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NATIONAL PLAN INTEGRATED FOR ENERGY AND CLIMATE

Ministry of the Environment and Energy Security

Italy

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SECTION A: NATIONAL PLAN

1 GENERAL OUTLINE AND PROCESS OF CREATION OF THE PLAN

1.1 Summary

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

Italy fully shares the Community's approach of strengthening the commitment to decarbonise Europe's energy and economic systems, and of making Europe the first regional area to have a social, economic and productive dimension with no net emissions, not least with a view to achieving leadership in this sector internationally and thus leading the world's other economies.

However, this path is highly complex and does not lend itself to simple solutions or predetermined choices, but it will require measures to encourage the use of all available technologies, behaviours and energy sources that can decarbonise the country's economy, adapting the different choices according to the needs of different production, economic and social sectors.

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

Recent events affecting social systems (the pandemic, Russia's war on Ukraine, soaring energy prices) have highlighted the fragility of the patterns of interdependence of energy and economic systems, showing that decarbonisation choices, which have become increasingly urgent in the light of the climate change that is already taking place, with effects particularly in Mediterranean areas, will also have to bear resilience factors, so that possible new adverse events can be mitigated.

Decarbonisation policies must be combined with policies aimed at maintaining the quality of life and social services, combating energy poverty, and maintaining competitiveness and employment, given the structure of the Italian manufacturing and production fabric, not only with regard to countries outside Europe that do not yet implement decarbonisation policies with equal determination and speed, but also by avoiding intra-European competition, as a result of national measures that are not harmonised at EU level.

It is therefore necessary to develop the measures described in this Plan in terms of policy, into operational instruments that together improve energy security, environmental protection and affordable energy costs, contributing to European energy and environmental objectives.

The actions underlying this commitment will be explained in various forms and directorates, 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 make an active contribution at the stage of their definition, with a view to achieving ambition and substance, promoting further and synergistic initiatives.

Looking at the scenarios in terms of emissions and the achievement of the global and sectoral targets for 2030 outlined in the 2019 Integrated National Energy and Climate Plan (INECP), we can see a distance in reaching them, due both to the fact that they were significantly challenging with regard to the actual possibilities of achieving them in terms of investment and delivery time, and to the obstacles encountered in their implementation, linked to difficulties in authorising new plants using renewable sources, and finally to the slowing down of activities in recent times of crisis. This leads to

a greater effort in meeting the new emission reduction targets set at Community level by 2030, which will have to be set in a pragmatic and truly achievable manner.

The way forward will therefore require an extreme effort, particularly as regards reducing consumption and emissions in sectors linked to the Effort Sharing Regulation (ESR1) commitments, i.e. in sectors such as transport, civil, agriculture, waste and small to medium industry. This means that, in addition to the measures to decarbonise the energy-intensive and thermoelectric industrial sectors linked to the objectives of the Emission Trading Scheme (ETS), drastic measures will also need to be taken to reduce the consumption and carbon emissions of the tertiary sector, the residential sector, and in particular transport through a decisive modal shift towards public transport (LPT), and to reduce mobility needs, without neglecting the replacement of public and private transport towards more efficient vehicles with reduced CO₂emissions.

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

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

In updating the INECP, Italy therefore intends to reap the significant benefits of the widespread deployment of renewables and energy efficiency, linked to the reduction of polluting and climate-changing emissions, to improving energy security and to economic and employment opportunities for households and the production system, and intends to continue firmly on this path, through a stronger approach aimed at diversifying the technological solutions available for decarbonisation, by continuing to finance the development of new energy technologies for the transition and their transfer to the business community.

Updating the INECP is also a time to rethink the system in the light of what has been experienced over the past year, strengthening its security of supply and its central role at Mediterranean and European level. It will be necessary to speed up and strengthen the path undertaken to make Italy a hub for energy generation and transit, with an increasing contribution from renewable energy, fully reaping its benefits in terms of diversification, security and liquidity of supplies, as well as those of strengthened partnerships with supplier countries.

Italy has historically been among the most advanced European countries in terms of energy efficiency. This positioning can be attributed both to the high energy costs that have always led businesses and consumers to an informed and rational use of energy, and to the fact that it has been one of the countries that, for the longest time and with increased efforts, has financed mechanisms to promote energy efficiency.

The challenge to reach the new 2030 targets is very complex. If the decarbonisation pathway is tracked and, as stated, represents an opportunity for us to seize, the trajectory defined at European level for 2030 includes recently revised upwards targets, through the REPowerEU programme and the FF55 package; very ambitious targets in particular with regard to Italy;

this is also due to the starting point of our country and probably, partly because of the fact that the INECP drawn up by Italy in 2019 set very ambitious sectoral and global targets, in some cases higher than the mandatory ones.

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

In updating the plan, the Ministry of the Environment and Energy Safety (MASE) started by reviewing the main energy and emission indicators in order to establish the state of the art as at 2021 (reference year for the construction of the new plan) and forecast for 2030 to current policies (trend scenario).

When compared with the objectives set out in the INECP 2019, these values revealed distances from the objectives that were intended to be achieved. By way of example, by 2030, the penetration of renewable energy sources into existing policies was 27 %, compared to a target of 30 % in the INECP 2019; final consumption under current policies is 109 Mtoe, against a 2019 Mtoe NECP target of 104 Mtoe; the reduction of emissions in the non-industrial sector (non-ETS) to existing policies is 28.6 %, compared to a target of 33 % in the INECP 2019. These gaps can mainly be attributed to the over-optimism of the 2019 Plan about the possibility of achieving the targets, the incomplete implementation of the planned measures and the changed context (pandemic, economic recovery, war).

The reference framework, compared to the period 2019-2020 in which the first plan was drawn up, is in fact radically altered.

Energy security and the speed of the decarbonisation process appear to be dimensions that are strengthened at European level, not least to take account of the extraordinary investment plans introduced by Europe with the National Recovery and Resilience Programme (NRRP), to boost the post-COVID economy and to address the impact of Russia's war on Ukraine. Similarly, measures to make the transition sustainable in terms 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, caused by a conflict affecting the natural gas supply routes in northern Europe and through Ukraine, involving the EU's main supplier, led the European Council to approve 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 programme², with a view to increasing the resilience, security and sustainability of the European energy system, by rapidly implementing new LNG supply infrastructure, through the installation of floating regasification and storage units, and by accelerating the development of renewables, energy efficiency and energy storage capacity.

Record energy prices since the second half of 2021, exacerbated by 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 instruments, resources and reforms (e.g. through the NRRP, the RePowerEU plan, etc.), it has created a complicated macroeconomic situation (inflation, supply chain bottlenecks, etc.) which demonstrate the limits of excessive acceleration of infrastructure works.

In launching the process of updating the Plan, a realistic and technology-neutral approach was followed, which, however, provides for a strong acceleration of: 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); deployment of electric cars and policies to reduce private mobility; CCS (CO₂ capture, transport and storage).

This was done by providing for: updating and developing existing policies (regulation, simplification, incentives); full implementation of what is already foreseen in the NRRP and the new REPowerEU chapter³ in the process of being finalised; the definition of further policies identified with the

²COM (2022) 108 REPowerEU and COM (2022) 230 REPowerEU Action Plan

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

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 objectives and the simultaneous need to maintain the safety and adequacy of the national energy system.

The context of the energy crisis, with the need to ensure the post-COVID economic recovery, has made it more sensible to ensure that the sustainability, including environmental sustainability, of the energy system is pursued with care and attention to the economic impact on consumers, a proportion of whom are also in a state of energy poverty and deserving 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, which is another reason for a particularly attentive approach to the costs of the energy transition.

In addition, due attention will be paid to ensuring compatibility between the energy and climate objectives and the objectives of protecting the landscape, air and water quality, preserving biodiversity and protecting soils and the green heritage of large removals of carbon dioxide such as forests, forests and agricultural areas, a matter of particular importance as recent weather events have shown.

The measures necessary for the increasing decarbonisation of the system will require the widespread construction of facilities and infrastructure that can also have environmental impacts. Some of these impacts can be mitigated – for example by promoting the deployment of photovoltaic (PV) on areas already built or otherwise not suitable for other uses – but in order to ensure the stability of the energy system, a series of physical infrastructure (upgrading interconnections, grid resilience, large-scale energy storage, carbon capture and storage systems) will need to be built in the medium term, with a view to achieving shorter authorisation times, while respecting dialogue and sharing with the regions. 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 in two years towards an acceptable safety situation even in the absence of Russian gas should be the rule, not the exception, for example in the case of wind farms and water storage for energy storage, without which the decarbonisation path will be unachievable.

The process leading to the identification of the mix of solutions and instruments most compatible with the objectives of the updated INECP and the need to assess environmental impacts involved various stakeholders, including through the public consultation carried out in May 2023.

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

The plan aims to contribute to a far-reaching 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 human-friendly economy, within a framework of integration of national energy markets into the single market and with adequate attention to affordable prices and security of supply and supply.

In updating the policies and measures contained in the Plan, particular attention has been paid to their feasibility and the need to combine energy security, affordable energy costs and the economic and social sustainability of the energy transition, including through a more diversified approach to the technological solutions available for decarbonisation.

Indeed, Italy is well aware of the need for the implementation of measures to reduce climate-changing emissions, promote renewables and energy efficiency, linked to the new and more ambitious European energy and climate targets, to be guided by the constant focus on improving energy security,

the industrial impact and their economic and social sustainability.

As regards the strategy for each of the five dimensions of the Energy Union, without prejudice to the objectives and measures set out in the relevant chapters, a number of main elements are set out below.

† **DECARBONISATION DIMENSION**

AND GREENHOUSE GAS MISSIONS AND REMOVALS

The recently updated Effort Sharing Regulation set an even more ambitious target for Italy, with emissions from non-ETS sectors (transport, residential, tertiary, non-ETS industry, waste and agriculture) to be reduced by 43.7 % by 2030 compared to 2005 levels.

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

Although the increased competitiveness of renewable electricity generation technologies makes it possible to accelerate without significant burdens the decarbonisation process in electricity generation, in order to promote a reduction in climate-changing emissions in the Effort Sharing sectors, a change in the electricity generation 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. taking into account the effect of the policies adopted on 31 December 2021) shows that, also as a result of the changed post-COVID-19 situation linked to the economic recovery and behavioural change following the pandemic, and the major changes in the geopolitical context, despite the adoption of the measures foreseen in the NRRP, the previous emission reduction target of -33 % by 2030 compared to 2005 levels is not met. The effort to reduce emissions in ESR sectors is therefore much more demanding and challenging in the light of the updated target.

Given the crucial role of transport and civil society in reducing emissions from the non-ETS sectors, it became clear in the update of the plan that additional policies and measures were needed to achieve greater energy efficiency in the civil sector (residential and tertiary), to reduce demand for private mobility and to promote the uptake of low-emission vehicles, including by upgrading the relevant infrastructure.

In the context of activities aimed at reducing GHG emissions, measures should be encouraged both to shift transport from private to public transport through modal shift and to promote soft mobility, as well as 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 have to be stepped up by identifying new instruments for involving the private sector and the public sector in the upgrading of the existing national building stock. An increased use of heat pumps as the main heating system could also make an important contribution to reducing emissions from buildings.

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

Lastly, for the ESR sectors, the involvement, both in the identification and implementation phase of new policies and measures, of other central administrations and local authorities with direct responsibility for the transport, residential and tertiary sectors is crucial.

For the sectors covered by the EU ETS, first and foremost thermoelectric and energy-intensive industries, the main contribution comes from the increase of renewables in the electricity generation mix.

In addition to electric renewables, additional emission reduction contributions from coal phase-out, increased energy efficiency in processing processes, the use of alternative renewable gases, such as biomethane and hydrogen, in end and energy uses, including hard-to-abate industrial sectors, can be reported.

In order to achieve the objective of limiting emissions, particularly in the industrial sector, the use of CO₂ capture, transport and storage/utilisation (CCUS) will also be necessary. To this end, specific targets for CO₂ capture and storage will be established based on the geological characteristics of the relevant storage sites that will be operationally available by 2030 and beyond.

ANDRENEWABLE ENERGY

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

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

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

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

For larger plants, the development of Contracts for Difference (hereinafter CDF) to be concluded following competitive procedures will continue, as well as the creation of a favourable framework for the conclusion of Power Purchase Agreements between private individuals (hereinafter PPA). Measures are also foreseen to support plants based on innovative technologies, as well as to safeguard and upgrade the production of existing plants that are still competitive.

Great attention is being paid to continuing the process of simplifying and speeding up authorisation procedures at all levels, and to identifying suitable areas in consultation with the regions through a process of sharing and sharing objectives at regional level (burden sharing).

The framework naturally 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 technologies that will see their contribution grow most are photovoltaic and wind energy, because of their increased competitiveness, which results in 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 revolutionic and offshore (wind and photovoltaic) plants. It is also intended to promote, from a few small islands that are not interconnected with national networks, the establishment of systems in which the accelerated decarbonisation of consumption using renewable sources is tested.

Related to the topic of renewable energy in the electricity sector is the development of hydrogen, which is expected to be used in industry as a 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 provided for in the NRRP and through a new tariff measure which will make

investments in a sector that is still far from competitive fairly profitable.

As regards the deployment of renewable energy in the transport sector, the Community context provides a favourable framework; in fact, 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, suppliers will gradually increase their obligation to release renewable products for consumption, 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 for consumption a quantity of renewable fuels of non-biological origin and to make a contribution from the use of pure biofuels.

As regards the thermal renewables sector, promotion instruments will continue to be coordinated with the multiple measures foreseen for energy efficiency, in particular for buildings. In addition, other measures that support 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 addition, biomethane (primarily) and hydrogen (the latter in particular in the industrial sector) will increasingly increase in the heat sector.

From a technology point of view, it will be important to continue to create an enabling framework for the wide deployment of heat pumps in the civil sector, leaving the selection of the most efficient option for each application to the market and also enhancing the use of cooling inputs.

† **DIMENSION OF ENERGY EFFICIENCY**

Energy efficiency is a key dimension of 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 inertial, 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 to the Energy Efficiency Directive III). The scenario with additional policies provides for recruitment of major technological and behavioural changes only if existing promotion tools are maintained and significantly strengthened.

Given the extremely challenging objective of reducing emissions from all non-ETS sectors, particular emphasis is placed on energy efficiency measures in the civil and transport sectors.

In line with the proposed renovation targets for the building stock with the revision of the Energy Performance of Buildings Directive (hereinafter EPBD), which is currently under negotiation, it has been planned to increase the renovation rate of buildings, with significant penetration of technologies for electrification of consumption, automation and control, and widespread deployment of dispersed surface insulation.

As regards building heating, it will be crucial to fully exploit the consumption reduction potential of heat pumps as the main heating system to be installed both in the context of deep upgrades of buildings and in addition to existing heat distribution systems. The development of heat pumps and electrification of other uses will be supported by the increasing uptake of domestic photovoltaic systems.

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

The leading role of the public administration will be of great importance, for which it will be necessary

to launch a major plan to improve the efficiency of the building stock and reduce energy consumption, which will provide for the sharing of targets with local and regional authorities. The policy scenario provides for achieving the EED III targets for renovating public buildings (3 % per year) and reducing public administration consumption (1.9 % per year). It will also be important to update existing measures to include the promotion of energy efficiency in buildings in the private non-residential sector, where there is still insufficient potential for savings.

The policy scenario is also particularly ambitious with regard to measures in the transport sector, for which priority has been given to policies to reduce mobility needs and to increase collective mobility, in particular by rail, including road to rail freight transport and soft mobility. Indeed, it is necessary to complement vehicle efficiency and emissions measures ('imtest' measures) with instruments aimed at reducing mobility needs ('avoid' measures) and displacement efficiency (shift measures). With regard to the remaining needs for private mobility and goods, the aim is to promote the use of alternative fuels and electric transport, increasing the share of renewables through economic and regulatory instruments coordinated with local self-government.

With regard to industry, simplification and extension of the measures allowed for existing support mechanisms have been envisaged, as well as a green revision of the existing tax benefits.

† **DIMENSION ENERGY SECURITY**

Recent war events of concern to Europe, market volatility with soaring gas prices but also oil prices, have had an impact on the European and national economy, with significant inflationary effects, and have raised concerns regarding energy supply, putting energy security at the heart of European and national policies.

The May 2022 Repower EU Communication emphasised the objective of reducing dependence on Russia by increasing renewables, energy efficiency and consumption reductions. The same communication called on the Member States to introduce policies to diversify gas supply sources, using natural gas, including through LNG, with infrastructure consistent with the 2050 deep decarbonisation scenario and, above all, indicating to the Member States the objective of eliminating dependence on Russian gas imports.

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

The country has also taken steps to strengthen its security of supply infrastructure. increasing the capacity of the regasification terminals (through the new Floating Storage and Regasification Unit (FSRU) of Piombino and Ravenna in operation in 2023-24 and increasing the regasification capacity of existing terminals), also aiming at expanding south-north transport capacity along the Adriatic backbone, 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 of supply will be monitored in order to ensure compliance with Safety Regulation No 1938/2017, including with regard to the Risk Analysis Document and the subsequent update of the preventive and emergency action plans. The new gas supply set-up, characterised by the reduction of Russian gas imports, 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 the decarbonisation objectives defined 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 indigenous

renewable sources. However, further upgrading of foreign electricity interconnections is planned on both the North and South borders, which will not only increase the security of interconnected systems, but will also promote both efficiency and competition with greater alignment of wholesale prices.

A great deal of 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 that enable the systems to restore their operation quickly.

† **DIMENSION OF THE INTERNAL MARKET**

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

With regard to transmission infrastructure, the operator of the National Transmission Network (RTN) has presented a new Development Plan (PdS) which addresses the decarbonisation challenges and aims to achieve the ecological transition objectives efficiently. The OP provides for a series of actions and new instruments to develop infrastructure that integrates renewable energy sources (RES) and increases transport capacity between different market areas, solving electricity system congestions. The plan takes into account the current requests for connection to the RTN, which indicate that market operators are concentrating the development of new RES mainly in the south and on the 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 the ability to exchange between different market areas.

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

It is important to stress that, in order to achieve the Community objectives, it is necessary to provide for an acceleration and simplification of the authorisation procedures for both network development works and the connection of renewable installations, thus enabling all the works needed to achieve the decarbonisation targets to be carried out in a timely manner.

The need for flexibility will benefit not only from the widespread use of accumulations, whether centralised or distributed, but also from the integration of systems (electricity, water and gas in particular), to be launched on a trial basis, also with a view to exploring the most efficient ways of storing renewable energy in the long term.

The expected reduction in the costs of electrolysis technology and the simultaneous launch of support measures will make it possible to have renewable hydrogen, including in *blending* with natural gas, to decarbonise energy-intensive industrial sectors and long-haul commercial transport.

With regard to energy poverty, in addition to the measures described below, further work has been undertaken to introduce efficiency measures and installation of renewable energy installations for self-consumption.

† **RESEARCH, INNOVATION AND COMPETITIVENESS DIMENSION**

The identification of national R & D & I targets on energy technologies is a priority in order to accelerate the market introduction of the technologies needed to meet the targets set by the Green Deal, while at the same time strengthening the competitiveness of national industry. With this in mind, the R & D & I objectives identify those energy technology clusters which, on the one hand, are likely to make it possible to achieve the 2030 and 2050 decarbonisation targets, both because of their potential for penetration and in making the transition technically feasible: on the other hand, they can maintain and strengthen the competitiveness of Italian industry.

The plan aims to draw up a long-term strategy setting out priorities and determining 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, strategic net-zero technologies objectives have been defined on the basis of three criteria: (1) technology Readiness Level (TRL); (2) contribution to decarbonisation, i.e. technologies expected to make a significant contribution to the emission reduction target; (3) contribution to the competitiveness of the industrial system and reduction of security of supply risks, thus strengthening sectors where Italy has a low specialisation index and increasing production capacity in the value chain of zero-emission technologies.

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

By 2030, the focus is on net-zero emission technologies at TRL 84 or higher level, which are expected to make a significant contribution to the Fit for 55 target of reducing net greenhouse gas emissions by at least 55 % below 1990 levels by 2030. In line with the net Zero Industry Act and the assessments of the IEA (Net Zero by 2050, A Roadmap for the Global Energy Sector), the objectives therefore relate to technologies that are now commercially available: solar photovoltaic and thermal, onshore and offshore renewable wind, batteries/storage, heat pumps and geothermal energy technologies, electrolysers and fuel cells, sustainable biogas/biomethane, carbon capture and storage, grid technologies.

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 prototype phase, especially in hard-to-abate and heavy transport applications (IEA, Net Zero by 2050, A Roadmap for the Global Energy Sector). The objectives of the R & I activity therefore target in this case the different technology clusters with a wider spectrum of maturity levels, including yet prototype technologies.

There is also great potential for Italy to contribute to the revitalisation of nuclear energy in Europe and worldwide, in terms of participation in testing programmes on innovative electro-nuclear generation solutions. This is to prepare the Italian nuclear industry in a 2050 perspective with the use of innovative technologies. In line with this potential, Italian participation in international and European programmes should gradually be encouraged.

Another objective of the research activity is to help overcome two problems of the current situation in Italy in several strategic technology clusters: Italian despecialisation in terms of innovative activity – measured by patent activity – in various strategic technologies; loss or lack of development know-how (e.g. geo engineering); a situation of a rapidly growing trade deficit.

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

111. Summary table with the main objectives, policies and measures of the plan

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, taking into account the effects of both the measures already planned and those which are still being defined on the path towards the 2030 strategic objectives.

The main targets of the plan to 2030 on greenhouse gas emissions and removals, renewable energy sources (RES), energy efficiency and the main existing or planned measures to achieve the objectives of the plan are presented in the tables below.

Table 1 – Main scenario indicators and 2030 energy and climate targets

unit of measurement	Data found	INECP 2023:	INECP 2023:	Objectives FF55
		Reference case	Policy scenario 5	REPowerEU
	2021	2030	2030	2030
Greenhouse gas emissions and removals				
GHG reduction vs 2005 for all installations subject to ETS legislation	%	– 47 %	– 55 %	– 62 % ⁶
GHG reduction vs 2005 for all non-ETS sectors	%	– 17 %	– 28.6 %	– 35.3 %/-37.1 % ⁷
Removals of CO ₂ LULUCF	MtCO ₂ eq	– 27,5	– 34,9	– 35,8 ³
Renewable energy				
Share of RES energy in gross final energy consumption	%	19 %	27 %	38.4 % – 39 %
Share of RES energy in gross final consumption of energy in transport (RED 3 calculation criteria)	%	8 %	13 %	29 % ⁹
Share of energy from RES in gross final consumption for heating and cooling	%	20 %	27 %	29.6 % ³ – 39.1 %
Share of RES energy in final consumption in the electricity sector	%	36 %	49 %	not planned
Share of RES hydrogen in total hydrogen used in industry	%	0 %	3 %	42 % ³
Energy efficiency				
Primary energy consumption	Mtoe	145	130	112,2 (115 flexibly) + 2.5 %)
Final energy consumption	Mtoe	113	109	92,1 (94,4 with flexibility + 2.5 %)
Annual savings in final consumption through energy efficiency obligation schemes	Mtoe	1,4		73,4 ³

constructed5 scenario considering the measures foreseen in June 2023, will be updated with submission of the final plan by June 2024

⁶binding only for overall emissions at EU level

⁷binding

⁸binding not only 2030 but the whole path from 2021 to 2030

⁹binding on economic operators

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

Summary name of the policy or measure	Emissions dimension	Renewable dimension	Efficiency dimension	Security dimension	Dimension Market, infrastructure, consumers	Dimension Research, Innovation, Competitiveness
SME Guarantee Fund, Tourism Special Section (NRRP)	Emissions	Renewables	Efficiency			R.I.C.
Research and Innovation Partnerships – 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 strategic chains for net zero technologies	Emissions	Renewables	Efficiency			R.I.C.
Transition 5.0 Green	Emissions	Renewables	Efficiency			R.I.C.
Actions for the environmental sustainability of ports – Green Ports (NRRP)	Emissions	Renewables	Efficiency			
Green Islands (NRRP)	Emissions	Renewables	Efficiency			
School building safety and upgrading plan (NRRP)	Emissions	Renewables	Efficiency			
National Innovative Programme for Quality of Living (NRRP)	Emissions	Renewables	Efficiency			
District heating systems (NRRPs)	Emissions	Renewables	Efficiency			
Invitation to tender	Emissions	Renewables	Efficiency			
Termico account. DM 16/02/2016	Emissions	Renewables	Efficiency			
Tax allowances for energy retrofitting 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			
Land account (update)	Emissions	Renewables	Efficiency			
Tax deductions for energy retrofitting and renovation of building stock (Ecobonus update, Sismabonus and Bonus Casa)	Emissions	Renewables	Efficiency			

Fund for the decarbonisation of public buildings (evolution of the Kyoto Fund)	Emissions	Renewables	Efficiency
Land account (extension and update)	Emissions	Renewables	Efficiency
Financing of zero-emission and circular production districts	Emissions	Renewables	Efficiency
Strengthening the role and adoption of the Covenant of Mayors and the Climate cities	Emissions	Renewables	Efficiency
Local energy desks	Emissions	Renewables	Efficiency
Technical support to public administration in funding calls	Emissions	Renewables	Efficiency
Development of Zero Energy Building buildings	Emissions	Renewables	Efficiency
Mitigation of the financial risk associated with PPP contracts from renewable sources	Emissions	Renewables	Market
Promotion of PPP for large RES installations	Emissions	Renewables	Market
Use of hydrogen in hard-to-abated sectors (NRRPs)	Emissions	Renewables	R.I.C.
Research and development on hydrogen	Emissions	Renewables	R.I.C.
Agrentaico (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	
Renewable promotion for energy communities and self-consumption (NRRP)	Emissions	Renewables	
Hydrogen testing for rail transport (NRRP)	Emissions	Renewables	
Hydrogen testing for road transport (NRRP)	Emissions	Renewables	
Biofuels. Sustainability certification. DM 14/11/2019	Emissions	Renewables	
Biofuels. Obligation to release for consumption	Emissions	Renewables	
Biomethane and advanced biofuels. DM 2/3/2018	Emissions	Renewables	
Energy account for photovoltaic installations	Emissions	Renewables	
Minor Islands Decree. DM 14/02/2017	Emissions	Renewables	
Guarantees of origin of electricity from renewable sources	Emissions	Renewables	
Incentivising collective self-consumption groups and renewable energy communities	Emissions	Renewables	
Incentives for non-photovoltaic renewable electricity. DM 23/6/2016	Emissions	Renewables	
Incentives for non-photovoltaic renewable electricity. FER-E. DM 6/7/2012	Emissions	Renewables	
Renewable electricity incentives. DM 4/7/2019 (FER-1)	Emissions	Renewables	
Obligation to integrate renewables into new or existing buildings	Emissions	Renewables	
On-site Exchange (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	

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Biofuels. Obligation to release for consumption (RED II update, Legislative Decree No 199/2021)	Emissions	Renewables	
Criteria for the inclusion and integration of floating photovoltaic systems	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 plants with mature technologies. FER-X	Emissions	Renewables	
Generation of electricity from innovative renewable installations. ERF 2	Emissions	Renewables	
Hydrogen Valleys (scale-up proposal)	Emissions	Renewables	
Incentivising collective self-consumption groups, renewable energy communities and remote self-consumption (update)	Emissions	Renewables	
Limitation of practices of grouping and felling of plant material at the place of production	Emissions	Renewables	
Operational mechanisms to promote the production of renewable hydrogen	Emissions	Renewables	
Obligation to supply renewable heat	Emissions	Renewables	
National plan for the conversion of greenhouses into agro-energy sites and forms and methods of connecting with the NRRP	Emissions	Renewables	
Projects for the transformation of traditional refineries into biorefineries	Emissions	Renewables	
Energy income	Emissions	Renewables	
Reduction of connection costs of biomethane plants	Emissions	Renewables	
Reform of the authorisation system for hydrogen production facilities	Emissions	Renewables	
Simplification and reorganisation of authorisation 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 gases) in public awards	Emissions	Renewables	
National Innovation Fund	Emissions	Efficiency	R.I.C.
Infrastructure Investment and Development Fund	Emissions	Efficiency	R.I.C.
Sustainable Growth Fund	Emissions	Efficiency	R.I.C.
Cohesion policies	Emissions	Efficiency	R.I.C.
Advanced diagnostics, monitoring, energy management, to facilitate efficient urban planning and management	Emissions	Efficiency	R.I.C.
Efficiency of judicial buildings (NRRP)	Emissions	Efficiency	

Energy efficiency of cinemas, theatres and museums (NRRP)	Emissions	Efficiency
Measures for the resilience, enhancement of the territory and energy efficiency of municipalities (NRRP)	Emissions	Efficiency
New charging stations in cities and highways to facilitate the use of electric vehicles (NRRPs)	Emissions	Efficiency
Safe and sustainable hospitals (NRRPs)	Emissions	Efficiency
School building replacement and energy renovation plan (NRRP)	Emissions	Efficiency
Infrastructure upgrading of regional rail transport and rapid mass transport systems (NRRPs)	Emissions	Efficiency
Simplifying and speeding up the procedures for implementing energy efficiency measures (NRRP reform)	Emissions	Efficiency
Electrification of quays, 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: facade 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 (eco-bonus vehicles)	Emissions	Efficiency
Marebonus and Ferrobonus incentive	Emissions	Efficiency
Obligation to make public lighting networks more efficient	Emissions	Efficiency
Sustainable Urban Mobility Plans – SUMP	Emissions	Efficiency
National infrastructure plan for electric vehicle charging – PNIRE	Emissions	Efficiency
Cargo Bike programme	Emissions	Efficiency
Incentive programme for sustainable urban mobility (Primus)	Emissions	Efficiency
Consumer Information and Training Programme (PIF)	Emissions	Efficiency
Programme for energy retrofitting of central public administration buildings (PREPAC)	Emissions	Efficiency
Experimental programme between case- school and work	Emissions	Efficiency
Replacement of vehicles for the transport of goods	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 LPT and sustainable public mobility	Emissions	Efficiency	
Fund for 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 to decarbonise the aviation sector (D.L. 347 of 21/10/2022: scope 4)	Emissions	Efficiency	
Measures to decarbonise the rail sector (Legislative Decree No 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	
Promotion of modal shift and intermodality of people	Emissions	Efficiency	
Resources for the metro network and rapid mass transport (D.L. 97/2022)	Emissions	Efficiency	
Support for charging infrastructure for electric vehicles within the TEN- T network (Decree-Law No 347 of 21/10/2022: scope 2)	Emissions	Efficiency	
Support for initiatives to reduce climate-changing emissions due to urban mobility (Decree-Law No 347 of 21/10/2022: scope 1)	Emissions	Efficiency	
LPT: Decree allocated resources (Ministerial Decree No 409/2022)	Emissions	Efficiency	
Rapid mass transport (metro, tramway, BRT)	Emissions	Efficiency	
Sustainable urban mobility and urban space management	Emissions	Efficiency	
Promoting urban cycling and pedestrian networks	Emissions	Efficiency	
Phase out of coal	Emissions		Security
Southern Cresci 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 in the context of the circular economy	Emissions		R.I.C.
National Indicative Code of Good Agricultural Practice for the Control of Ammonia Emissions	Emissions		
Guidelines for environmental labelling of packaging	Emissions		
National Air Pollution Control Programme	Emissions		
Animal feeding experimental programme	Emissions		
State of play Circular Economy: (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 with a view to a circular economy	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 waste taxation system	Emissions				
Circular Economy Strategy: (5) right to re-use 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				
CCS (Carbon capture and storage): CO ₂ transport and storage hubs	Emissions				
Water desalination	Emissions				
National Climate Change Adaptation Plan (NECP)	Emissions				
National forestry accounting plan	Emissions				
National Waste Management Programme	Emissions				
Experimental programme of interventions for adaptation to climate change in the urban context	Emissions				
Public register of voluntary agroforestry carbon credits	Emissions				
National Forest Strategy (NFS)	Emissions				
Removal from excise duty on energy products used in rail passenger and freight transport (SAD)	Emissions				
Removal from excise duty on energy products used for the production of magnesium from seawater (SAD)	Emissions				
Financing of actions for adaptation to climate change in the urban context	Emissions				
Capillary greening 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 upgrading energy distribution infrastructure and smart grids		Renewables	Security	Market	
Aggregation of generation facilities and utilities (Legislative Decree No 102/2014)		Renewables		Market	
Hydrogen – Production of electrolyzers (NRRP)		Renewables			R.I.C.

Renewables and batteries (NRRP)		Renewables		R.I.C.
National rules governing the Idonee areas		Renewables		
Regional regulation of the Idonee areas and digital platform		Renewables		
Arrangements for the award of concessions for large hydroelectric derivations		Renewables		
Single model for integrated photovoltaic systems on building roofs		Renewables		
Simplification of the authorisation process for renewable installations		Renewables		
Simplification of the authorisation process 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 tackle energy poverty			Efficiency	Market
Capacity market			Security	Market
Diversification of LNG supply and upgrading 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 depots			Security	Market
Reinforcement of internal network to foster RES integration			Security	Market
Installation and connection of a new FSRU to the national gas network			Security	Market
Interconnection Sicily, Sardinia, Italian Peninsula (Tyrrhenian Link)			Security	Market
Adriatic gas pipeline line (phase 1)			Security	Market
New Italy-Tunisia interconnection (tunite)			Security	Market
Upgrading of energy transmission infrastructure			Security	Market
Project to increase gas export capacity to Austria (Export – phase 1)			Security	Market
Promotion of centralised accumulations			Security	Market
Renewal and upgrading of the Sardinia – Corsica – Italian peninsula link (SA.CO.I 3)			Security	Market
Sustainable, circular and secure supply of critical raw materials (RAAE reform)			Security	R.I.C.
Network digitalisation projects				Market R.I.C.
Measures on climate resilience networks (NRRPs)				Market
Smart grid reinforcement (NRRP)				Market
Bonus sociale gas				Market
Social light bonus				Market
Energy-intensive Decree				Market

Active consumer role and market liberalisation	Market
Resilience networks	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: CCS, nuclear, wind	R.I.C.
Electricity system search	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

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

Since the signing of the Kyoto Protocol, the European Union and its Member States have committed themselves to a pathway to combat climate change through the adoption of Community and national policies and measures to decarbonise the economy.

This was confirmed at the XXI Conference of the Parties to the Framework Convention to Combat Climate Change, held in Paris in 2015, which adopted the Paris Agreement by Decision 1/CP.21. The Agreement sets out the need to limit 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. Upon accession to the Agreement, each country must prepare and communicate its *Nationally Determined Contribution* (NDC) with an obligation to pursue policies and measures for its implementation. Any subsequent national contribution will have to be a step forward in terms of ambition compared to the previously submitted contribution, thus undertaking an increasing ambition path that should lead the Parties to reach the collective target.

The European Union, on the basis of the conclusions of the European Council of 23 and 24 October 2014, has therefore presented a NDC requiring an overall reduction in greenhouse gas (GHG) emissions of -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, mandated by the European Council in December 2020, the European Union updated its NDC by amending the binding target of reducing greenhouse gas emissions from -40 % to -55 % by 2030 (compared to 1990 levels).

This legally binding target was incorporated into Regulation (EU) 2021/1119, the 'European Climate Law' adopted on 30 June 2021, which also provides for the achievement of climate neutrality by 2050.

In order to implement the net emissions reduction target of -55 % by 2030, and to make the EU decarbonisation pathway in line with the objective of climate neutrality by 2050 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 efficiency and renewable targets, faster transition to low-emission modes of transport and strengthening the necessary infrastructure for this purpose; an alignment of 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 enhance natural carbon sinks (e.g. forests).

Within this international and European framework of increasingly challenging and ambitious targets, it should be noted that from an emission point of view there was a significant recovery in GHG emissions in 2021, largely due to both the post-economic recovery.

COVID-19 and productive activities and the growth of private mobility. As regards the non-ETS sectors, the failure to reduce emissions in the transport and civil sector, which accounts for the largest share, resulted in an overshooting of annual emission allocations (AEAs) by 10,9 MtCO_{2eq} in 2021.

From an energy point of view, in 2021 the total gross final energy consumption (CFL) (calculated according to RED II criteria) in Italy stood at 120,5 Mtoe, with growth not insignificant compared to 2020, mainly due to the recovery in consumption in the aftermath of the COVID-19 health emergency

restrictions. In fact, this has brought consumption back in line with the trend observed in previous years. In 2021, the gross final consumption of RES energy in Italy, still calculated under Directive (EU) 2018/2001 (RED II), was 22,9 Mtoe, slightly higher (+ 3.9 %) than in 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 %: in 2021, therefore, there was a reduction in the RES share of the final gross energy consumption. On this dynamic, the effects of the COVID-19 health emergency are evident: compared with relatively modest growth in RES energy consumption (+ 3.9 %), the country's overall energy consumption grew at a rate more than twice as high as in 2020 (+ 10.6 % – it should be noted that the transport sector alone, which was hit particularly hard by the effects of the pandemic, increased by 20.7 % in 2021).

As regards the electricity sector, in 2021 national gross production from RES amounted to 116.3 TWh, or 40.2 % of total national production. On the other hand, the RES share of total gross domestic consumption, calculated in accordance with RED II criteria, was 36 %. The renewable source that guaranteed the main contribution to overall RES electricity production in 2021 was hydroelectric (39 % of the total RES), followed by solar (21.5 %), bioenergy (16 %), wind (18 %) and geothermal (5 %). By 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 power compared to 2020 (+ 2.5 %) is mainly due to new installations of photovoltaic (+ 944 MW) and wind (+ 383 MW) installations.

In the heat sector, just under 20 % of total energy consumption comes from renewable sources. In particular, in 2021, about 11,2 Mtoe of RES energy were consumed, of which about 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 district heating systems powered by biomass). It should be noted that, since 2021, renewable energy for cooling has also been considered in the heat sector, which is not accounted for in ordinary statistics, although its contribution is very low. The most widely used renewable source in the heat sector is solid biomass (6,8 Mtoe), which is mainly used in the household sector in the form of firewood and pellets. Heating and domestic hot water (ACS) supplied by heat pumps (2,5 Mtoe) are also very important, while contributions from other sources (geothermal and solar) are still limited.

In the transport sector, more than 1,7 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 2021, Eurostat's energy productivity index for the whole Italian economy is EUR 10,14/kggep, which is the fourth best performing country than the EU-27 with an average of EUR 8,54/kggep. 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 (source Eurostat energy balances), slightly down from 2015 (-3 %). The transport sector is characterised by the highest final energy consumption of 35,3 Mtoe (-3 % compared to 2015); consumption in the residential sector amounted to 32,0 Mtoe (-1.4 % compared to 2015). The services and industry sectors consume 17,5 Mtoe and 25,3 Mtoe respectively and recorded increases in consumption compared with 2015.

In 2021, Italy's primary energy intensity was EUR 98,6 toe/mlnEUR; the decrease from 2015 by -2.6 % is rather small, while this index is among the best in Europe.

The progressive incidence 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.

In 2021, primary energy demand grew significantly compared to the previous year (+ 9 %), where there had been a significant contraction linked to pandemic restrictions; oil (still accounting for one third of the total), solid fuels (at 3.5 %) and imported electricity (at 2.4 %) are less and less satisfied. On the other hand, the contribution of gas is growing (at 40 %) and the contribution of renewable sources is confirmed (just under one fifth).

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

A number of major strategic and planning documents have been adopted in recent years, creating a favourable environment at national level for the implementation of the new and more ambitious energy and emission targets of the INECP. The most representative are 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 the transformation of Europe 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 (NECP)** is being drawn up, the main objective of which is to provide a national framework for implementing actions aimed at minimising the risks arising from climate change, improving the adaptability of socio-economic and natural systems and taking advantage of any opportunities that may arise from new climatic conditions. The NECP is currently subject to the Strategic Environmental Assessment (SEA) procedure.

In addition to the NECP, it is important to mention **the ‘National Forest Strategy for the forestry sector and its sectors’ (SFN)**, whose mission is to bring the country to have extensive and resilient forests, rich in biodiversity, capable of contributing to climate crisis mitigation and adaptation actions, providing ecological, social and economic benefits for rural and mountain communities. The NFS stems from a European commitment, the EU Forest Strategy of July 2021, and was published in the Official Journal on 9 February 2022, with a validity of twenty years.

Another priority theme for decoupling economic growth from the environmental impacts of resource extraction and use, reducing greenhouse 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 Circular Economy Strategy** aimed at defining 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 vis-à-vis virgin raw materials, contribute to the achievement of climate neutrality objectives and implement a roadmap of measurable actions and targets by 2035.

