Termico Account and Bianchi Certificates), which are financed through specific components of charges in consumers' gas bills. On the other hand, measures, such as tax deductions, based on general taxation. In the area of efficiency, there are also measures benefitting from NRRP resources, such as measure Transition 5.0 in the industrial sector or the measure dedicated to the development of efficient district heating/cooling networks. Other efficiency measures such as the National Energy Efficiency Fund are financed through ETS revenues.

In the field of transport, there are measures with multiple sources of funding. First, considering renewables, there are mandatory schemes, such as those for those who emit fossil fuels for consumption, which bear the burden of release for consumption of biofuels and their certification scheme, which are likely to overturn the final pump prices as they are freely defined by suppliers. For advanced biomethane, the support also partially benefits from a capital contribution from NRRP resources. The same measure provides that, where biomethane is destined outside the transport sector (other thermal uses), the operating support is financed from the cost of consumers' gas bills.

In the transport sector, there are also other measures benefiting from specific NRRPs resources, such as electricity recharging or hydrogen refuelling infrastructure, but also measures linked to national resources, such as the eco-bonus for the purchase of low-emission vehicles.

As regards the research, innovation and competitiveness dimension, many measures benefit from European funding such as: Mission Innovation, Innovation Fund and Horizon Europe. However, there is no lack of projects supported by national resources such as system research financed by the energy bill or other national funds.

❖ SUSTAINABLE FINANCE: THE ITALIAN EXPERIENCE FOR THE INECP

♦ *EUROPEAN REGULATORY AND REGULATORY FRAMEWORK*

Following the signature of the Paris Climate Agreement and the UN 2030 Agenda for Sustainable Development, the EU has embarked on a path to mainstream sustainability into economic policies, with the aim of achieving the transition to a circular, low-carbon and energy-efficient model of economic development in line with the different environmental issues (Green Deal).

The process of regulatory and regulatory development of sustainable finance and the political and economic dimension of the European Union therefore become interlinked and part of a single process, including its starting point in the Action Plan Financing Sustainable Growth published by the European Commission in 2018.

In July 2021, the Commission published the *Renewed Sustainable Finance Strategy* redesigning actions, regulatory framework and projects aimed at ensuring private investment to achieve the Green Deal objectives.

Thetable below summarises the European regulatory framework, taking into account the actions and objectives for which the rules have been designed.

Table 101 - Summary of the state of the art of the regulatory framework – primary and secondary legislation issued

ACTIONS	OBJECTIVE	REGULATORY FRAMEWORK	SECONDARY LEGISLATION
	Primary and secondary legislation enacted		
Environmental taxonomy	Develop a common identification system for sustainable activities	Status: in force since 1 January 2022	**Four delegated acts:** **1 in Climate change Mitigation and AD Climate Chiange Adaptation – in force since 1-01-22.** **2 additional Article 8 (AD 2021/2178 EU) adopted on 6 July 2021** **3 ad Complementary Climate – in force from 1-1-23** **4 ad Environment – in force since 11-12-23..**
Benchmark	Developing climate benchmarks and related disclosures	Status: in force from 30 April 2020	**Ad (EU) 2020/1818 – in force since 23 December 2020.** **2°AD under preparation by ESAs (Eba, Eiopa, Esma)**
Directive (EU) 2022/2464 (CSRD)	Harmonise sustainability reporting.	Status: in force since 5 January 2023.	**1. Two delegated acts containing the ESRS (European Sustainability Reporting Standard) that companies subject to CSRD will be obliged to use to report their sustainability reporting:** **2. an ESRS AD with two cross-cutting standards and ten thematic standards divided into 5 environmental, 4 social and 1 governance standards – in force since 01-01-24** **3 AS under preparation by EFRAG.) 2 AD under preparation by EFRAG**
Implementing Regulation (EU) 2022/	Amends the implementing technical standards on disclosure of environmental, social and governance risks.	Status: in force from 19 January 2023	**NA**
Directive (EU) 2022/2381	Improve the gender balance among directors of listed companies.	Status: in force from 27 December 2022	**NA**
Sustainable Finance Disclosure Regulation (SFDR) (EU) 2019/2088	Introduces new transparency requirements for institutional investors to integrate ESG factors into their decision-making process.	Status: in force from 10 March 2021	**Ad 2022/1288 – effective from 1 January 2023.** **Ad 2023/363 – effective from 1 January 2023.**
	Primary and secondary legislation enacted		
Proposal for a Green Bond Standard Regulation (COM/2021/391)	Introduction of a voluntary standard certifying the alignment of projects to be funded with taxonomy.	Status: published in the Official Journal of the EU on 23 November 2023, it is in force on 14 December 2023.	**NA**
Proposal for Corporate Sustainability Due Diligence Directive (CSDDD) – COM (2022) 71 —	Introduces due diligence obligations for certain categories of companies against actual or potential adverse human rights and environmental impacts.	Status: On 24 May, the EU Council announced its final adoption. Pending publication in the Official Journal, it will enter into force on the twentieth day following the date of publication.	**NA**
Proposal for the	It establishes a classification	Status:	**NA**