Another document of relevance to the INECP is **the National Waste Management Programme**, also adopted in June 2022, which has a six-year horizon (2022-2028) and is worded as follows: sets the macro-objectives, macro-actions and targets; defines the criteria and strategic guidelines to be followed by the Regions and Autonomous Provinces when drawing up waste management plans; it 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 decreasing the landfilling rate of municipal waste to below 10 % in 2035; it indicates the need for regional planning based on quantification of waste streams and identifies the Life Cycle Assessment (LCA) methodology to compare management scenarios, taking into account all environmental impacts.

Also on the subject of 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, the 2023 edition of which is currently being approved, and is intended to replace the plan adopted in 2008 and amended in 2013. The purpose of that plan is also to link the objectives to 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, i.e. the environmental requirements defined for the various stages of the purchasing process, aimed at identifying the design solution, the product or the best service from an environmental point of view over the life cycle, taking into account the availability of the market.

It should be pointed out that the national policy on green public procurement is extremely relevant,

for this purpose, due to the effects of the legislative provisions of the Public Procurement Code, which make it mandatory for contracting authorities, at least, to include technical specifications and contractual clauses of minimum environmental criteria in the design and tender documentation for all categories of supplies, services and works for which these criteria have been adopted.

Reference should also be made to the **Action Plan on Sustainable Consumption and Production (NAP)** currently being drawn up, which forms part of international and national policies and strategies on the circular economy, resource efficiency and climate protection, which implements the Community guidelines on the European Action Plan on Sustainable Consumption and Production and on Sustainable Industrial Policy COM (2008) 397 and the United Nations 2030 Agenda.

Another key planning tool is the **National Strategy for Sustainable Development (SNSvS)**, approved by the CIPE in December 2017, which was reviewed together with the system of institutional, territorial and non-state actors that are part of the approval process by the State-Regions Conference in September 2022, with recommendations on the need to adopt it as a shared reference framework for public policies at the various territorial levels. In accordance with Article 34 of Legislative Decree No 152 of 3 April 2006, the SNSvS is the reference framework for the strategic environmental assessment of plans and programmes and defines the need for **integrated monitoring** of the ability to achieve the sustainability objectives set by the Strategy and for an assessment of the contribution that the various plans and programmes make to achieving them. The programme for Policy Coherence for Sustainable Development, annexed to the new SNSvS, aims to support administrations in this exercise through the design of sustainability governance tools and mechanisms, 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 cooperation. The role of the territories is central to the process of implementing the SNSvS: 17 strategies of Regions and Autonomous Provinces have so far been approved, in continuity and consistency with SNSvS, as well as 6 metropolitan agendas for sustainable development. In many cases, regional strategies for sustainable development integrate the lines of action on energy, climate and in particular climate change adaptation as priority areas for action and act as integrated strategies. Finally, since 2019, the **National Forum for Sustainable Development has been set up**, with 204 registered organisations, as a tool for the continuous involvement of non-state actors in multilevel processes for sustainable development.

Transport is affected by both the National **Infrastructure Plan for the Recycling of Electrical Energy Vehicles (PNIRE)**, approved in 2012 and updated in 2016, through a route shared with the main competent departments and stakeholders in the sector, and the **National Control Programme for Atmospheric Pollution (PNCIA)**, approved in December 2021. The NIRP will have to be updated on the basis of the results of the measures provided for in the NRRP.

The PNCIA sets out all the measures and initiatives to be implemented at national level to achieve the reduction targets for sulphur dioxide (SO₂), nitrogen oxides (NO_x), volatile organic compounds other than methane (NMVOC), ammonia (NH₃) and PM_{2,5} particulate matter imposed by Directive 2016/2284 (so-called NEC Directive). The main lines of action cover all sectors producing polluting emissions (electricity production, residential production, transport and agriculture), and may be implemented either through regulatory instruments (phase out of coal, energy efficiency, use of effluent in agriculture, use of renewable sources) or through incentive programmes (incentives for the deployment of electric vehicles, for the replacement of old wood-based heating systems, for the renewal of the LPT fleet, for the use of agricultural fertilisers with a lower emission impact, and for technological renewal in agriculture). As regards financial coverage, Law No 234 of 2021 (Article 1 (498)) established in the budget estimates of the Ministry of the Environment and Energy Safety, 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 specific decrees of the Minister for the 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, mention should be made **of the Strategy for the Energy Renovation of the National Building Stock (STREPIN)**, 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, which describes an overview of the building stock and then identifies the rate of energy retrofitting of the current building stock and the objective, also highlighting the desirability of carrying out an integrated approach that improves cost-effectiveness. The strategy will need to be updated to take into account the increased ambition provided for in the European directives forming part of the Fit for 55 package.

On hydrogen, the document '**National Hydrogen Strategy – Preliminary Guidelines**' has been drawn up, setting out 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 Strategy for full decarbonisation in 2050. The strategy also identifies the sectors in which it is believed that this energy carrier can become competitive quickly, but also to check the areas of intervention that best adapt to develop and implement the use of hydrogen.

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, by implementing a range of social, environmental, economic and political measures. The objectives of the Plan, in line with Community policy, include climate neutrality, zero pollution, climate change adaptation, 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 programme lines set out in the NRRP, provides for full achievement of the objectives in 2050, as set out to a large extent in the national long-term strategy. More specifically, the issues outlined and dealt with in the Plan are divided into: decarbonisation, sustainable mobility, improving air quality, combating land consumption and hydrogeological instability, improving water resources and related infrastructure, restoring and enhancing biodiversity, protecting the sea, promoting the circular economy, bio-economy and sustainable agriculture.

The plan is the result of an effort by the public administration in its entirety, which aims to increase interaction and consistency between sectoral policies through joint decision-making processes both between the departments of the Committee for the Ecological Transition (CITE) and with local administrations and civil society, in order to implement, monitor, evaluate and reorient, in line with the objectives achieved, in line with the 2030 Agenda and the priorities set out at European level, national policies for the ecological transition.

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 Regulation (EU) Governance. The strategy, which will be updated once the INECP is finalised, identifies possible decarbonisation pathways, taking into account various technological options, including the most innovative ones, which are not yet fully developed, in order to achieve the 2050 climate neutrality objective.

In addition to these strategic and planning instruments, as part of **Next Generation EU**, the instrument established at European level to respond to the pandemic crisis caused by COVID-19, on 13 July 2021 it was definitively approved by a Council Implementing Decision, which incorporated the European Commission's proposal, **the National Recovery and Resilience Plan (NRRP)**, 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 time-bound objectives and targets, to which the allocation of resources is linked on a semi-annual basis.

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

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

In particular, more than 37.5 % of total financial resources (climate tagging) are linked to the ecological transition. The largest allocation of resources was foreseen for Mission 2 'Green Revolution and Ecological Transition', to which 31.05 % of the total amount of the Plan was allocated, i.e. around EUR 59,46 million to step up Italy's commitment in line with the ambitious objectives of the *Green Deal* on the following issues:

- incentives for energy efficiency of buildings;
- increasing the share of energy produced from renewables and innovation in the industrial supply chain, including hydrogen;
- strengthening electricity transmission and distribution infrastructure smart grids and network resilience;
- promotion of energy communities and self-consumption;
- development of biomethane and agri-ethanol;
- sustainable mobility with the enhancement of cycling, the development of rapid mass transport, the renewal of the rail and bus fleet and the installation of electric charging infrastructure;
- sustainable agriculture and circular economy.

Specifically, Mission 2 consists of 4 Components:

- C1. Sustainable agriculture and circular economy for funding of EUR 5.27 m;
- C2. Renewable energy, hydrogen, grid and sustainable mobility for funding equal to MLDEUR 23,78;
- C3. Energy efficiency and renovation of buildings for financing of 15,36 MLDEUR;
- C4 Protection of land and water resources to finance EUR 15,05 million.

The **REPowerEU Plan** aims to ensure Europe's energy security and independence by freeing Europe's consumption from fossil fuels, in particular from Russia.

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

The amendments made to Regulation (EU) No 241/2021 are intended to strengthen the capacity of the Recovery and Resilience Facility to support reforms and investments aimed at diversifying energy supply, increasing the resilience, security and sustainability of the European energy system, as well as fostering Europe's energy autonomy.

Each Member State should submit its REPowerEU chapter in the form of an addendum to its recovery and resilience plan. REPowerEU chapters should inter alia contribute to increasing the share of sustainable and renewable energy in the energy mix and addressing energy infrastructure bottlenecks.

The discussion on the RePowerEU initiative was launched by the Government on 6 February 2023 with the meeting of the National Recovery and Resilience Board chaired by the Prime Minister,

attended by the Minister for Foreign Affairs and International Cooperation, the Minister for Infrastructure and Transport, the Minister for Enterprise and Made in Italy, the Minister for the Environment and Energy Security, the Minister for Agriculture, Food Soverty and Forestry, and the Minister for Economic Affairs and Finance, together with the main energy companies involved by the State. At the same meeting, the National Recovery and Resilience Department set up a dedicated inter-ministerial technical group to investigate investment and reform proposals to be included in the REPowerEU chapter.

Subsequently, on 7 March 2023, Cabina di regia met with representatives of Regions, Provinces and Municipalities to request their contributions on REPowerEU and, on 28 March 2023, Cabina di regia was attended by all Ministers. Finally, several sessions of Cabina di regia were held on 20 April 2023 to discuss with the social partners and trade associations.

On 18 May 2023, Italy sent the European Commission a preliminary proposal for a REpowerEU chapter with three axes: energy networks; green transition and energy efficiency; green supply chains.

The Government will continue its discussions with the European Commission to ensure that Italy is central to the European response to the energy crisis under the REPowerEU initiative.

The process of defining the new REpowerEU chapter will be completed by August 2023.

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

Italy has and continues to devote great 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 for the five dimensions of the Energy Union.

Table 3 – Current key energy and climate policies and measures across the five dimensions of the Energy Union

Summary name of the policy or measure	Emissions dimension	Renewable dimension	Efficiency dimension	Security dimension	Dimension Market, infrastructure, consumers	Dimension Research, Innovation, Competitiveness
SME Guarantee Fund, Tourism Special Section (NRRP)	Emissions	Renewables	Efficiency			R.I.C.
Research and Innovation Partnerships – Horizon Europe (NRRP)	Emissions	Renewables	Efficiency			R.I.C.
Business investment facilitation for capital goods (new Sabatini)	Emissions	Renewables	Efficiency			R.I.C.
Actions for the environmental sustainability of ports – Green Ports (NRRP)	Emissions	Renewables	Efficiency			
Green Islands (NRRP)	Emissions	Renewables	Efficiency			
School building safety and upgrading plan (NRRP)	Emissions	Renewables	Efficiency			
National Innovative Programme for Quality of Living (NRRP)	Emissions	Renewables	Efficiency			
District heating systems (NRRPs)	Emissions	Renewables	Efficiency			
Invitation to tender	Emissions	Renewables	Efficiency			
Termico account. DM 16/02/2016	Emissions	Renewables	Efficiency			
Tax allowances for energy retrofitting 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			
Use of hydrogen in hard-to-abated sectors (NRRPs)	Emissions	Renewables				R.I.C.
Agrentaico (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				

Renewable promotion for energy communities and self-consumption (NRRP)	Emissions	Renewables	
Hydrogen testing for rail transport (NRRP)	Emissions	Renewables	
Hydrogen testing for road transport (NRRP)	Emissions	Renewables	
Biofuels. Sustainability certification. DM 14/11/2019	Emissions	Renewables	
Biofuels. Obligation to release for consumption	Emissions	Renewables	
Biomethane and advanced biofuels. DM 2/3/2018	Emissions	Renewables	
Energy account for photovoltaic installations	Emissions	Renewables	
Minor Islands Decree. DM 14/02/2017	Emissions	Renewables	
Guarantees of origin of electricity from renewable sources	Emissions	Renewables	
Incentivising collective self-consumption groups and renewable energy communities	Emissions	Renewables	
Incentives for non-photovoltaic renewable electricity. DM 23/6/2016	Emissions	Renewables	
Incentives for non-photovoltaic renewable electricity. FER-E. DM 6/7/2012	Emissions	Renewables	
Renewable electricity incentives. DM 4/7/2019 (FER-1)	Emissions	Renewables	
Obligation to integrate renewables into new or existing buildings	Emissions	Renewables	
On-site Exchange (SSP)	Emissions	Renewables	
National Innovation Fund	Emissions		Efficiency R.I.C.
Infrastructure Investment and 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 (NRRP)	Emissions		Efficiency
Energy efficiency of cinemas, theatres and museums (NRRP)	Emissions		Efficiency
Measures for the resilience, enhancement of the territory and energy efficiency of municipalities (NRRP)	Emissions		Efficiency
New charging stations in cities and highways to facilitate the use of electric vehicles (NRRPs)	Emissions		Efficiency
Safe and sustainable hospitals (NRRPs)	Emissions		Efficiency
School building replacement and energy renovation plan (NRRP)	Emissions		Efficiency
Infrastructure upgrading of regional rail transport and rapid mass transport systems (NRRPs)	Emissions		Efficiency
Simplifying and speeding up the procedures for implementing energy efficiency measures (NRRP reform)	Emissions		Efficiency
Electrification of quays, 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: facade 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 (eco-bonus vehicles)	Emissions	Efficiency	
Marebonus and Ferrobonus incentive	Emissions	Efficiency	
Obligation to make public lighting networks more efficient	Emissions	Efficiency	
Sustainable Urban Mobility Plans – SUMP	Emissions	Efficiency	
National infrastructure plan for electric vehicle charging – PNIRE	Emissions	Efficiency	
Cargo Bike programme	Emissions	Efficiency	
Incentive programme for sustainable urban mobility (Primus)	Emissions	Efficiency	
Consumer Information and Training Programme (PIF)	Emissions	Efficiency	
Programme for energy retrofitting of central public administration buildings (PREPAC)	Emissions	Efficiency	
Experimental programme between case- school and work	Emissions	Efficiency	
Replacement of vehicles for the transport of goods	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 LPT and sustainable public mobility	Emissions	Efficiency	
Phase out of coal	Emissions		Security
Southern Cresci 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 in the context of the circular economy	Emissions		R.I.C.
National Indicative Code of Good Agricultural Practice for the Control of Ammonia Emissions	Emissions		
Guidelines for environmental labelling of packaging	Emissions		
National Air Pollution Control Programme	Emissions		
Animal feeding experimental programme	Emissions		
Circular Economy Strategy: (8) minimum environmental criteria (CAM)	Emissions		

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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 with a view to a circular economy	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 waste taxation system	Emissions				
Circular Economy Strategy: (5) right to re-use 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 generation facilities and utilities (Legislative Decree No 102/2014)	Renewables		Market		
Hydrogen – Production of electrolysers (NRRP)	Renewables			R.I.C.	
Renewables and batteries (NRRP)	Renewables			R.I.C.	
National rules governing the Idonee areas	Renewables				
Regional regulation of the Idonee areas and digital platform	Renewables				
Arrangements for the award of concessions for large hydroelectric derivations	Renewables				
Single model for integrated photovoltaic systems on building roofs	Renewables				
Simplification of the authorisation process for renewable installations	Renewables				
Simplification of the authorisation process for renewable installations: unique models and digital platform	Renewables				
Capacity market		Security	Market		
Diversification of LNG supply and upgrading 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 depots		Security	Market		
Reinforcement of internal network to foster RES integration		Security	Market		
Measures on climate resilience networks (NRRPs)			Market		
Smart grid reinforcement (NRRP)			Market		
Bonus sociale gas			Market		
Social light bonus			Market		
Energy-intensive Decree			Market		
Active role of consumers and liberalisation of markets			Market		
Electric buses: channel			production plan (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

Tax credit. Transition Plan 4.0

Electricity System Research Fund

R.I.C.

R.I.C.

R.I.C.

iii. Key issues of cross-border relevance

† **ELECTRICITY SECTOR**

In 2021 electricity demand was 319.9 TWh, an increase of 6.2 % compared to the previous year, and 86.6 % was met by domestic production (277.1 TWh, + 3.0 % compared to 2020) net of the consumption of ancillary services and pumping. The remaining share of needs (13.4 %) was covered by net imports from abroad, amounting to 42.8 TWh, an increase of 32.9 % compared to the previous year.

In 2022, according to preliminary data from the TSO (Terna), the electricity demand in Italy was 316.8 TWh, a decrease of 1 % compared to 2021. The energy demand was covered for 273.8 TWh from domestic production, of which 31 % from renewable sources (with a marked decrease in hydropower production). The remaining share of needs was covered by net imports from abroad (43 TWh).

The modest contraction in electricity demand in 2022 is the result of a “two-speed” year, with positive changes in the first part of the year and negative changes from August onwards, reflecting a number of concurrent factors: the high prices that have characterised the energy markets, the measures to curb electricity consumption implemented by citizens and businesses, including on the instructions of the Government, and the rather mild temperatures recorded in the autumn and winter months. On the production side, the contraction in hydroelectric generation (37.7 %), due to the long period of drought, was partly offset by the increase in thermoelectric generation (+ 6.1 %) and in particular by the increase in coal generation as a result of the measures taken by the Government to tackle the gas crisis. In this scenario, the external balance remained broadly unchanged compared with 2021, against a background of strong volatility in energy market prices over the course of the year.

The national transmission grid is interconnected with abroad through 26 lines: 4 with France, 12 with Switzerland, 2 with Austria, 2 with Slovenia, 4 direct current connections (the cable with France, the cable with Greece, the cable with Montenegro and the double connection, known as SACOI, with Corsica, mainland on the one hand and Sardinia on the other), an additional alternating current cable between Sardinia and Corsica, a 220 kV submarine and terrestrial cable connection between Italy and Malta.

Below is 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

(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 mixes with lower production costs and less flexibility, which leads to even negative prices during reduced hours of load and higher renewable production. Rather consolidated dynamics, but which may evolve in the following years to combine several factors, including: the clear prevalence of RES generation, high CO₂ prices, hydrogen production and changes in market regulation.

Cross-border capacity has been overwhelmingly developed on the northernwestern border (France and Switzerland) to which around three quarters of the volumes of imported electricity can be accounted for. It should be noted that over the period 2021-2022 interconnection capacity increased by around 1.5 GW mainly linked to the border with France. For the French border, we would point out that the first hub of the Italy-France interconnection entered into operation in November 2022, which made available an additional 600 MW of interchange power between borders (entry into operation of the second cluster is expected to take place in 2023). These reinforcements are in addition to the previous entry into operation of MONITA (ITALY – MONTENEGRO interconnection) at the end of 2019. These projects were mentioned in the previous INECP 2019.

Figure 1 – Cross-border import and export trading capacity of existing interconnections (maximum NTC 2023 processing and transit limits – source Terna)



The national electricity system operator has identified medium- and long-term projects that will allow for an increase in foreign interconnection capacity; increase mainly at the northern and southern borders of the country. In the medium term (2030), the estimated total increase is around 1.900 MW, due to the expected entry into operation of the HDVC interconnection project with Tunisia “tunita” (NTC increase on the border of 600 MW), the second HDVC interconnection with Greece “GRITA 2” (NTC increase on the border from 500 to 1 000 MW), the connections with Austria “Nauders-Glorenza” (NTC 300 MW) and “Prati di Vizzi – Steinach” (NTC 100 MW) and the reduction of capacity limitations with Slovenia (with NTC increment on the border of 400 MW). In the long term (2040) an overall increase of 3.560 MW is expected, with the development of the interconnection with Switzerland Valtellina – Valchiavenna with two additional interconnections with Austria (total NTC 660 MW).

In addition, a number of private projects for interconnection with abroad (so-called merchant lines), some of which have already been authorised and are in the process of being implemented.

† **GAS SECTOR**

As regards the natural gas sector, the balance sheet for 2021-2022 is shown.

Table 5 Natural gas balance sheet, 2021-2022

Natural gas balance – Italy (1)				
(million cubic metres at 38.1 MJ/m³)				
January – December				
		2022	2021	Variation %
a)	Domestic production (2)	3.316	3.343	– 0.8 %
b)	Imports	72.403	72.592	– 0.3 %
	Mazara del Vallo	23.554	21.169	11.3 %
	Gela	2.619	3.231	– 18.9 %
	Tarvisio	13.989	29.061	– 51.9 %
	or in Q)	7.593	2.170	250.0 %
	AB C s	10.325	7.124	43.1 %
	o -Mc 3	2.244	1.054	112.9 %
	(U Q_	8.243	7.219	14.2 %
	Livorno (2)	3.785	1.416	167.4 %
	Gorizia	26	39	– 34.1 %
	Other	25	19	31.0 %
c)	Exports	4.614	1.543	198.9 %
D)	Variation in stocks (2)	2.581	– 1.591	– 262.2 %
(e) = a) + b) - c)	Consumption	68.524	75.983	– 9.8 %
-d)	Internal Lordo			

(1) Pre-balance-sheet net of transits

(2) Includes consumption and losses

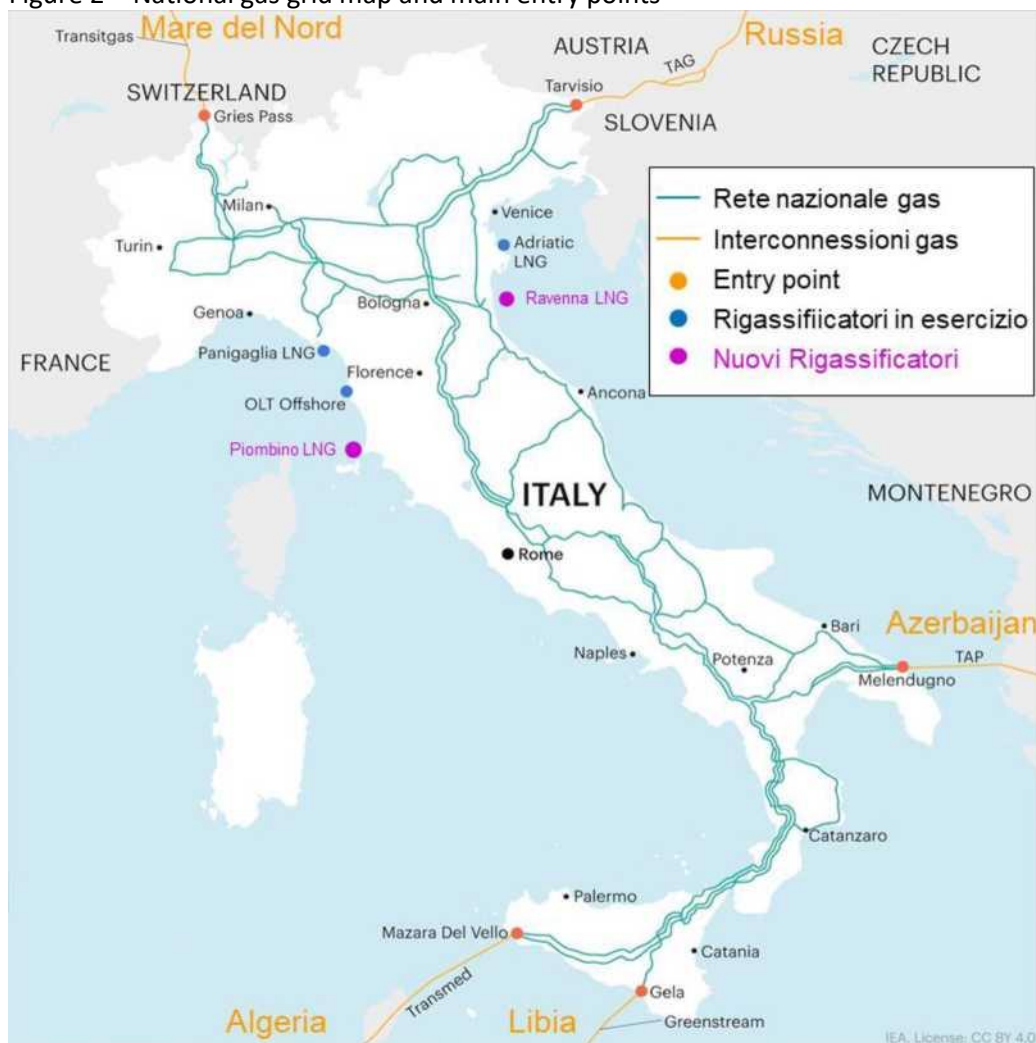
The Russian war in Ukraine has seen Italy and the other EU countries strongly engaged in a huge effort to reduce imports from Russia from the outset. Italy managed to reduce gas imports by more than 50 % through the methane pipeline entering Tarvisio, increasing the use of regasification plants and imports from Algeria (Mazara del Vallo) and Passo Gries (Norway, mainly). It is also noted that gas exports have increased by almost 200 %. As a result, Italy is able to position itself as an energy hub towards Europe, so that relations with countries bordering the Mediterranean are becoming increasingly crucial.

Consumption in Italy in 2022 amounted to 68,52 bcm of Sm³, a decrease of around 10 % compared to 2021 data (75,98 bcm³). As mentioned above, 2022 was a particularly critical year due to the Russian war in Ukraine, which led to a direction of European policies aimed at finding a replacement for 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 taken led to a reduction in gas consumption, which in turn led to a reduction in the use of storage, the lowest that has historically occurred.

The gas from abroad is fed into the national gas pipeline network through 6 entry points for interconnections with imported gas 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 it places at Panigaglia, 'Adriatic LNG' in the offshore Upper Adriatic, which it places at Cavarzere and 'OLT Offshore' in the Tyrrhenian Sea in front of the Tuscany coast which it releases to Livorno.

To accelerate independence from Russian import, two new FSRUs were authorised, the first of which was placed in Piombino; the second one will be located in Ravenna. The two new regasification plants will be able to guarantee an incremental regasification capacity of around 10 billion cubic metres per year.

Figure 2 – National gas grid map and main entry points



This also includes the so-called doubling of the Tap, which will allow greater gas import capacity to be available since 2026.

Finally, the project to interconnect with Malta through a new pipeline from Gela (PCI Project) was authorised. This project will operate on an export basis.

The current quest for diversification of gas supply sources can lead Italy to become a *hub* in the Mediterranean, becoming a gas injection point.

transport to other European countries (Malta, Slovenia, Slovakia), including through the reinforcement of some cross-border and internal infrastructure (to Austria) (Adriatic Line).

Major natural gas discoveries in the Eastern Mediterranean area in recent years, 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, also with a view to increasing security and diversification of supply. As a result of the success of these exploratory activities, Egypt has become self-sufficient and an exporter; Israel has become a natural gas producer and in turn exporter through Jordan; there are still many areas to be explored in Cyprus' EEZ, but also in Egypt and the rest of the Levant. The significant amounts discovered will be fully marketable in the coming years and therefore concrete export options need to be identified 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 initiated by Egypt, which also brings together Greece, Cyprus, Israel, Jordan and the Palestinian Authority with the aim of creating a platform for cooperation, also involving the private sector, on common policies for the use of uncovered gas 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. The founding member countries of the EMGF have been joined by France as a fully-fledged member, while the United States, the European Union and the World Bank are members of the EMGF as observers.

The Forum, which is strongly promoted by Egypt – is located in Cairo and the position of Secretary General is from Egypt's constitution – it has been an important interlocutor between producing, importing and transit countries for gas not only to make the significant quantities of gas discovered and to be discovered marketable, but also to promote the energy transition and policies aimed at decarbonising the gas sector in the Levant basin, also in the light of Egypt's recent presidency at COP 27.

The recent Russian-Ukrainian crisis and the consequent need to be independent from Russian gas supplies have called for gas and LNG imports from supplying countries to be maximised. 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 bcm).

Finally, it is important to highlight the strategic role played by gas storage in ensuring energy security and ensuring seasonal demand modulation, with around 18,5 billion cubic metres of storage capacity.

✚ ILO SECTOR

OLEODOTTO TRANSALPINO (SIOT)

The Transa-Alpine Pipeline (Transa-Alpine Pipeline) is an important crude 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 passes through Italy, Austria and 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 della Valle tank park and the marine terminal located in the Port of Trieste.

Figure 3 – Translpine pipeline, plotted



The oil tankers arrive at the two lanes of Terminale Marino in the Port of Trieste, where the oil is unloaded and transferred to the Park Serbatoi of San Dorligo della Valle (Trieste); from there, the Transalpino Pipeline crosses Friuli-Venezia Giulia, three regions of Austria (Carinthia, Salzburg and Tyrol) and Bavaria to arrive at the 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, of which only six are 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 self-sufficiency in energy through the construction of four small thermal power stations in Friuli, Trieste, Reana del Rojale, Cavazzo and Paluzza, which are necessary to operate the oil push pumps, without having to feed through the electricity grid.

PTANKS OF SAN D ORLIGO OF THE VTO

LL Park Serbatoi di 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 can be stored there at the same time as different grades of crude oil. Crude oil from the two marshes of Terminale Marino in the Port of Trieste is stored in the San Dorligo tanks, and within the Serbatoi Park, through the first pumping station, the crude oil is fed into the oil pipeline on its journey to the north.

The tank park is located in the south-east of the industrial zone of Trieste and, as stated, is used to store and transport crude oil from Terminale Marino.

DCOASTAL REPOSITORY OF MINERAL OILS SEASTOK

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

✚ FURTHER AREAS OF CROSS-BORDER COOPERATION

1 **CROSS-BORDER COOPERATION IN CCS**

Italy intends to develop Carbon Capture and Storage (CCS) technology. Together with France and Greece, a regional plan to support the development of CCS infrastructure in the Mediterranean Sea basin within the scope of the TEN-E Regulation was developed and presented in March 2023. The cross-border plan is scalable and the development of CCS value chains, such as those presented below, allows the promotion of further projects in the region. As a result, other Mediterranean countries could join later to strengthen regional cooperation on CCS.

The role of CCS is widely recognised in achieving climate neutrality and the objective of limiting global warming to 1,5 degrees. CCS value chains have crystallised in northern Europe by leveraging the use of depleted oil & gas deposits in the North Sea, and are in relatively advanced stages of development. As of 2023, the development of such infrastructure in South Europe is lagging behind. By engaging in enhanced collaboration, France, Greece and Italy have expressed a common interest to facilitate CCS projects: maximising synergies on the processes of liquefaction, transport and storage of CO₂ and promoting third-party access infrastructure are key factors for the uptake of CO₂ capture in EU Member States intending to use CO capture. The Mediterranean CCS Plan 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 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 value chains of liquefaction, transport and storage of CO₂ will need to be developed at regional level, for reasons related to:

- Diversity of routes and depots,
- Increased competition between alternative infrastructures,
- avoid dominant positions (which could be created, for example, if CO₂ value chains only occur in parts of Europe),
- optimisation of CO₂ transport routes.

□ **POTENZIALI NATIONAL AND CROSS-BORDER FLOWS**

With regard to international flows of CO₂ from other countries in the Mediterranean area, expressions of interest in injection in Italy have been received, under the procedures of the TEN-E Regulation, from foreign emitters totalling over 1 Mton/year of CO₂, 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 the first half of 2030. Further developments are likely, as the potential expansion of the network and the large capacity of CO₂ storage sites on Italian territory allow for significant volumes of CO₂, which is captured by national and other Mediterranean industrial plants, in particular France. On the other hand, as mentioned above, Italian volumes of CO₂ caught are also expected to be exported to other storage sites in the Mediterranean basin, in particular to Greece.

The PCI candidate projects (Projects of Community Interest) covering the Mediterranean region (Callisto Mediterranean CO₂ Network, Augusta C2 and Prinos CO₂ storage project) are specifically designed in a cross-border context and involve Italy at different levels. The CALLISTO Mediterranean CO₂ Network is part of the wider scope of the Italian Ravenna CCS project, which aims to provide a large-scale open access infrastructure, offering industries and power plants located in both Italy and South Europe with hard to abate a timely and economical decarbonisation solution on a transparent and non-discriminatory basis. The Callisto project involves Italy along the whole CCS chain, providing significant commitment to the development of CO₂ capture, transport and storage infrastructure in Italy. In this project, Italy is the recipient country for CO₂ emissions from other countries, becoming the cornerstone of the sector through its geological storage site in the Adriatic Sea. On the other hand, both in Prinos's CO₂ storage project and in the C2 Augusta project, Italy is part of the process as an emitter country, as the CO₂ storage is located at the Prinos storage site (Greece).

Cooperation with France and Greece on continuous implementation both in the context of the evaluation process for PCI projects provided for in the TEN-E Regulation and in the bilateral context.

CROSS-BORDER OFFSHORE RENEWABLE ENERGY OPERATION AND OFFSHORE GRID CORRIDORS PRIORITIES

According to the policy scenario developed for this plan, a total of around 131 GW of renewable plants are installed by 2030 (of which approximately 80 GW PV and around 28 GW wind), with an increase in capacity of around 74 GW compared to 2021 (of which approximately + 57 GW from photovoltaic and around + 17 GW from wind power). This capacity could develop for a significant part in the centre-south of the country due to the increased wind and solar production capacity, always respecting regional burden sharing. In order to achieve these challenging objectives, it will be important to use the various renewable technologies available, including offshore (including floating) technologies in order to exploit further sunny and sunny areas by limiting land use and landscape impact.

At European level, as we know, 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 2050 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 the specificities and development in each region, to conclude a non-binding agreement to cooperate across borders on the targets for offshore renewable energy to be achieved by 2050 within each sea basin, with an indication of the intermediate steps in 2030 and 2040, in line with the INECs and the offshore renewable potential of each sea basin.

Italy, bordering 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 (specifically for Italy the collaboration takes place with Greece, Spain, France, Malta, Croatia and Slovenia), with a commitment to connect 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” to the Italian national grid by 2030.

CO OPERATION FOR THE DEPLOYMENT OF A CROSS-BORDER HYDROGEN INFRASTRUCTURE

The South H₂ corridor project, developed by SNAM and several Austrian and German TSOs, is part of the European Hydrogen Backbone¹⁰ and provides for the creation of a series of infrastructure linking

¹⁰The European Hydrogen Backbone (EHB) initiative is made up of a group of 32 energy infrastructure operators to build a European infrastructure for the transport of hydrogen from import and production sites to consumption centres. The initiative aims to define the role of hydrogen infrastructure – based on new or upgraded existing gas pipelines to enable the development of a European market for renewable and low-emission hydrogen.

possible future renewable hydrogen production sites in North Africa and South Italy to the EU by exploiting the Italian gas infrastructure that has been adapted to transport this carrier together with new sections to be built. Together with the competent authorities of Germany and Austria, a positive assessment was given to launch the studies necessary to carry out the project that has been applied for the status of a Project of Common Interest within the meaning of the TEN-E Regulation (Regulation (EU) 2022/869) in order to access the funds of the Connecting Europe Facility (Regulation (EU) 2021/1153). In addition to Germany and Austria, several other EU Member States in the Eastern Central Region have expressed an interest in connecting to the South H₂ corridor backbone. The corridor would connect Italy to Germany via Austria and has the potential to be further developed, opening up the Trans Tunisian Pipeline (“TTPC”) and Trans Mediterranean Pipeline (“TMPC”) pipelines linking Algeria/Tunisia and Italy to North Africa’s renewable resources through exploitation. The project, for the Italian part, concerns the construction of an Italian backbone for dedicated transport to meet Italian and European demand for hydrogen by linking production facilities and import infrastructure to final demand and neighbouring countries.

Finally, at the end of 2021, the SunsHyne Corridor project was launched by 5 European TSOs – including Italian Snam, Austrian TAG, Slovak Eustream, Czech NET4GAS and German OGE – to import green hydrogen produced in North Africa into Europe.

The initiative provides for the ‘refilling’ of part of the current European natural gas network to allow the influx of NorthAfrican H₂ on European markets.

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 issue of ‘national production, transport and distribution of energy’ among the competences shared between the State and the Regions.

The text of Article 117 of the Constitution retained, under the exclusive jurisdiction of the State, 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 public safety and security;
- the protection of the environment and the ecosystem.

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

- 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 safety, environmental and territorial compatibility;
- security, reliability and continuity of regional supplies.

Moreover, because of the three constraints that the State and the Regions have in legislating – compliance with the Constitution, compliance with EU law and compliance with international obligations – the Regions are jointly and severally liable with the State to meet the binding energy and climate targets set for 2030 by the European Union. A method of linking the State and the regions to share and achieve national targets adopted at EU level has been tested with reference to the 2020 targets on renewable sources. Pursuant to the so-called burden sharing Decree (Ministerial Decree of 15 March 2012), the contribution that the various Regions and Autonomous Provinces were required to make in order to achieve the national target was set, assigning to each of them specific regional RES

use targets for 2020. An approach based on the sharing of efforts between the different regions is appropriate, at least in some areas and in appropriate ways, beyond 2020, to ensure that objectives are shared and that territorial governments are called to contribute consistently to achieving them. The distribution of the target renewable power by region (burden sharing) will be updated in the Decree on suitable areas to be issued.

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

The functions of the State involve, in the first place, the **Ministry of the Environment and Energy Security (MASE)**, whose scope of action is very wide, having all the environmental competences within it, as well as some of the key competences in the ecological transition process, which relate mainly to the energy sector, including security and affordability 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 Economic Affairs and Finance (MEF)**, the **Ministry of Infrastructure and Transport (MIT)**, the **Ministry of Enterprise and Made in Italy (MIMIT)**, the **Ministry of Agriculture, Food Soving and Forestry (MASAF)**, the **Ministry of Universities and Research (MUR)**, the **Ministry of Culture (MiC)**.

Furthermore, it should be pointed out that the Interministerial Committee for the Ecological Transition (CITE) was set up at the Prime Minister's Office by Decree-Law No 22 of 1 March 2021, which stems from the need to provide an initial definition of the *governance* of the ecological transition, with the task of coordinating national policies on reducing greenhouse gas emissions, sustainable mobility, combating hydrogeological instability and land use, water resources and related infrastructure, air quality and the circular economy.

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

In addition to the central government authorities, a number of other entities, operating in a framework consistent with European rules, contribute to the implementation of national policies linked to the achievement of national objectives. These include, first and foremost, the **Autorità Garante per la Concorrenza e il Mercato (AGCM)** and the **Regulatory Authority for Energy, Networks and Environment (ARERA)**: while respecting their independence from the executive, these bodies have, albeit with different roles, essential tasks of protecting consumers' interests and promoting competition, ensuring efficiency and the deployment of services with adequate levels of quality, including in the field of energy, and, in the case of ARERA, regulating most of the instruments related to national energy policies.

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

Snam S.p.A. is the main infrastructure operator for the transport and dispatch, storage and regasification of natural gas. With regard to transmission and dispatching, the subsidiary **Snam Rete Gas** is an operator of the natural gas transmission system under ownership unbundling in accordance with Legislative Decree No 93 of 1 June 2011, 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 gas pipeline network of Snam Rete Gas, as well as the quality of service levels, are laid down 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 with a view to a long-term strategy, is the strengthening of cooperation between Terna and Snam, with the aim of coordinating the development of their respective ten-year plans on the basis of scenarios that are shared and consistent with the INECP and the long-term strategy, in relation to the needs related to the penetration of non-programmable renewable sources.

The electricity distribution network in Italy is currently divided between 126 **distribution companies (DSOs)** operating on the basis of concessions from the Ministry of the Environment and Energy Safety and the Provinces of Trento and Bolzano. These are very different entities in terms of the size of the territory served, the size and the legal rules of reference (municipalities, municipal undertakings, types of company). The ministerial concession documents are published on the website of the Ministry of the Environment and Energy Safety; in addition, Terna publishes and keeps up-to-date on its portal the list of distribution 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 has been more structured and, moreover, 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 the Environment and Energy Safety and responsible for managing and monitoring support mechanisms for renewable energy – in the electricity, heat and transport sectors – and for energy efficiency.

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

RSE is a company active in the analysis, study and research applied to the whole energy sector, with particular reference to strategic national projects of general public interest, funded by the System Research Fund and international funding. The main contents of RSE 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 orientations and EU energy programmes.

GME is responsible for the organisation and economic management of the electricity market, the environmental, natural gas and fuel markets in accordance with the criteria of neutrality, transparency and objectivity, as well as the operation of the platform for the registration of forward power purchase contracts concluded outside the market.

Au has the role of ensuring the supply of electricity to customers in the protected market (until this segment of the market is exceeded), and, on behalf of ARERA, operates the Consumer Window to provide assistance to final customers of electricity and gas and the Conciliation Service for the settlement of disputes between customers and operators. In addition, through the Integrated Information System (SIII), it is at the heart of the information flows relating to liberalised electricity and gas markets, with a database of collection points and customer identification data. Lastly, the company was entrusted with the functions and activities of the Central Italian Storage Agency (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 Safety, for 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 administrations and

citizens, in accordance with the directives issued by the Ministry. It shall also act as the National Energy Efficiency Agency and implement the technology transfer of research results to enterprises.

The Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA) is the public body under the supervision of the Minister for the Environment and Energy Safety (MASE), which carries out research and experimentation, monitoring and evaluation, strategic advice, technical and scientific assistance, information, dissemination, education and training in environmental matters, with regard to water protection, protection of the atmosphere, soil, subsoil, marine and terrestrial biodiversity and their crops.

Monitoring;

The framework outlined is structured and therefore suggests that both coordination and monitoring activities should be strengthened in order to achieve synergy in pursuit of the ambitious 2030 and 2050 targets.

The scenario set out in the INECP is the target scenario that is now considered to be the most likely of all those assessed during the planning process and which stems from the design of public policies and measures contained in the INECP itself. In order to monitor the effectiveness of these policies and measures over time and to take corrective action if necessary, it is important to have a monitoring function on 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 with the provisions of Eurostat/EU – play a very important role in ensuring accurate identification and verification of the decarbonisation pathway, the degree of achievement of the objectives and implementation of energy and emission policies, both to provide timely feedback to public decision-makers on the effectiveness of the measures and their possible need for updating (active monitoring) and to provide clear and up-to-date information to all stakeholders. With this in mind, in the context of the competences shared between the State and the Regions, while respecting the roles of the sectoral authorities, network operators and market operators and in order to enable the plan to be properly implemented, the intention is to establish a stable technical centre for active monitoring called the ‘PNIIEC Observatory’; this Observatory will also take over the existing Renewable Energy Observatory, in order to verify both the evolution of 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 consists of representatives of the other competent central administrations, a representation of the Regions designated by the Energy and Environment Coordination of the State-Regions Conference, ANCI, GSE, RSE, ISPRA and ENEA, and 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 standard at the State-Regions or Unification Conference, and sharing the necessary evolutionary corrections to the INECP during implementation.

To support the monitoring activities of the INECP 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 it possible to make available information on the level of achievement of the various targets and the effectiveness of policies, the spread of investments on the ground and the performance of authorisation procedures, the evolution of the costs of technologies and the economic and employment impact. The collection and processing of this information, from various sources, will also make it possible to draw up the regular monitoring reports provided for in Regulation (EU) 2018/1999 and to provide input for the INECP’s environmental monitoring plan and 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 pointed out that the verification of emission targets resulting from national, European and international rules and agreements is carried out, managed and updated by ISPRA in accordance with national legislation, and by means of communications pursuant to Regulations (EU) No 525/2013 and (EU) 2018/1999, including through the ‘National System for the Implementation of the National Greenhouse Gas Inventory’ and the ‘National system for policies and measures and projections’.

Finally, in the light of what has been mentioned in Eurostat, namely to strengthen energy statistics and extend their scope to encourage and support policy decisions, so that Italy can keep up with this evolving scenario, it is planned to allocate specific resources to periodic statistical surveys to reconstruct the structure and characteristics of energy consumption in the various sectors (residential, tertiary, industrial, transport), using harmonised methods, definitions and methodologies at Eurostat. At the same time, the aim is to exploit the information in the administrative files of the various bodies and administrations.

1.3 consultations and involvement of national and Union bodies and outcomes

The need for and appropriateness of appropriate public consultation on the INECP stems not only from the relevance of the document, but also from specific provisions of the Governance Regulation, under 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 has launched, from the stage of preparing the 'proposal' for updating, numerous activities, many of which will continue in 2023 and the first half of 2024 in the context of drawing up the 'final version' of the INECP precisely in order to 'continue' the reflection on the new initiatives to be implemented, particularly in the transport, civil and agricultural sectors.

On the basis of the European Commission's recommendations, the results of the consultation launched in the context of the SEA and the work of further technical work to identify additional measures in cooperation with the other competent central administrations, after consulting the Parliament, the regional authorities and the local authorities, will be drawn up the final text of the INECP to be sent in June 2024.

Please find below a summary of the consultation and involvement activities planned for the 2024 INECP.

i. Involvement of the national Parliament

In line with the 2019 INECP, the proposal for updating the Plan will be made available to the Presidents of the Senate and the Chamber of Deputies, who will assign the analysis to the relevant parliamentary committees, in order to launch the usual institutional channels of dialogue with the administrative structures involved in the implementation of national energy and climate policies.

ii. Involvement of local and regional authorities

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

During the preparation of this update proposal, 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 relevant 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.

The comparison with local and regional authorities will continue in 2023 and the first half of 2024 as part of the preparation of the final version of the INECP. The preferred place of discussion will be the Unified State-Cities and Local Self-Government Conference, with the participation of the Ministry of the Environment and Energy Security and the other Ministries involved in the process of identifying and implementing policies and measures, the Regions and the National Association of Italian Municipalities (ANCI).

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

✦ INVOLVEMENT OF INSTITUTIONS AND SECTORAL STAKEHOLDERS

Given the ‘cross-cutting’ nature of the plan, MASE involved the central authorities responsible for pursuing energy and climate objectives¹¹ in the process of identifying policies and implementing the measures relating to the five dimensions of the Energy Union. The main aim of this involvement was to obtain proposals on policies and measures deemed useful for achieving the increasingly challenging objectives stemming from the new European framework.

In addition, a consultation was launched with stakeholders from the productive world, associations and research with a view to obtaining information on specific areas of interest in the Plan. To this end, around fifty associations that are particularly representative of a number of sectors have been involved, including associations in the industrial sector, which is characterised by high energy consumption, and transport (including maritime transport), gas, agriculture, water services, renewables, energy efficiency and the environment.

In particular, the associations were involved by inviting them to fill in a special sheet for collecting the possible policies and measures to be assessed for the Plan, including an indication of any potential, project, constraints and problems, without prejudice to the possibility for associations to express their views on the issues of major interest and on the various and overall issues covered by the Plan.

The contributions received from the associations provided confirmation or more details of certain potential and options to overcome any problems linked to the new and more challenging objectives set out in the Plan. The most recurrent themes were the development of renewables and energy efficiency, including in the industrial sectors, the deployment of biomethane, biofuels, hydrogen and e-mobility. In addition, the various themes and proposals planned will be the subject of further examination during the process of finalising the Plan, which will end in June 2024, in order to identify the additional measures needed to achieve the plan’s decarbonisation objectives.

This consultation took place in May 2023 and participation in this process did not preclude participation in the drafting of the consultation questionnaire published online by MASE.

✦ ONLINE PUBLIC CONSULTATION

Through a dedicated online portal, citizens, businesses, workers’ associations, trade associations, not-for-profit associations, professionals in the sector, financial institutions and investment funds, etc., were given the opportunity to give guidance and make proposals and comments on the main areas of interest of the plan.

The consultation gave rise to a significant participation demonstrating interest in energy and climate issues, offering various insights into: a total of 925 respondents responded (72 % citizens, 22 % companies and trade associations, 3 % environmental associations, 3 % institutions and research bodies).

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 renewables, in the electricity sector, the construction of large installations was also considered essential, with priority being given to the adoption of innovative technologies in particular for wind turbines (especially floating foundation solutions), while for PV, it is considered desirable to give priority to the deployment of industrial and civil buildings over coverings, while other solutions are also used 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 authorisations, not least calling for a reorganisation of the procedures. They were also considered important instruments for the economic support of initiatives, such

¹¹Ministry of Enterprise and Made in Italy (MIMIT), Ministry of Infrastructure and Transport (MIT), Ministry of Economic Affairs and Finance (MEF), Ministry of Universities and Research (MUR), Ministry of Agriculture, Food Soverty and Forestry (MASAF).

as two-way contracts and PPA (Power Purchase Agreement); for the latter, it is hoped that public guarantees and measures will be made available to encourage the aggregation of supply and demand.

With regard to smaller plants, as well as confirming the need for economic incentives to implement them, many stakeholders are confident that energy communities and collective self-consumption will be fully supported in order to encourage distributed generation. These configurations are also considered essential as a means of improving the social acceptability of renewable installations.

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

In the field of energy efficiency, major efforts will be required in the civil field; most stakeholders consider it a priority to continue to focus on significant economic benefits for retrofitting measures, along with the strengthening of the retrofitting requirement for less performing buildings. Other levers, such as those on awareness of available technologies, measures and incentives, are also considered to be important, so that appropriate information and promotion measures are considered important. In the industrial sector, it is considered a priority to promote measures through tax incentives and other instruments, mainly focused on process innovation and the adoption of certified energy management systems. For the public sector, on the other hand, in addition to economic instruments, both the adoption of obligations to reduce consumption and measures of a behavioural nature, training and information on the benefits of efficiency are considered a priority.

Decarbonising transport is one of the most important challenges for emissions and energy transition objectives. In this context, stakeholders highlighted as a priority the reduction of transport demand (smart working, digitalisation of services) and modal shift from private road transport to other means (LPT, rail, etc.), which, however, considered it necessary to significantly improve the quality of services and to integrate them more closely. Equally important is the deployment of innovative technologies, including primarily the deployment of e-mobility. In this context, direct 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 increased urban regulation are also considered important to reduce the average age of the fleet. As regards freight transport, modal shift from road to rail and ship is considered to be the main policy area, 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.

In order to achieve the necessary developments in the field of energy security, stakeholders consider that both electrification of consumption and diversification of sources by promoting renewable gases such as biomethane and hydrogen are a priority. With regard to the flexibility of the electricity system, priority is given to developing renewables in areas with greatest potential, while developing networks and accumulating them in order to facilitate their integration. Lastly, it is considered that the CCUS emission abatement technology should be used primarily for the *hard-to-abate* industry and then for thermoelectric power.

With regard to the market, most stakeholders consider that further instruments are needed in addition to improving those available under current regulations. In order to accompany consumers to the free market, training and information measures on the choice of supplier and on the understanding of bills are considered necessary, although several stakeholders reduce the prolongation of protection schemes. For the most vulnerable consumers, both strengthening existing bonuses and efficiency measures to reduce consumption are considered a priority.

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

With regard to emissions reduction, the replacement of fossil fuels, especially through electrification and the use of hydrogen, is a priority in industry; energy efficiency measures are followed. In the field of agriculture, stakeholders are in favour of a mix of solutions, including, in the first instance, greater regulation of agricultural practices (particularly for manure management), as well as changes in the types of livestock and

crops. Forest development and active policies to combat forest fires are prioritised over the use of forest raw materials. With regard to citizens, raising consumer awareness of sustainable choices and behaviour is a priority, followed by reducing the amount of waste generated and reducing emissions in transport.

With regard to research, stakeholders consider renewable energy as a priority, followed by energy efficiency, storage systems and smart grids.

✦ **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 SEA methodology, as laid down in Article 4 of Legislative Decree No 152/2006, as amended, has as its primary objective ‘to ensure a high level of environmental protection and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development’.

In accordance with Articles 13 and 14 of Legislative Decree No 152/2006, the draft plan, the environmental report and a non-technical summary thereof will be made available to the bodies responsible for the environment and to the public concerned for their views.

This consultation phase will be launched after this proposal to update the National Integrated Energy and Climate Plan is submitted to the European Commission (EC).

iv. Consultations with other Member States

Of course, Italy cooperates with other Member States on many energy and environmental issues. Specifically, with regard to the INECP, the consultation phase with the other Member States will be launched after the submission of this proposal for updating the Plan, taking into account the results of this consultation for drawing up the final version of the Plan.

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 NECPs¹², held up to the first half of 2023, during which discussions were held with the European Commission (EC) and the other Member States on the individual points making up the national plans. These meetings examined the aspects of the five dimensions of the Energy Union, on which particular attention should be paid to the proposal to update the Plan, also in the light of the changed EU regulatory framework, in particular since the 'Fit for 55' legislative package and the Repower EU plan, as well as the changed geopolitical arrangements and the COVID-19 pandemic, which put an even greater emphasis on aspects such as energy security, consumer protection and the fight against energy poverty.

Dialogue with the EC was also maintained 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 current INECP was monitored on time. This process proved to be very useful in monitoring progress towards the objectives, the identification of gaps to be filled and the areas on which more attention was needed in this proposal. In the context of the preparation of the interim report, the comparison with the EC was 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 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.

During the period between the submission of this proposal and the preparation of the final update of the Plan, Italy will maintain constant dialogue with the Commission, also in order to take due account of any recommendations under Article 34 of Regulation (EC) No 1999/2018.

¹²National Energy and Climate Plans

1.4 regional cooperation for the preparation of the plan

i. Elements subject to joint or coordinated planning with other Member States

The recent energy crisis calls for greater regional security coordination with a particular focus on the Mediterranean, infrastructure planning to facilitate the different technologies for decarbonisation and ensuring the adequacy of the energy system, as well as on market design issues. To date, there have been bilateral comparisons, which will also be intensified with a view to the final update of this document.

As also explained in paragraph 1.2 (iii) on cross-border cooperation, one of the themes related to the ecological transition for which Italy is in the process of regional planning is the development of:

- Hydrogen Italian Backbone: 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 Russian fossil fuel imports. The ambition is to produce 10 million tonnes and import 10 million tonnes of renewable hydrogen into the EU by 2030. The Italian hydrogen backbone will offer significant transport capacity for renewable hydrogen produced from South Italy and supplied by North African countries, using mainly existing infrastructure. Redundancy of gas infrastructure along the routes will maintain security of supply for both the gas and the nascent 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 northern EU corridors. It will provide the shortest route to the market for Central Europe;
- electricity interconnections: several initiatives aim to expand the existing interconnection capacity between Italy and neighbouring countries with benefits for the management of the increasing share of non-programmable production. The ELMED or tunita project (included in the CIP) provides for a submarine interconnection with Tunisia in direct current, which would be the first electricity connection between Italy and North Africa, which will strengthen and improve the integration of the EU and North African electricity markets. In addition, the ringmlach – Somplago interconnection, the Lienz – Veneto interconnection and the SACOI 3 Interconnection between Italy and France (in detail the link will be between Corsica and Sardinia and Tuscany) are very important projects to significantly improve the integration of the European market;
- 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 join later in order to strengthen regional cooperation on CCS; also in the CCS field, PCI candidate projects covering the Mediterranean region ('Callisto Mediterranean CO₂ Network', 'Augusta C2' and 'Prinos CO₂ storage') are born in a cross-border context involving Italy at different levels;
- 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 the aim of creating a platform for cooperation, including the private sector, on common policies for the use of uncovered gas 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. To the founding member countries of the EMGF, France was added as a fully-fledged member, while the United States, the European Union and the World Bank were members of the EMGF as observers;
- 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 the 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, bordering both the Eastern Mediterranean and the Western Mediterranean basin, adopted in January 2023

two such non-binding agreements together with the other Member States concerned (Greece, Spain, France, Malta, Croatia and Slovenia), which committed to connect 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” to the Italian national grid by 2030.

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

In view of the regional cooperation activities already under way, including those listed in the previous paragraph, Italy intends to carry out regional discussions, including on specific issues the relevance of which has recently emerged, such as:

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

In addition to these projects, which are also linked to European funding under the REPower EU, bilateral comparison initiatives will be developed in the future, especially in terms of energy security and diversification of sources of supply.

On this point, we would point out that cooperation between the various European countries is now structural in various 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 ENTSO-E and ENTSG), including the definition of energy scenarios (ENTSO-E/ENTSG Scenario Report), the Ten-Year Network Development Plan and the European Resource Adequacy Assessment, working 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 shown by the process of writing the new European network code on demand response, involving not only ENTSO-E, but also the DSO Entity, the distributors’ association.

2 NATIONAL OBJECTIVES AND TARGETS

2.1 Decarbonisation dimension

2.1.1 Greenhouse gas emissions and removals¹³

1. 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 achieve the objectives and targets of the Energy Union and the Union's long-term greenhouse gas emission commitments in accordance with the Paris Agreement, other objectives and targets, including sectoral and adaptation targets*

The European Council of 10-11 December 2020 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, making the EU 2030 target consistent, 'setting a binding target of climate neutrality in the Union by 2050' and 'establishing a framework for progress towards the global adaptation goal'.

The European target of at least 55 % domestic reduction in net greenhouse gas emissions by 2030 compared to 1990, which also includes removals and greenhouse gas emissions from the LULUCF (land use, land use change and forestry) sector, is broken down into emissions subject to the ETS (from energy industries, energy-intensive industrial sectors and aviation) and not covered by this scheme, which are more briefly referred to as non-ETS (transport, residential, tertiary, non-ETS, agriculture and waste). Removals of CO₂ and greenhouse gas emissions of CH₄ and N₂O from the LULUCF sector are regulated by Regulation (EU) 2018/841.

Recent revisions of the relevant legislation included in the *Fit for 55* package foresee a higher reduction in ETS emissions at European collective level from -43 % to - 62 % and non-ETS emissions from -30 % to -40 % compared to the year 2005. Emissions not subject to the ETS (and those resulting from the activity 'maritime transport' and from activities included in the ETS only for the purposes of Articles 14 and 15 of that Directive) fall within the scope of Regulation (EU) 2018/842, known as the Effort Sharing Regulation.

The *Fit for 55* package also includes provisions redefining the scope of the ETS, which will immediately integrate emissions from shipping and, from 2027, emissions from buildings heating and road traffic, which, although regulated by the ETS instrument, will still be included in Effort Sharing.

In addition, with regard to the LULUCF sector, the revision of Regulation (EU) 2018/841 foresees the achievement of the emission neutrality objective by 2025, with reference to the accounting period.

2021-2025, and an additional collective emissions removal target by 2030 of 310 MtCO₂eq, with an Italian target of a net absorption of -35,8 MtCO₂eq by 2030.

Greenhouse gas (GHG) emissions from energy uses account for 80 % of the national total of about 418 million tonnes of CO₂ equivalent in 2021 [Mt CO₂ eq] (national inventory of greenhouse gas emissions,

¹³ Consistency to be ensured with long-term strategies pursuant to Article 15.

excluding the balance of emissions/removals from the LULUCF sector). The remaining share of emissions comes from non-energy sources, mainly related to industrial processes, F-gases, agriculture and waste.

The table below summarises the weight of each sector in terms of GHG emissions (Mt CO₂eq) in the period 1990-2021.

Table 6 – Evolution of emissions by sector 1990-2021 (GHG emissions, Mt CO₂eq) [Source: ISPRA]

	1990	2005	2010	2015	2016	2017	2018	2019	2020	2021
From ENERGY USE, of which:	426	488	430	360	356	351	347	336	300	333
Energy industries	138	160	137	106	105	105	96	92	82	86
Manufacturing industries and	92	92	70	56	54	53	54	50	46	54
Transport	102	128	116	107	106	102	105	106	87	103
Civil	78	96	96	82	83	83	84	81	79	83
Other	15	12	10	9	8	8	8	7	7	6
By OTHER FONTI, of which:	97	106	94	86	87	86	87	86	85	85
Industrial processes and F-gas	41	47	39	33	34	34	35	34	31	32
Agriculture (livestock and crops)	38	35	32	32	33	33	32	32	33	33
Waste	19	24	22	20	20	20	20	20	20	20
TOTAL	523	594	523	446	443	437	434	422	385	418

While for emissions subject to the ETS the target is at European level, as the system is applied to all Member States in a harmonised and centralised manner, for other emissions (transport, residential, tertiary, non-ETS industry, agriculture and waste) the greenhouse gas reduction target is divided between Member States.

These emissions are regulated by Regulation (EU) 2023/857 (the ESR Regulation) on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030, recently adopted, which set an even more ambitious target for Italy, with a 43.7 % reduction by 2030 compared to 2005 levels. This target will have to be achieved according to a reduction trajectory that will result in an annual cap on emissions (AEAs, annual emission allocation).

To achieve the ESR targets, Member States will be able, within certain limits, to make use of flexibility mechanisms to manage the reduction trajectory (intra-period banking and borrowing operations) and to transfer emission allowances with other Member States. In addition to these instruments, there is additional flexibility linked to the accounting of removals and greenhouse gas emissions from the LULUCF sector. This is only allowed on condition that the commitments under Regulation (EU) 2023/839 (LULUCF Regulation) are met. In any case, the LULUCF flexibility sets the cumulative amount of removals for the period 2021-2025 and 5.75 MtCO₂ eq for the subsequent period 2026-2030 at 5.75 MtCO₂ eq. Finally, the *Effort Sharing Regulation* establishes the ‘Safety Reserve’. This reserve, consisting of a volume of allowances of 105 Mt, is intended for countries with a GDP per capita of 2013 below the EU average, which, by 2020, will have made greater reductions beyond their own target (‘*overachievement*’). However, access to the reserve is granted ‘only’ at the end of the 2026-2030 compliance period, since it is in any case conditional on the ‘achievement’ of the EU reduction target by 2030.

The table below gives a quantitative indication of the national location in relation to the objectives agreed at European level in 2030 (old and new target).

Table 7 – ETS, ESR and LULUCF emissions targets

	Reference scenario as at 2030	Objective 2030 (INECP 2019)	Objective 2030
ETS emissions	– 55 %	---	– 62 % *
ESR emissions	– 28.6 %	– 33 %	– 43.7 %

Removals LULUCF	34,9 MtCO ₂ eq	35,8 MtCO ₂ eq
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* *European target*

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

Much more demanding and challenging is therefore the reduction effort in the light of the update of the Effort Sharing target: in order to meet the emission trajectory for the period 2021-2030 (trajectory still under definition), which should lead to a reduction of 43.7 % compared to 2005 levels, it will be necessary to start immediately a significant emission reduction of more than 30 % compared to 2021 levels, to be achieved mainly in the transport and civil sectors. There is no doubt that the way forward to achieve the new European target will require a major effort, including in terms of investment, from the entire country system, not least in the light of the major and profound changes in the economic and geopolitical environment.

With reference to the previous Effort Sharing period (2013-2020), Italy achieved emission reductions in excess of those needed to meet the targets. Although the year 2020 was strongly influenced by the effects of COVID-19 closures, significant emission reductions were already observed in previous years in all major sectors. 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 by the structural crisis triggered since the global financial crisis of 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 emissions in the sector is the evolution of temperatures and the consequent need for warming. In the transport sector, on the other hand, policies on emission and consumption standards for new vehicles have been largely offset by economic dynamics and growing demand for private transport, including changes in behaviour as a result of the pandemic. In summary, for sectors less affected by the economic situation, such as transport and civil society, there are no significant emission reductions since 2013. Therefore, although the reductions required by compliance with the annual allocations for the period 2013 – 2020 were not only achieved but largely exceeded (a total ‘overapplication’ is calculated for the period in terms of emission reductions of 190 MtCO₂eq), the failure to reduce emissions from the transport and civil sectors has led to a gradual approximation of Italian emission levels to the AEAs, until they are exceeded for 2021. This overrun is 10,9 MtCO₂eq.

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

In the update of the plan, it became clear that additional policies and measures were needed to achieve greater energy efficiency in the civil sector (residential and tertiary), to reduce demand for mobility and to promote the uptake of low-emission vehicles, including by increasing their infrastructure.

In civil society, in order to achieve the reduction of emissions by 2030 compared to 2005 and to promote an increase in final energy consumption savings, measures have been put in place to accelerate the rate of efficiency of existing buildings, reinforced by a greater uptake of deep renovation measures and the application of particularly efficient technologies (such as heat pumps and BACS systems).

For the transport sector, emission reductions can be achieved effectively, in addition to the gradual and natural replacement of the vehicle fleet, primarily through the development of shared/public mobility and the progressive deployment of vehicles with low energy consumption and very low or zero CO₂ emissions.

Moreover, looking ahead, a role in driving the decarbonisation of the civil and transport sectors is likely to come from the revision of the ETS Directive, which foresees, inter alia, the creation of a dedicated ETS system that will also cover these sectors: the cap and trade mechanism will complement national policies and measures from 2027.

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

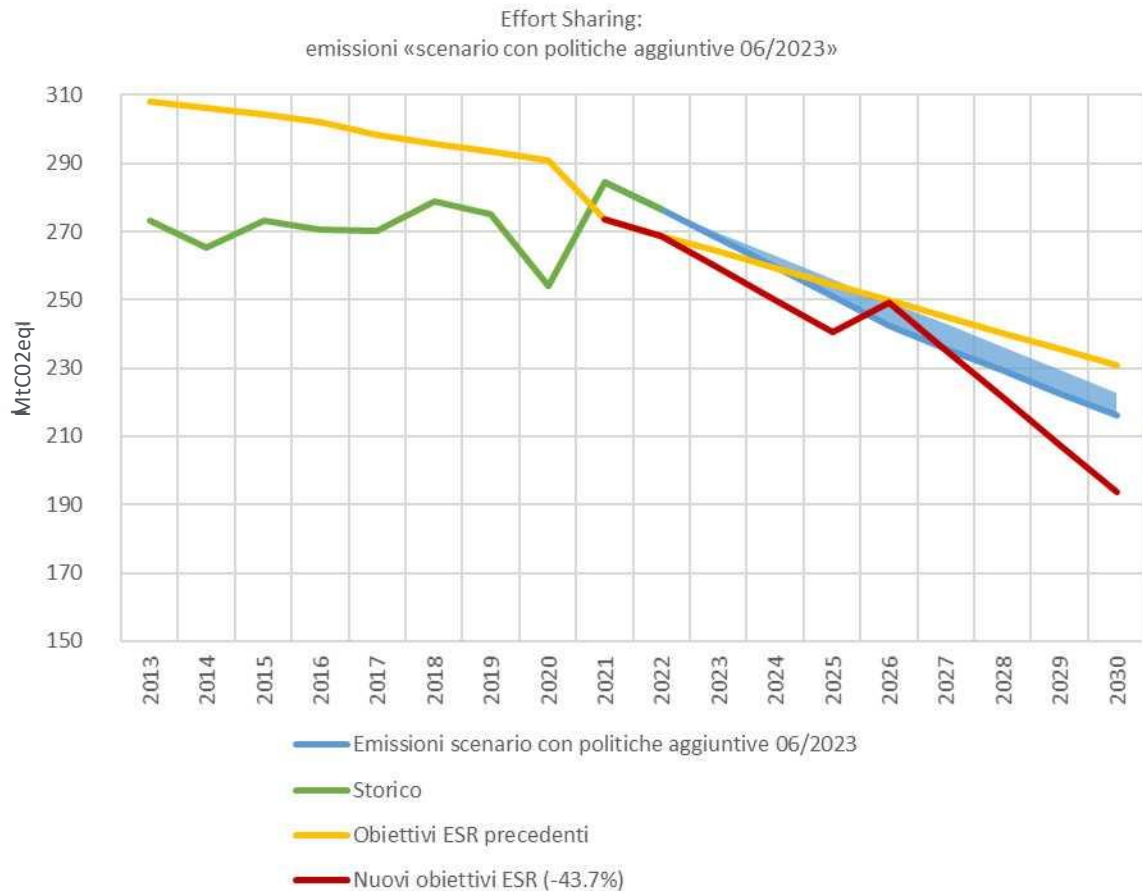
Emissions from industrial processes mainly affect cement, lime and steel production and the use of fluorinated gases. The former are not easily compressible as they are directly proportional to the quantities produced. On the other hand, the implementation of the new Regulation, currently under negotiation, which will replace Regulation (EC) No 517/2014 and which will lead to an even stricter control of F-GAS, will have an effect on fluorinated gases.

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

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

In the agricultural sector, emissions reflect the evolution of factors such as the number and type of livestock, changes in cultivated areas and types 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 in the Rural Development Plans. In the last ten years, however, this sector has remained relatively stable, only marginally influenced by biogas production and the reduction/change in fertiliser use.

Figure 4 – Historical evolution of emissions in the Effort Sharing sectors and future scenarios to additional policies (Mt CO₂eq) [Source: ISPRA]



As shown in the chart, despite the policies identified (included in Cap. (3) there is still a considerable distance from the new Effort sharing target. The combination of these policies, although very ambitious in the civil and transport sectors, currently leads to a reduction in emissions of between 35 % and 37 % 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 in order to achieve the target by identifying new instruments for the involvement of the private and public sector in the upgrading of the existing national building stock. In the transport sector, on the other hand, measures to shift transport from private to public transport through modal shift, to reduce demand for private mobility through smart working policies and to assess the reduction of working days for the same hours worked will need to be more strongly encouraged. It will also be necessary to make full use of digitalisation and the resulting reduction in 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.

With this in mind, further technical work on the Effort Sharing sectors, including in cooperation with the other competent central administrations, will be carried out during the preparation of the final version of the Plan, scheduled for June 2024, also in the light of the consultation process that will be carried out on this text through the Strategic Environmental Assessment (SEA) process. With this in mind, this document, with a view to the final version to be presented in June 2024, should be seen as a shared basis for identifying additional measures in particular in the transport, civil and agriculture

sectors.

Finally, with regard to the LULUCF sector, the contribution for compliance with the ESR target is limited to what is provided for in the LULUCF flexibility (5.75 MtCO₂eq 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) 2018/841 (the LULUCF Regulation) lays down, for the period from 2021 to 2025, a target of neutrality between emissions and removals for the sector ('no *debit rule*') and, for the period 2026-2030, a European target of 310 million tonnes of CO₂ equivalent of net greenhouse gas removals by 2030, distributed among Member States as binding annual national targets calculated on the basis of a linear trajectory. The new LULUCF rules recently approved by Regulation (EU) 2023/839 provide for a minimum 2030 absorption target for Italy of 35.8 Mt CO₂eq.

Over the last 25 years, changes in land use in Italy have led to an increase in forest area (+ 23 %), wetlands (+ 2 %) and urban settlements (+ 42 %); there is also a decrease in the area of grassland, pasture and other wooded land (-5 %) and agricultural land (-18 %) compared to 1990. These dynamics underpin the change in removals and emissions from the LULUCF sector, which overall shows a high degree of variability influenced mainly by the annual fire surfaces and related greenhouse gas emissions.

The table below shows removals and greenhouse gas emissions, in MtCO₂eq, from the LULUCF sector, estimated on the basis of 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 – LULUCF category projections (MtCO₂eq) [Source: ISPRA]

	2005	2015	2020	2025	2030	2035	2040
LULUCF (Land Use, Land-Use Change and Forestry)	— 35,6	— 44,0	— 41,9	— 33,9	— 34,9	— 29,6	— 36,5
Forests	— 34,9	— 40,2	— 35,4	— 34,6	— 35,8	— 36,7	— 36,6
Agricultural land	— 1,8	0,7	— 0,5	1,3	1,3	1,7	1,6
Meadows and pastures, other wooded land	— 6,1	— 9,3	— 8,1	— 5,0	— 3,9	1,6	— 4,9
Wetlands	0,0	0,1	0,0	0,1	0,1	0,1	0,1
Urban settlements	7,7	4,7	5,5	4,7	4,6	5,0	4,7
Harvested wood products (HWP)	— 0,5	0,1	— 3,5	— 0,3	— 1,2	— 1,3	— 1,4
LULUCF (Land Use, Land-Use Change and Forestry)	— 35,6	— 44,0	— 41,9	— 33,9	— 34,9	— 29,6	— 36,5

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

As indicated in section 3.1.1 of this Plan, the National Strategy for Adaptation to Climate Change, adopted in 2015, and the National Plan for Adaptation to Climate Change (NECP), which is currently subject to the Strategic Environmental Assessment (SEA), are the national strategic and planning instruments for adaptation.

From a systemic point of view, the overall objective of the NECP is broken down through four specific objectives:

- define national governance for adaptation, clarifying the need for coordination between the different levels of territorial governance and the different policy areas;
- improve and systematise the knowledge framework on the impacts of climate change, vulnerability and risks in Italy;
- define the arrangements for including the principles, actions and measures to adapt to climate change in the national, regional and local plans and programmes for the areas of action identified in the NECP, exploiting synergies with the other national plans (mainstreaming);
- define sectoral and cross-sectoral modalities and tools for implementing the actions of the NECP at different levels of government.

A second level of intervention is also aimed at exercising a “steering role”, in particular towards the regional and local level, by establishing a comprehensive framework of possible adaptation options, consisting of sectoral measures, which will be applied in the sectoral and cross-sectoral plans in the modalities to be identified by the governance structure. The “steering function” is complemented by two documents in the NECP for the definition of regional and local climate change adaptation strategies/plans.

Following the approval of the NECP, as indicated in section 3.1.1 of this plan, a phase will be opened for planning adaptation actions in the different sectors. The results of this activity will converge into sectoral or cross-sectoral plans, outlining the actions to be implemented.

With the aim of making information and data from the NECP available to all citizens and to support the regions and local authorities in the decision-making process, the “National Climate Adaptation Platform” was made available online in October 2022.

As indicated by the Commission, Member States are invited to strengthen the resilience of the energy system in line with the Climate Law. The draft NECP sets out a number of areas of relation between climate change and energy: firstly, the increase in cooling demand leading to an increase in electricity consumption over the summer period, directly linked to the increase in average temperatures. The same phenomenon leads to lower energy demand to meet heating demand in the winter. Moreover, as stated in the Environmental Report drawn up in the context of the SEA procedure, the increased demand for cooling during the summer period and the consequent increase in the peak electrical power required to meet it may increase the risk of blackouts. This risk must also be seen in the light of the electricity consumption of the various sectors of production. In particular, the high electrification of industry makes this sector particularly vulnerable. The increase in drought periods leads to a problem directly related to water availability. The use of this key resource in the various sectors could be affected by the need for quotas to be used. There is no production or civil sector that does not use water and therefore detailed knowledge of the quantities targeted in agriculture, industry, electricity, civil and other uses is needed.

In relation to electricity production, the trend in the intensity and frequency of extreme precipitation events, if accompanied by a reduction in cumulative precipitation, may have a direct impact on hydroelectric production. A major factor in this respect is the variability in rainfall and the increase in the frequency of drought periods, leading to management problems, especially if some reservoirs were to be closed. This impact is directly related to the melting of glaciers and the resulting change in the regime of watercourses fed by glaciers. As pointed out in the Environmental Report, the change

in the rainfall regime and the melting of glaciers is a critical issue for hydroelectric production, which accounts for a significant proportion of electricity production from renewable sources. The fall in hydropower production therefore 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 the cooling of the plants. The drought in 2022 has shown that water scarcity is also having an impact on the thermoelectric sector. Some production facilities on the River Po were forced to shut down due to the lack of water needed to cool them.

A further impact on electricity transmission and distribution due to the increase in temperature is the expected increase in cable resistance and thus grid losses, which inevitably leads to an increase in production to meet demand, and a more difficult heat dissipation. The risk of power transmission being disrupted due to extreme weather events should also be highlighted.

In view of the above, in order to build a resilient energy system that remains reliable through short- and medium-term climate scenarios and that can evolve coherently also in long-term scenarios, a framework of possible adaptation options (Annex IV of the draft NECP) is available, including, for example, measures to:

- promoting the development of *micro grids* to encourage self-generation of urban communities, while respecting the security and overall efficiency of the system;
 - implementation of programmes and tools for *demandside management*;
 - increasing the degree of interconnection of the electricity grid also in order to complement contributions from renewable sources;
 - the deployment of networks of interconnected regional or national basins with renewable sources, such as floating photovoltaic where applicable;
 - improving interconnection with European networks to compensate for the use of discontinuous renewable sources;
 - reducing the vulnerability of thermoelectric plants to rising temperatures and reducing river body flow rates by replacing open-cycle cooling systems with closed-loop systems, equipping them with air evaporative towers and/or air capacitors;
 - diversification of energy sources to increase security of supply.
- **CARBON CAPTURE AND STORAGE (CCS)**

The use of CO₂ capture and storage/use is essential in order to meet the objective of limiting global warming mentioned in the first part of this plan. The use of CCS (*Carbon Capture and Storage*) is necessary because it allows for:

- decarbonisation of industrial sectors where CO₂ emissions are unavoidable part of the production process. The International Energy Agency recognises that CCS and CCUS are technologies that can make a major contribution to reducing carbon emissions, especially in hard to abate industrial sectors;
- decarbonisation (together with hydrogen and biomethane) of non-electrified industrial sectors due to the need to achieve high process temperatures through combustion or the need for direct feedstock of the production process;
- decarbonisation of industrial processes that generate emissions that are not linked to combustion but which are typical of the production process itself, which cannot otherwise be avoided;
- decarbonisation (together with renewables) of the electricity sector, preserving a share of decarbonised and dispatchable electricity generation;
- a faster development of the hydrogen sector, through the integration of renewable hydrogen with low carbon hydrogen (together with CCS);
- absorption of CO₂ from the atmosphere through the use of bioenergy associated with CCS

(Bio-Energy Carbon Capture and Storage, BECCS) and Direct Air Carbon Capture and Storage (DACCS).

The CO₂ capture and storage sector is regulated in Europe by Directive 2009/31/EC, transposed in Italy by Legislative Decree No 162/2011, which laid down a legislative framework to allow the storage of CO₂ in appropriate geological formations.

The sites where it is technically possible to carry out permanent storage of CO₂ can be distinguished from depleted deposits (in particular gas fields) and saline aquifers.

The depleted deposits have many advantages resulting from a thorough knowledge of the characteristics of the storage site, which has been acquired over the years of hydrocarbon development and production. The exploration and exploitation phases of the deposit have made it possible to characterise the geology of the site, to have knowledge of the dynamics of the deposit and to demonstrate the hydraulic tightness of the cover and its characterisation. The presence of hydrocarbons in the deposits also confirms the definition of a geological trap that may contain CO₂ in the future, as it has contained gas for millions of years. Finally, depleted or depleted deposits are characterised by the presence of industrial infrastructure in the production phases (plants, pipeline wells), part of which can be reused for new developments in the storage of CO₂, fuelling a virtuous circular economy.

In view of the potential of these fields, an analysis of the storage potential was launched in Italy focusing on depleted or depleted oil & gas fields relating only to the Eni mining rights portfolio. The results of ENI's analyses showed a storage potential for the oil & gas fields used in Italy of around 750 Mt.

In addition to the depleted oil & gas fields, as mentioned above, permanent storage of CO₂ may be carried out in saline aquifers.

The advantage over depleted deposits is typically a higher capacity of individual sites to the detriment of less geological knowledge due to a lack of data and specialised studies.

The storage potential of saline aquifers in Italy is not fully known. However, several estimates exist in the literature (Buttinelli et al., 2011; Donda et al., 2011, 2013; Civile et al., 2013; Foxes et al., 2015).

More specifically, in the context of studies carried out, including through national assessments, to identify potential sites for the storage of CO₂ in saline aquifers, reference is made to the study carried out 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 different storage systems in saline aquifers in the areas of Emilia-Romagna, Marche, Abruzzo, the North Adriatic on-offshore, the Middle Bas-Adriatic – Zone B, the Marchian offshore, the offshore Calabro, the Sulcis coal basin and the onshore Malossa (Lombardy). Some of these sites were found to be suitable, resulting in an estimated minimum storage capacity (*worst case*) of 2.152 million tonnes of CO₂. Another public study by the National Institute of Oceanography and Experimental Geophysics (*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 CO₂. Overall, the studies carried out have therefore led to an overall minimum storage capacity in the saline aquifer of around 5 billion tonnes of CO₂.

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

In view of the technical feasibility of storing CO₂ in the various types of deposit described above, Legislative Decree No 76/2020 renewed the legal framework transposing the Directive by introducing special simplification rules, Article 60-bis providing for the suitability of depleted offshore hydrocarbon deposits for use in experimental programmes for the geological storage of CO₂. Therefore, for the application of the current standard for experimental programmes, the CO₂ storage

capacity for saline aquifers, as calculated by the studies mentioned above, is not functional; to date, however, only the CO₂ storage capacity associated with depleted oil & gas fields needs to be considered.

However, in general terms, we would point out that the regulatory framework is being updated, above all, in order to speed up the authorisation process, to define the technical rules and requirements for the transport and storage of CO₂, as well as the business model and the associated regulatory framework for CCS.

The INECP 2019 had recognised the possibility of capturing and storing carbon in both the energy and industrial sectors by 2040 in order to achieve full decarbonisation of the energy system by 2050. Carbon capture, transport and storage facilities were subsequently explicitly included in the list of infrastructure needed to achieve the INECP objectives (Decree-Law 76/2020 and Decree-Law 77/2021). As such, they are of overriding public interest and eligible for a dedicated accelerated authorisation process.