structure of social taxonomy	system that identifies activities that contribute substantially to their achievement and steers private investment towards socially relevant activities.	presented by the Platform on Sustainable Finance on 28 February 2022.	
Ecolabel for retail investments	**It establishes a certification scheme for financial investment products in line with the environmental and climate objectives of the European Union.**	**Status: At the design stage**	**NA**

Havingregard to the European regulatory framework set out in Table 92, in the context of financial regulation, it is useful to point out two other relevant rules in order to frame the regulatory framework of the European financial system:

- The EBA (European Banking Authority) published, in January 2022, complementing Basel III[163], Pillar III, which provides for the disclosure by large listed banks of ESG, qualitative and quantitative indicators, in particular as regards physical and transition risk management and climate change mitigation, in particular key performance indicators (KPIs).
- EFRAG, as part of the mandate given by the CSRD, published a draft sustainability standards for listed SMEs (ESRS LSME ED) and a draft voluntary sustainability standards for unlisted SMEs (VSME ED). The consultation on the two proposals ended on 21 May 2024. The objective of the two sets of standards is to establish reporting requirements that are proportionate and relevant to the scale and complexity of the activities and the capacities and characteristics of SMEs.

♦ *ITALIAN REFERENCE FRAMEWORK*

Given the European regulatory and regulatory framework set out above, the following rules are in force at national level:

- Primary national legislation
  - Legislative Decree No 58 of 24 February 1998, Consolidated text of provisions on financial intermediation, pursuant to Articles 8 and 21 of Law No 52 of 6 February 1996. *The*Decree is updated with the amendments made by Legislative Decree No 29 of 10 March 2023, in force since 7 April 2023 and Legislative Decrees Nos 30 and 31 of 10 March 2023, in force since 8 April 2023.
  - Legislative Decree No 385 of 1 September 1993, the Consolidated Law on Banking and Credit.
- Secondary national legislation
  - Regulation No 209 of the Ministry of Economic Affairs and Finance of 4 October 2022 implementing Article 111-bis of Legislative Decree No 385 of 1993 September 1, as amended by Law No 232 of 11 December 2016 on the regulation of ethical and sustainable financial banking operators.

[163] The Basel 3 agreement, initialled in 2010 and entered into force in December 2013, is the third of the Basel agreements governing the world of banks, financial intermediaries and all credit institutions.

♦ ***SUSTAINABLE FINANCE IN THE NATIONAL FRAMEWORK***

The most widespread green and sustainable finance instruments on the market include green bonds, i.e. debt securities issued by companies, banks, states, other public bodies and supranational bodies (e.g. Mondiale Bank) to raise resources exclusively for financing or refinancing environmental projects.

The ecological transition requires the green transformation of energy and transport infrastructure and strong investments in the building stock and the industrial sector, to support its modernisation and sustainability. In this context, the public financial sector plays a key role.

In the context of the INECP and energy transition policies, with regard to public sustainable finance instruments, the Mefil of 3 March 2 021 launched the first issuance of Green BTP, in line with the position taken by the Budget Law for 2020 (No 160 of 27 December 2019) and announced in the 2021 Guidelines on Public Debt Management, amounting to EUR 8.5 billion. Green BTP securities are medium- to long-term securities and have the same characteristics as the other State Treasury Buoni. The first Green BTP, issued expires on 30 April 2045.

For the issuance of Green State Bonds, the Mef has set up the Green Bond Framework, which sets out the environmental strategy and four key mechanisms that will accompany the issuance of Green BTP: the criteria for selecting expenditure in the State budget considered eligible for green BTP emissions, the use of the proceeds of the various emissions, the monitoring of these expenditures and their environmental impact.