In accordance with the EU Governance Regulation and in order to ensure consistency between its long-term strategy and the INECP, Italy published in January 2021 the Italian Lungo Strategy on the reduction of greenhouse gas emissions.¹⁴ The document identifies possible pathways to achieve climate neutrality in Italy by 2050. To achieve this, 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 reduced to zero by 2050 due to the use of CCS. A total of 418 million tonnes of CO₂ equivalent were issued in Italy in 2019, of which 84 were from the industrial sector. Of these, 54 (or 13 % of the national total) came from hard to abate sectors such as chemicals, cement and steel, for which CCS may be the most realistic decarbonisation option.

- **NEW OBJECTIVES OF THE INECP**

With the current update of the 2019 INECP, as set out in the Commission Communication on guidance to Member States for the update of the National Energy and Climate Plans 2021-2030¹⁵, Member States are invited to step up the green transition towards climate neutrality and strengthen the resilience of the energy system in line with the Climate Law, the Fit for 55 package and the REPowerEU package, while ensuring a just and fair transition. Carbon capture and storage, thanks to its high potential in the race to achieve climate neutrality at a reasonable cost, is an essential decarbonisation technology that is crucial to achieving the new climate targets, while preserving European competitiveness and mitigating social and employment impacts. In particular, the Commission calls for the following information to be included in the updated INECPs:

- aggregate annual projection of inherent process emissions to be reduced through CO₂ capture. On the basis of the objectives set by the Italian Lungo Strategy, the target for reducing greenhouse gas emissions is expected to be approximately 20 to 40 Mt CO₂ by 2050 by storing CO₂, compared with emissions of around 5060 Mt/year – 54 in 2019 – from hard-to-abate sectors, for which CCS is a key, if not the only, resource for decarbonisation;
- annual amount of biogenic CO₂ and directly captured from the air that will be available for the geological storage of CO₂ – geological storage capacity of CO₂ that can be operationally made available on an annual basis. Based on the available data, it is not possible to provide a technical/quantitative estimate for this parameter;
- annual storage capacity of CO₂ which could be available at the end of the exploitation of hydrocarbon deposits – planned infrastructure for the transport of CO₂;

Italian¹⁴ Lungo Strategy on reducing greenhouse gas emissions – January 2023, the Ministry of the Environment and the Protection of Natural Resources and the Sea, the Ministry of Economic Development, the Ministry of Infrastructure and Transport, the Ministry of Agricultural, Food and Forestry Policy (https://www.mase.gov.it/sites/default/files/lts_gennaio_2021.pdf)

15Commission notice on the guidance to member states for the update of the 2021 2030 national energy and climate posts (2022/C 495/02)

- 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 phases of design, from Horizon Europe research (first Horizon 2020) to commercial demonstration and pilot projects under the Innovation Fund, to the deployment of the infrastructure with Connecting Europe Facility.
- At Italian level, the Fund for Sustainable Growth (FCS) is intended to finance programmes – consistent with the objectives of the Green and Innovation Deal – for industrial research and experimental development for all businesses, while for SMEs alone support is also provided for the industrialisation phase;
- possible other measures to support the spread of opportunities for long-term geological storage of CO₂. Possible further measures to support the development of storage opportunities in Italy could cover 2 main areas of intervention:
 - o the assessment of storage potential including all types of storage site (i.e. depleted deposits and saline aquifers).
 - o the definition of the market model and the introduction of support mechanisms for the CCS chain, both in the form of investment support (grants) and in the form of support for operating costs.

Italy also plans to set specific targets for carbon capture and storage in the updated INECP, based on the geological storage capacity of CO₂ that can be operationally made available by 2030 (and beyond), starting from the exploitation of depleted offshore hydrocarbon deposits. As stated above, this storage capacity consists, in total, of more than 500 million tonnes resulting from the conversion of ‘depleted or depleted’ gas fields in the offshore Central Adriatic¹⁶. According to the programmes submitted, storage capacity of around 100 million tonnes over twenty-five years resulting from the implementation of the Ravenna hub storage programme alone can be made available.

❖ NATIONAL PROJECTS

In order to facilitate the start-up of projects and the achievement of storage capacity, Italy also plans to rapidly establish a coherent regulatory framework to support the rapid deployment of long-term geological storage opportunities, the development of capture projects and the gradual growth of transport infrastructure, including cross-border flows. Italy intends to fill any remaining regulatory or procedural gaps in the process of permitting storage and development of the CCS sector. In addition, in order to allow for cross-border projects, Italy intends to deposit a formal declaration of provisional application of the 2009 amendment to Article 6 of the London Protocol and to enter into discussions with France and Greece with a view to concluding bilateral agreements on transboundary transport of CO₂ to develop projects for permanent geological storage under the seabed.

2.1.2 renewable energy

1) The elements referred to in Article 4(a) (2)

2)) With regard to renewable energy:

With a view to achieving the binding EU target of at least 32 % renewable energy in 2030 as 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 consumption of energy 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.

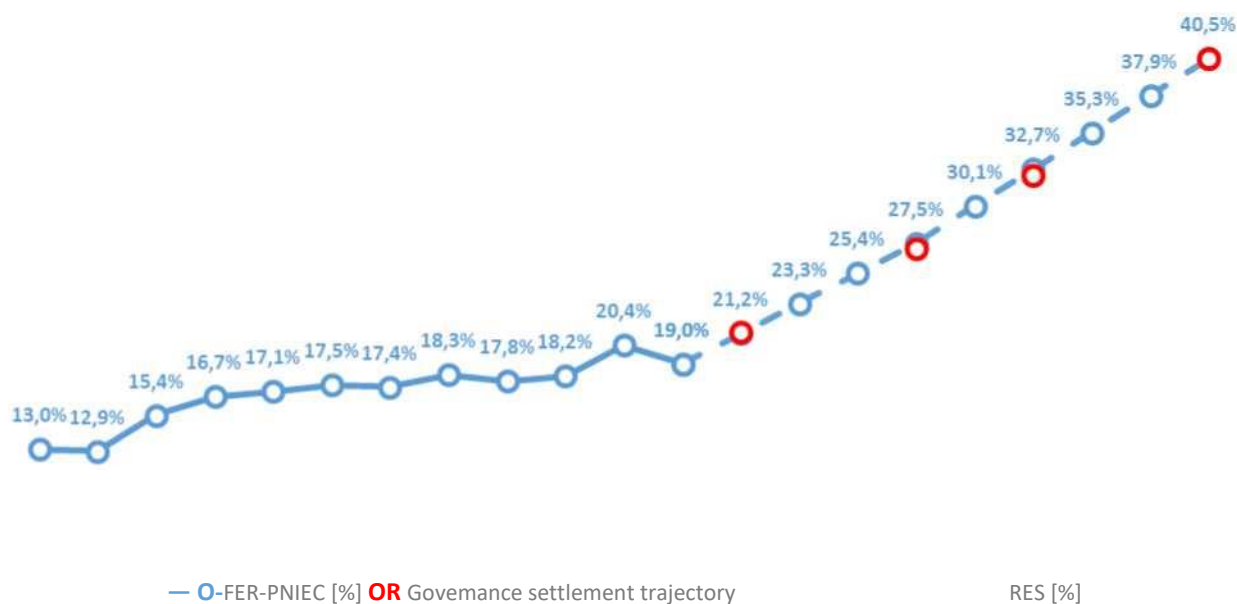
By 2030, the indicative trajectory shall reach at least the Member State's planned contribution. If a Member State expects to surpass its binding 2020 national target, its indicative trajectory may start at the level it is projected to achieve. The Member States' indicative trajectories, taken together, 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 covering 40.5 % of gross final consumption of energy from renewable sources in 2030¹⁷, outlining an ambitious growth path for these sources with full integration into the national energy system; for 2030, in particular, gross final energy consumption is estimated at around 100 Mtoe, of which 43 Mtoe from RES.

The evolution of the share covered by renewable sources is in line with both 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 (between 38.4 % and 39.0 % with the EU target to be achieved of 42.5 %) and the indicative minimum trajectory set out in Article 4(a) (2) of that Regulation (the 'Governance Regulation').

It17 should be noted that, 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 laid down in Directive (EU) 2018/2001 (RED II), as amended by the so-called RED III (of which the texts available in June 2023 are taken into account). As the detailed calculation criteria have not yet been disseminated by Eurostat, some values presented below may change in the coming months.

Figure 5 – Overall RES share track (Share of gross final energy consumption covered by sources renewable) * [Source: GSE, RSE]



2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030

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

Table 9 – ERF overall objective at 2030 (ktoe) [Source: RSE, GSE]

ktoe	2020	2021	2025	2030
Numerator – Gross final energy consumption from RES	21.900	22.934	31.554	43.038
Gross electricity generation from RES	10.176	10.207	13.545	19.580
Final RES consumption for heating and cooling	10.378	11.176	14.519	19.029
Final consumption of RES in transport	1.346	1.552	3.490	4.429
Denominator – Total gross final energy consumption	107.572	120.506	114.655	106.331
Total RES share (%)	20.4 %	19.0 %	27.5 %	40.5 %

II. Estimated trajectories for the sectoral share of renewable energy in final energy consumption from 2021 to 2030 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 as at 2030 (40.5 % of total gross energy consumption) is differentiated between the various sectors as follows:

- *electricity sector*: the share of total national electricity consumption covered by renewable sources is 65.0 %;
- *thermal sector*: the share of total energy consumption for heating and cooling covered by renewable sources is 36.7 %. It should be noted that RED III leads to a sectoral target for Italy of 29.6 % for 2030, which rises to 39.1 %, taking into account the indicative increases provided for in Annex 1a to the same Directive;
- *transport sector*: share of total transport energy consumption covered by renewable sources, calculated using the accounting criteria for the obligation laid down in the revision of RED II, as amended by RED III, of 30.7 % against a sectoral target of 29 % set by the same Directive.

The graphs below show in detail the data on total and sectoral energy consumption and their RES share; for the years up to 2021, the statistical data collected are reported, for subsequent years the scenario calculations.

Figure 6 – Overall RES share track [Source: RSE, GSE]

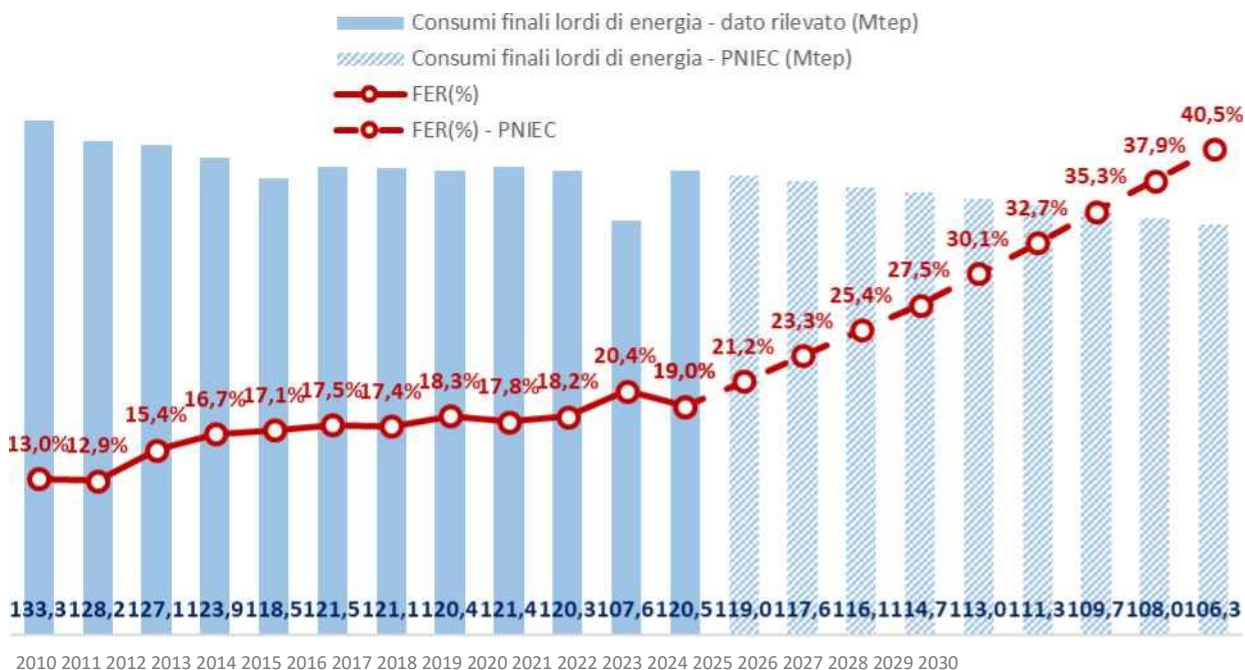


Figure 7 – Electricity RES quota track [Source: RSE, GSE]

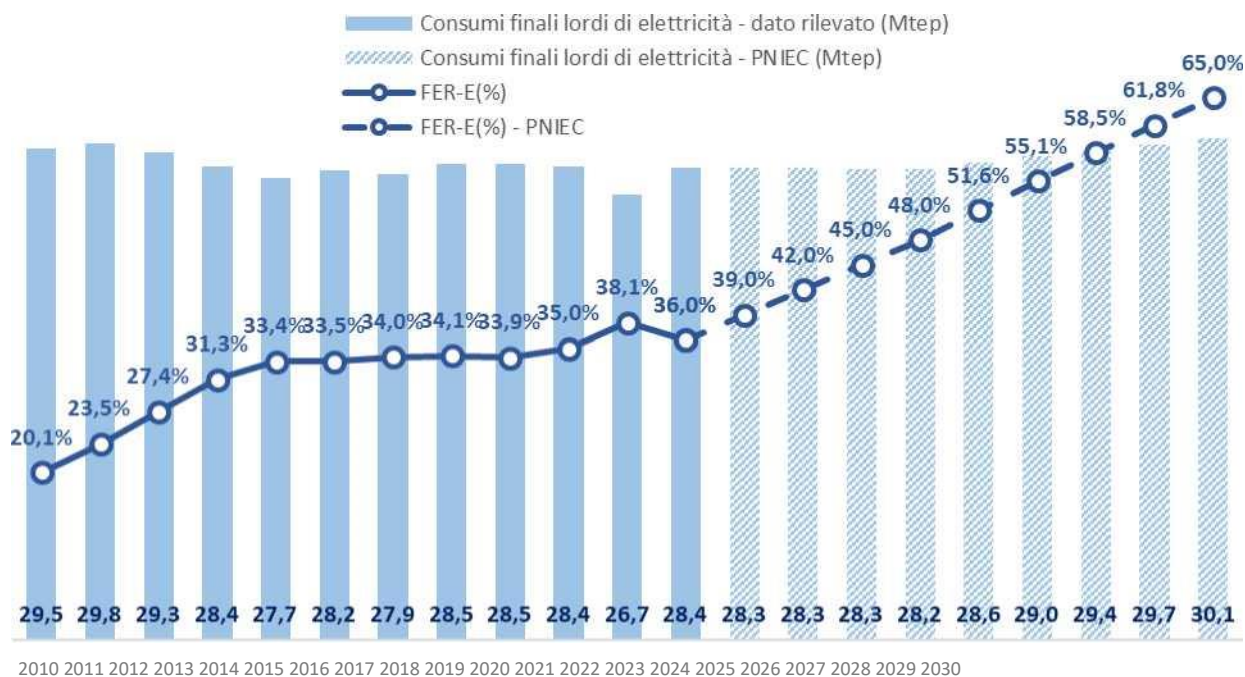


Figure 8 – Traiettoy of RES share in the thermal sector [Source: RSE, GSE]

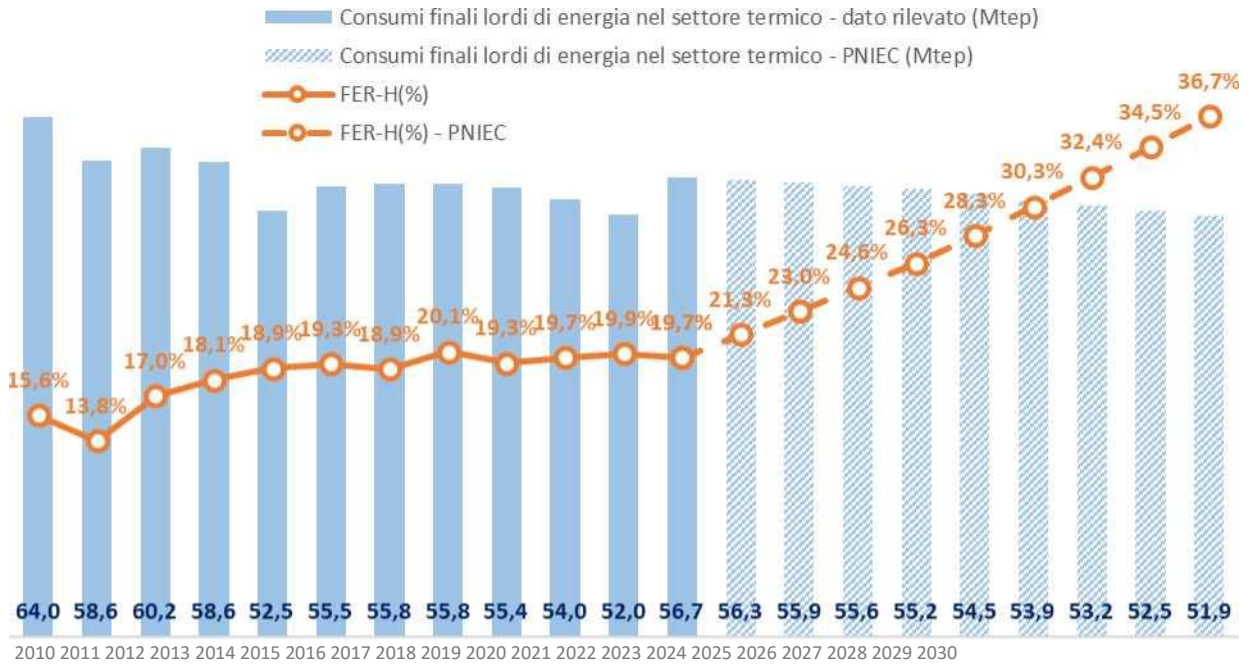
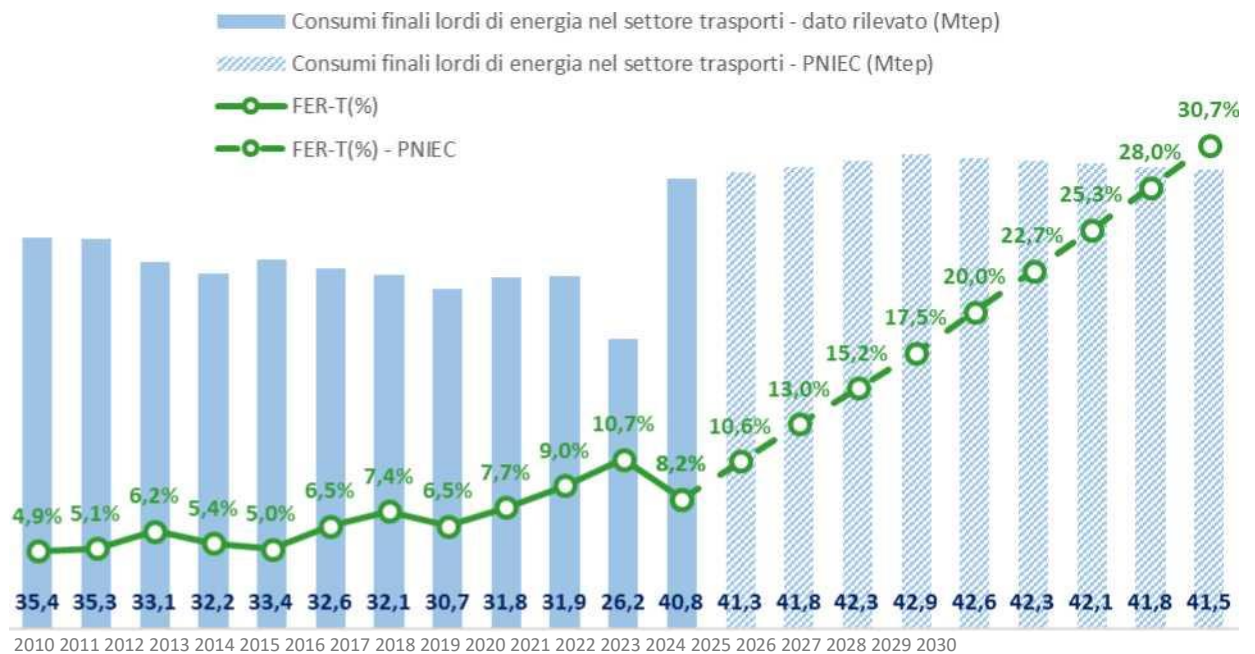


Figure 9 – Traiettoy of the RES share in the transport sector (++++) [Source: RSE, GSE]



++++The variation, between 2020 and 2021, in the overall sectoral consumption for which the share covered by RES is calculated is mainly due to two phenomena: (1) until 2020, the data shall be calculated by applying the criteria and multipliers set out in RED I, and from 2021 onwards applying those set out in 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 general context, RED III requires Member States to define specific targets on RES penetration, which are transversal to the macro-sectors described above. In particular:

- in the district heating and cooling sector, RED III provides for an indicative increase of the renewable share to close to 48 % by 2030;
- with regard to the industrial sector, the indicative increases provided for in RED III lead to a RES quota for Italy of 29 % in 2030; this value is slightly higher than the one resulting from the full policy impact scenario (27 %);
- finally, with regard to buildings, Member States are required to set a target in terms of RES share to reach an EU RES share of 49 %; according to the calculations developed for the policy scenario in this Plan, this share in Italy could amount to 42.5 % in 2030.

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

❖ **ELECTRICITY SECTOR**

According to the objectives of this Plan, the power park module is undergoing a major transformation due to *the phase out* of coal generation and the promotion of the extensive use of renewable energy sources.

The main contribution to the growth of renewables will come from the electricity sector: RES generation will be around 238 TWh by 2030 (228 TWh excluding uses in hydrogen electrolyzers). This RES generation value is already removed from the non-integral part ('overgeneration'), since it would not be economically rational or beneficial to integrate all non-programmable renewable production. A residual share of overgeneration is inevitable as a result of an excellent technical and economic system that limits the development of accumulations to a minimum level of utilisation. The high penetration of renewable electricity generation technologies, mainly photovoltaic and onshore wind, will allow the sector to cover around 65 % of gross final electricity consumption with renewable energy, a significant increase from the 36 % recorded in 2021. The significant technically and economically exploitable incremental potential, combined with the reduction in the costs of photovoltaic and wind power plants, envisages a major development of these technologies, whose production is expected to increase fourfold and more than triple by 2030.

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 investment in revamping and repowering existing wind turbines with more advanced and efficient machines, taking advantage of the good ventosity of sites already known and used, will also make it possible to limit the impact on land use.

A similar approach will be followed, inspired by the reduction in land consumption, to guide the deployment of the significant incremental photovoltaic capacity planned for 2030, promoting its installation primarily on buildings, roofs, parking spaces, service areas, etc. However, the deployment of large ground-based photovoltaic systems also remains important for the achievement of the 2030 targets, but priority is given to unproductive areas that are not intended for other uses, such as land that cannot be used for agricultural purposes, including through the process of identifying suitable areas. In this perspective, projects in marginal areas, contaminated sites, landfills and areas along the infrastructure system should be encouraged.

Support will also be given to agutonal installations aimed at maximising the synergy between electricity production and agricultural activity, while respecting certain technical and environmental requirements.

Innovative technologies will support the construction of floating photovoltaic systems, both on inland and offshore waters.

Wind is expected to contribute offshore, for which floating technology should be the main technology, partly because of the depth of the seabed (beyond 12 miles), as evidenced by the large number of initiatives being developed using this innovative approach.

Efficient development of floating offshore wind requires the simultaneous development of infrastructure (in particular ports) capable of enabling the construction and assembly phase of the production facilities. At the same time, it is necessary to promote the management of the contracting process that takes into account the territorial planning of the Regions and the network development planned by Terna in order to combine ventosity, impact on the electricity grid, local impact and spill-over effects on the territory. The speed with which these aspects will be managed and the increased competitiveness of these technologies will make it possible to shift the wind target from onshore to offshore.

As regards the other sources, moderate growth in geothermal power and stability of hydroelectric power by

2030 is considered.

As far as hydropower is concerned, there is no doubt that this is a resource that has already been exploited to a large extent but of a major strategic level in the policy in 2030 and in the long term until 2050, and production will need to be maintained and increased.

In this respect, a slight increase in production is expected, partly as a result of increased invasion volumes, facilitated by the promotion of their maintenance, for example by measures to reduce the accumulation of sediment of materials. This increase could be useful to balance any drop in production resulting from severe drought events.

For bioenergy, it is considered likely that the total capacity will decrease, consistent with a framework of extensive conversion of biogas plants to biomethane, and the use of only bioliquid plants 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 that ensure their competitiveness. Account should also be taken of the impact of Article 40 (1) (c) of Legislative Decree No 199/2021, i.e. 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) must be reduced, unless they are certified as having a low indirect land-use change risk, in compliance with the criteria laid down in Article 4 of Commission Delegated Regulation (EU) 2019/807.

Table 10 – Renewable power growth targets at 2030 (MW) [Source: RSE, GSE]

	2020	2021	2025	2030
Water *	19.106	19.172	19.172	19.172
Geothermal energy	817	817	954	1.000
Wind	10.907	11.290	17.314	28.140
— of which off-shore	0	0	300	2.100
Bioenergy	4.106	4.106	3.777	3.052
Solar energy	21.650	22.594	44.848	79.921
— of which Concentration	0	0	300	873
Total	56.586	57.979	86.065	131.285

* pure and mixed pumping equipment is excluded.

Table 11 – 2030 growth targets for renewable electricity share (TWh) [Source: RSE, GSE]

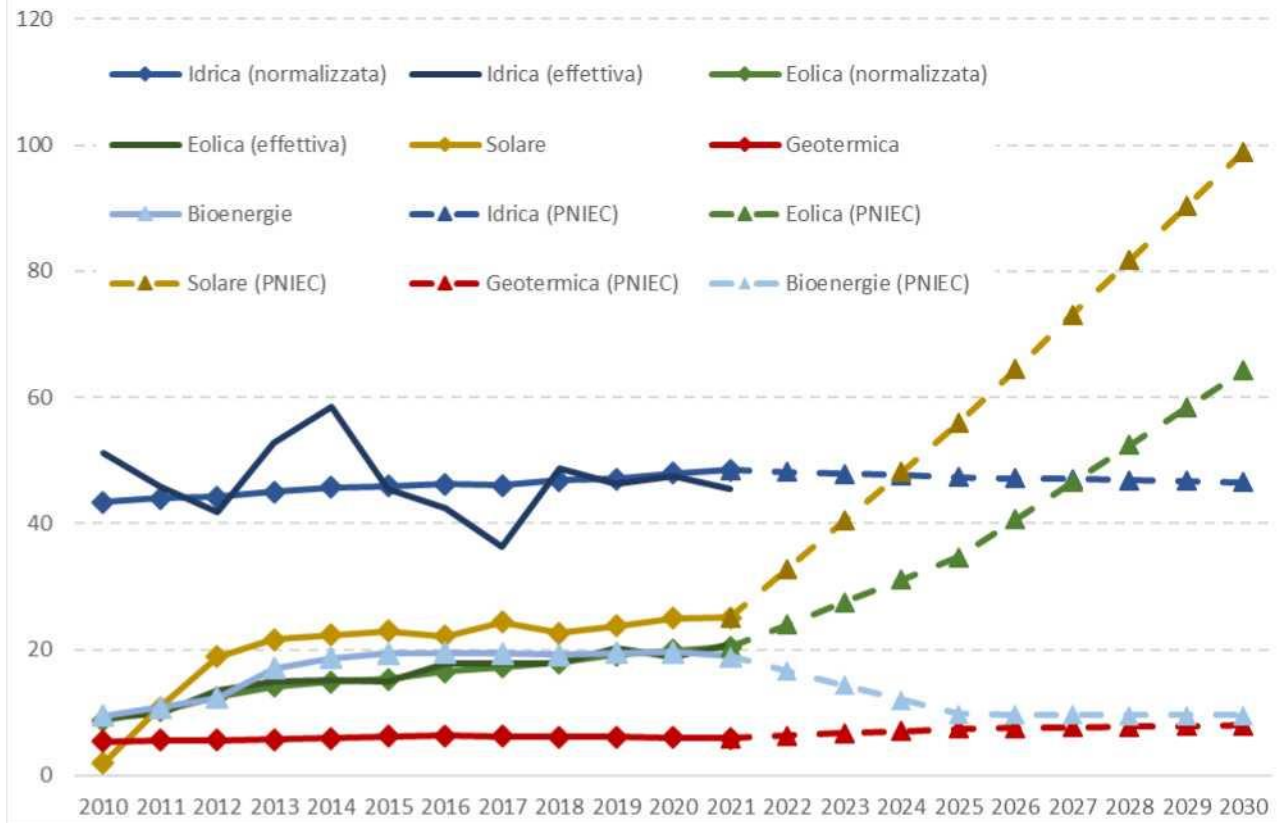
	2020	2021	2025	2030
Numerator – Gross electricity production from RES####	118,4	118,7	157,5	227,7
Water (actual)	47,6	45,4		
Water (normalised)	48,0	48,5	47,5	46,9
Wind (actual)	18,8	20,9		
Wind (normalised)	19,8	20,3	34,8	64,1
Geothermal energy	6,0	5,9	7,5	8,0
Bioenergy#####	19,6	19,0	10,4	9,6
Solar energy *****	24,9	25,0	57,3	99,1
Denominator – Gross inland consumption of electricity	310,8	329,8	328,4	350,1
FER-E share (%)	38.1 %	36.0 %	48.0 %	65.0 %

####The electricity production net of uses in electrolyzers for hydrogen production is shown, in line with the accounting criteria of RED II as amended by RED III. Considering also the consumption of electrolyzers, the expected gross RES production in 2030, which also includes overgeneration, would be more than 238 TWh.

The contribution of solid biomass, biogas and bioliquids that comply with sustainability requirements is##### reported.

Solar***** production by 2030 is reduced by about 10 TWh, which is intended for the operation of electrolyzers for the production of green hydrogen.

Figure 10 – Electricity growth tracks from RES to 2030 (TWh) * [Source: GSE, RSE]



* For water and wind production, for the years 2010-2021, both the actual figure (continuous line) and the normalised figure, in accordance with the rules laid down in the RED Directives, are reported. Only the contribution of solid biomass, biogas and bioliquids meeting sustainability requirements is reported.

❖ THERMAL SECTOR

The heat sector plays a very important role in achieving the renewable targets; a decisive technological change towards solutions conducive to the penetration of renewable energy sources is required. In absolute terms, renewable energy consumption is expected to exceed 19 Mtoe in the heating and cooling sector.

The development of the thermal RES sector is affected by the particulate emissions impacts of existing solid biomass heating systems. Therefore, the installation of new biomass heating systems will have to be guided in such a way as to favour high environmental quality and high efficiency systems, also considering the possibility of introducing restrictions on ex-novo installations in areas with critical air quality situations. In order to stimulate the renewal of old installations with efficient and low emission technologies, stringent 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 to the benefit of the most efficient and less emitting appliances, which meet the best standards with environmental classification (Ministerial Decree No 186/2017), and to consider structuring measures to fund research and technological innovation for this type of plant, with a view to further improving their energy and environmental performance.

It is also intended, with a view to the circular economy, to promote the exploitation of agricultural residues, not least in order to avoid burning them in the field that is currently widespread and, in compliance with European rules, to promote

local biomass with a short chain traceability procedure that meets favourable environmental and social sustainability and balance sheet criteria.

Given their high performance, heat pumps will play an increasing role in the renewable heat mix, further supported by technological progress in the sector, in which the different performance and characteristics of electric and gas pumps can be compared.

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

In order to promote the decarbonisation of natural gas uses, it is intended to promote the injection of biomethane into the grid and its use in the heat sector.

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

Solar thermal can play an increasing role in integrated efficient and renewable heat production systems, such as hybrid systems and integration into district heating plants, including through the promotion of seasonal storage.

The increase in the share of total heating and cooling consumption covered by RES will also be achieved through widespread renovation of the existing building stock leading to a significant reduction in consumption, in particular fossil fuels.

For district heating from renewable sources and waste heat from various industrial processes, there is scope for development, also driven by specific obligations for operators, already provided for 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.

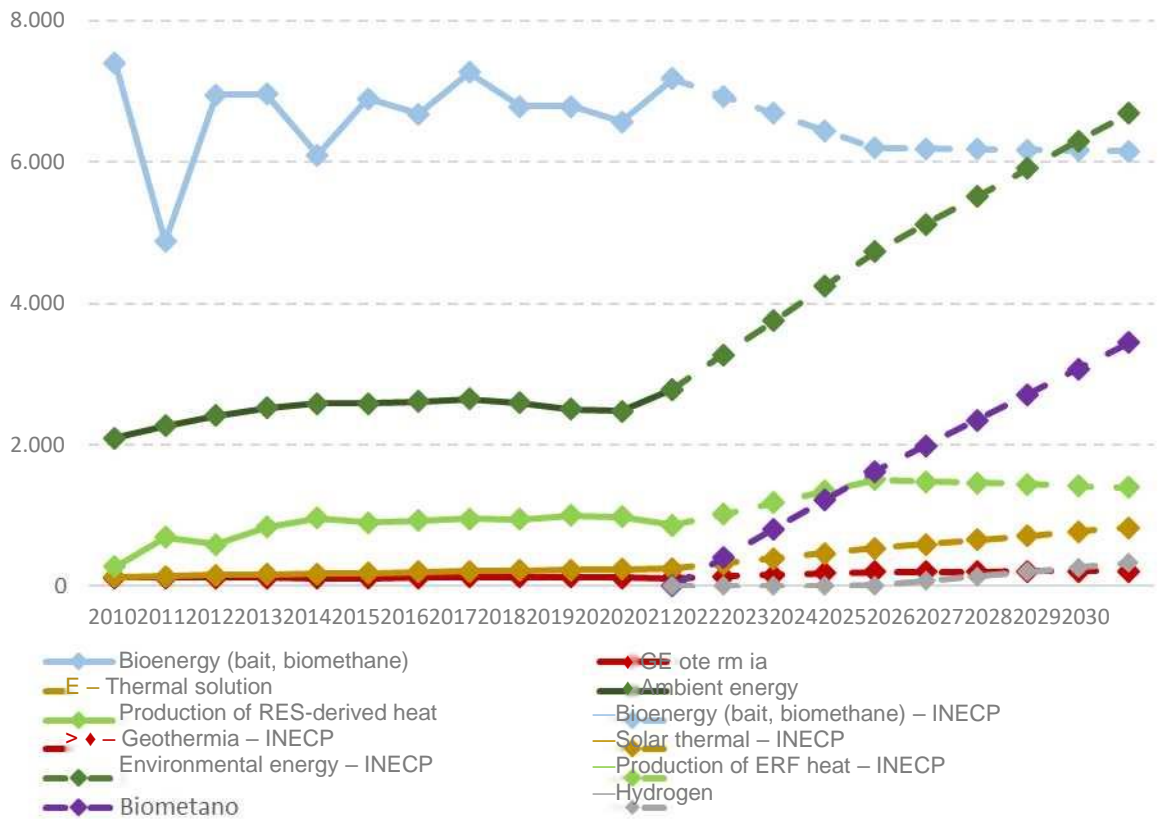
Lastly, we would point out that, according to the calculations developed for this plan, the total national production of biogas for thermal and electrical purposes and biomethane for combustion and use in transport will amount to around 5 Mtoe in 2030.

Table 12 – 2030 growth targets for the renewable share in the heat sector (ktoe) [Source: GSE, RSE]

ktoe	2020	2021	2025	2030
Numerator	10.378	11.176	14.519	19.029
Gross RES heat production	983	862	1.174	1.096
Final RES consumption for heating and cooling	9.395	10.314	13.345	17.933
<i>of which biomethane *</i>	0	0	1.659	3.724
<i>of which other bioenergy *</i>	6.564	7.171	6.207	6.155
<i>of which solar</i>	236	247	534	829
<i>of which geothermal</i>	120	115	204	213
<i>of which hydrogen</i>	0	0	12	330
<i>of which ambient energy</i>	2.475	2.782	4.729	6.683
Denominator – Gross final consumption in the thermal sector	52.023	56.710	55.178	51.884
FER-C share (%)	19.9 %	19.7 %	26.3 %	36.7 %

**Only the contribution of solid biomass, biogas and bioliquids meeting sustainability requirements is reported*

Figure 11 – Energy growth paths from RES to 2030 in the thermal sector – ktoe [Source: GSE, RSE]



- **TRANSPORT SECTOR**

The RED III Directive further increased the specific target in the transport sector to 2030 under RED II (14 %) to 29 %. In order to achieve this objective, the obligation on suppliers should be gradually increased while promoting the use of more than one energy carrier; the combined effect of the measures is projected to reach a renewable share of 30.7 % by 2030.

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 already play a key role in the short term as they contribute to the decarbonisation of the existing fleet and not only to that of new registrations. Moreover, in the long term, biofuels would play an important role in decarbonising sectors that are difficult to electrify, particularly in the aviation and shipping sectors.

The optimal mix for achieving the target for renewable sources in transport is given by the guidance contributions for the various types of renewable sources set out below:

- first generation biofuels: for single counting biofuels, an increase is estimated in absolute terms (from around 210 ktoe to 950 ktoe in 2030, or 2.3 % of total transport consumption). However, in line with the Directive, a move away from the use of biofuels from palm and any other high ILUC-risk feedstock is foreseen;
- advanced biofuel: it is planned to exceed the specific target laid down in the RED III Directive of 5.5 % by 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 and Ministerial Decree of 16 March 2023) until a target of around 10 % is reached;
- biofuels Annex IX Part B: this category currently includes waste vegetable oils and animal fats of categories 1 and 2, but is being extended. For this reason, even though the Directive imposes a ceiling of 1.7 %, leaving Member States the option of increasing this value, the previous INECP proposed an increase of up to 2.5 % by 2030, with a final contribution of no more than 5 % (with double counting); this ambition must be undermined in particular with raw materials harvested domestically, respecting the principle of the circular economy and discouraging the use of imported products whose sustainability and traceability is less certain. We will then assess in detail, but it seems very likely, in the light of the ongoing update of the entire Annex IX, that the ceiling should be increased to 5 % (with a contribution to achieving the target of up to 10 %).
- RES electricity consumed in the road sector: an important contribution is expected in 2030 from pure electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV), which appear to be a private urban mobility solution that can contribute to the reduction of final consumption in private transport for equal journeys and facilitate the integration of electricity renewable generation. An overall uptake of almost 6,6 million electrically powered vehicles by 2030 is expected, of which around 4,3 million pure electric vehicles (BEVs); it is intended to introduce mandatory quotas of electric vehicles specifically for public transport; overall, the contribution of e-mobility by road is expected to be 0,95 Mtoe (3,8 Mtoe taking into account the reward coefficient of 4).
- RES electricity consumed in the rail sector: this consumption will weigh approximately 0,34 Mtoe, multiplied by 1,5 (multiplication factor), representing about 1 % 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, of mobility for people and goods.

renewable non-organic fuels (RFNBO): hydrogen produced from non-organic RES is expected to contribute at least 2 % of total sectoral consumption, higher than that provided for in RED III (including double counting); this contribution will be provided through use in refineries or direct use in cars, buses, heavy goods transport and hydrogen trains (for some non-electrified routes) and, in the medium to long term, in marine transport or through the injection of methane into the network, including for transport purposes. hydrogen of biological origin, produced by gasification of biomass or steam reforming biomethane: this type of fuel is expected to play an increasing role in achieving decarbonisation, but its size is difficult to quantify at present; a process will have to be taken to ensure that each type of product, the environment and the technical regulations are regulated;

aviation and maritime biofuels: a contribution from these sectors is expected, especially following the adoption of the FuelEU Maritime and ReFuel Aviation Regulations; at the moment, however, the same seems difficult to quantify. In the first instance, the release for consumption of biofuels in aviation and shipping is estimated at around 250 ktoe by 2030.

recycled fossil fuels: they are non-renewable fuels produced through carbon recovery, with life-cycle emissions savings of at least 70 % (example: plastics collected separately or fuel obtained from the recovery of CO₂ from the steelworks). This type of fuel will certainly play a role in achieving decarbonisation by promoting the recovery of waste from a circular economy perspective, but its size is difficult to quantify; a process will have to be taken to ensure that the individual types are classified from the point of view of production, the environment and the technical and regulatory aspects.

Table 13 – RES contribution in the transport sector provided for in 2030, in accordance with the calculation criteria laid down in the RED III Directive for obligations on fuel and electricity suppliers – by mode of transport (ktoe) *

	coeff. Red III since 2021	2020	2021	2025	2030
Numerator – RES energy		2.810	3.335	7.495	12.735
Liquid biofuels		1.264	1.415	2.812	2.828
— of which single counting	1	402	213	984	951
— of which double counting		862	1.202	1.828	1.877
of which by road/iron	2	862	1.202	1.755	1.677
of which in ships or	2,4	0	0	73	200
Biomethane		82	137	669	1.242
— of which single counting	1	0	0	0	0
— of which double counting		82	136	669	1.242
of which by road/iron	2	82	136	634	1.186
of which in ships or	2,4	0	0	35	56
Renewable electricity		295	327	653	1.576
— of which in road transport	4	6	13	231	963

	— of which in transport by iron	1,5	135	156	224	339
	— of which in other types of	1	154	158	198	275
RFNBO			0	0	9	390
	of which by road/iron	2	0	0	9	361
	of which in ships or aircraft	3	0	0	0	29
Denominator – Gross final consumption in transport * *			26.178	40.754	42.877	41.546
FER-T share (%)			10.7 %	8.2 %	17.5 %	30.7 %

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

Table 14 – RES contribution in the transport sector planned for 2030, according to the defined calculation criteria the RED III Directive for the obligations of fuel and electricity suppliers – by type of raw material (ktoe)

<i>with multipliers</i>	2020	2021	2025	2030
Numerator – RES energy	2.810	3.335	7.495	12.735
Liquid biofuels	2.126	2.618	4.669	4.785
– of which single counting	402	213	984	951
– of which double counting is not	1.073	1.600	2.139	2.068
– of which advanced double counting	651	805	1.545	1.766
Biomethane	164	273	1.351	2.506
– of which single counting	0	0	0	0
– of which double counting is not	0	0	0	0
– of which advanced double counting	164	272	1.351	2.506
Renewable electricity	520	445	1.456	4.635
RFNBO	0	0	19	808
Denominator – Gross final consumption in transport	26.178	40.754	42.877	41.546
FER-T share (%)	10.7 %	8.2 %	17.5 %	30.7 %

Figure 12 – Biofuels evolution tracks in the transport sector [Source: GSE, RSE]

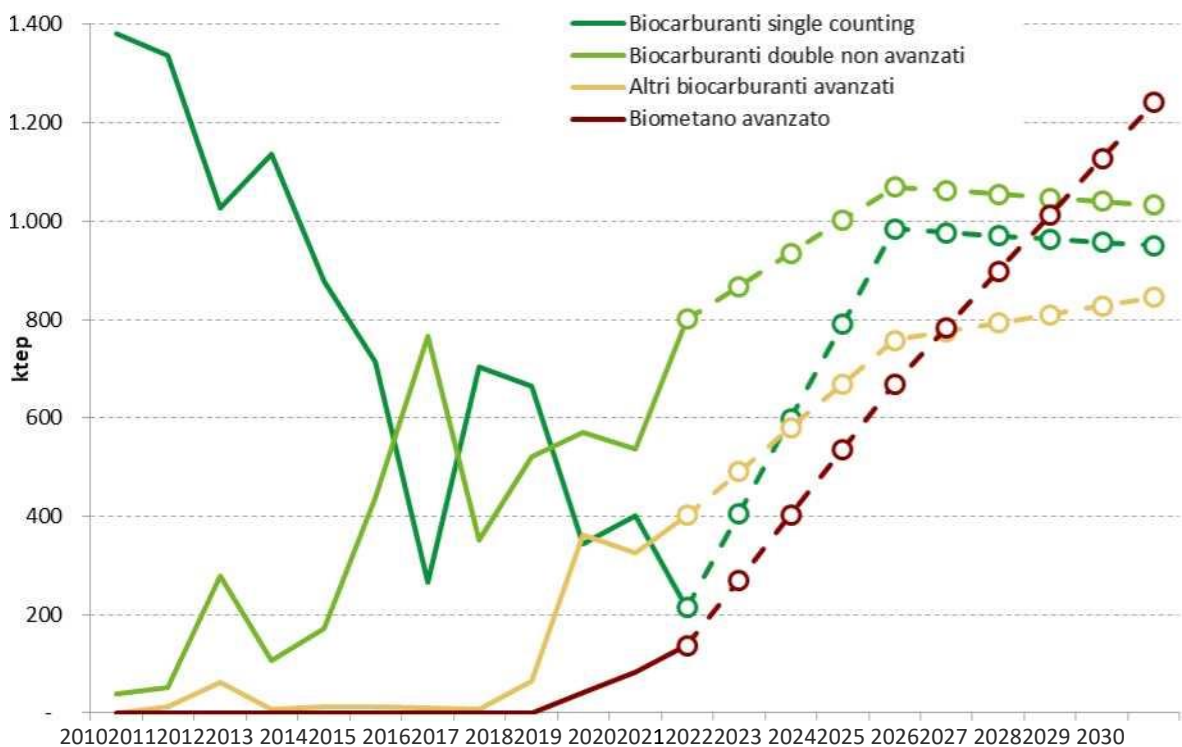
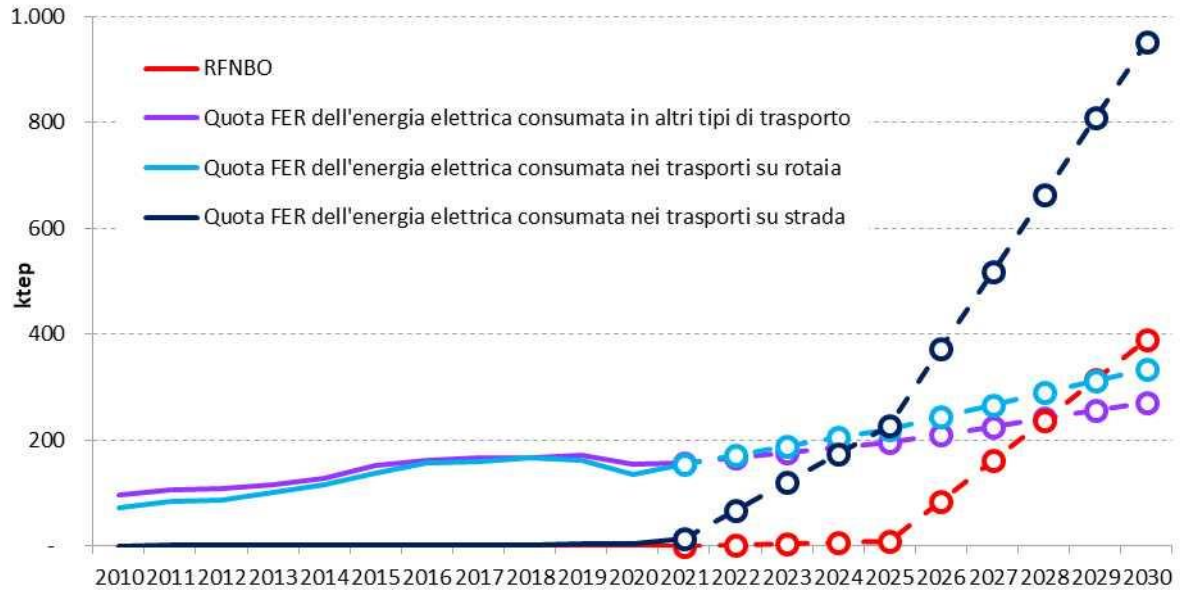


Figure 13 – Developments in the consumption of RFNBO and the RES share of electricity in the transport sector [Source: GSE, RSE]



❖ **HYDROGEN**

The RED III Directive, as well as the proposals for a Regulation of the EU Aviation and FuelEU Maritime (texts subject to political compromise) set out 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 shall be at least 42 % of the hydrogen used for final energy and non-energy purposes in industry. By 2035, this contribution has to increase to 60 % (RED III);
- by 2030, at least 1 % of the energy supplied to the transport sector shall come from renewable fuels of non-biological origin, taking due account of the methodology for calculating double counting under RED III;
- by 2030, at least 1.2 % of the aviation fuel (national and international) shall be sourced from renewable fuels of non-biological origin. The possibility of considering recycled carbon fuels and low-carbon hydrogen is also being considered as part of the approval process for the EU Aviation;
- since 2030, states must commit 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). In addition, from 2025 to 2050, the FuelEU Maritime Regulation includes an increasing obligation to reduce greenhouse gas emissions from energy consumed, to be pursued through 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 % if the Member State is on track to reach the renewable energy production target, or the share of hydrogen from fossil fuels consumed does not exceed 23 % in 2030 and 20 % in 2035.

In view of the fact that the definition of specific national obligations will be quantified only after the adoption of the aforementioned Directive and the aforementioned Regulations, we are setting out initial assessments of the above-mentioned obligations and the definition of the relevant national targets.

Projections of the use of hydrogen in industry indicate that around 330 ktoe of renewable, bio and non-bio hydrogen will be needed to reach the sectoral target by 2030. On transport, an overall consumption

of around 390 ktoe of renewable hydrogen (including RFNBOs) is estimated (see more details in the dedicated section). In addition to the above, it is considered important to assess the need to promote the use of low-carbon hydrogen as a vector for decarbonising hard to abate sectors and transport, in particular shipping and aviation, in combination with the use of CCS.

Overall, the obligations to use renewable hydrogen by 2030 would lead to consumption of around 0,25 Mton/year. It is estimated that at least 80 % of this demand will be produced in Italy, the remaining quota will be imported. Assuming a 40 % load-factor of electrolyzers, then a (electrical) capacity of about 3 GW of electrolyzers would be needed.

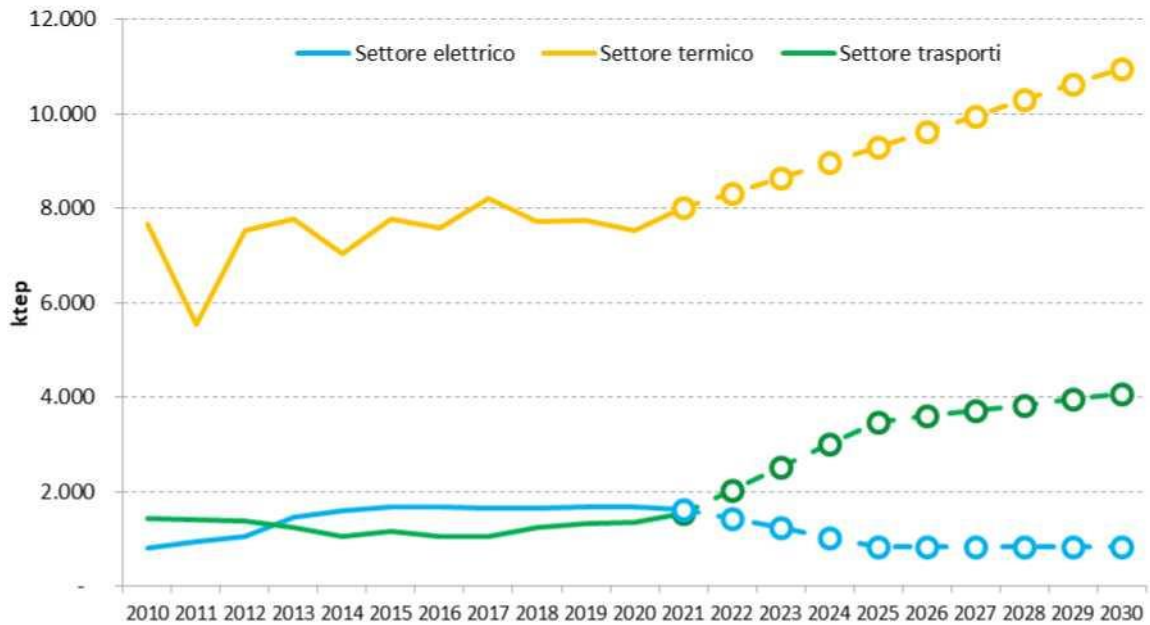
A summary table showing the minimum hydrogen consumption targets by 2030 is given in the table below.

Table 15 – Estimated hydrogen consumption targets by 2030

Year	Sector	Quantity H ₂	
		ktoe	Mton
2030	Industry	330	0,115
	Transport	390	0,136
	<i>of which aviation/navigation</i>	29	0,010
	TOTAL	719	0,251

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 14 – Developing trends in the contribution of bioenergy in the various sectors to reach the RES target by 2030 [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 the first one is expected to have low variability in the supply mix (currently 80-85 % of energy content is from national sources), biomethane will be of purely national origin; this will increase the share of total bioenergy consumption covered by domestic production/origin.

In the electricity sector, the trend is estimated to reduce total bioenergy production, since, although during the transition period all sources can and should make an important contribution, it is expected that there will be a sustained trend in upgrading plants from biogas to biomethane production and using only bioliquid plants that comply with the sustainability requirements laid down in Article 42 of Legislative Decree No 199/2021 and which, in particular, come from national sectors that ensure their competitiveness.

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

Finally, the transport sector is expected to grow decisively in the use of biomethane, in this case accompanied by increases in other types of biofuels.

v. *Where applicable, other national trajectories and objectives, including long-term or sectoral ones (share of renewable energy in district heating, renewable energy use in buildings, renewable energy produced by cities, energy communities)*

renewable and renewable self-consumers, energy recovered from sludge from waste water treatment)

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

In order to promote the spread of plants using renewable sources throughout Italy, by Legislative Decree No 199/2021 Italy introduced the category of 'Idonee areas', immediately identifying some of them by means of national legislation and leaving it to regional legislation to identify further areas on the basis of uniform criteria and principles identified at national level. See paragraph 3.1.2 for a detailed description.

It is of course important to accompany the entire process of high penetration of renewables in all sectors by strengthening the simplification and digitalisation of authorisation processes. The NRRP itself provides for a comprehensive and comprehensive strategy for the modernisation of public administration, through full digitalisation of internal processes through the reengineering of administrative procedures and the development of new technological infrastructure and digital services. Further facilitation of the process of penetration of renewables will be achieved by implementing the so-called digital platform for suitable areas and by standardising regional and local authority authorisation models through the single digital platform for authorisations of renewable installations.

2,2 dimension of energy efficiency

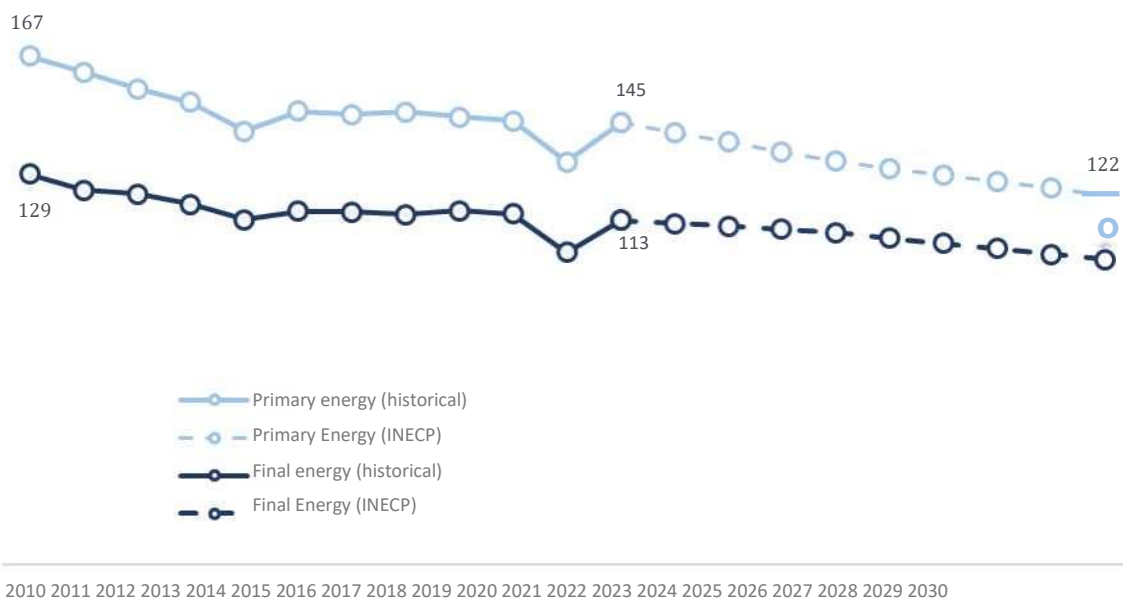
1. The elements referred to in Article 4(b)

(1) the indicative national energy efficiency contribution to achieving the Union's energy efficiency targets of at least 32.5 % in 2030 as referred to in Article 3(5) and Article 1(1) of Directive 2012/27/EU, based on either 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 contribute to achieving the European Union's binding final energy consumption target (referred to in Article 4 (1) and Annex I to the EED¹³ III), according to the calculation formula set out in Annex I to the 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 Directive provides for a flexibility of + 2.5 % (Article 4(4)): the application of this flexibility brings the indicative targets for Italy to 115 Mtoe of primary energy and 94,4 Mtoe of final energy.

The national scenario with policies, which internalises the effect on the reduction of consumption of the implemented and planned measures, estimates final consumption of around 100 Mtoe by 2030. In order to bring this level of consumption to the indicative target described above, further measures in the non-ETS sectors will be considered in order to contribute simultaneously to the emission reduction target.

Figure 15 – Overview of primary and final energy consumption (Mtoe) in the period 2010-



¹³ energy Efficiency Directive (text available in June 2023).

(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;

According to 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:

- By 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;
- 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 necessary step in the calculation of 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 20202030).

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

Table 16 – Distributed final energy and average for the three-year period 2016-2018 (data in Mtoe)
[calculations on Eurostat data]

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

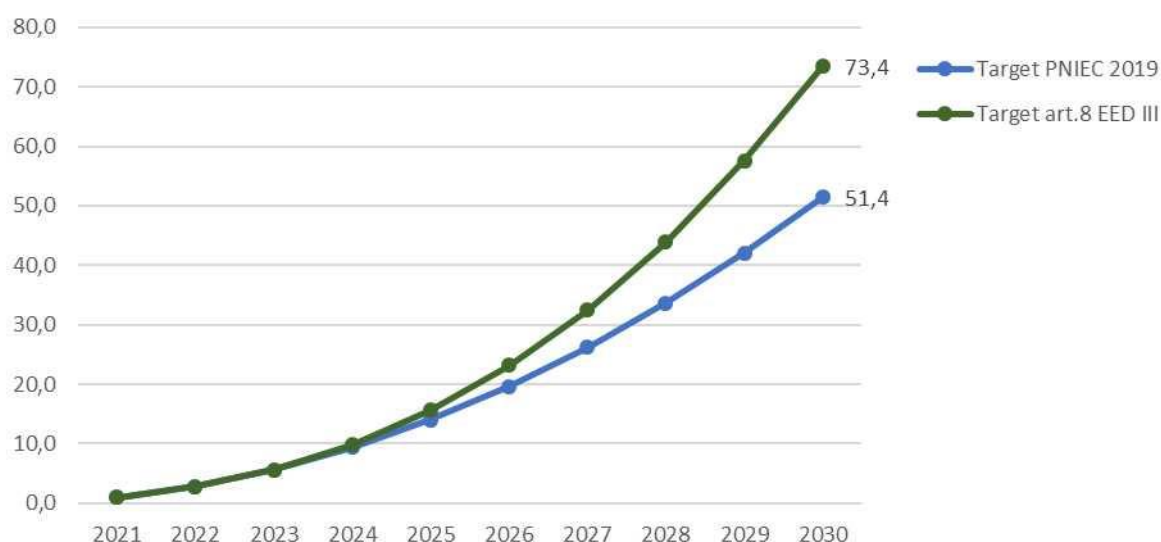
On the basis of the average final energy consumption over the three-year period 2016-2018, it is possible to calculate the annual savings to be achieved in the period 2021-2030; accordingly, the cumulative savings to be achieved by 31 December 2030 shall be calculated. These values are given in the table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

Table 17 – Risks to be achieved in the period 2021-2030 on the basis of the calculation provided for in Article 8, paragraph 1 EED III (data in Mtoe)

Year	Annual savings	Annual final energy savings (Mtoe)										Annual Total (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 the cumulative total amount, this translates into 73,42 Mtoe of final energy savings to be achieved through active policies in the period 2021-2030, compared to the 51,4 Mtoe planned in 2030 by the previous INECP.

Figure 16 – Energy saving target from energy efficiency measures compared to 2021-2030 (Article 8 EED III and PNIEC 2019) (Mtoe)



In accordance with Article 8(3) EED III, a share of the above 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 chose not to make use of the flexibilities provided for in Article 8 (6) to (9) EED22III.

In terms of consumption sectors, there is a need to prioritise energy efficiency measures in the civil and transport sectors, both because of the considerable scope for reducing these sectors and because of the synergies needed to meet the other challenging targets for non-ETS emissions and renewable allowances to be achieved in thermal and transport uses.

In the civil sector, action will need to be taken in particular to reduce the energy needs of buildings by means of deep renovation measures and by increasing the uptake of highly performing technical systems such as heat pumps and BACS systems²³. The needs will then have to be met mainly by renewable sources, so it will be important to promote the integration of thermal and electric renewables into buildings.

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

(3) the indicative milestones of the long-term strategy for the renovation of the national stock of residential and non-residential buildings, both public and private, the roadmap with domestically established measurable progress indicators, an evidence-based estimate of expected energy savings and wider benefits, and the 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 is currently responsible for around 44 % of national final energy consumption and 29 % of direct emissions from non-ETS sectors. These data show the importance of energy retrofitting of buildings in this sector in order to achieve the energy and emission reduction targets outlined in this plan, while also ensuring economic and social benefits.

In addition, the Commission's proposal to revise the EPBD²⁴, presented as part of the FF55 package, introduces important building renovation targets.

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-a 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, subsequently, identifies the rate of energy retrofitting of the current building stock and that objective, also highlighting the desirability of energy retrofitting with an integrated approach that improves cost-effectiveness.

The²² above 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.

²³Building & Automation Control System

²⁴Energy Performance of Building Directive

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

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

Table 18 – Number of Italian municipalities by climate zone and degree day (ENEA compiled from ISTAT data)

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

For the winter heating of existing buildings, national energy consumption may be considered to be proportional to the product between the grades day and the population; climate zone E, which is the most populated, is therefore the one with the greatest weight on consumption, while climate zone B is the smallest, excluding zone A, where only 0.04 % of the population resides (being represented by only two municipalities).

The consumption pattern of final uses in 2021 shows the large 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**

Residential buildings account for 12,42 million, with almost 32 million dwellings. More than 60 % of this building stock is over 45 years old, i.e. before Law 373/1976¹⁷, the first law on energy savings. Of these buildings, more than 25 % have annual consumption from a minimum of 160 kWh/m² year to more than 220 kWh/m². Below is the situation of the housing stock in the residential sector, broken down by year of construction and climate zone.

¹⁷ rules for the containment of thermal energy consumption in buildings

Table 19 – Residential buildings, number and surface area at 2018, by time of construction

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

Table 20 – Residential buildings, number and floor area at 2018, by climate zone

Climate condition	Number of	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

The growing importance of energy poverty makes it worthwhile to focus on public housing (dwellings owned or managed by former IACP companies)²⁵, which in Italy are just over 710.000, as shown in the table below.

Table 21 – Ex-IACP residential buildings, number and area, in 2018 by climate zone

Climate condition area	Number of dwellings in ex-IACP residential buildings	m ²
zone A	323	25.525
zone B	47.370	3.707.379
zone C	149.549	12.248.408
zone D	189.043	14.282.064
zone E	306.167	22.115.704
zone F	18.142	1.291.259
Total	710.594	53.670.340

²⁵When discussing public housing, it is preferable to talk about dwellings, given that ownership of different properties within a building is often mixed, as some residents may have bought their home and also subsequently sold it.

According to ISTAT, there are 1.576.159 buildings and complexes of buildings for non-residential use in Italy, representing around 11 % of the total; these buildings are grouped by ISTAT into the following uses: productive, commercial, directional/tertiary, tourist/hospitality, services and other types of use. For the purposes of this analysis, buildings intended for non-residential use have been grouped into the most widespread classes, excluding production: schools, offices, commerce, hotels, health, prisons, barracks.

Table 22 – Consistency of the building stock by sector (Source: processing of various data by ENEA.)

Intended use	Number of buildings/facilities	Surface
Mono Residential —	9.298.410	1.347.849.624
Multi-family residential	3.121.993	1.701.956.558
Government offices	17.229	27.845.573
Hospitals	27.103	49.600.000
Schools	56.049	84.338.970
Private offices	57.129	35.167.597
Hotels	27.143	36.550.400
Penitentiaries	198	3.138.257
Barracks	2.489	13.965.365
Trade:		
<i>Mini-market</i>	5.724	1.654.028
<i>Supermarket</i>	10.781	10.124.147
<i>Hypermarket</i>	692	3.973.374
<i>Department store</i>	3.263	3.578.382
<i>Large surface area</i>	1.847	5.653.377
<i>Other</i>	853.993	262.156.892

Source: processing of various data by ENEA.

❖ NZEB

Since 2021²⁶, all new buildings or buildings undergoing major first-level renovation must comply with the technical and performance requirements laid down in 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 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.

It can be seen that in all regions of Italy there is an increase in nZEB, the number of which in 2018 amounted to around 1400 buildings, mostly new (90 %) and residential (85 %), as indicated by the NZEB Observatory. Non-residential nZEB buildings are thus also on the increase, thanks in part to incentive policies currently in place for public buildings. In this area, the most common interventions generally concern the envelope part (opaque, transparent and solar shields), the replacement or efficiency of air-conditioning, ventilation, lighting and domestic hot water systems, the installation of automatic management and control technologies for thermal and electrical systems, including heat regulation and metering systems, the installation of monitoring and control systems.

²⁶Since 2019 for public administration buildings.

and regulation, installation of renewable energy generation systems for self-consumption (solar thermal, photovoltaic, heat pumps, biomass generators).

ENEA's publication "Observatory of Nearly Zero Energy Buildings (nZEB) in Italy 20162018" estimated that more than one hundred and thirty public buildings, mainly non-residential buildings, could be renovated at nZEB level by 2020. However, the share of nZEB in the existing stock of buildings does not exceed 0.03 % on a regional basis and less than 10 % of the total nZEB are existing buildings upgraded to this standard, mainly small mono or bi-family buildings and schools. Another problem is the adoption of a reduced set of technologies to achieve this standard, which very often does not take account of the climate zone in which the buildings are located (increased insulation of the building envelope, electric heat pumps/condensing boilers, photovoltaic and solar energy systems for the production of hot water). This shows that much still needs to be done to aspire to a building stock with very high energy efficiency standards and consistent with a goal of almost complete decarbonisation of the civil sector.

❖ **ASSESSMENT OF 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/m² 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 23 – Intended use and average annual consumption indicator weighted by climate zone

Intended use	Electricity 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
Government properties	50	114	164
Hospitals	211	185	396
Schools	20	130	150
Offices	67	130	197
Hotels	92	139	231
Penitentiaries	50	191	241
Trade:			
<i>Mini-market</i>			535
<i>Supermarket</i>			598
<i>Hypermarket</i>			527
<i>Department store</i>			255
<i>Large specialised store</i>			219
<i>Other</i>			388

Source: processing of various data by ENEA.

The analysis developed by ENEA and Assoimmobiliare (National Real Estate Association), on the basis²⁷ 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 % between networked and self-generated and self-consumed energy. 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 about the m² m per bed 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 as part of the Energy Retrofitting Programme for Central Government Buildings (PREPAC) have also provided useful supplementary information.

Finally, we would point out that a recent survey carried out by Cresme on a sample of 1.430 public housing dwellings shows an overall level of consumption around 4 % higher than the total value of the housing stock estimated by Cresme for 2018. This difference seems to be determined by the electrical component, which is greater than about the

²⁷Received by ENEA under the obligation set out in Article 8 of the EED II.

16 %, while the thermal component appears more online (+ 1 %). This figure needs to be read taking into account different specificities: a lower share of unoccupied dwellings by residents in public housing, an increase in the use of dwellings (older people and fewer workers), a combination of the age of heating systems and a low uptake of energy retrofitting 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.

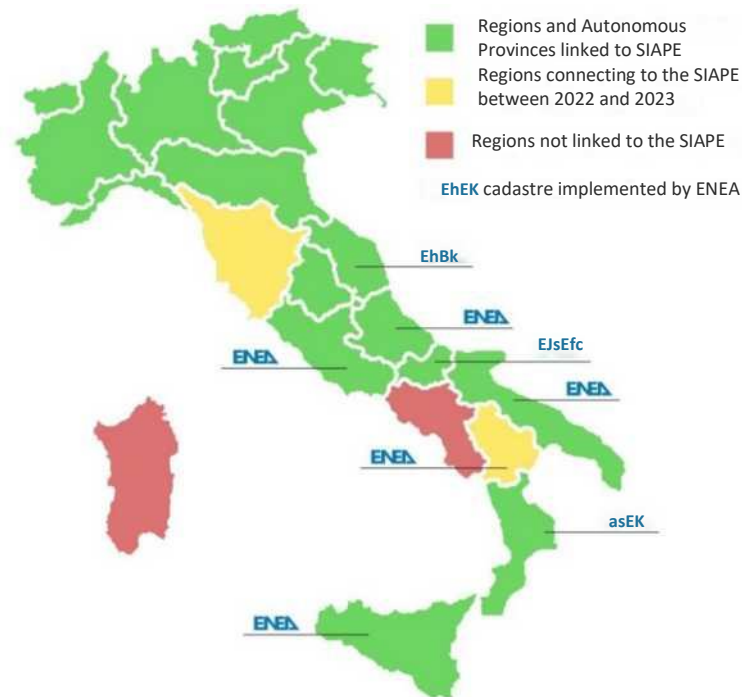
In general terms, consumers in the non-residential sector, in particular in the case of certain uses, are characterised by very high consumption, thus leaving room for a high potential for energy efficiency.

NONETHELESS, *IL SISTEMA INFORMATIVO SUGLI ATTESTATI DI PRESTAZIONE ENERGETICA – SIAPE*

The Energy Performance Certificate Information System (Il Sistema Informativo sugli Attestati di Prestazione Energetica – SIAPE) is the national tool for collating energy performance certificates, set up in accordance with the Interministerial Decree of 26 June 2015. The SIAPE, created and managed by ENEA, is supplied with data from the Regions and the Autonomous Provinces, thanks to a single shared XML path, which creates a connection between the national land register and the regional and provincial land registers. Access is granted to Regions and Autonomous Provinces on the basis of their geographical area of competence; data relating to the rest of the national territory can only be consulted in aggregated form. This second form of access is also open to citizens, as is the opportunity to generate statistics relating to existing energy performance certificates.

As at 01/04/2022, after the legal deadline for including the EPAs issued in the previous year, there were 17 bodies linked to the national system (15 regions and 2 autonomous provinces), an increase of 4 regions compared to the 2020 legal deadline (Figure 15); in addition, Tuscany started the transfer of data to SIAPE in June 2022 and Basilicata will grant access between 2022 and 2023. ENEA has played a key role in this process by actively cooperating on the development of regional EPA collection systems; in fact, 7 of the databases linked to SIAPE have been implemented and are managed by ENEA and another one will be finalised between 2022 and 2023.

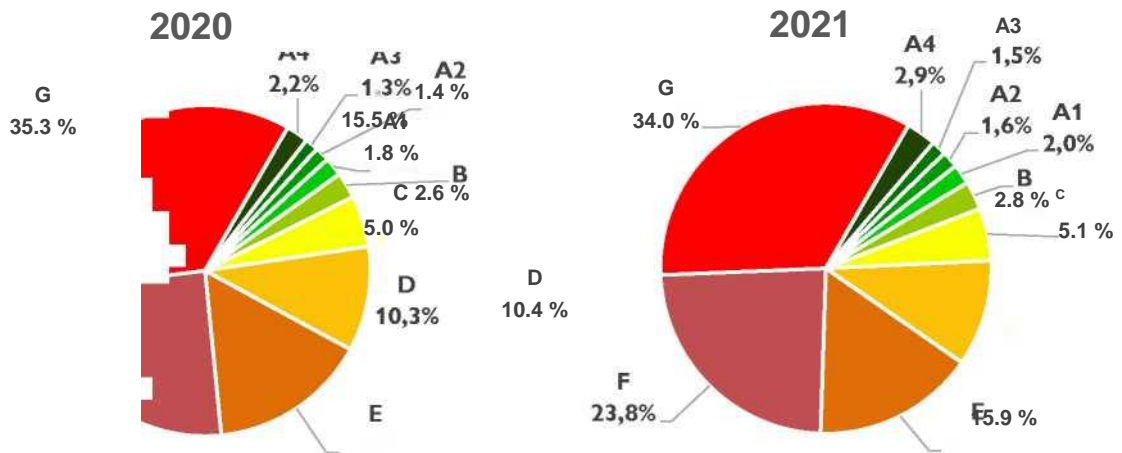
Figure 17 National map of regions and autonomous provinces linked to SIAPE as at 01/04/2022



At the end of the legal deadline for the inclusion of the previous year's EPAs (01/04/2022), the database contained data on approximately 3.800.000 EPAs distributed over the period 2015-2022. The increase over time in the EPAs available on the SIAPE reflects the gradual increase in the number of regions and autonomous provinces linked to the national cadastre, and it can be noted that between 2021 and 2022 the growth in data was more significant than in previous years, doubling the data recorded. This was mainly due to the fact that the new connected regions also sent the historian available to them.

The first information contained in the EPA on which analyses have been carried out is the distribution by energy class, including any variations in the same results obtained for the 2020 emission year (Figure 16). Although the data confirm more than half of the cases as having poor energy performance (almost 60 %), the comparison between 2020 and 2021 shows a reduction in the share of buildings in energy classes F and G of around 2 %, in favour of C-E (+ 0.5 %) and A4-B (+ 1.5 %), reviving the positive trend observed in the four-year period 2016-2019 and interrupted in 2020.

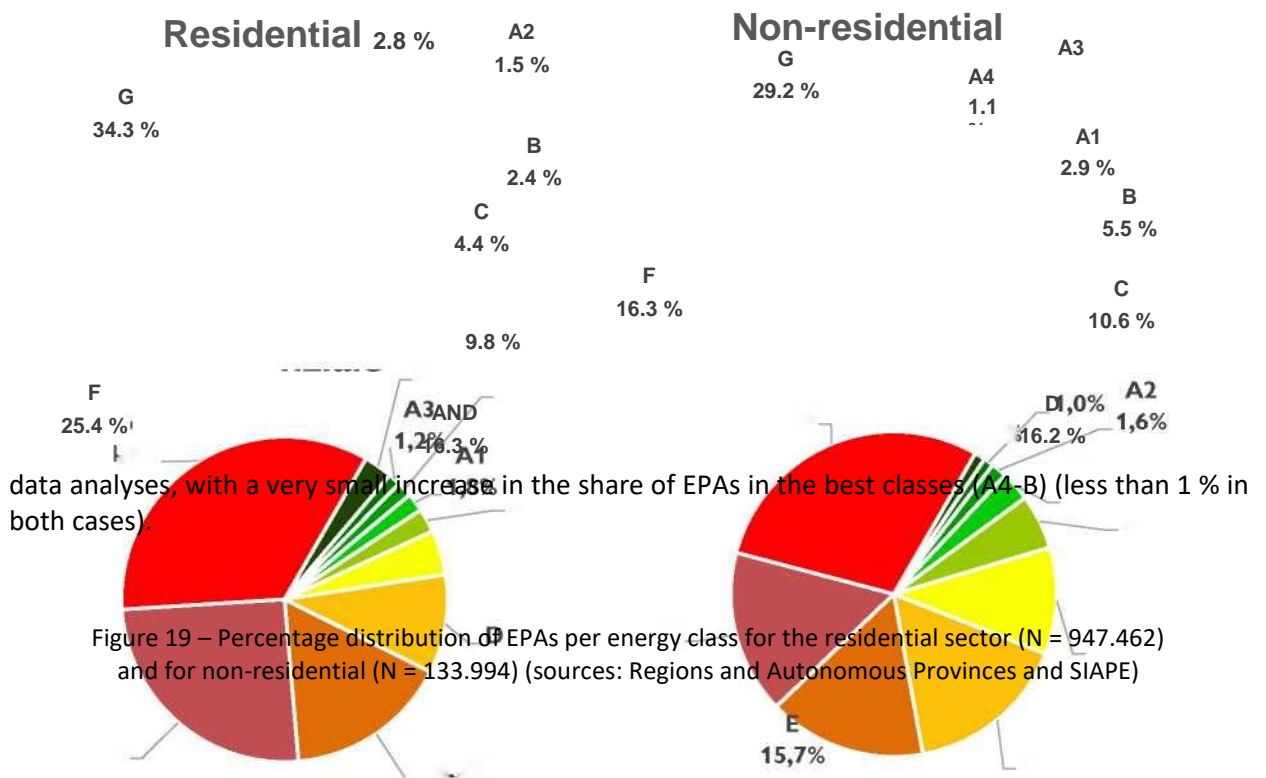
Figure 18 – Distribution of EPAs issued in 2020 (N = 1.054.055) and in 2021 (N = 1.271.437) by class energy (sources: Regions and Autonomous Provinces and SIAPE)



Numbers drop significantly in each climate zone as the energy class improves, confirming the low level of energy retrofitting of the national building stock. In fact, more than half of the buildings are in the worst energy classes (F-G).

The breakdown between residential and non-residential use of the buildings covered by the EPAs issued in 2021 is 87.6 % and 12.4 % respectively, similar to the 2020 data and the ISTAT 2011 census.

The evolution by energy class of the residential sector follows that of the total sample, with a distribution of cases increasing as the energy class deteriorates, while the non-residential sector is characterised as a whole by higher percentages of certified EPAs in the best (A4-B) and intermediate (C-E) energy classes. Both sectors show a substantial stability in the distribution of energy classes between the 2020 and 2021



data analyses, with a very small increase in the share of EPAs in the best classes (A4-B) (less than 1 % in both cases).

Figure 19 – Percentage distribution of EPAs per energy class for the residential sector (N = 947.462) and for non-residential (N = 133.994) (sources: Regions and Autonomous Provinces and SIAPE)

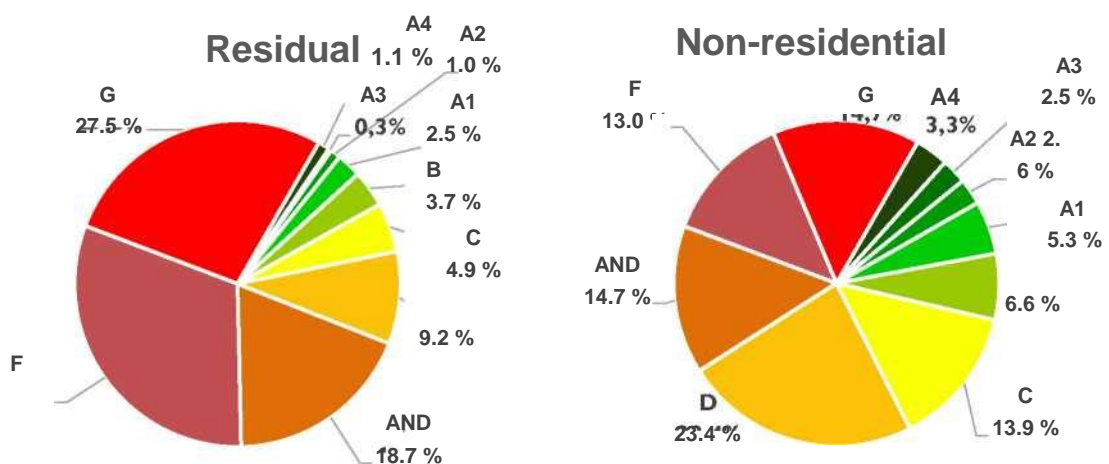
A focus on publicly owned real estate

The analyses concern only EPAs issued in 2021 relating to public property (around 5.700 EPAs), excluding certificates relating to buildings for public use (around 1.800 EPAs).

The sample of EPAs analysed for public ownership is 61 % owned by the residential sector and 39 % by the non-residential sector.

The distribution by energy class of the public residential sector shows a proportion of poorer energy performance cases of almost 60 %. In particular, compared to 2020 data, there is an increase in F-G energy classes (+ 5.5 %) and a smaller increase also from A4 to B (+ 2 %). The non-residential sector, on the other hand, shows percentages with different trends, with EPAs in the best energy classes exceeding 20 % of the sample analysed, up by around 2.5 % compared to 2020 figures.