The contents of the Framework were drawn up within the Interministerial Committee for Green State Securities, which was specifically set up under the Budget Law for 2020 and of which the MASE is a member. The Framework will be regularly updated in relation to developments in the sector, in particular as regards compliance with any updates of the ICMA Green Bond Principles, the European Taxonomy for Sustainable Activities and the European Union Green Bond Standards, which are being published.

With the proceeds of Green State Bonds, Italy finances State expenditure to help achieve the environmental objectives outlined by the European Taxonomy for Sustainable Activities and will help Italy support the Sustainable Development Goals of the UN 2030 Agenda.

In order to beeligible for eligibility in line with the provisions of the Framework, expenditure must fall within one of the following sectors:

- Renewable electricity and thermal sources;
- Energy efficiency;
- Transport;
- Pollution prevention and control and circular economy;
- Protection of the environment and biological diversity;
- Research.

This expenditure shall be included in the State budget for a period from the third year preceding the year following the year of issue.

On 20 0 October 2021, the Mef reopened, through a trade union, the BTP Green for an amount of EUR 5 billion and, in line with the previous issuance, the net proceeds were earmarked for financing State green expenditure in accordance with the Framework.

In May 2022, the Mef published the 2022 Allocation and Impact Report (2022 BTP *Green Allocation and Impact Report*) of the net revenues collected through the 2021 Green BTP emissions, which shows the allocation of emissions revenues, in line with the criteria set out in the Framework and, where available, the positive environmental impact of the interventions covered by green expenditure. The document provides a detailed analysis of the programmes and projects on the basis of their financial nature (tax breaks, capital expenditure and current expenditure), their temporal breakdown over the four-year period 2018-2021 and their relative weight on the total allocated. Among the eligible costs, the costs falling within the remit of the Pniec are:

- Renewable electricity and thermal sources;
- Energy efficiency;
- Transport

Out of the total green expenditure indicated as eligible, during the four-year period 2018-2021 the transport category is the main item (EUR 7.62 billion), accounting for 57 % of total expenditure. Most of them are related to capital investments (railway infrastructure, electrification of railway sections, construction of new sections of Alta Velocità/Alta Capacities – AV/AC, contributions to support rail mobility – people and freight). A share of 12.2 % of the total expenditure reported (i.e. EUR 1.63 billion) was allocated to the energy efficiency category, represented by a series of facilitation measures granted for expenditure incurred for energy retrofitting of buildings. Finally, incentive measures for the production of energy from renewable sources account for 2.2 % (or EUR 296 million) of total green expenditure reported in the four-year period 2018-2021.

In 2023, Mef issued new Green BTP with a maturity of EUR 10 billion and an annual rate of 4.00 %, paid in two six-monthly coupons.

On 13 May 2024, the Treasury announced a new issuance of Green BTP due to expire on 30 October 2037.

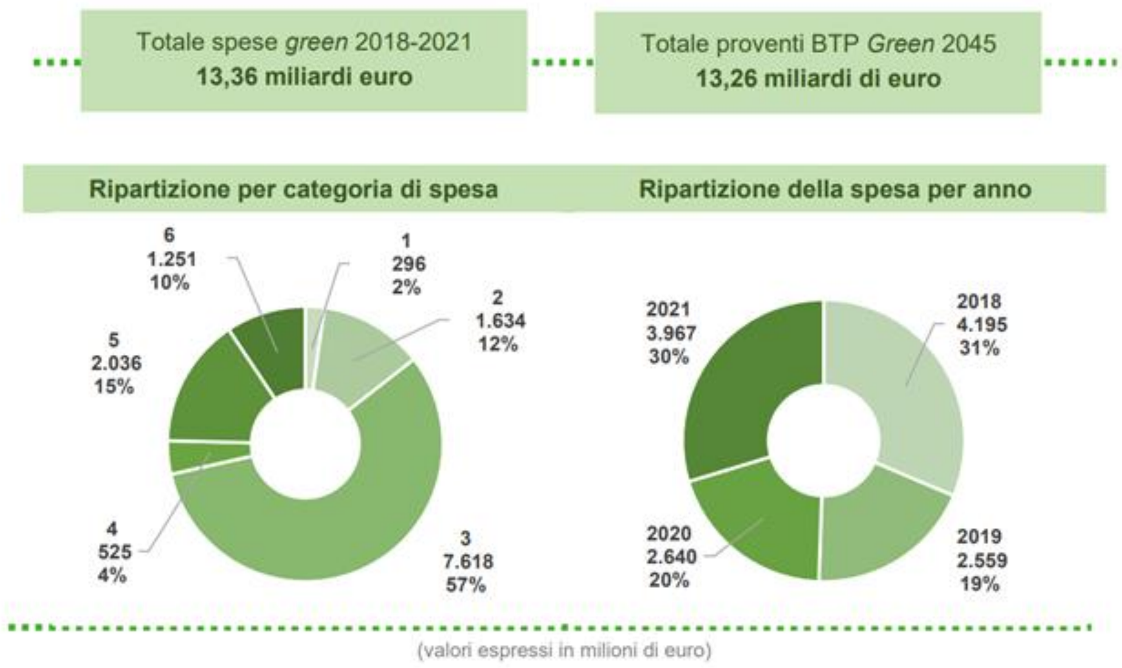
Please find below a table summarising the green expenditure covered by the issue and a figure summarising the impacts of expenditure, as shown in the 2022 report referred to above.