Figure 20 – Percentage distribution of EPAs related to public property by energy class for the residential (N = 3.503) and non-residential (N = 2.193) sectors (sources: Regions and Autonomous Provinces and SIAPE)



- ESTIMATION OF THE RETROFITTING RATE

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 worth estimating the rate of energy retrofitting: this will make it possible to quantify the distance between the current situation and the objective of energy savings and decarbonisation expressed in terms of the retrofitting rate needed to achieve them.

As is known, the current incentives not only promote deep renovation, but also encourage individual measures such as simply replacing windows. In order to develop a meaningful and measurable indicator of progress in terms of upgrading, an indicator called virtual deep renovation rate has been developed with ENEA, ISPRA and RSE. 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 process carried out – based on monitoring data from Ecobonus and Bonus Casa – transforms, by means of the energy savings achieved, the real intervention rate (which takes into account all the buildings on which work has been carried out, even at least), into a so-called virtual deep renovation rate, the value of which therefore represents the retrofitting rate that would be achieved if all the savings obtained were from building and plant 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 with reference to different types of intervention and technological solutions, based on data on access to tax deductions for energy efficiency measures.

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 with energy savings of 0,332 Mtoe/year.

For the purpose of exploring virtual deep renovation rates by 2030, a dedicated modelling tool has been developed and reported below. Please note, however, that the retrofitting rate will be updated in accordance with the objectives of this plan in its final version.

The following tables set out a roadmap to 2030, 2040 and 2050 in terms of indicative targets on the annual retrofitting rate for the residential and tertiary sector.

Table 24 – Roadmap of targets in terms of annual retrofitting rate

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

Source: production of ENEA.

Considering the specific savings in 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, the latter around three times the current virtual retrofit rate, which best reflects the need for increased efforts. The overall retrofitting rate would involve measures being carried out on two-thirds of Italy's national building stock.

These objectives will need to be updated in the near future in the light of the adoption of the FF55 package, so the objective set out here can be considered as a minimum target.

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

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 (MiSE Decree of 26 June 2015). There are many new developments introduced by the transposition of EPBD III, and in particular by Article 4. In summary, there are:

- new detailed provisions concerning technical building systems, aimed at facilitating the installation, where possible, of the most efficient technologies, as well as advanced regulatory and control systems;

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- points to the need to promote healthy indoor weather conditions, fire safety and to limit the risks associated with seismic activity, thereby creating elements of integration of transversal regulations affecting buildings;
- introduction of the rules for the integration of electric vehicle charging infrastructure into buildings, which need to be duly implemented.

In addition to the points mentioned above, 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) and to provide for a 'reasoned' update on the basis of experience gained in applying the standard in recent years.

Please find below a brief discussion of the issues under discussion, with the support of ENEA and the cooperation of the CTI, on the basis of which the Decree is being updated:

- update of the minimum performance requirements for installations and building elements based on the application of the comparative methodology as updated in 2018;

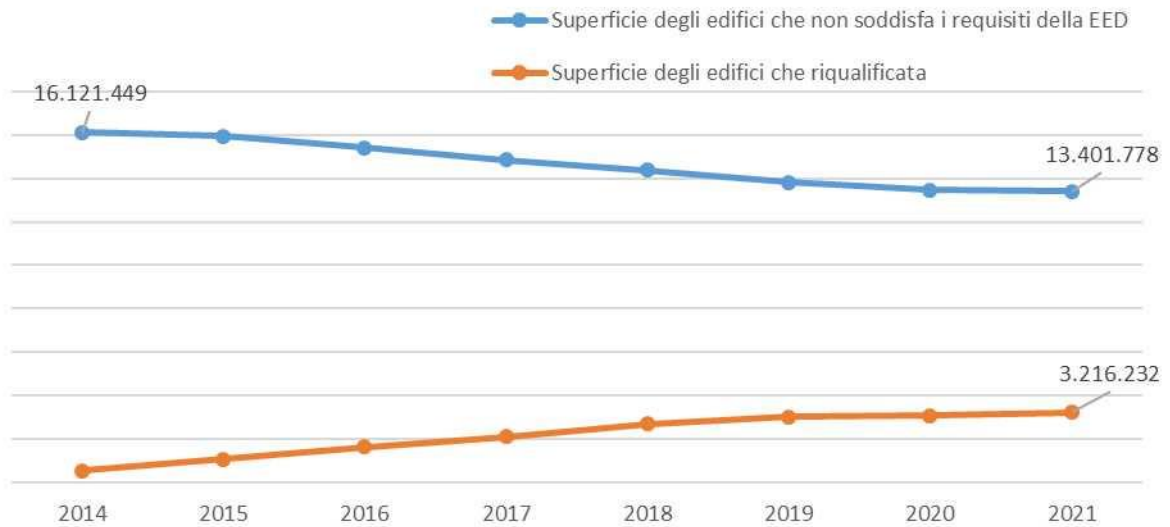
- update of the global average heat exchange coefficient (H't);
 - updating the rules on thermal bridges to make it more consistent with situations project real;
 - integration of electric vehicle charging infrastructure: on the basis of the information provided by the Legislative Decree and the European Directive, an in-depth analysis was carried out with RSE, with a view to determining the requirements on residential and non-residential buildings, in terms of the number and type of recharging points to be provided.
- (4) the total floor area to be renovated or the equivalent annual energy savings to be achieved between 2021 and 2030 pursuant to Article 5 of Directive 2012/27/EU on the exemplary role of public bodies' buildings;

- **OBLIGATION TO UPGRADE CENTRAL PUBLIC ADMINISTRATION BUILDINGS**

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

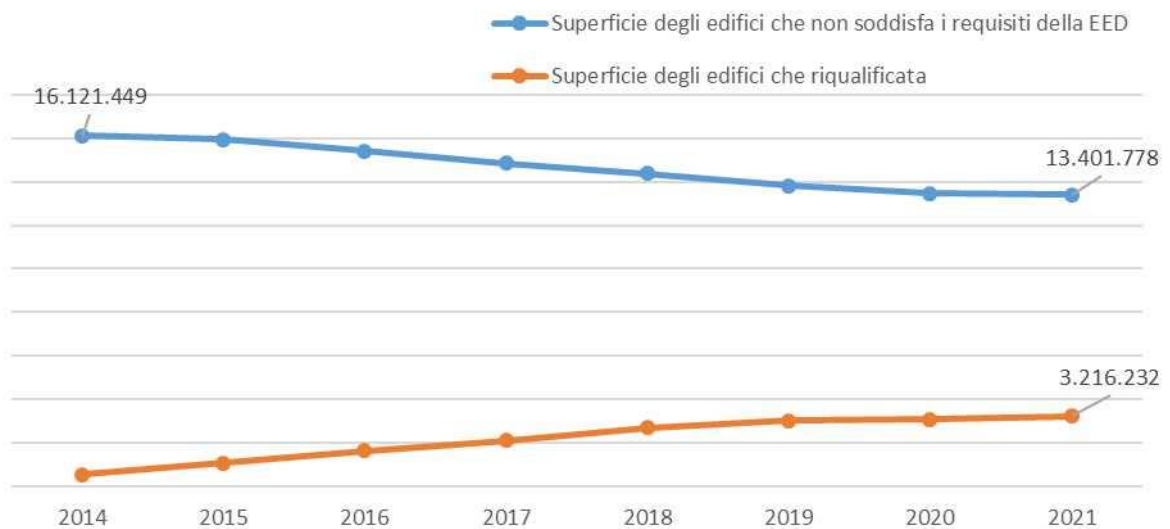
Looking at the final results for the period 2014-2021, we would first point out that further refinements in the inventory of buildings have brought the total surface area to 16,1 million square metres. It can also be noted that the area for which regeneration was planned and financed in 2021 (thanks to the approval of specific projects) is 3,2 million square metres, compared to the 3,6 foreseen in the roadmap previously envisaged. 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 operating model of the mechanism, in addition to that already carried out under the NRRP, is being considered.

Figure 21 – Upgrading of the building stock of the central government building stock in the final accounts for the period 2014-2021 (m²)



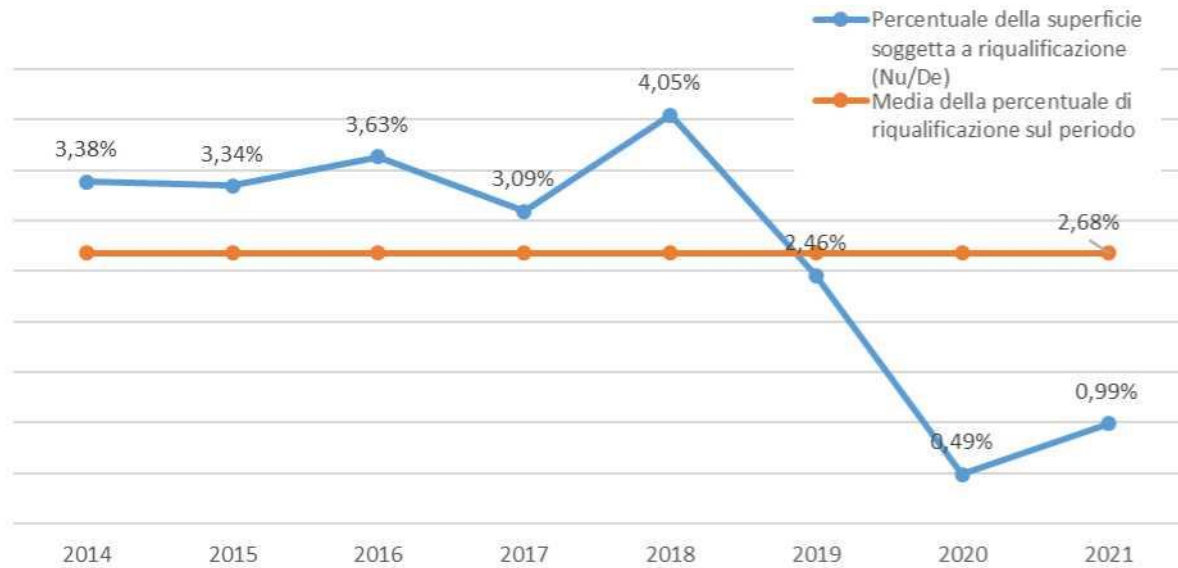
In terms of annual and average rates, the graph below shows the above-mentioned negative inflation, from 2019 onwards, in the area planned for regeneration, as a result of the decrease in approved projects. Despite this, an average regeneration rate of 2.7 % of the area subject to the obligation under Article 5 of Directive 2012/27/EU is recorded in the period 2014-2021.

Figure 22 – Renovation rate of the building stock of the central PA in the final accounts for the period 2014-2021 (%)



In terms of annual and average rates, the graph below shows the above-mentioned negative inflation, from 2019 onwards, in the area planned for regeneration, as a result of the decrease in approved projects. Despite this, an average regeneration rate of 2.7 % of the area subject to the obligation under Article 5 of Directive 2012/27/EU is recorded in the period 2014-2021.

Figure 23 – Renovation rate of the building stock of the final central public administration for the period 2014 – 2021 (%)



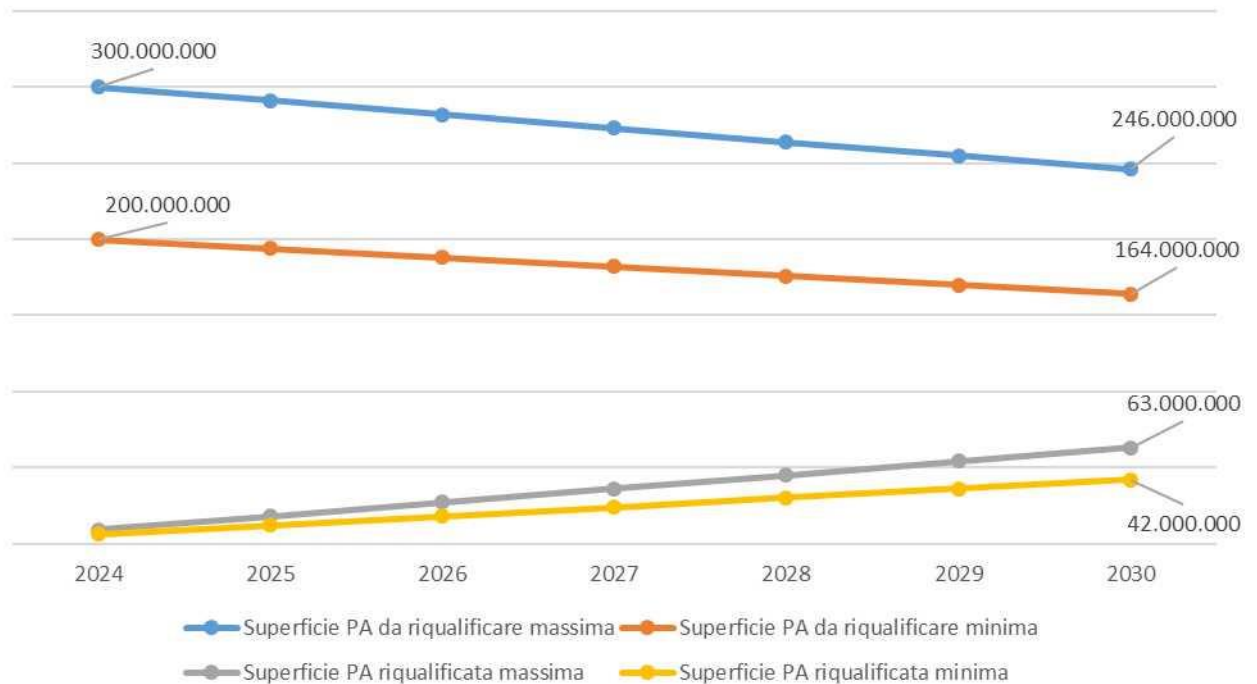
❖ **EXTENSION OF THE TARGET TO LOCAL PUBLIC ADMINISTRATION**

Article 6 EED III, currently awaiting adoption, provides for 3 % of the air-conditioned area owned by the public administration to be upgraded per year, meeting the requirements of at least a nearly zero-energy building.

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

Estimates for the Requalification Strategy published in 2021 show that the total assets of the national public administration amount to approximately 300 million square metres. Further work is underway to define this value more precisely and to quantify the possibilities for exclusion provided for in Article 6(1) of the EED III.

Pending these investigations, we assume below the trend of annual retrofitting from 2024 to 2030, which should be sustained in order to comply with the obligation, considering a range of mandatory areas ranging from a minimum of 200 million square metres to a maximum of 300 million.

Figure 24 – Trend of upgrading the building stock of the total PA assumed for the period 2024-2030 (m²)

❖ **ANNUAL REDUCTION OBLIGATION IN GOVERNMENT CONSUMPTION**

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

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

The 2014 GSE and RSE study entitled 'Energy consumption by public authorities – Estimated consumption and scenarios for energy retrofiting' can be used as a first reference to assess the impact of the obligation.

The following table, resulting from the above-mentioned study, shows the electricity and heat consumption for 2012 of the buildings of the public administration and public lighting, broken down by sector and by region. In fact, the study excludes consumption in the transport sector and instead includes the armed forces in an aggregated manner with the central public administration. Further investigation will be needed in order to isolate in more detail the consumption of the armed forces.

Table 25 Regional breakdown of annual consumption by public authorities

	Electricity consumption [ktoe]						Thermal consumption [ktoe]				
	PA and Defence	Instructors	Health care	Sports and leisure activities	Nazio Illumi	Total Elettric	PA and Defence	Education and	Sanit à	Sport and leisure activities	Total termic
Piedmont	20,3	16,7	18,3	17,9	42,6	115,8	53,6	65	28,3	132,2	279,1
Aosta	1,6	0,4	0,5	1,8	2,4	6,7	3	3,5	1	16,1	23,6
Lombardi a	29,4	29,3	45,2	31,2	81,9	217	73,3	109,5	59,7	228,2	470,6
Trentino	12,9	3,9	4,3	8,2	10,2	39,5	23,4	25,9	7,9	165,5	222,7
Veneto	20,2	16,8	23,8	16,6	37,8	115,1	48,3	60	31,9	123	263,2
Friuli	14	5,5	6	6	11,5	43,1	27,5	17,6	7,5	38,8	91,5
Liguria	13,4	5,5	7,3	7,2	13,3	46,7	19,1	11,9	5,9	28,8	65,7
Emilia	21,6	21,1	21,3	17,6	44,8	126,4	50,9	53,1	27,3	126,1	257,4
Tuscany	22	16,8	13,3	20,6	31	103,7	38,9	35,7	14	113,2	201,9
Umbria	4,5	4,4	3,5	4,2	8,7	25,3	9,6	12,5	4,2	27,6	53,9
Marche	7,3	4,8	6,3	8,5	16	42,9	14,4	17,4	7,4	50,2	89,4
Lazio	73,6	58,7	19	18,6	41,6	211,4	116,4	55	17,5	90,9	279,8
Abruzzo	7,7	6,2	4	11,3	15,6	44,8	14,9	17,4	4,9	66,7	104
Molise	2,1	1,4	1,4	2,4	4,3	11,5	4,4	5,3	1,7	14,9	26,4
Campania	30,9	16,8	13,9	15,5	40,6	117,8	38,3	36,3	10,4	57	142
Apulia	30	12,1	15,7	8,6	36,5	102,9	38,5	24,9	11,9	33,7	108,9
Basilicata	2,9	2,7	2,4	2,2	7,7	17,8	5,9	8,7	2,7	13,6	31
Calabria	11,4	10,8	4	6,4	26,1	58,6	15,7	23,7	3,8	25,2	68,4
Sicily	32,3	16,4	13,1	9,7	49,2	120,7	31,2	30,5	8,5	29,8	100
Sardinia	14,4	6,1	5,7	8,6	16,9	51,7	15,9	13	4,5	29,9	63,3
TOTALS	372,4	256,2	229	223,1	538,5	1.619,2	643,4	626,8	261	1.411,2	2.942,3

The study shows annual PA consumption of 1,62 Mtoe electric and 2,94 Mtoe thermal, a total of 4,6 Mtoe per year.

Without prejudice to the necessary update of consumption data by 2021, this estimate leads to an annual savings target of 86,7 ktoe, which may be reduced with the exclusion of the consumption of the armed forces, and the derogations granted by the EED III Directive.

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

- during a transitional period of two years from the date of transposition of the Directive, the target will be indicative. During the transitional period, estimated consumption data may be used and, subsequently, the target must be adjusted to actual consumption;
- the obligation does not include, until 31 December 2026, energy consumption by public authorities in local administrative units with fewer than 50.000 inhabitants and, until 31 December 2029, energy consumption by public authorities in local administrative units with fewer than 5.000 inhabitants.

In order to take particular account of 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, progress indicators developed at national level, a reliable estimate of expected energy savings and wider benefits, and their contributions to the achievement of the 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 buildings, both public and private, 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 objectives, as described above, is strategically linked to the renewal of the building stock, both by public authorities and by the private sector, giving priority to energy efficiency and the use of renewable energy.

Achieving the targets requires the deployment of technologies that can deliver low heating, cooling and domestic hot water (ACS) needs to be met with high energy efficiency and the use of renewable sources. Consideration should also be given to the increased demand for comfort in dwellings, in particular related to the relatively new need for cooling.

Among the solutions available, heat pumps (pdc), both electric and gas, play a strategic role, which make it possible to provide heating, air-conditioning and ACS-production services with only one appliance, making the pdc a device of safe interest for the air-conditioning of many of the civil buildings located in Italy.

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 report assessing the national potential for applying high-efficiency cogeneration and efficient district heating provided for in Article 14 of the EED Directive, drawn up by the GSE in 2015 and updated in 2021, the economically sustainable potential for increasing district heating energy is around 20.9 TWh of heat supplied annually (compared to 9.8 TWh in 2018), with an extension of the district heating and cooling networks at national level of around 3.700 km (+ 77 % compared to 2018) and new volumes connected amounting to 340 million cubic metres.

The above assessment of the incremental potential of district heating was carried out in conjunction with the analysis of the incremental potential of high-efficiency cogeneration and has now focused primarily on the main sources for both purposes (DH and HE CHP), 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.

The security dimension concerns the energy system as a whole and presupposes the security of energy supply to consumers at sustainable prices capable of maintaining the competitiveness of the industrial

and manufacturing sector and must be seen in a context, such as the Italian one, where energy supply is mainly provided by renewable and gas sources, with an increasingly marginal role for coal, in line with the phase-out objective. Security of energy supply will be supported 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 must 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, national production of energy sources decreased overall by 3.4 % compared to the previous year, from 37.673 ktoe to 36.402 ktoe. Oil and petroleum products production fell from 5.856 ktoe to 4.922 ktoe (-16 %), natural gas, from 3.287 ktoe to 2.689 ktoe (-18.2 %) and non-renewable waste, from 1.190 ktoe to 1.157 ktoe (-2.8 %), while production in the renewable energy and bioliquids sector increased slightly from 27.339 ktoe to 27.635 ktoe (+ 1 %).

With regard to the national upstream oil and gas sector, exploration permits and cultivation concessions have decreased, resulting in restrictions on the areas concerned: for research permits, the decrease was 1.115 km², from 24.500 km² in 2020 to 23.345 km² in 2021, while for the areas covered by the cultivation concessions it fell from 14.113 km² in 2020 to 12.410 km² in 2021, a decrease of 1.703 km². No new exploration wells were drilled in 2021 and only one development well was drilled, so domestic production of natural gas continues based on the natural decline of the fields in production.

By contrast, the feed-in of biomethane continues its growing trend, reaching 159 million cubic metres in 2021. At the end of 2021, 46 installations were connected to the Snam Rete Gas network, while 8 were connected to other transmission networks. Of particular interest is the production of biomethane from municipal bio-waste (FORSU), which makes it possible to valorise the organic fraction of waste by obtaining both a form of renewable energy and the use of CO₂ from biogas purification for industrial purposes, for example in the food industry (which is now forced to import it). Mention should also be made of the production of biomethane from the agricultural sector, which uses agricultural waste and livestock waste, on the one hand, to curb emissions from the agricultural sector, which is difficult to reduce and, on the other, to increase the soil's capacity to store carbon dioxide.

Net energy imports increased: it rose from 105.799 ktoe in 2020 to 114.600 ktoe in 2021 (+ 8 %). In particular, there was a strong increase in net electricity imports (+ 33 %) and solid fuels (+ 13.6 %). More moderate increases were recorded in net imports of natural gas (+ 8.1 %) and petroleum products (+ 6.9 %). Net imports of renewable energy and bioliquids (-1.5 %) decreased slightly.

The share of net imports in gross energy availability, an indicator of the country's degree of dependence on foreign sources, increased from 73.5 % in 2020 to 74.9 % in 2021.

Since February 2022, the severe war between Russia and Ukraine has created major challenges in terms of security of supply for the whole of Europe, 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 billion cubic metres per year). The economic sanctions imposed on Russia in reaction to the invasion of Ukraine have called for a drastic strategic rethinking of sources of supply in Italy and open up opportunities to accelerate the energy transition towards a more efficient and sustainable system that ensures greater energy independence.

The only marginal deterioration in the security situation of the Italian system due to the conflict is due to the fact that the plan to contain gas consumption and record energy prices have reduced demand for gas and electricity and guaranteed acceptable capacity margins in both the gas system, despite the fact that 1/4 of the 2021 imports and the electricity system fell. 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 for the last five years, while the peak in daily demand was exceptionally low (just over 300 million m³ m 1/5 below the potentially critical threshold of 400 million m³m).

Consumption control measures and very high energy prices – which political decisions have only partially mitigated – have led to adaptation strategies and behavioural changes, which have led to a significant drop in gas (especially) and electricity consumption; on the supply side, the policies of accelerated filling of gas storage, maximising LNG imports and the use of coal and fuel oil in electricity generation ensured the availability of natural gas throughout the winter.

Figura 25 — Deviation of monthly consumption of gas and electricity in the euro area compared to the average of the latest 5 years

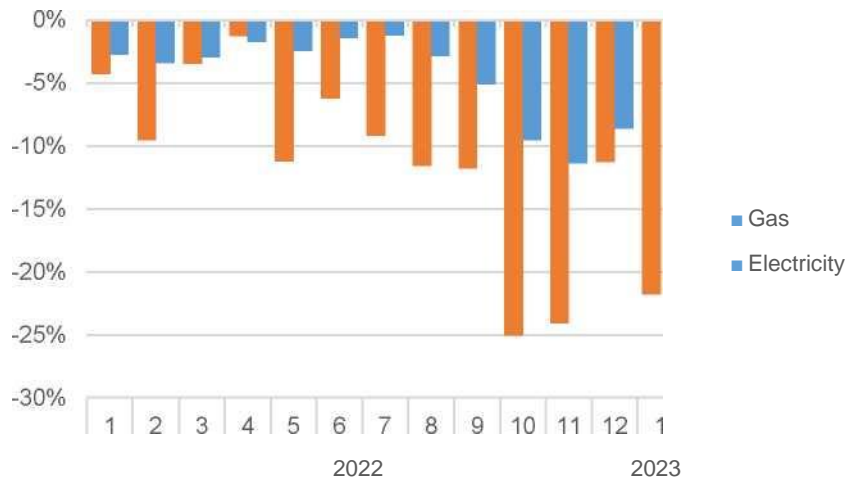
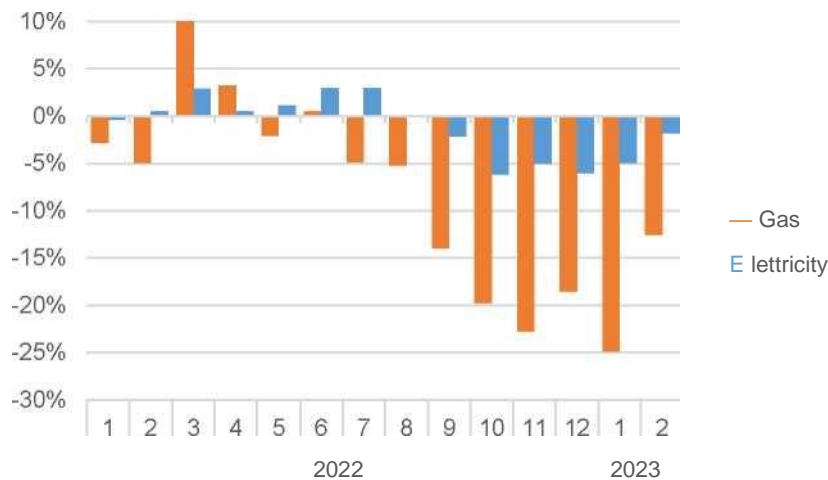


Figura 26 — Deviation of the monthly consumption of Italian gas and electricity compared to the average over the last 5 years



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 set out a path towards the progressive replacement of imports from Russia in order to strengthen and accelerate the measures of the Fit-for-55 package.

The measures set out in the REPowerEU Communication can be summarised as follows:

- diversification of gas supply sources through agreements with several countries: the Commission recommends strengthening gas transmission infrastructure, including at continental level, and making it compatible with hydrogen transport;
- doubling the availability of biomethane compared to the pace of growth foreseen in the Fit-for-55 package;
- changing the energy mix by increasing the penetration of renewables (in particular onshore and offshore wind and photovoltaic) much faster than the Fit-for-55 targets, including a 20 % increase, including by *simplifying planning and permitting*, identifying suitable areas and implementing *regulatory sandboxes*;
- doubling the target for heat pumps to reach 10 million parts installed within 5 years in the EU;
- acceleration of 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 integration of renewables.

In this sense, the security of Italian energy supply will be strengthened by stepping up the efforts already undertaken to diversify the sources of supply of natural gas, including to reduce dependence on imported Russian gas, continuing the action taken in the course of 2022 following the Russian war in Ukraine. 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 plants, removal of gas transport bottlenecks. Finally, Italy intends to further develop its national biogas production and optimise the production of natural gas.

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

(1) national objectives with regard to:

- 1. increasing the diversification of energy sources and supply from third countries, the purpose of which may be to reduce energy import dependency,*
- 2. increase the flexibility of the national energy system;*
- 3. addressing constrained or interrupted supply of an energy source, for the purpose of improving the resilience of regional and national energy systems, including a timeframe for when the objectives should be met;*

❖ **GAS SECTOR**

Gas will continue to play a crucial role for the national energy system during the transition period and will integrate with the increasing volumes of renewable gases (biomethane, bioLPG, bioLNG, renewable dimethylether, hydrogen and synthetic methane) and the uptake of alternative fuels and fuels in the energy sectors, including the transport sector.

Gas demand amounted to 76,4 billion cubic metres in 2021, an increase of 5,2 billion cubic metres (+ 7.2 %) compared to the previous year. The increase was significant for virtually all sectors, after the relaxation of the COVID-19 pandemic containment measures implemented in the course of 2020.

In addition, in 2021 there was a significant increase in exports of gas via tube to European countries, which increased from 0,35 billion cubic metres to around 1,54 billion cubic metres. Demand for gas (including exports) was 4 % covered by domestic production and the remaining 96 % by import. National production, 3,2 billion cubic metres, was down by 20.7 %, while imports, 73 billion, increased by 9.9 %; finally, there was approximately 1,6 billion cubic metres of gas supply from the storage fields.

Domestic production also includes biomethane, which rose from 99 million cubic metres in 2020 to 159 million cubic metres in 2021. Pipeline imports in 2021, amounting to 62,9 billion cubic metres, representing 86.5 % of total imports, increased by 9,4 billion cubic metres compared to 2020. In particular, inputs from northern Europe (Netherlands and Norway) fell to 2,2 billion cubic metres (-75 %), from Libya (3,2 billion, -28 %), while imports from Algeria were on the rise (21,2 billion cubic metres, + 76 %). As regards injections from Russia, this figure was slightly higher for 2021 than in the previous year (+ 29,1 billion, + 2 %). In December 2020, the new import of gas was launched with a point of entry at Melendugno. Gas from Azerbaijan, via TAP (injection into Melendugno), with import flows starting in the last few days of December 2020, provided in 2021 7,2 billion cubic metres, contributing to security and diversification of supply sources for Italy and Europe.

LNG's contribution in 2021 amounted to around 9,8 billion cubic metres, 13.5 % of total imports, down by 22 % compared to the previous year, equivalent in absolute terms to around -2,8 billion cubic metres. In particular, the following LNG arrivals are recorded at the three national terminals: LNG Adriatic (Cavarzere) 7,3 bcm (+ 7.5 %); LNG Italy (Panigaglia) 1,1 billion cubic metres (-57.3 %); Olt (Livorno) 1,4 billion cubic metres (-56.1 %).

The civilian sector goes from 27,6 to 29,2 billion cubic metres, an increase of 1,6 billion cubic metres (+ 5.8 %) divided into the two components of the Residential and Tertiary components. The increase is driven by both a colder 2021 climate than in 2020 and a recovery in the tertiary sector.

after the reduction in 2020 due to Covid, it regained pre-pandemic levels of turnover and consumption.

For the thermoelectric sector and the combined generation of electricity and heat from natural gas, consumption increased in 2021 by around 2 billion cubic metres (+ 5.8 %), in absolute terms equivalent to a higher gas generation of around 10 TWh (+ 7.8 %) driven by the recovery in electricity demand, which is 320 TWh, an increase of around 19 TWh (+ 6.2 %) compared to 2020. The increase in thermoelectric gas generation was partly contained by rising gas prices, which, especially in the second part of the year, made coal-fired generation more attractive than in 2020.

Gas demand for industrial direct uses in 2021 was 10,8 billion m³, an increase of around 1 billion m³ (+ 9.7 %). All sectors are recovering after the fall in 2020 due to the pandemic.

The table below shows the consumption of the main industrial sectors directly interconnected with the Snam Rete Gas network. Since 2015, gas off-takes have totalled around 13 billion cubic metres on an annual basis; these quantities also include consumption for cogeneration and consumption of the energy system. In particular, in the latter sector representing gas consumption in petrochemical clusters and refineries, gas is mainly used in desulphurisation and hydrogen production processes by Steam Reforming natural gas, with consumption averaging around 1,3 billion m³.

Table 26 – 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 mill	1.975	1.983	1.959	1.800	1.983
Iron and steel	1.753	1.780	1.706	1.477	1.719
Food	1.191	1.175	1.217	1.238	1.254
Other	4.395	4.187	4.057	3.840	3.841
Total	13.560	13.507	13.262	12.696	13.491

The transport sector deserves specific attention, given the particular interest that has emerged in recent years towards natural gas for transport as an alternative to oil fuels. The following table shows the gas consumption for transport. As can be seen, the sector is dominated by the use of gas in the form of compressed gas (CNG), which has been accompanied in recent years by the use of LNG as a fuel for heavy transport. In the table, it can be seen that part of the LNG is not used as liquid fuel but is regasified on site at distributors and used as CNG (L-CNG).

Table 27 – Gas consumption for transport

Road transport	2017 [MSm3]	2018 [MSm3]	2019 [MSm3]	2020 [MSm3]	2021 [MSm3]
CNG by distributors connected to the SRG network	775	748	723	546	591
CNG by 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 transport Stradali	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 exchange 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 shown over the years an increasing dependence on foreign sources of supply, particularly during the winter period, when prices were dependent on imports from northern Europe. Imports from northern Europe, in addition to the increased liquidity of the FTT market, also suffered from an incomplete integration of the Italian market with the Northern European markets, given the connection via the Swiss Transitgas pipeline with short-term transmission capacity management that did not comply with European rules, which did not allow prices to be balanced daily between the two markets. This situation worsened in 2017 as a result of the decommissioning of one of the two pipelines constituting the TENP transmission system in Germany, linking the Transitgas pipeline to the north of Europe. However, the supply situation has improved compared to the situation analysed in the last edition of the INECP and in the Preventive Action Plan (PAP) of 2017, in particular as of December 2020 with the entry into operation of the TAP gas import pipeline from Azerbaijan, which, with an annual capacity of up to 9 billion cubic metres per year, enabled access to a new supply resource at competitive costs. Already in the course of 2021, thanks to the contribution of this new source of supply, conditions for aligning prices with the hubs in northern Europe took place, which allowed the gradual increase in exports from the Italian system to centralnorthern Europe to around 4,7 billion cubic metres by 2022. Prior to the events linked to Russia's invasion of Ukraine, the Italian gas system had practically aligned itself 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 transport system and LNG, which can be regained in the three existing plants (Panigaglia, offshore Adriatic, OLT), to which the Government decided to respond to the crisis resulting from the Russia-Ukrainian war, a fourth FRSU type facility in the port of Piombino with a regasification capacity of 5 billion cubic metres per year.

The differentiation of supply to the Italian gas system is also supported by one of Europe's most developed and flexible storage systems, which makes available to the country a key resource in the winter season in which consumption is highest, consisting of a volume of strategic storage (owned by the storage companies and payable in the event of an emergency), and a volume of modulation storage which is stored in the summer by operators of the marked gas and delivered during the winter period.

As a result of the crisis resulting from the Russian – Ukrainian conflict, access to alternative sources of supply to gas from Russia and the possibility of using gas present in Italian storage facilities have created important opportunities for the Italian gas system, improving its competitiveness and highlighting its role in supporting the European internal market, especially for countries heavily

dependent on gas from Russia and poorly interconnected with alternative sources of supply. This is confirmed by the increase during 2022 in the frequency and volumes exported both to Austria via the Tarvisio exit point (and thus potentially to other countries interconnected through the Baumgarten hub) and to Switzerland (and thus potentially also to Germany and France, via the Passo Gries exit point).

Below is the outline of possible new sources of supply aimed at reducing the dependence of the Italian system on Russian gas by 2025.

Table 28 – Contributions for reducing dependence on Russian gas, incremental bcm compared to 2021

	2.S 2022	2023	2024	2025	
Pipe gas and domestic production					
Algeria via 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 end 2023/inizio 2024
Total incremental tube gas	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, Other
Total incremental LNG gas	1,5	7,9	9,5	12,7	
Saving gas consumption					
	0,4	2,4	4,9	7,3	Incremental 8 GW/year assumptions. Assumption 1° of household saving first 2 years, equivalent efficiency to follow
Savings from electric renewables					
Savings from containment of thermal and electrical consumption	1,0	2,0	2,0	2,0	
Savings from biogas and biofuels development	0,1	0,6	1,1	1,6	
Savings from temporary coal-fired thermoelectric power generation (max two)	1,1	2,3			plus 10/12 TWh in 2023 compared to 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 supporting the internal and European market has been reduced by measures aimed at increasing the production of renewable gases (which exploit the country's sustainable agricultural and biomass potential), traditional gas production and by concluding international agreements ensuring an increase in both LNG imports and pipeline imports from North African countries and Azerbaijan. In infrastructure development, account must also be taken, 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.

in North African countries already interconnected with the Italian gas system, a resource which will become essential for achieving the country's decarbonisation objectives together with the use of carbon capture and storage technologies.

In the gas sector, therefore, the main objective is to ensure a safer, more flexible and resilient system overall, capable of facing a more uncertain and volatile market environment and of 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 view of the peak demand that coincides with the low levels of production of renewable sources.

In addition to the objectives set out above, attention should be paid, in particular, to LPG supply depots (located on State-owned maritime land and in inland areas), with a view to preserving the infrastructure network already in place and ready to accommodate blends of LPG with bio (bioLPG) and renewable (rDME) products.

❖ **PETROLEUM PRODUCTS SECTOR**

Although the demand for petroleum products fell by 2030, they will still account for a significant share of the total national energy needs, particularly in the transport and petrochemical sectors. On the path outlined first by the Green Deal and then by the Repower EU, 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 low-carbon economy, with a high degree of specialisation, cutting-edge production processes and continued strong research and development efforts aimed at transforming production processes for the production of increasingly climate-neutral fuels.

Oil products, however, still represent the energy source that accounts for more than 80 % of the energy demand of the transport sector, with peaks close to 100 % in heavy road transport, maritime transport and aviation. While the demand for these products in these sectors is set to decline in the perspective of 2030, maintaining the competitive position of the domestic refining sector is crucial for continued security of energy supply. In addition, petroleum products are an essential raw material for green chemistry and for the production of plastics, fibres and synthetic rubbers, detergents and other widely used products. In recent years, petroleum products have covered around 90 % of petrochemical feedstock needs, followed by gas and solids only to a marginal extent. The most important supplies from abroad are oil and refined products. However, as the domestic refining capacity exceeds domestic demand for petroleum products, Italy is not only self-sufficient in terms of finished products, but also a country that exports significant quantities of finished products.

The supplies also come from countries with high geopolitical risk profiles; the recent Russian – Ukrainian war has highlighted precisely this risk, although the energy crisis has been managed smoothly by the national refining system thanks to the strong diversification of suppliers, which started in historic times (Algeria, Libya, Iran, Russia) and continued actively to date (e.g. Azerbaijan, Qatar, USA, Canada). The recent energy crisis was mainly the result of a general freeze on investment in traditional forms of energy, which led to a sharp imbalance in demand and supply when consumption picked up. Therefore, in line with EU 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 banning traditional energy sources before the renewable alternative is fully available. The processing of refineries towards the

the production of carbon neutral fuels must therefore be carried out in accordance with the above principle.

In 2021 gross inland consumption of oil and petroleum products grew by 6.5 % compared to the previous year, with an increase of around 2.905 ktoe, mainly due to post-pandemic recovery. Transport fuel consumption was 30.145 ktoe, an increase of 17.5 % (4.485 ktoe) compared to 2020. Petrol grew by 22.0 %, diesel by 13.7 %. Gas oil, which is also used by heavy-duty vehicles, recovered from the decline in 2020, returning to pre-pandemic levels.

To the needs of 47.817 ktoe, domestic production accounted for around 10 %, while net imports (net of accumulated stocks) covered more than 90 % of demand.

Italian imports of crude oil, semi-finished products and petroleum products, totalling 72.184 ktoe, increased by 9 % compared to 2020. Imports of crude oil (57.025 ktoe) increased by 13.2 %, while imports of semi-finished products and petroleum products (15.159 ktoe) decreased slightly by 3.0 %.

Imports from Africa increased (+ 61 %, from 13.511 ktoe in 2020 to 21.736 ktoe in 2021), Europe (+ 8 %, from 16.431 to 17.794), Asia (+ 3 %, from 14.736 to 15.248). Only negative changes were recorded in purchases from the Middle East (-15 %, from 17.466 to 14.815) and America (-34 % from 3.845 to 2.531).

Total exports of crude, semi-finished and petroleum products (27.119 ktoe) increased by 13.9 % compared to 2020. In absolute terms, 2021 saw an increase in gross domestic consumption of oil and petroleum products of 6.5 % compared to the previous year, with an increase of around 2.905 ktoe, mainly due to post-pandemic recovery. Transport fuel consumption was 30.145 ktoe, an increase of 17.5 % (4.485 ktoe) compared to 2020. Petrol grew by 22.0 %, diesel by 13.7 %. Gas oil, which is also used by heavy-duty vehicles, recovered from the decline in 2020, returning to pre-pandemic levels.