Table 102 – Green expenditure – First BTP 2045 issue of 3 March 2021 (EUR million)

		Year of reference				Four years
Category		**2018**	**2019**	**2020**	**2021**	
1	Tax incentives for energy from renewable sources	59,6	59,6			119,2
2	Tax incentives for energy efficiency of buildings	1.634,2	1.828,9			3.463,1
3	Transport	1.565,5	1.277,6	178,6	111,7	3.133,4
4	Pollution prevention and control and circular economy	90,3	60,4	116,1	69,3	336,1
5	Protection of the environment and biological diversity	348,1	187,2	195,3	235,5	966,1
6	Research	127,1	62,4	141,2	140,9	471,6
Total		3.824,8	3.476,2	631,2	557,5	8.489,7

Source: MEF – 2022 BTP Green Allocation and Impact Report

Figure 99 – Allocation and impact of BTP 2045 issuance of 3 March 2021



Source: MEF – 2022 BTP Green Allocation and Impact Report

♦ *OTHER NATIONAL EXAMPLES OF SUSTAINABLE FINANCE INSTRUMENTS*

The issuance of ESG bonds by public institutions is a relatively new phenomenon that has experienced a fast growth rate since 2007. Green bonds are now the most representative securities of a financial instrument ecosystem that includes *social bonds*, *sustainability bonds* and *climate bonds*.

The sustainable investment market has always been driven by institutional investors; in Italy, Cassa Depositi e Prestiti, as the reference institutional investor, issues *green, social security* and *sustainability bonds*. CDP has also published a framework, aligned with ICMA principles, on which the issuance rules are based. In particular, CDP has defined four *Eligible Categories*:

- infrastructure and development of cities;
- financing for SMEs and large enterprises;
- social*housing*;
- clean energy and environmental sustainability.

Examples of *green, social and sustainability bonds* identified by the CDP Framework are given in *the* table below.

Table 103 - Examples of green, social and sustainability bonds within the CDP framework

Product type	**Eligibility category**	**Subcategory**	**Eligibility criterion**	**Example of project**

Green bonds	D	Sustainable management of natural resources	• Improving waste management • Extension of the useful life period of the asset • Reduction of raw material consumption and waste generation	• Recycling or composting facilities to intercept share of waste otherwise landfilled • Extension of the useful life of a product or its intensity of use
Social bonds	C	Access to the house	• Increased access to subsidised social housing services for people in social and economic marginalisation	• Construction, retrofitting or repurposing of buildings for social housing
Sustainability bonds	A + D	Sustainable and accessible urban infrastructure	• Development of quality, sustainable and universal infrastructure contributing to the improvement of living conditions in urban agglomerations and underserved areas	• Development of a cycling and/or pedestrian road network (i.e. soft mobility) or other zero-emission modes of transport • Digitalisation and service virtualisation projects

Source: reprocessing MASE on CDP data

In 2021, the Deposits and LoansFund arrived at its sixth issue of *social bonds*. The following table summarises *social* security and *sustainability bonds* issued by CDP since 2017.