Following the transposition by Italy of Directive 2009/119/EC of the European Community, by means of Legislative Decree No 249 of 31 December 2012 implementing Directive 2009/119/EC imposing an obligation on 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., and the establishment of an IT information exchange platform, set up by MASE in collaboration with OCSIT, for the electronic exchange of all information flows on the levels and location of stocks, both in Italy and abroad.

Stocks are held in order to deal with possible crises in the supply of crude oil or petroleum products (they have been used recently in the Russian-Ukrainian war and in the past in connection with the damage to the US refining system caused by Hurricane Katrina and during the blockade of crude oil imports from Libya during the armed conflict). Stocks to be held amount to 90 days of net imports of crude oil and petroleum products.

The refining crisis has led, in Italy, to the conversion of five major refineries: Mantova, Rome and Cremona were converted into logistics hubs, while Marghera and Gela were converted into biorefineries. The reconversion of the two refineries provides a current biofuel production of over 750.000 tonnes, which will reach 1,1 million tonnes in the future, mainly advanced biofuels. Italy has an important international technological leadership in this sector and will build on this as a basis for the future transformations of Italian refineries.

◆ ELECTRICITY SECTOR

In the electricity sector, the energy security objectives are currently reflected in objectives aimed at increasing energy security under the various expected conditions, while management objectives have been consolidated in relation to the 2019 INECP, aimed at implementing the legislation necessary to remove the obstacles and constraints that slow down the implementation of the above-mentioned measures.

The national transmission grid is interconnected with abroad through 26 lines: 4 with France, 12 with Switzerland, 2 with Austria, 2 with Slovenia, 4 direct current connections (the cable with France, the cable with Greece, the cable with Montenegro and the double connection, known as SACOI, with Corsica, mainland on the one hand and Sardinia on the other), an additional alternating current cable between Sardinia and Corsica, a 220 kV submarine and terrestrial cable connection between Italy and Malta.

Below are the data on imports and exports from the various countries with which Italy is interconnected:

Table 29 – - Data on imports and exports from the various countries with which Italy is interconnected

GWh	France	Switzerland	Austria	Slovenia	Greece	Malta	Montenegro
Import 2021	15.153,1	19.468	1.257,9	5.449,6	1.856,8	33,6	3352,7
Export 2021	1.184,9	1.256,4	12,4	73,9	517,6	547,2	189,5
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

(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.

It is planned to further strengthen interconnections towards these borders through medium- and long-term projects identified by the national electricity system operator, which will allow for an increase in foreign interconnection capacity, mainly located at the northern and southern borders of the country. In the medium term (2030), the estimated total increase is around 1 900 MW, due to the planned entry into operation of the HDVC interconnection project with Tunisia “tunita” (NTC increase on the border of 600 MW), as well as the second HDVC interconnection with Greece “GRITA 2” (NTC increase on the border from 500 to 1 000 MW), but also due to the connections with Austria “Nauders-Glorenza” (NTC 300 MW) and “Prati di Vizze – Steinach” (NTC 100) 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 3 560 MW is expected, with the development of the interconnection with Switzerland Valtellina – Valchiavenna with two additional interconnections with Austria (total NTC 660 MW).

In addition, a number of private projects for interconnection with abroad (so-called merchant lines), some of which have already been authorised and are in the process of being implemented.

Internally, the new generation system will increasingly be characterised by a strong growth of non-programmable renewables, with increasing management complexity for the grid and a growing demand for flexibility for balancing. Even considering the possibility that

the infrastructure structures and the same market design are gradually being changed. Today, the scenarios for strong growth in renewable production are technically sustainable under safe conditions, provided that the network development works (new power lines and upgrading of existing sections) already provided for in

the Terna plans are carried out at the same time, so as to manage the phenomena induced by the change in the production mix, including the phase out process from coal, and to increase cross-zonal transit capacity.

In order to address the new challenges of the energy transition, a series of measures have therefore been put in place on the RTN with the ambitious aim of reducing the negative safety impacts of RES generation, such as north-south zonal congestion (caused by RES production that is mostly located in the south and thus far from consumption units), the reduction in the adequacy margin of the system caused by the peak loads characterising RES production, the reverse flow from primary cabins 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 2019 INECP objectives, measures to develop the RTN necessary to achieve the decarbonisation and energy security objectives have already been introduced in the Terna Development Plan, including the well-known Tyrrhenian link (HVDC Campania-Sicilia-Sardinia link), the Adriatic link (HVDC Fano – Villanova), the renewal and upgrading of SACOI (the Tuscany HVDC link – Sardinia – Corsica), the 380 kV Bolano – Paradiso cable power line.

In addition to the development measures referred to above, which are characterised by complex infrastructure measures on the RTN backbone, there are many measures put in place, both for RES integration and for the resilience of the electricity system, which have not required complex authorisation steps, since they have benefited from the simplified authorisation procedures (such as the notification of commencement of operations) provided for by the simplification rules introduced over the last 2 years (including Decree-Law No 76 of 16 July 2020, Decree-Law No 17 of 1 March 2022 and Decree-Law No 50 of 17 May 2022). These include the installation of synchronous compensators, all extraordinary maintenance activities for the purposes of the RTN's resilience to violent weather phenomena, the reconstructions of existing obsolescent overhead lines and all operations involving the improvement of the operational performance of existing lines or enabling the operation of existing direct current lines, which are used for the transport of renewable energy.

In this composite and complex landscape, the key objective of updating the INECP is to maintain system adequacy conditions also in the medium to long term, especially in a scenario of major changes in the national and European generation mix and in the range of possible resources. For this reason, in the latest development plan submitted by the operator (Annual 2023), the development projects already planned to implement the INECP objectives are supplemented by other, even more challenging ones, which have the objective of fermenting the national transmission network towards the energy transition, by modernising the existing power lines on the eastern and western backbones of the country to the southern regions and the islands, taking advantage of direct current transmission technology (HVDC), together with the development of new 500 kV submarine connections. This will improve and increase the performance of the power lines, allowing the transfer of increasingly renewable power in southern Italy to the load areas in the north.

This project, known as 'Hypergrid', therefore provides for the modernisation of existing 220 kV or 380 kV power lines, by means of works on existing lines built on the same route or adjacent, with an improvement in operating performance or in order to enable them to be operated on a direct current basis.

The work carried out by the operator with other European and national stakeholders to strengthen and improve the RTN aims to improve the country's energy security standards by reducing

dependence on foreign sources and making the supply of energy production stable in relation to the country's needs.

A second vital objective will be to increase the resilience of the system to take into account the impacts of climate change that are causing increasingly significant disruptions linked to the occurrence of extreme events. This objective requires the planning and operating aspects of the system to be considered in an integrated and coordinated manner by means of appropriate methodologies to establish overall action plans aimed at minimising the scale of service failures.

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 objectives for reducing dependence on energy imports from third countries, with a view to increasing the resilience of regional and national energy systems.*

iv. *national objectives with regard to increasing the flexibility of the national energy system, in particular by means of deploying domestic energy sources, demand response and energy storage*

❖ **GAS SECTOR**

Given that gas will continue to play an essential role in the short to medium term, in synergy with renewable sources, for industrial and household uses (as well as 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 sources of supply can be pursued either through the conclusion of new agreements or through the upgrading of the necessary infrastructure. As Russian gas supplies cease to exist, Italy, due to its geographical location, can strengthen its role in supporting the European gas market.

To this end, the following objectives are set out:

- create the conditions for the upgrading of the Southern Corridor through TAP (Trans Adriatic Pipeline), supporting an increase in capacity from the Azerbaijan supply route of an additional 10 billion m³ per year.
- increase transport capacity from the points of entry to southern Italy through the creation of the “Adriatica line”, which is essential in order to be able to increase flows to northern Europe, as a result of the increase in gas imports from Algeria, caused by the reduction of Russian gas flows from Austria.
- optimise the use of LNG import capacity in existing terminals and develop new regasification and liquid storage capacity (SSLNG warehouses), which are of strategic importance for Italy’s participation in the Mediterranean and global LNG market in competition with northern European terminals.
- strengthening the storage system, allowing for a more flexible and resilient system.
- update the preventive action plans and emergency plans, bearing in mind that, with gas supplies from Russia being reduced to zero, the role of the increased gas infrastructure for calculating N-1 conditions within the meaning of Regulation (EC) No UE/201771938 is now represented by the Transmed gas pipeline for interconnection with Algeria, and their relationship with the plans of the other Member States interconnected with Italy;

- encourage the development of new renewable gas plants, in particular biomethane.
- to stabilise the savings measures taken in winter 2022-2023 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 amending the annual start-up periods, reducing the daily duration of plant activation and the maximum permitted indoor temperature of the environments, and revising the values of the so-called ‘day degrees’ based on obsolete meteorological averages.²¹;
- encourage the development of a gas transmission system that can also be suitable for developing a multi-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 provide for the creation of suitable infrastructure for the transport of carbon dioxide (CO₂) in order to connect the large emitters equipped with capture facilities with the CO₂ storage facilities to be studied in the High Adriatic;
- complete the assessments in relation to the EastMed-Poseidon gas interconnection project which could allow further diversification of the current routes, sourcing from promising offshore gas fields

in the Eastern Mediterranean. However, for the Eastmed route, some further work still needs to be carried out, particularly in relation to the geopolitical situation, since its route covers areas of the submarine continental shelf which are still the subject of international disputes over their delimitation.

It is also useful to promote the production of renewable gases for all end uses, even if not connected to the gas pipeline network, thereby 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 between industrial sectors with a view to a circular economy.

With reference to increasing 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 with complementary solutions (such as LPG and LNG, bioLPG, bio-LNG and renewable dimethylether, resulting from both biological and recycled carbon processes) which, based on a distribution infrastructure that is already widely spread across Italy, can immediately contribute to the decarbonisation of users that are not connected to the methane pipeline network (of a residential, industrial and agricultural nature). both employment in the transport sector (light and heavy road, as well as maritime).

In this regard, we would point out that, in order to build on the existing infrastructure that is already ready and available (storage depots, fuel outlets and facilities already installed at utilities), the industry is planning significant investments in the decarbonisation of LPG, with the aim of releasing for consumption, in the medium term (until 2030), a mixture of 40 % of organic and renewable products (bioLPG and renewable dimethylether) and 60 % of conventional LPG.

¹ the result of the administrative measures can be achieved through a combination of reducing the winter heating period by 15 days, reducing the indoor temperature by 1 °C (from 20 °C to 19 °C) and reducing the internal temperature by one hour per day, with a total value of around 2,7 billion cubic metres of saved gases (of which 1,65 billion for the reduction of 1 °C alone and 550 million m³ for the reduction of one hour per day alone). These measures do not substantially reduce the comfort of the environment, which can also be adopted with a view to decarbonising energy consumption.

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From 2030 onwards, on the basis of these investments, a potential annual availability of 750.000 tonnes of rDME and around 700.000 tonnes per year of bioLPG is estimated in Italy (the latter, to date, already available in the two national biorefineries that currently produce around 40.000 tonnes of bioLPG per year), which could be released for consumption for transport or combustion, mainly in the civil sector.

❖ **ELECTRICITY SECTOR**

In updating the INECP energy security objectives, it is necessary to continue to develop instruments that can support renewable energy production, in order to meet the challenging EU-unit generation mix targets 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 total decarbonisation by 2050, also ensuring the abandonment of coal by 2025 (with the exception of installations located in Sardinia). This will require the development of new *utility scale* and distributed electrical storage capacity.

Below is the presentation of the forecast data on accumulations prepared by Terna in PdS 2023:

Figure 27 – Localisation accumulating 2019 and 2030 (GW)



The increasing penetration of non-programmable renewable generation capacity with almost no variable costs has, among other things, exacerbated the riskiness factors typical of private investment in electricity generation and storage capacity, making it extremely difficult for the individual private investor to predict, solely on the basis of spot market price signals, the profitability associated with its investment choices. In the absence of sufficiently developed futures markets, the expected revenues from participation in *spot* markets are surrounded by a considerable degree of uncertainty because of their dependence on exogenous factors which are increasingly difficult for the investor to foresee, such as: the growth of renewables, the development of storage, the evolution of demand, network developments and the behaviour of the system operator in the ancillary services market.

The adoption of market mechanisms, such as *capacity market*, will therefore need to continue to ensure the availability of the necessary capacity for system adequacy. .

An additional objective to be pursued is to increase electricity storage capacity to ensure the integration of renewables into the electricity market and to manage overgeneration efficiently. In this regard, Article 18 of Legislative Decree 210/2021, followed by ARERA Decision 247/2023, laid the basis for the establishment of a centralised procurement mechanism dedicated to this type of resources.

Among storage technologies, pumping facilities are still an important resource for adequacy as well as for system security and flexibility, as they are able to provide the maximum available capacity during the highest load hours, provided by filling up the reservoirs upstream, following the pumping of these plants during low load hours.

Another objective to be pursued to ensure the security of the energy system is the development of a network resilient to weather events induced by climate change which, increasingly extreme in terms of intensity, extent and frequency, increase risks to the electricity system, leading to failures and failures of components with impacts on entire areas of the national electricity system.

The objective of increasing the resilience of the electricity system, already set out in the 2019 INECP, requires, to date, the implementation of actions aimed at adopting passive and active solutions to mitigate the effects on transmission and distribution networks, through the optimisation of coordination mechanisms between the various competent institutional bodies.

This objective will cover the deployment of mitigation measures at all stages of electricity system operation, from planning to operation, so as to enable more efficient and effective management of extreme events. It will therefore be necessary to improve the system's resilience to stress events, the effectiveness of early intervention and the restoration of service in the event of disruption, and the safety of all those 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 when drawing up national plans.

Compared to the resilience plans already drawn up by distribution agents and Terna at the direction of the then MISE, integrated and coordinated plans to increase resilience will need to be developed over the medium term, based on both passive (planning for strengthening networks) and active (protection, automation control and defence) solutions, including improving restoration plans in order to reduce the durations and impacts of disruptions, reducing Loss of Load Expectation and EENS (Expected Energy Not served). In addition, the plans will have to consider both the reduction of probability of failure and the reduction of risks of discharging, with the aim of improving the stress tightness and reliability of the system in the face of extreme events.

2.4 dimension of the internal energy market

2.4.1 Electricity interconnectivity

1. The level of electricity interconnectivity that the Member State aims for in 2030 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) price differential in the wholesale market above an indicative threshold of 2 EUR/MWh between Member States, regions or bidding zones;*
- 2) nominal transmission capacity of interconnections less than 30 % load top level;*
- 3) nominal transmission capacity of interconnections less than 30 % of installed renewable energy generation capacity.*

Each 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 for new public networks included in Terna's development plans, which are supplemented by new interconnections financed in full 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 own TSO mandate 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 2023 Development Plan, in line with the previous plans, maintains the reinforcements of the transmission network in order to develop interconnection capacity with the electricity systems of the neighbouring countries in order to ensure greater safety, through the possibility of mutual assistance between the interconnected systems. In this respect, in line with what was also noted in the previous Terna Development Plans, the aim is to develop Italy's interconnection capacity, in particular with Corsica, Tunisia, Greece, Slovenia, Austria, Switzerland and Malta.

Developing 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. Interconnection will contribute to increasing the benefits not only for the Italian electricity system but overall for the European system as a whole, especially 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 Agreement requires the TSO to take these projects into account when defining the development lines, with particular reference to the identification of the need to upgrade the external interconnection network. In order to improve long-term planning capacity, it is also useful to point out that in Italy the so-called merchant initiatives

line (ML), which is still in place, is also particularly numerous in terms of authorisations granted.

The electricity interconnection target of 15 % by 2030 is currently assessed as the ratio of Net Transfer Capacity (NTC) to installed generation capacity. The significant growth in installed generation capacity expected due to the new solar and wind power by 2030 (+ 74 GW in the Policy scenario, with fossil capacity maintained as a complement, flexibility and reserve) 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 to provide regulatory instruments in order to guarantee the necessary reserve margins for the safe operation of the system.

More details on the planning of interconnections will be dealt with in paragraph 3.4.1.

In any event, as stated by the Expert Group and shared by the Commission, it is *essential for* the establishment of a new interconnection to undergo socio-economic and environmental cost-benefit analyses to ensure 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 Member States recruited for 2030, which will become available only after the publication of the respective integrated national 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 economically justified in this differential.

As regards indicator 2), the estimated value for 2030 in the scenario of the PdS of Terna is 28 – 33 %, considering only the projects planned to date with entry into operation by 2030, which highlights the need to develop further interconnections already planned beyond the horizon that can contribute to achieving the targets.

As regards indicator 3), the estimated value for 2030 in the scenario of the PdS of Terna is 16 – 20 %, which highlights the need to develop further interconnections already planned beyond the horizon that can contribute to achieving the targets. However, as mentioned above, although this figure shows a gap from the 30 % threshold, it is reduced by the significant share of renewable installations (108 GW) provided for in this Plan in 2030.

2.4.2 energy transmission infrastructure

1. 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

❖ **ELECTRICITY SECTOR**

With regard to the national electricity transmission grid (RTN), the decarbonisation targets impose new challenges for the development and operation of the grid. In particular, the requests for connection 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 the RES needed to achieve European objectives, it will be essential to develop new efficient infrastructure capable of connecting the areas with the highest RES production – in the south and on the islands – with consumption centres, mainly located in the north of the country.

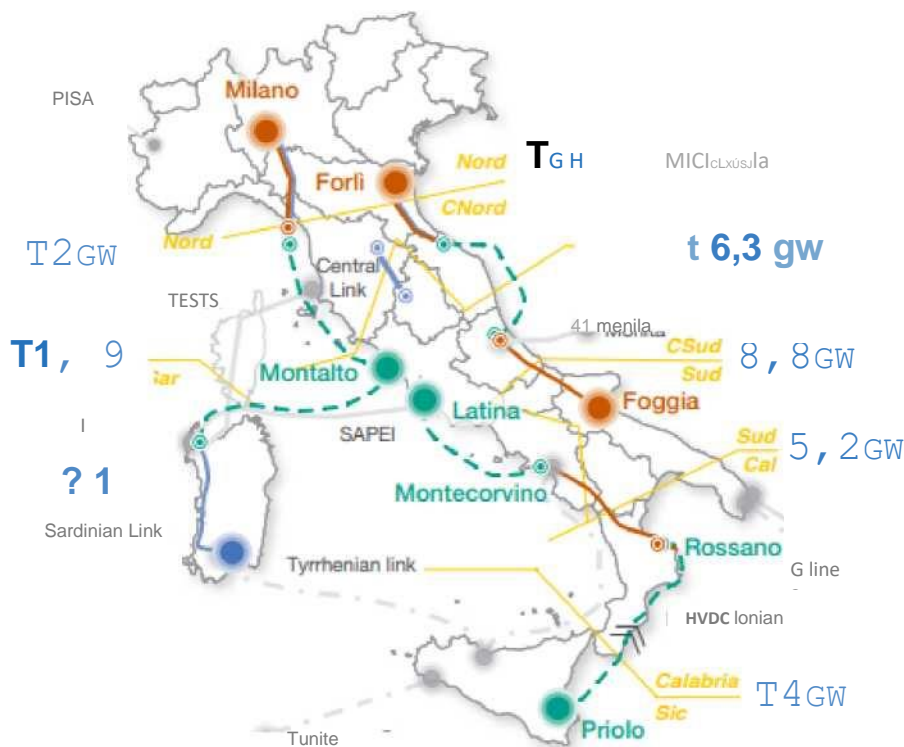
In this context, Terna, in the new Development Plan submitted in March 2023, provided for infrastructure development measures and new tools to achieve the ecological transition objectives in the most efficient way.

The objectives of the Development Plan include:

- Integrate RES;
- increase transport capacity between market areas and resolve electricity system congestions;
- developing interconnections with foreign borders;
- improve the levels of security, 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-system oscillations.

One of the main expected benefits of the measures provided for in the 2023 Development Plan will be to increase the capacity to trade between areas, i.e. to double the current trading capacity between market areas from around 16 GW today to over 30 GW. In this context, upgrading the power lines with works on existing lines, whether carried out on the same route or adjacent, improving their operational performance to enable them to operate in direct current (DC), in addition to the use of underground/submarine cable technology and innovative alternating current (innovative AC) solutions, will allow a significant increase in transport capacity; this will enable the implementation of a DC layer (“Hypergrid”), which will enable an active and highly stabilising network to be set up. The new Hypergrid development measures will allow for a doubling of the current exchange capacity between market areas and, in synergy with the measures planned in previous plans, will contribute to the reduction and resolution of future congestions of the National Transmission Network.

Figure 28 Terna Development Plan 2023: Overview of new interventions and increases in transport capacity (GW)



HYPERGRID DORSAL

	E.E	MLM EUR
HVDC MilanoMontalto	3Cti E vaO32	2.675
Cantra] Link	2030	230
SAP Et 2 & Sajdinlan Unti	2040	1.422
HVDC Ionnan	208S	1.410
HVDC Ftaasana-Lalna	20GS	2.724
H7DC Foggia - Fori	SCtiMCtiÉ	2.355

The set of measures provided for in the Terna Development Plan is described in paragraph 4.5.2.

In parallel to the flexibility infrastructure, it is also important that the network equip itself 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 load control services to ensure high standards of service quality and system security.

Additional investments in distribution networks, which are increasingly affected by the deployment of small and medium scale plants, should be added to the above mentioned actions. On the distribution networks, it is extremely complex to estimate the overall scale of the modernisation measures needed to achieve the objectives, given the varied geographical location of distributed generation (mainly photovoltaic conversion) and electrification of end uses. For the latter, in particular, the largest effects are expected in densely populated areas, while the effect of distributed generation is reasonably more likely to be felt in low-load rural areas. In any case, the spatial consistency between generation and load does not guarantee the coincidence in time between production and off-takes, as injections that have not been consumed locally (in individual users or with users close to them) may have recovered to the higher levels of the network.

❖ GAS SECTOR

During 2020, the methane pipeline connecting the TAP to the national transmission network was completed, which made a new source of supply, Azerbaijani gas available, through a new route increasing diversification, security of supply and resilience of the gas system.

The transport network also continues to be adapted in relation to solutions aimed at overcoming difficulties in carrying out maintenance work on sections of the network which cross heavily urbanised areas. It is therefore necessary to follow the intervention programmes on the network in order to ensure continuity of service to final customers, given the ageing of natural gas transmission infrastructure, both national and European, forming part of a network that has developed more than 40 years ago, and, in the future, to provide for the restructuring 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 upgrade existing plants 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 will be located off the coast of Ravenna, with expected entry into service in 2024. Further initiatives of regasification terminals located in southern Italy and Sardinia will also be assessed.

Construction work is also underway for a new natural gas production plant near Gela and its connection to the national gas grid. The disbursement is expected to start by the end of 2023 for this initiative.

In the gas sector, several projects of small-scale coastal depots (SSLNG) for the discharge of LNG from small methane vessels, storage and subsequent loading onto bettoline vessels (bunkering) for the refuelling of household and industrial customers and fuel refuelling stations are also being authorised and evaluated at MASE. In particular, in Sardinia a number of solutions were put forward to load LNG on bettolins at existing regasification plants (Panigaglia and Livorno in particular) to provide small storage/regasification plants located on the island and connected to the future gas network in Sardinia.

- . *National objectives related to other aspects of the internal energy market, such as increasing system flexibility, in particular in relation to the promotion of competitively determined electricity prices in line with relevant sectoral legislation, market integration and coupling, with a view to increasing trading capacity of existing interconnectors, smart grids, aggregation, demand response, storage, distributed generation, mechanisms for dispatching, redispatching and curtailment and real-time price signals, including a timetable for when the objectives are to be met*

The electricity market was originally designed to pursue, by promoting competition in *spot* markets, both short-term and long-term production and allocation efficiency objectives. More recently, the challenging objective of decarbonising the electricity system has been added to these traditional objectives. The need to pursue the latter in an effective and efficient manner has highlighted the need to reform the market design.

Indeed, the original market design – focused on spot markets – has clear limitations in securing the investments needed to pursue the challenging decarbonisation objectives, while at the same time ensuring the availability of the necessary resources to preserve the adequacy and safety of the electricity system.

In order to ensure effectiveness and efficiency in the transition to decarbonising the electricity system, it is therefore considered a priority to strengthen the role of futures markets with the aim of promoting the investments in renewable generation capacity necessary to *meet* the decarbonisation targets, while ensuring:

- an efficient distribution of these resources both between different market areas and due to the different production profiles expected; going beyond the concept of cost minimisation to also take into account the value generated for the system also due to the evolution of the 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 functional resources to maintain the security and adequacy of the system.

This requires not only the introduction of new segments of centralised futures markets, such as the one for the supply of utility stairway storage resources referred to in Article 18 of Legislative Decree No 210/2021, and the innovation of existing ones, such as the mechanisms for long-term contracting of renewable production by the system (with two-way contracts for difference), but also:

- encourage *merchant* initiatives for the development of renewable energy and storage, for example through *Power Purchase Agreements* or PPAs;
- ensure efficient coordination between the various contract term mechanisms and *merchant* initiatives, in order to maximise their synergies and ensure the optimisation of the *mix* of resources present in the electricity system;
- ensure the full integration of the resources supplied forward by *spot* markets, so that these markets can continue to express correct signals in relation 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 futures markets, we intend to continue the process already under way, aimed at fostering closer integration of the Italian market with the other European markets and at making the functioning of the wholesale *spot* and *retail markets more efficient*.

- **THE DEVELOPMENT OF FORWARD ELECTRICITY TRADING INSTRUMENTS**

The energy crisis has made it even more pressing to make structural, alongside the short-term markets that serve the efficient dispatching of resources in the short or very short term, instruments for negotiating in the long term the resources needed to:

- pursue decarbonisation objectives (PPP 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 (mechanism for supplying utility stairway storage resources referred to in Legislative Decree No 210/2021);
- ensure the adequacy of the electricity system (capacity market).

- **POWER PURCHASE AGREEMENTS AND WARRANTS FOR TWO-WAY PATCHES**

With regard to instruments for long-term contracting of renewable capacity, we believe it is necessary to encourage *merchant* initiatives, for example, through *Power Purchase Agreements* or PPAs, and above all to innovate the contracting mechanisms by the system such as two-way or CfD contracts for difference.

PPPs are useful tools to promote new investments in renewable generation capacity and, in particular, to promote the decarbonisation of the energy consumption of large industrial consumers. This medium to long term contract instrument makes it possible, in relation to the electricity covered by the contract, to stabilise the price over time, ensuring stable revenue streams for the producer over the medium to long term (necessary to ensure the viability of the project) and for the consumer to protect 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 concluding contracts with very long horizons. This burden makes PPPs not suited to the needs of, in particular, small consumers.

The main measures that can be taken to resolve the above-mentioned problems and to promote the long-term contractualisation of renewable production through PPAs are:

- standardisation of contract parameters;
- the management of counterparty risk through the establishment of a CCP futures market;
- the possibility of introducing public guarantee schemes to support operators.

As a contract instrument with the renewable generation capacity system, CfDs are a crucial tool to ensure that decarbonisation objectives are pursued at a low cost and in line with network developments and the necessary investments in storage systems.

The CfD tool can provide significant benefits in terms of price stabilisation over time, providing the renewable producer with certainty of revenue flows in the medium term and the consumer with protection against price volatility in *spot* markets. To this effect

it should be added that the signing of fixed-term contracts such as CfDs allows the system to benefit both from the lower costs associated with reducing the risks to which producers remain exposed and from the increased competition that characterises fixed-term supply.

In order to improve the effectiveness and efficiency of this tool, 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 the 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 the consumer and without compromising the security of the electricity system. In this connection, it should be borne in mind that minimising costs for the system requires consideration to be given, first of all, to the different market value associated with the expected production profiles of the various 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 the assignees, will have to evolve with the dual aim of efficiently allocating risks and responsibilities between the system and private investors and to better integrate renewable capacity into the dynamics of *spot markets*. In particular, it will assess:

- the introduction of automatic tariff adjustment mechanisms to deal with increasing costs and risks related to inflation;
- the possibility of recognising the tariff payable on the basis of different profiles the actual injection of the installation in a way that promotes efficient investment and resource management solutions, as well as a more correct allocation of risks among the different actors in the system. In a first step, for example, the fee payable could be recognised on the basis of the installation's potential inputs instead of actual net input at times when renewable production cuts occur 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-shifting products *provided* for in Legislative Decree No 210/2021, the tariff to be paid could be recognised on the basis of *standard* profiles consistent with the requirements of the electricity system (e.g. *baseload* and/or *peakload*), with the obligation to feed renewable energy into the grid, on an annual basis, equal to a share of the contracted profile. This type of contractual structure would leave to private investors responsibility for the optimal *mix* of renewable technologies to be implemented.

NONETHELESS,

M LONG-TERM SUPPLY OF UTILITY SCALE STORAGE RESOURCES

With reference to long-term contractualisation instruments that serve the safety of the electricity system and the efficient integration of renewable sources into the electricity market, we believe it is necessary to introduce as soon as possible the market segments provided for in Article 18 of Legislative Decree No 210/2021 (and the sale to the market of *related time-shift products*). In particular:

- The new long-term supply segment of utility scale storage capacity will *promote the* development of new storage capacity, which is conducive to the effective integration of renewables into the electricity system; this will reduce overgeneration *inline* with network developments and in line with the regulatory needs of the network operator. Adequate storage capacity (both widespread and concentrated) is important in view of the significant growth of non-programmable renewable sources and the consequent increased need for flexibility required by the system, also due to the gradual decommissioning of thermoelectric capacity. Among the technologies of storage, hydroelectric and electrochemical storage systems are now the most mature option;
- The new market segment for time-shift products will *promote the* efficient use of contracted storage capacity, as well as greater integration of renewables into the markets. Terna

downstream of the supply of storage capacity will emit the aforementioned *time-shifting products* built from the *pool* of previously contracted physical resources. These products, characterised by different time horizons (e.g. multiannual, annual, daily), will be made available through competitive auctions to third party market operators on a platform operated by GME. Market participants in possession of time-shifting products *will have* virtual storage units to be used on energy markets to shift energy from hours with low prices to hours when the price is higher. The availability of these products will allow operators wishing to invest in non-programmable renewable capacity to manage more efficiently the typical profile risk of long-term transfer 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 the dynamics of *spot* markets.

NONETHELESS, *MCAPACITY MARKET*

Italy has for some time been equipped with one of the most sophisticated capacity remuneration mechanisms at European level (the so-called capacity market). The Capacity Market will continue to play a structural role in the Italian electricity market design to ensure the adequacy of the electricity system, including in the transition towards full decarbonisation.

The capacity market is open to all technologies capable of delivering adequacy and the negotiated product ('*reliability options*') has the advantage of incentivising the maximum availability of contracted capacity by mitigating the market power phenomena that typically affect electricity markets in situations of scarcity.

In order to ensure efficient coordination between the various forward contractualisation mechanisms, the capacity needs to be supplied within the CM will have to cover the contribution to adequacy made by:

- the available storage capacity, including that supplied through the mechanism referred to in Legislative Decree No 210/2021;
- available renewable generation capacity, including that contracted on a forward basis through PPA and CfD.

- **STRENGTHENING THE PROCESS OF MARKET INTEGRATION**

In recent years, the EU's drive to harmonise national rules for the operation 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 (EC) No 2195/2017) set out a precise market model, both for electricity trading and for the supply of dispatching services. Specifically:

- As regards the day-ahead market (GMP), Italy is already integrated with France, Austria, Slovenia and Greece through *market coupling*, which will eventually also be launched at the border with Switzerland (subject to 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 in the market, while enabling efficiency criteria to ensure system security to be met.
- With regard to the integration of balancing markets, Regulation (EU) No 943/2019 on the internal market in electricity aims to develop common platforms for the exchange of flexibility services and resources between network operators in EU countries; this will facilitate cross-border imbalance clearing, 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 harmonising balancing rules appears to be more delicate, as it affects the operation of network operators at near-real-time deadlines and thus the security of the system in the short term. In this context, since January 2020, Terna has been participating in the IGCC platform for the offsetting of imbalances at the European level of the areas of the different TSOs, and since January 2021, it has been participating in the Terre platform for the exchange of balancing energy from replacement reserve at European level. In addition, by July 2023, Terna will participate in the Picasso platform for the exchange of balancing energy from secondary reserve and by July 2024 in the Mari platform for the exchange of balancing energy from rotating tertiary reserve.

- **PROMOTING THE ACTIVE ROLE OF DEMAND**

The role of the consumer is changing from taxable to active, 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 be mainly at three levels:

- choice of supplier and proper assessment of commercial offers and related services;
- self-generation and use of storage and efficient consumption management systems;
- change of load following demand response.

On the first point, the Italian authorities will conclude at the beginning of 2024 the long-established process of overcoming the regulated retail price regime in the energy markets, extending it to domestic customers, in accordance with the provisions of Law No 124 of 2017 on competition and in accordance with the reform programme for the liberalisation of the sector approved by the European Commission (M2-C1-7).

In addition, as from 2023, efforts will be stepped up, particularly with regard to domestic customers, to ensure that final consumers are more aware of them.

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 existing competition and sectoral rules, which define essential steps for the proper exercise of consumer sovereignty in a free market context.

The development of widespread self-production may be expressed through various forms, be it individual or collective, in the industrial/commercial sphere or as an expression of citizens' initiatives, including for social and environmental purposes. The spread of self-consumption – also ensured by public policies to encourage shared energy tariffs within the various possible self-consumption configurations, including the Renewable Energy Communities – will naturally 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 to high-efficiency renewable and cogeneration sources, with lower costs for users. This phenomenon should be supported, through enabling public policies based on efficiency criteria, enabling market players to organise themselves.

The development of *demand response* also requires changes in market rules to make consumers perceive the benefits of flexible consumption.

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 as well as for the aforementioned diversification of sources of origin.

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

In order to ensure non-discriminatory participation of renewable energies, it will be necessary to complete the authorisation to participate in the markets for distributed renewable generation services and to fully exploit demand and other flexibility resources (including storage systems), including through aggregation, in accordance with the principles of technological neutrality and minimisation of costs, as provided for in the definition by ARERA of the Integrated Text on Electricity Dispatching (TIDE), which will take into account the results of the consultation on the Authority's final guidelines (consultation document 685/2022/R/EEL) and be consistent with the European balancing code (Commission Regulation (EC) No 2017/2195). This objective is based on awareness of the expected significant growth of installations connected to distribution networks and the need to open up energy markets more to new players.

In addition to promoting greater integration with other European markets, the reform path of the services market will be instrumental in achieving the objectives of:

- sustainability, as the increasing openness of the MSD allows for a more effective integration of renewable energy sources into the market and the electricity system;
- competitiveness, as the increased availability of resources and technologies capable of providing the required service strengthens competitive conditions between operators, with potential positive effects on the dynamics of service costs and the risk of abuse of a dominant position.

With regard to increased demand participation, one of the objectives is to complete the process of making electricity consumption and withdrawal data available to final customers and third parties designated by the customer, which relies on the deployment of smart meters at an advanced stage.

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 to promote self-consumption and to develop and support renewable energy communities, mainly through regulatory instruments 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 undergoing a gradual reduction in conventional capacity for years, introduced in 2019 an instrument to ensure adequacy for the electricity system by concluding long-term contracts (*capacity market*) and open to generation capacity (without prejudice to emission constraints), as well as storage systems and *demand response*.

Adequacy is regularly analysed and reviewed by Terna, both in the medium to long term and in the short term, paying particular attention to times of increased seasonal demand and particular exogenous problems. In its 2022 Adequacy Report, Terna pointed out that, despite the new contracted capacity and the planned new network works, there remains a specific risk of adequacy in the medium term relating to the possible occurrence of prolonged periods of high temperatures, low rainfall and a simultaneous reduction in the availability of *imports* from neighbouring countries. Indeed, high temperatures and low rainfall lead to peaks in the demand for electricity for air-conditioning and, at the same time, unavailability of water and thermoelectric generation (due in turn to *thermal* derating phenomena due to high temperature at discharge and low level of watercourses), making the Italian system dependent on *import* at the northern border to ensure continuity of service. In addition to constantly monitoring the implementation of the capacity contracted through *capacity market* auctions and continuing to implement the network works already planned by Terna, it will be appropriate to identify solutions to improve the availability of the current power park module in cases of high temperatures and low levels of rivers, also considering the major problems of availability of

the French power park module.

With regard to the flexibility of the electricity system, in view of the expected significant growth of non-programmable renewable sources and the consequent increased need for the energy produced to shift over time, it is necessary to develop new storage capacity, both centralised and distributed, in order to enable more efficient management of overgeneration *phenomena*.

The objective of flexibility is distinct from the adequacy objective and both, as necessary, require dedicated instruments as part of an organic market design that addresses the objectives of sustainability, competitiveness, adequacy and flexibility and at the same time ensures the security of the electricity system. For this reason, both capacity market and forward auctions for accumulations should be developed and maintained.

Other possible storage solutions involving the use of alternative carriers such as hydrogen will also *be* assessed in the light of the need for flexibility and in light of the cross sector aspects of energy, in coordination with the aim of promoting a suitable market and infrastructure environment for the development of this resource.

v. If 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* with respect to the European average, albeit gradually narrowing, still persists. The main cause of this *gap* is a higher wholesale energy price, which in turn depends on a number of factors, including a gas price (main and marginal source for Italy) still higher than the European average, and that the energy mix is still strongly shifted towards gas combined-cycle plants which, although more efficient, have higher variable costs than, for example, nuclear power plants, which are still significantly present in the European energy mix.

The objective of increasing renewable energy sources is therefore confirmed, including with a view to containing prices, 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.

Promoting the active role of consumers is closely linked to improving the transparency and competitiveness of the retail market. In this respect, it is essential that this result be achieved in coordination with the above-mentioned completion of the process of liberalisation of the retail market, which will lead to the definitive overrun of the price regulation system (More protection), which currently affects more than 30 % of household 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 international debate, both in terms of analysis/evaluation and the identification of law enforcement policies; the economic crisis linked to the pandemic and the recent rise in prices – which has affected energy products in particular – have further called for attention and responses from the institutions of 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 customers²².

In the following years, the picture has worsened: in 2021, according to the data in the report ‘The national energy situation’ by the Ministry of the Environment and Energy Security, Italian households’ expenditure on electricity and gas bills increased by around 20 % compared to the previous year.

Moreover, in prospective terms, the evolution of some economic variables affecting the EP is a further element of attention. This refers, for example, to:

- Expected energy price developments. According to the European Commission’s projections for Italy (EU Reference Scenario 2020), which were developed before the Russian-Ukrainian conflict and the inflationary dynamics of the following years, the final electricity price is expected to increase at an average annual rate of 0.7 % in the decade 2020-2030. No information on the price of gas or other energy products is available, but overall energy expenditure would increase by 3.3 % per year if it had the same estimated trend for the total energy related costs under the same scenario;
- The dynamics of household expenditure on energy products. According to projections by the EU Reference Scenario 2020 itself, the heading ‘Energy expenditure in households (% of private consumption)’ would increase by 1.0 % per year in the decade 2020-2030;
- The evolution of residential energy consumption and its composition between the various sources. In the trend scenario of this Plan, in this case residential consumption is expected to fall by around 6 % in 2030 compared to 2020, with an increase in the electricity component (by 3.5 %), compared with a reduction in gas (-8 %) and oil products, which are increasingly marginal.

In order to ensure institutional coordination of analysis and enforcement activities at the EP, and following the provisions of the INECP 2019, the Italian National Energy Poverty Observatory was established in Italy by the Decree of the Ministry of Ecological Transition of 29 March 2022, which is explained in paragraph 3.4.4.

²² by subsequent 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 economically disadvantaged conditions or who are in (or are) in a severe state of health, requiring the use of life-saving medical and therapeutic equipment powered by electricity;
- people with disabilities;
- entities whose users are located in the minor islands which are not interconnected;
- persons whose users are located in emergency housing facilities following catastrophic events;
- persons over 75 years of age.