Table 104 – Social and sustainability bonds issued by CDP from 2017 to 2021

Year of issue	Typology	Intended use	Nominal	Gross annual coupon	Deadline	SDG
2017	Social bonds	Support for SMEs with fewer than 250 employees and located in Italian regions with a GDP per capita below the national average or in areas affected by seismic events	EUR 500 million	0.75 %	5 years	8 DECENT WORK AND ECONOMIC GROWTH
2018	Sustainability bonds	Support for the development and modernisation of the Italian water infrastructure	EUR 500 million	2.125 %	5 years	6 CLEAN WATER AND SANITATION
2019	Social bonds	Financing for the construction and energy and seismic upgrading of public school and university buildings, as well as for urban regeneration projects, in areas prone to degradation, social exclusion, insecurity.	EUR 750 million	2.125 %	7 years	11 SUSTAINABLE CITIES AND COMMUNITIES 4 QUALITY EDUCATION
2020	COVID-19 Social response bond (dual tranche)	Special support to companies affected by the economic effects of the pandemic	EUR 500 million	1.50 % (3 years) 2 % (7 years)	3 years (tranche 1) 7 years (2)	8 DECENT WORK AND ECONOMIC GROWTH
2020	Social housing bonds	Support for social and subsidised housing projects for the most vulnerable population groups, which do not have the requirements for subsidised construction or the economic capacity to be subject to housing market conditions	EUR 750 million	1.00 %	10 years	1 NO POVERTY 11 SUSTAINABLE CITIES AND COMMUNITIES
2020	Social bonds	Support Italian companies investing in research and innovation, as well as those affected by the pandemic	EUR 750 million	1.00 %	8 years	8 DECENT WORK AND ECONOMIC GROWTH 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
2021	Social bonds	Supporting Italian SMEs and Mid Cap located mainly in the regions of southern Italy	EUR 500 million	0.75 %	8 years	8 DECENT WORK AND ECONOMIC GROWTH 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

Source: reprocessing MASE on CDP data

Green bonds can be “corporate” if issued by the private sector, “municipal” if they are issued by local governments and “city” if they are issued by cities.

In 2017, the Italian Stock Exchange launched the sustainable segment of the bond market, a cross-cutting segment, the creation of which offers institutional and retail investors the opportunity to identify the instruments whose revenues are intended to finance sustainable growth.

To date, the Italian Stock Exchange has identified 225 sustainable finance instruments worth more than EUR 300 billion. There are 49 issuers, divided between corporate, supranational, governmental and banking issuers. The use of *green* and/or *social* emissions is of interest not only for large listed issuers, but also for SMEs, in 9 they issued certified ‘mini’ green bonds, with a total collection of over EUR 124 million.

Overall, there were 115 *green* tools, 70 *sustainable*, 22 *social*, 12 *sustainability linked*, 5 *transition* and 1 *climate action bonds.*

- ***SACE GUARANTEES***

Finally, in the context of sustainable finance instruments, reference is made to SACE guarantees. Pursuant to Article 64 of the Simplifications Decree (Decree-Law No 76 of 16 July 2020), SACE S.p.A. was authorised to issue guarantees (‘SACE Green Guarantees’) in order to support projects to facilitate the transition to a clean and circular economy.

The instrument, signed by a memorandum of understanding between the Ministry of Economic Affairs and Finance and SACE, consists of the possibility of requesting the issue of bank guarantees by SACE to facilitate the financing of sustainable projects, i.e. meeting the sustainability objectives of the European Taxonomy and the objectives of the National Sustainable Development Strategy.

Specifically, the provision authorises the Ministry of Economic Affairs and Finance to intervene, through the granting of one or more guarantees issued by SACE, in support of specific investment programmes aimed at carrying out economically viable projects and having as their objective, inter alia, the decarbonisation of the economy, the circular economy, the adaptation and mitigation of risks on the ground arising from climate change.

Guarantees ensure easy access to medium/long term financing, or to the increase of the lending lines available in the banking system. This is an instrument that facilitates access to private credit through public guarantees, an example of effective cooperation between public economic policies and private action by the banking and credit system.

5.4 Impacts of planned policies and measures described in section 3 on other Member States and regional cooperation at least until the last year of the period covered by the plan, including comparison to projections with existing policies and measures

I. Impacts on the energy system in neighbouring and other Member States in the region to the extent possible

Regional cooperation will lead to the identification of areas of cooperation both technological and exchange of best practices which will lead to the creation of important new synergies in the various areas of cooperation with other Member States. Furthermore, the topics identified as potential for regional collaborations may indeed give rise to joint projects.

As regards the electricity sector, the 2023 development plan for the national transmission network of Terna, concerning cross-border interconnections, provides for the following actions:

- increasing interconnection capacity at the northern border (France, Switzerland, Austria and Slovenia), including through solutions to optimise the use of existing infrastructure;
- interconnection between the electrical systems of Corsica, Sardinia and the Italian Peninsula, mainly for security and integration of production from renewable sources;
- the development of interconnection capacity with North Africa, of strategic relevance, which would generate benefits in Italy and Tunisia, providing an additional tool to optimise the use of energy resources between Europe and North Africa;
- the development of a new interconnection with Greece to ensure the safe operation of the network and increase the efficiency of markets and services.

The expected impacts of these actions to develop cross-border interconnections are:

- greater integration of the European market, allowing greater efficiency and strengthening competition through the use of resources at lower cost in each country;
- a diversified supply of the production mix through better use of immediate aid mechanisms between transmission system operators;
- improved secure management of electricity systems through cheaper and more diversified supply of reserves and balancing services from abroad.

As regards the gas sector, the current regional and global context has required a radical change in European gas flows, which has encouraged inter-national cooperation, creating new infrastructure needs to improve the functioning of the European gas system.

In this context, the upgrading of existing infrastructure and the development of new initiatives to import natural gas will allow Italy to diversify its sources of supply and potentially to make the new resources available also for the benefit of other European countries. This is being done by:

- to increase the transport capacity from the entry points of southern Italy through the construction of 'Linea Adriatica';
- to create the conditions for the upgrading of the Southern Corridor through TAP by favouring an increase in capacity from Azerbaijan, including the deployment of the Matagiola Massafra methane pipeline;
- optimise the use of LNG import capacity in existing terminals and develop new regasification capacity, which will continue to play a strategic role in facilitating Italy's participation in the Mediterranean and global LNG market in competition with Northern Europe terminals.

The initiatives described above will lead to the Italian system becoming a reference for many EU Member States and other neighbouring third countries.

II. Impacts on energy prices, utilities and energy market integration

In the electricity sector, the development of the interconnections referred to in the previous paragraph should lead to lower prices on the national electricity market, reducing the price gap which has historically penalised Italy due to greater market integration. The price gap is expected to gradually narrow, also because of the progressive convergence of European countries' generation mix towards systems that are largely based on non-programmable renewable sources.

In addition to the coupling of day-ahead and intraday markets, which have long been fully operational, the setting up of all European balancing platforms provided for in Regulation (EU) 2017/2195 will reduce the costs of these services, with access to a wider pan-European market.

As far as utilities are concerned, the consequences of closer cooperation should mainly result in an improvement in the environmental quality of transport and, consequently, air.

In the gas sector, the new gas supply possibilities at competitive prices and the resulting increase in liquidity will influence the price formation of the PSV and make the Italian hub more attractive for export, including through the deployment of infrastructure that will allow the enhancement of total export capacity to Austria and north of Europe and the creation of export capacity to Malta.

In order to promote security of supply in the context described above, the adaptation of the Italian storage system to the new needs for modulation, which will also have to take into account the quantities of gas that will be exported from the Italian system during the winter season at times when the signal of the gas price differential between PSV and neighbouring markets will allow this. With this in mind, the development of new storage capacity at the Alfonsine deposit is strategic in addition to the initiatives for the renewal and adaptation of the existing storage system. In addition, consideration should be given to the increase in increasing shares of production and feed-in of renewable gases into the Italian system, as well as the possibility of accessing the green gases potentially produced by North African countries that can be made available to the European market through the Italian transport network.

III. Where appropriate, impact on regional cooperation

Italy is involved in the regional cooperation groups chaired by the European Commission, which are responsible for ensuring close cooperation between Member States, national regulatory authorities, project promoters, ACER, ENTSOG and stakeholders in order to build a broad consensus on the infrastructures identified as priorities and facilitate their implementation. Finally, the support of Italian infrastructure operators to international trade associations and working groups should be emphasised.

In the meantime, efforts will be maintained to extend as much as possible the number of Member States with which a solidarity agreement is in place for the mutual supply of natural gas in extreme emergency situations and to address the shortage of storage capacity of neighbouring systems, as provided for in Regulation (EU) 2017/1938 et seq.