In Italy, there is currently no official definition of the EP, and the activities of the National Observatory include the definition of proposals to this end, with the identification of indicators that can be monitored over time, in a way that is consistent with national specificities and on the basis of the evolving European legislative and programming framework. In particular, reference is made to:

- The definition of energy poverty set out in Recommendation (EU) 2020/1563 of 14 October 2020, namely the situation of households who are unable to access energy services that are essential for a decent standard of living and health, and the ongoing development of the relevant European legislative and policy framework;
- The proposal for a revision of the Energy Efficiency Directive, COM (2021) 558 final, which is part of the ‘Fit for 55’ legislative package and is currently being issued, in which the EP is defined as the lack of access by households to essential energy services that provide basic levels of living and decent standards of life and health, including heating, hot water, cooling, lighting and energy adequate to power appliances, in the relevant national context, existing social policy and other relevant policies, caused by a combination of factors, including, but not limited to, non-affordability, insufficient disposable income, high energy expenditure and poor energy efficiency of homes;
- The proposal for the establishment of the Social Climate Fund and the Council Recommendation of 16 June 2022 on ensuring a fair transition towards climate neutrality, in which reference is made to the definition provided in the proposal for the revision of the Energy Efficiency Directive.

For the purposes of this plan, we consider that the definition of EP contained in the proposal for the revision of the Energy Efficiency Directive should be considered as a priority reference.

With regard to the monitoring of energy poverty, on the other hand, reference should be made to indicators:

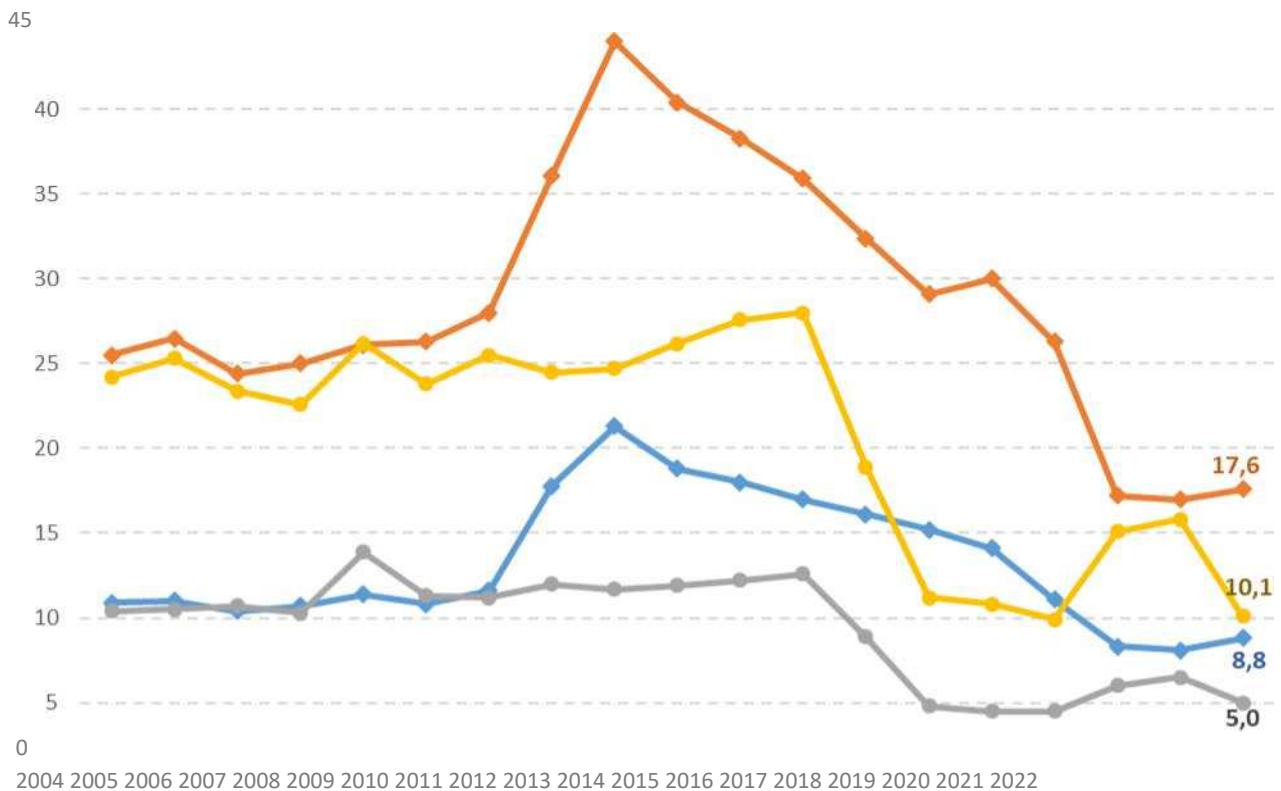
- able to measure the phenomenon reliably and effectively;
- able to monitor it over time, on an annual basis;
- for which precise targets are to be set for 2030.

Recommendation (EU) 2020/1563 proposes the use of different indicators to measure the different aspects that characterise the EP. The following are based on the replies provided in the context of 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) who is unable to keep their home adequately warm, based on the answers to the question “Can your family afford to keep the house adequately warm?”;
- share of the total population unable to keep their dwelling adequately warm, based on the answers to the question referred to in the previous point;
- share of population at risk of poverty (below 60 % of national median equivalised disposable income) in arrears with utility bills;
- Share of population in arrears with utility bills.

The graph below shows the development over time of the values of the four indicators now listed.

Figure 29 – Evolution of four indicators proposed by Recommendation (EU) 2020/1563 [Source: Eurostat]



% population unable to heat their home adequately (out of total population)

% population unable to adequately heat their homes (out of the population at risk of poverty)
% population in arrears on utility bills (out of total population)

population in arrears on utility bills (on population at risk of poverty)

Pending the identification of a national definition of energy poverty and the selection of appropriate monitoring indicators, this plan intends to take as a reference the indicator '*Share of the total population unable to keep their homes adequately warm*'. In addition to its relevance in itself to the phenomenon that is 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 to Eurostat (the baseline survey, in particular, is the EU-SILC referred to above). It is therefore constantly subject to the monitoring 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 monitoring the *Sustainable Development Goals*, with particular reference to Goal 7 "*Affordable and clean energy*".

In terms of targets for 2030, and taking into account both the trend over the past 10-15 years and the projected trend in energy prices and household energy expenditure for the years to come, it is assumed that in the coming years, if appropriate measures are taken to combat this indicator, the value of this indicator may fall by around 0,8 percentage points compared with the figure recorded in 2022: thus from 8.8 % to 8.0 %.

On the other hand, this indicator is not the only one that reflects the needs to combat energy poverty in Italy; in the coming years, including with the support of the Observatory referred to above, analysis and evaluation activities will be launched, thus reserving the possibility of dynamically selecting new indicators that reflect the nature of the indicators.

multidimensional of the phenomenon itself and to express the objectives to be achieved on the path towards 2030.

In this regard, in the second part of 2023, Italy will also launch a methodological statistical project entitled Energy Poverty Indicators Calculation (EPIC project), which aims to design and implement analytical and statistical processes on the EP, filling the current gaps and increasing capacity and evaluation tools;²⁸ this objective will also be pursued without limiting analysis and results to the national context alone, but rather raising them to European level, by providing proposals (approaches, methodologies, data sources, indicators) which may also be replicated in other countries.

2.5 research, innovation and competitiveness dimension

1. National and funding targets for public and, where available, private research and innovation related to the Energy Union and, where appropriate, a timetable for when the objectives are to be achieved

The aim of this plan is to set out a medium- and long-term strategy (at least until 2030 with a 2050 perspective), indicating, for the research, innovation and competitiveness areas, objectives and priorities and the measures needed to achieve them.

The identification of national R & D & I targets on energy technologies is a priority in order to accelerate the market introduction of those technologies needed to meet the targets set by the Green Deal, while at the same time strengthening the competitiveness of national industry. With this in mind, the R & D & I objectives therefore identify those energy technology clusters that we believe could make it possible to:

- achieving the decarbonisation targets, both by 2030 and 2050, both because of their potential for penetration and because of their role in making the transition technically feasible;
- maintain and strengthen the competitiveness of Italian industry.

It is also intended 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**

The European Commission presented in December 2019 its Communication on the European Green Deal (COM (2019) 640 final), which confirms and updates its commitment to tackle climate change and environmental challenges and to embark on a decisive transition of the energy system, with the aim of achieving climate neutrality by 2050.

With the new European 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.

Italy's participation in the call for tenders launched by Eurostat on energy poverty, which was subsequently implemented in the EPIC project, has given rise to the specific issue of deepening the EP's theme, including in terms of developing new indicators; for example, it is envisaged to produce some originals extending EP monitoring also to mobility and more generally to the transport sector, which has hitherto been neglected by the technical literature on EP measurement.

In July 2021, the Commission published the *Fit for 55* package, containing regulatory proposals to implement the interim objectives of the Green Deal to achieve a 55 % reduction in net GHG emissions by 2030 compared to 1990 levels and to make the EU's decarbonisation pathway aligned with climate neutrality by 2050.

With the Communication '*REPowerEU: Joint European Action for more affordable, secure and sustainable energy*' COM (2022) 108 of 8 March 2022), the Commission set out a path towards the progressive reduction of fossil fuel imports, which, including energy efficiency and consumption reduction, strengthens 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.

- **SET-PLAN**

The SET-Plan was set up by the European Commission in conjunction with the "Package 20-20-20" 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 the energy sectors through the establishment of 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 led to the establishment of fourteen Implementation Working Groups (IWG) to define the priority lines of research for each technological area and forecasts of financial needs. Italy supervises each of the IWG with experts in the sector from research bodies and universities, who have set up permanent consultation groups with national companies and research organisations, working in partnership with other Member States, which have often resulted in joint participation in Horizon projects (CETP, DUT, CHP in particular).

Italy continues to regard the EETS Plan as the key instrument for addressing the new challenges posed by decarbonisation and agrees with 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 targets. Italy will continue to progressively align the objectives and priorities of public investment in energy research and innovation with those of the EETS Plan. Italy has also ensured from the outset its accession to the new IWG on hydrogen in the process of being established.

- **HORIZON EUROPE**

Horizon Europe is the programme of the integrated funding system for research activities of the European Commission for the period 2021-2027. Horizon Europe's overall objective is to generate scientific, technological, economic and societal impact through EU investments in research and innovation, so as to:

- strengthening the scientific and technological bases so as to promote competitiveness in the Member States;
- implement the Union's strategic priorities and contribute to the achievement 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 world's leading funding programmes for the commercial demonstration of innovative low-carbon technologies. The Fund has a financial availability linked to the auctioning mechanism of approximately 450 million EU ETS allowances for the period 2020-2030, the value of which depends on the average market price of the tonne of CO₂. The JTF aims to support highly innovative clean technological solutions that can be rapidly deployed so as to contribute to the Union's transition towards climate neutrality as soon as possible. The sectors eligible to participate in calls for tenders from the Fund are:

- energy-intensive industrial sectors, including carbon capture and utilisation (CCU) and carbon-intensive substitutes;
- projects for CO₂ capture and geological storage (CCS);

- innovative technologies for renewable energy production; energy storage technologies.

- **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) in support of relevant technological innovation general for the electricity sector, structured on a three-year basis;
- “*Italian Mission Innovation Programme*”;
- ‘*Research on hydrogen NRRP*’ under the National Recovery and Resilience Plan.

The extension of these programmes has enabled a new organisation of investments in Italian energy research through enhanced coherence between financial resources, objectives and the technological readiness of results (expressed in terms of TRL-Technology Readiness Level).

R & D should contribute both to reducing GHG emissions and to supporting the competitiveness of the economic system by accelerating the market introduction of new innovative technologies, products and services.

A further objective is to target 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 to be achieved in the sector.

Looking ahead to the next decade, three key criteria should inform action on research and innovation in the energy sector over the next decade:

- Finalising resources and activities towards (i) developing processes, products and knowledge that have an outlet in open markets, (ii) supporting the use of renewable technologies, energy efficiency and grids;
- Synergistic integration between systems and technologies;

move to 2030 as an intermediate step in the so-called “deep decarbonisation”, to which Italy has committed itself in line with the 2050 Long-term Strategy.

NONETHELESS, *GTHE PRIORITY TECHNOLOGICAL AREAS FOR THE ITALIAN RESEARCH SYSTEM*

The aim of the 2030 programming period is to provide continuity for national energy research, with a view to consolidating the results and promoting progress in the technological readiness level of the projects financed, seizing the opportunities of further development areas and bringing it into line with the proposal for a regulation entitled ‘Net Zero Industry Act’, which identifies a set of net-zero emission technologies, which are considered strategic for achieving the 2030 GHG reduction and climate neutrality objectives 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)
- hydrogen;
- fuels renewables several hydrogen;
- nuclear;
- capture, use and storage of CO₂(CCUS);
- Network technologies and digitalisation;

- Critical raw materials and advanced materials for the energy transition and related national supply chains.

The main lines of activity for the above mentioned priority technology areas are described below.

- ***Electric storage (innovative accumulators)***

Research and development of next generation batteries (from 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 durability; (III) increased economic and environmental sustainability. The latter is crucial to foster the growth of Europe’s competitiveness in the global battery market and to prevent Europe, by continuing to use critical raw materials (CRM), from being heavily reliant on the external supply of key materials or products for the energy economy. Another priority theme is the reuse, recycling and recovery of spent batteries in order to bring key raw materials back into circulation, as provided for in the new European Batteries Regulation currently being drawn up. Italy will therefore focus on the development of batteries with a high level of sustainability, 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 supply, extraction and processing capacities of raw materials (primary and secondary).

To respond to the upcoming short-term needs of the battery industry, research on generation 3 (optimised lithium ions), 4a generation (solid state lithium ions) and 4b generation (solid state lithium metal) is supported by several measures to ensure the market entry of new European technologies already from 2025.

A cross-cutting enabling role will be played by digitalisation, which offers opportunities for acceleration across the battery sector, from the discovery of materials to the optimised cross-sectoral use of battery systems to support the energy grid. Digital twins and big data analytics will be crucial for the advancement of Battery Management Systems (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 Electrical System Research and the IPCEI (Important Projects of Common European Interest) 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)***

Solar photovoltaic (PV) will 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) increased generation efficiency (photovoltaic cells and modules), (ii) land use for the needs of new installations and (iii) the revitalisation of 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 present on the market and of interest to the Italian industry (silicon hetero-junction cells or concentrated cells). In parallel, further innovation needs to be created through research into innovative materials and technologies for new generation photovoltaic cells and modules, with a focus on environmentally sustainable cell and module production and flexible applications.

A rapid and sustainable expansion of photovoltaic capacity also requires actions for (i) the development and testing of innovative photovoltaic systems integrated in the built environment (BIPV), (ii) the development of floating photovoltaic systems and (iii) the development of “agvovoltaic” systems, in which agricultural production and photovoltaic generation integrate without impacting

on land use. In particular, it is necessary to give continuity to the actions provided for in the NRRP in support of the agvoltaico and to create the conditions for the creation of a specific market, by means of a thorough and reliable assessment of the country's agvolutionic potential. To this end, it is useful to feed research into innovative, spatial and explicit methodologies (i.e. GIS-MCDA/AHP) in order to draw up maps of agvolutionic potential at regional level and national coverage. Highly specialised methodologies that identify the suitability of areas on the basis of a set of multidimensional criteria, geared towards optimising the production of the agvoltaical system (minimisation of land use, energy yield, agricultural production).

The need to regain ground in terms of competitiveness for a national sector supply chain requires an effort to diversify industrial operators in order to ensure optimal coverage of the most significant segments of the PV value chain. Research and innovation in manufacturing processes are essential to support the 'high' part of the supply chain and to provide fertile ground for the creation of new production sites (gigafactories), in addition to those already planned. At the same time, there is a need to support the need for innovation in other high-impact segments: operation of photovoltaic (O & M) systems with technical progress on monitoring and detection of system malfunctions and anomalies; forecasting 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 allow for environmentally compatible and energy-efficient application, taking into account the typical Mediterranean conditions and the capacities of the Italian industry's value chain in the sector. On the other hand, as regards onshore wind, the focus will be 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 reblading industry.

As regards geothermal energy, Italy is among the European leaders with a rated power above 900 MW and an annual electricity production of around 6 TWh. Thanks to the historical presence of geothermal energy in Italy, there are advanced industrial and scientific expertise in both geological and energy conversion. The main research bodies and various universities are involved in research in this field, with scientific results recognised in the international community and links with industry and local actors. Italy's participation in the sector's industrial ETIP and the association for the promotion of the EGEC sector is also important in the European context. Technological development objectives can be identified in the following lines of research, in line with the main international trends:

- extension of energy conversion to geothermal resources that are poorly valued or difficult to access (low enthalpy, deep superhot/supercritical fluids);
- development of closed-loop systems, well exchangers including heat recovery from oil wells and depleted gases, underground heat storage as an energy storage system;
- performance improvement of power or heat production plants and technologies, including low-enthalpy geothermal plants with heat pumps and combined development with other RES,
- testing of the extraction of critical raw materials from geothermal fluids;
- innovation in plant components, well drilling and construction systems, geothermal exploration methods for research and characterisation of geothermal resources.

The energy resource from the sea (marine energy) has great potential both for the amount of power available globally and for its power density, which is estimated to be more than 20 times that of the wind resource and its increased predictability. In Europe, the availability of marine energy resources is higher along the Atlantic coast (Ireland and Scotland). However, the Mediterranean Sea also offers

interesting opportunities for both energy production and technology development. The ENEA evaluations have shown that the areas with the highest energy potential from waves are the western coasts of Sardinia and the Strait of Sicily, where the average flow of energy ranges between 10 and 13 kW/m. Strengthening the role of energy from the sea in the Mediterranean now appears to be a necessity rather than a choice, as evidenced by the growing interest of local authorities (e.g. Italian ANCIM – National Association of Municipalities for Minori Islands). In addition to industrial use, offshore energy devices can cover the needs of local and isolated markets, where they are already more competitive (for example, marine energy devices are more competitive than diesel generators used for desalination or fish farming). Therefore, a major effort is being made by the national scientific community to develop devices for the conversion of wave to electricity, following shared methodologies for the assessment of their Technological Readiness Level (TRL) and converging towards a limited number of optimal solutions that avoid the dispersion of funding and expertise, taking into account the different conditions of use and specific needs.

Research and development activities are supported by funding instruments operating at 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 Plan (SET-Plan). In this context, Italy, represented by ENEA, chairs collaborations between Member States interested in energy from the sea. R & D 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 issue of the National Guidelines for a Hydrogen Strategy, R & D activities on hydrogen were launched in a structured way, using 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), to the development of pilot and demonstration projects, to first full-scale applications, with the aim of supporting the entire industrial chain.

Under the NRRP, R & D activities are carried out on enabling technologies, covering the whole hydrogen value chain, such as:

- technologies for the production of renewable and low-carbon hydrogen;
- innovative technologies for the storage and transport of hydrogen and its transformation into derivatives and e-fuels;
- fuel cells for stationary and mobility applications;
- digitalisation and integration of electricity/gas grids to improve the resilience and reliability of hydrogen-based infrastructure.

Further R & D activities, with a particular focus on the power to gas approach, concern the development of technologies and systems to foster the integration of the electricity grid with the natural gas grid, with a network balancing function, such as long-term storage and transmission infrastructure, and

distribution of hydrogen over long distances. These activities are carried out in the context of Electrical System Research through the ‘Integrated Hydrogen Technologies Project’.

Higher TRL R & S (≥ 6) are carried out as part of Mission Innovation, through the construction of two ‘Hydrogen demo Valleys’, i.e. multifunctional platforms to test and validate hydrogen chain technologies in an integrated manner and on a pre-commercial scale. The two Hydrogen Valleys will be located respectively at the ENEA Research Centre of Casaccia (Rome) and at the CNR in Capo D’Orlando.

The objectives of the national R & D 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 document ‘Strategic Research and Innovation Agenda 2021-2027’, which defines the target KPIs (Key Performance Indicators) for research and development.

Technological innovation is accompanied by a pathway that aims to increase the skills and new jobs needed for the introduction of hydrogen into the production system.

Nonetheless, *renewable fuels other than hydrogen*

Biofuels are produced from biomass or organic biological material. Of particular interest for sustainability aspects are advanced biofuels produced from wastes, residues, non-food cellulosic material and ligno-cellulosic material, as detailed in Annex IX to Directive 2009/28/EC. The main technological sectors, with reference to the transport sector, include:

- liquid biofuels through fermentation (e.g. bioethanol, microbial oils), pyrolytic conversion (e.g. bio-oils and bio-crude for refining treatments), or thermochemical gasification processes (e.g. methanol, ethanol);
- gaseous biofuels from biological processes (e.g. biomethane) and thermochemical processes (e.g. dimethyl ether DME, bio-SNG).

Some of these biofuels can already be used directly in existing engines and are therefore referred to as drop-in.

The degree of maturity of the various sectors is different. Research is essentially aimed at analysing their sustainability and neutrality, optimising processes, reducing costs, and not least expanding the applicable matrices.

E-fuels (renewable liquid and gaseous fuels of non-biological origin – RFNBO – specified in RED II) are obtained by chemically combining ‘renewable’ hydrogen and carbon dioxide. E-fuels include methane, synthetic products such as diesel and kerosenes and other fuels/chemicals such as methanol and ammonia. Green hydrogen can also be coupled with gasification processes for the treatment of synthesis gas and the production of biofuels.

In addition, RED II also contains another category of fuels, ‘*recycled carbon-based 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, the R & D activity on the topic will be aimed at:

- develop technologies and processes that are more flexible in terms of nutrition, for example capable of processing feedstocks that contain different kinds of biomass but also other sources of sustainable carbon 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 derived from by-products or wastes;

- performing processes to produce green hydrogen and capturing CO₂.

- **Nuclear**

Together with renewable energy resources, new generation nuclear technologies will play an important role in the energy transition towards climate neutrality. There is great potential for Italy to contribute to the revitalisation of nuclear energy in Europe and worldwide, in terms of participation in testing programmes on innovative electro-nuclear generation solutions. This is to prepare the Italian nuclear industry in a 2050 perspective with the use of innovative technologies. In line with this potential, Italian participation in international and European programmes, particularly in the Western context, for innovation in the nuclear source should gradually be encouraged. The EU has included certain types of nuclear installations in the European taxonomy list of economic activities considered sustainable in support of the Green Deal. For advanced nuclear technologies to make a substantial contribution to decarbonisation objectives, their deployment will have to take place in the next decade, leaving the market in the 2030-2035 segment. In addition, the ability of the “new nuclear” to (i) replace end-of-life nuclear power plants, (ii) provide for industrial cogeneration (industrial heat), district heating and hydrogen production, represents an added value in facilitating their penetration into future and more sustainable hybrid energy systems.

Economic competitiveness is presented as one of the strengths of Small Modular Reactors (SMRs) and Advanced Modular Reactor (AMR) and is generally claimed by developers/designers. The decisive factors to compensate for the lack of economy of scale would be: (I) reducing the time and costs 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 small size of the investment for each modular unit, would make it possible to achieve the full benefit of the learning curve more quickly and with lower overall expenditure.

Nuclear fusion is one of the energy sources that, in the long term (beyond 2050), will be able to ensure sustainability without CO₂ generation. 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.

- **CO₂ capture, utilisation and storage (CCUS)**

Over the last 4-5 years, as a result of decarbonisation policies, mainly in the hard-to-abate sectors promoted by the European Union, Italy has seen renewed interest in CCUS technologies. This involved 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, a number of initiatives have been launched on CO₂ technologies (CCU), in particular for power-to-fuels applications for chemical storage of renewable energy and the production of synthetic fuels (e-fuel), which are alternatives to fossil fuels.

We would also point out that in Italy ENI S.p.A. has recently been granted the first authorisation to carry out an experimental programme, called ‘CCS Ravenna Fase 1’, for the capture, transport and geological storage of carbon dioxide from the ENI plant in Casalborgorsetti (RA), in the storage complex identified in the context of an offshore hydrocarbon production area with a target 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.

With this in mind, as explained in detail in paragraph 1.2 on cross-border cooperation, Italy has 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 the joint cross-border management of CCS. Requests for cooperation were received from companies in the sector, operating in Italy, France and Greece, with candidate projects for inclusion on the Union list of Projects of Common Interest (PCI), pursuant to TEN-E Regulation 2022/869, in the thematic area of cross-border carbon dioxide transport and storage networks (CO₂). Italy’s potential

in this sector is considerable, as it can rely on a large network of depleted or near-depleted gas fields, especially in the Adriatic offshore, which could be converted to CO₂ storage using a large part of the existing infrastructure (production platforms, sealines and wells), making it possible to significantly lower the costs of geological storage.

- ***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 a variety of installations. Achieving the ambitious decarbonisation objectives requires, in addition to a high degree of reliability, security and flexibility of the national energy system, a substantial integration of the national energy system with digital technologies, so as to ensure both optimised management of renewable energy production and the empowerment towards greater electrification of consumption.

As highlighted in Terna's 2023 Development Plan, cooperation between AC infrastructures and the 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 projects of Hypergrid. From a technological point of view, this will be enabled by the use of multi-terminal configurations using high voltage DC circuit breakers, which are currently not available on the market. These switches may, unlike conventional switches, isolate a failure on an HVDC line without interrupting the supply flow. New insulation technologies are also being developed to withstand higher voltages and currents, supporting the development of HVDC systems with higher nominal powers. In addition, broadband HVDC control systems can better regulate the flow of energy in 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 demand for raw materials and critical materials. Among these are Critical Raw Materials (CRM) those of high strategic importance with high supply risk. The CRM list currently includes 30 feedstocks (source COM (2020) 474 final) and is subject to regular updating. In this context, it is of key importance to promote technological innovations, not only in the extractive sector, 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.

At the same time, experimentation in the field of materials science for energy use can offer innovative solutions that complement the use of CRMs by replacing them and/or reducing their intensity 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. The 2022-2024 Triennial Plan for Electrical System Research (LTRL) provides for an experimental research line dedicated to the development of frontier materials for energy use. Under the Mission Innovation (Medium TRL) initiative, the IEMAP (Italian Energy Materials Acceleration Platform) has been funded. IEMAP activities are divided into three strands:

- battery materials: screening of possible new materials with lower CRM intensity; recovery of materials (lithium, cobalt, nickel, copper) from urban mining systems;
- electrolyser materials: synthesis of new electrode materials offering better performance and lower costs;

photovoltaic materials: development of alternative materials to those currently in use.

- *1. Where available, national 2050 targets related to the promotion of clean energy*

technologies and, where appropriate, national targets, including long-term objectives (2050), for the deployment of low-carbon technologies, including technologies for the decarbonisation of energy and carbon intensive industrial sectors and, where applicable, of 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 energy were identified as the main options to be used to increase electricity production from renewable sources. However, there are development values 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 to manage these issues. In addition to targets for substantially increasing the efficiency of devices for converting primary renewable sources into electricity, a priority action line should be considered the efficient use of renewable sources available at sea and the valorisation of geothermal energy.

From another point of view, it will be appropriate to investigate the possibilities of using arid land that cannot be used for other purposes, including in third countries. Other innovative technology options have been considered and, for each, the real technical and economic feasibility will have to be assessed.

Italy's participation in Mission Innovation, the famous initiative aimed at accelerating innovation in technologies for the energy transition, is an opportunity for the Italian industry operating in the energy materials sector for the coming decades to participate in highly innovative pre-competitive research projects; this will pave the way for a significant global strengthening of national companies in the sector.

Another area of research and development of particular interest, especially in the medium to long term, relates to technologies for the integration of electricity and gas systems through the development of pilot projects for power to gas, power to hydrogen. Integration of the gas network to support the development and deployment of renewable gases by exploiting an increasing amount of intermittent renewable sources of electricity, and – through conversions of the electricity carrier into gas and vice versa – a pillar of an integrated energy infrastructure, which makes it possible to exploit the full potential of renewable energy sources, also 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 hydrogen produced using electricity from renewable sources: research in the coming years should be directed towards improving the performance and costs of electrolyzers, as well as the 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, there is scope for using existing infrastructure to add increasing amounts of hydrogen blended with natural gas. For 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 there is no electrified infrastructure and more convenient than electrification, to replace diesel locomotives. For the use of hydrogen in the shipping sector, studies and research are also ongoing and Italy is engaged with the main national manufacturers, but the time to develop and the scale of investments are high.

It will be essential to establish a clear and certain regulatory and regulatory framework in order to promote the injection of hydrogen into the current gas infrastructure, as an additional energy source in blended with natural gas (inter alia by implementing the application of selective hydrogen separation systems, such as membranes), to explore the implications of its injection into the storage system and to end uses, and to provide for possible incentives for the various technological options aimed at developing hydrogen production from renewable sources in synergy with the electricity and bioenergy sector, or from zero emissions such as methane cracking. There should be clear rules for

potential investors in power to gas installations 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 large alliances with a European and also non-European dimension, bringing together all stakeholders (institutions, universities and research centres, businesses) to support R & D in the sector and facilitate the market introduction of new technologies, including measures to address the regulatory and regulatory framework, with the aim of removing barriers to market entry and supporting the attraction of funding and the return of investments. In this regard, synergies need to be improved and maximised in the triangle of universities, research bodies and businesses, distinguishing between long-term public research and innovative industrial research that best meets national industrial policy needs, characterised by different TRLs (Technology Readiness Level).

Another important issue 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 several opportunities: (I) reuse of waste CO₂; (II) balancing networks by absorbing overgeneration from RES; (III) seasonal storage of electricity produced from RES.

The development of smart grids will also be a dominant theme for the coming decades, making it easier for small producers, large companies and individual citizens. The availability of a network in which all devices communicate with each other will enable software, equipped with artificial intelligence, to manage large amounts of information and data that will allow energy demand to be properly predicted, with positive effects on the stability of the transmission and distribution network. The increasing use of these technologies, however, raises a number of legal questions that could be an obstacle to the full and full exploitation of their potential.

As digitalisation grows, the risks associated with it will increase. This is a field of cyber security, where great space and development opportunities are opened up. Therefore, the plan for cyber research in the electricity sector in Italy will, in the coming years, also have to address the issue of energy infrastructure innovation from a long-term perspective by means of modelling and simulation activities, as well as experimental activities to verify the preventive and reactive safety measures used in electricity sector communication systems.

- II. 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 Italy's productive fabric is still below the European average, despite the good recovery recorded in recent years, with the share of firms' R & D expenditure as a share of GDP in 2021 being just over 0.9 % compared with 1.4 % in the EU as a whole. In view of this situation, there is a strong limitation of the innovation capacity of Italian industry, which may not contribute adequately to the process of decarbonising the economy. This could lead to the need to increase imports from abroad, with, for a long time, a burden on the foreign deficit, putting the country's development at risk. In view of national climate energy policy strategies, in line with the European decarbonisation pathway, 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 of some strategic technologies for the Net Zero transition: solar photovoltaic and thermal, onshore and offshore renewable wind, batteries/storage, heat pumps and geothermal energy technologies, electrolyzers 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 (patent-based technology specialisation index below unit) for most of the technology clusters for which data are available (photovoltaic, wind, batteries/storage, hydrogen, 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 makes it a priority to rebalance Italian specialisation in strategic decarbonisation technologies so as to overcome the current situation in the medium term and, in the long term, to achieve a situation of relative specialisation in at least some of them. Such an evolution could over time also lead to a rebalancing of the trade balance of strategic technologies.

The challenge for Italy's competitiveness is the development of an integrated research – industry system, 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 to promote the Italian clean energy production chain, so as to also have a positive economic and employment impact.

The increase in research and development appropriations provided for by membership of Mission Innovation, the refinancing of the funds for Electrical System Research and for measures and measures for technological and industrial development, 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 demonstrated by the ‘TANGO’ (Italian Giga Factory) project, one of the seven initiatives funded by the Commission – for EUR 118 million – under the first Innovation Fund call for major projects, which is expected to produce photovoltaic modules of 3 GW/year (the largest in Europe) by 2025, using innovative technologies (solar cells with perovskite/silicon tandem technology) on which the Italian R & D activity, funded by the ‘Electrical System Research’ programme, is highly competitive worldwide.

R & D activities in Italy are also aimed at finding new technological solutions to promote the integration of RES into the energy system, supporting the production chain of digital storage and architectures and automation systems linked to network services, given the growing interrelation with the renewable supply chain, strengthening cooperation at EU level in initiatives such as the EBA, to assess ‘gigafactory’ industrial cooperation projects for storage systems and for electrolyzers for hydrogen production. From this point of view, it is noteworthy that the other three Italian projects funded by the Innovation Fund concern intraday storage and hydrogen. Italy also participates in the ‘European Battery Innovation (EuBatIn)’ project, funded with EUR 2,9 million under the second IPCEI, which aims to build 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 industrial side.

The digitalisation of the energy sector is closely linked to this strand of activity and requires technological standardisation in order to be properly promoted. The generation of data by the energy system, the increase in the data transmission capacity of telecommunications networks (broadband) and the accessibility of a huge amount of data generated outside the energy system (e.g. IoT), but also relevant to the industry, require operators to equip themselves with big data capabilities both to improve their operations and to offer new services.

The other main sectors that Italy intends to pursue, including with a view to development on foreign markets, are the entire circular economy, geothermal energy and plant production linked to the production and use of hydrogen and renewable gases in general.

The second pillar for setting competitiveness objectives is the Critical Raw Materials Act (CRMA), which points to the need to ensure that the acceleration of the transition does not go hand in hand

with a worsening of European dependence on critical materials, so that a secure and sustainable supply of critical raw materials for European industry is a priority. An analysis of Italy's situation of dependence on foreign sources for many strategic technologies shows that none of the raw 10 critical raw materials imported into Italy are on the list of materials which, according to the IEA, are 'critical' for clean energy technologies, namely copper, lithium, nickel, cobalt, neodymium and polysilicon. The strategy to strengthen Italian industrial specialisation in priority energy technologies for the transition could lead to the risk of negatively affecting the current low levels of Italian imports of critical materials. It is therefore necessary that the strengthening of domestic production of clean energy technologies goes hand in hand with the strategy to improve European independence on critical materials.

Italy, as part of Mission Innovation, has long launched a research programme with the main public research bodies to develop an integrated computational and experimental platform for research into innovative materials for energy. The aim is to achieve a significant reduction in the number of syntheses carried out in the laboratory by accelerating the selection of new materials for energy applications that meet the sustainability criteria (economic and environmental).

In general, all the measures that Italy intends to adopt with the aim of promoting 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 regular close monitoring and analysis of costs and benefits. In this way, including 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, in accordance with the Green New Deal.

3 POLICIES AND MEASURES

3.1 Decarbonisation dimension

3.1.1 Greenhouse gas emissions and removals

1. Policies and measures to achieve the target set by Regulation (EU) 2018/842, as specified in point 2.1.1, and policies and measures to comply with Regulation (EU) 2018/841, covering all major emitting sectors and sectors for the enhancement of removals, with the long-term perspective and goal of becoming 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 provides for a national reduction target of – 33 % compared to 2005. Recently, with Regulation (EU) 2023/857,²⁹ this target is more ambitious and much more challenging, having 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.

The sectors responsible for greenhouse gas emissions and removals falling within the scope of Regulation (EU) 2023/857 are: transport, residential, services, non-ETS industry, waste, agriculture and LULUCF. Some of the emissions from the transport, residential and industry sectors not yet covered by the ETS sector, such as the heating of industrial installations, as well as from the maritime

²⁹Regulation (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.

sector, 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 complement the cap and trade mechanism provided for under the new ETS Directive³⁰.

For details of the national measures relating to the decarbonisation of transport and the energy efficiency of residential, tertiary and non-ETS industry, please refer to the following relevant sections of this Plan (paragraphs 3.1.2, 3.1.3 and 3.2).

The following are the main policies and measures that specifically affect the circular economy and waste, agriculture and LULUCF and F-gas sectors for the achievement of the 2030 greenhouse gas emission reduction target. Finally, policies on methane emissions have led to a reduction as a result of action in the waste, agriculture, livestock farming and energy sectors.

- **CIRCULAR ECONOMY AND WASTE**

In 2023, only 7.2 % of the world economy is circular, five years ago it³¹ was 9.1 %. The global economy consumes 100 billion tonnes of materials per year. They are expected to grow 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 conditions of the planet. In particular, the extraction of virgin material could decrease by more than one third (-34 %) and greenhouse gas emissions could be reduced, helping to limit the increase in global temperature to 2 °C, making it increasingly important to promote the circularity of our economies. This need 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 for geopolitical reasons.

In general, climate change mitigation policies to date have focused on energy efficiency rather than material efficiency as the main driver of technical performance improvement. 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 sectors with the greatest impact, while at the same time ensuring coherence and synergy with the programming of other policies.

This general policy 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 attentive to the efficient use of material resources, creating a significant synergy between the circular economy and all sustainable development policy and financial instruments, and, given the specificities of our country, particular attention will have to be paid to the manufacturing, food, textile, construction and mobility sectors.

Recent international studies (<https://www.resourcepanel.org/>) are starting to specifically explore the issue of the efficient use of materials and their potential contribution to reducing greenhouse gases. In particular, some studies identify the following specific strategies that can be used to improve this efficiency:

- extension of the useful life of products;
- repair and repair;
- choice of less Carbon-Intensive materials at the production stage;
- reduction of materials and choice of lighter materials;
- improved performance in the process productive;
- asset sharing;

³⁰Directive (EU) 2023/959 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC establishing a system 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.

³¹15 report on the circular economy in Italy – 2023. Summary, CEN

- industrial symbiosis;
- recycling and cessation of the qualification of refusal.

The circular economy, understood as a new model of production and consumption aimed at the efficient use of resources and the circular maintenance of their flow in the country by minimising waste, is a landmark challenge aimed at the eco-design of durable and repairable products to prevent waste generation and maximise its recovery, reuse and recycling, with a view to creating new supply chains for secondary raw materials, replacing virgin raw materials.

The success of the ecological transition therefore depends, on the one hand, on the ability of the public administration, business and non-profit sector to work in accordance with simpler, faster and more efficient rules and, on the other, on a general increase in public awareness and participation (especially among young people and consumers in general), including through an effort to provide information, communication and national education towards achieving full sustainable development.

For a country that is poor in raw materials and geographically marginal compared to major markets in central Europe, such as ours, the complete transition to the circular economy is therefore a strategic objective to tackle the major transformations that are affecting the global economy.

The National Strategy for the Circular Economy, the policy document that Italy adopted in June 2022, which identifies the actions, objectives and measures that are intended to be pursued in defining institutional policies to ensure a genuine transition to a circular economy, includes among the priorities the contribution to achieving the climate neutrality objectives, setting out a roadmap of measurable actions and targets between now and 2035.

The strategic themes for the circular economy, defined also on the basis of discussions with the European Commission, are: eco-design, reuse and reparability of products and process innovation that are part of the upstream production processes; there are also waste management, implementation of minimum environmental criteria (CAM), financial instruments to support the circular economy and the *end of waste*. Among the particularly challenging topics are: critical raw materials, the development of a second raw materials market and industrial symbiosis.

The Strategy also sets out the overall picture of the objectives to be pursued until 2035:

- 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 (eco-design, product durability extension, reparability and reuse);
- the development and dissemination of product life cycle assessment methods and models and waste management systems in order to identify the activities we are developing and their overall effects by scientific technical methods;
- improving the traceability of the waste stream;
- education and the creation of skills in the public and private sectors on the circular economy as a driver for the development of youth employment (men and women).

The National 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.

Implementing measures may be grouped into the following macro-categories:

- governance of the strategy requiring the establishment of a National Observatory (established DD 180 of 30 September 2022) and the publication of an annual progress report on the implementation of the Circular Economy Strategy (starting in 2023);
- the implementation of the new waste traceability system, adopted by the Decree of 14 April 2023;

- tax incentives to support recycling and use of secondary raw materials;
 - the revision of the system of environmental taxation of waste in order to make recycling more convenient than landfilling and incineration on national territory;
 - the right to re-use and repair (please note the adoption of the Regulation under Article 214-ter (2) of Legislative Decree No 152 of 2006 to encourage re-use and repair, pending publication in the Official Gazette);
-

- 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:
 - or Ministerial Decree No 254 of 23 June 2022 on CAM – supply, hire and service of extension of service life of interior fittings;
 - Ministerial Decree No 255 of 23 June 2022 on CAM – award of a contract for the collection and transport of municipal waste, road cleaning and sweeping, the supply of related vehicles and containers and bags for the collection of municipal waste;
 - or Ministerial Decree No 256 of 23 June 2022 on CAM – award of planning and contracting services for building works;
 - Ministerial Decree No 152 of 27 September 2022 establishing an end of waste regulation pursuant to Article 184-ter of Legislative Decree No 152/2006 on construction and demolition waste;
 - or Ministerial Decree of 19 October 2022 on CAM – award of the service for the organisation and organisation of events referred to in ‘Reform 3.1 – Adoption of minimum environmental criteria for cultural events’ in the 4.0 tourism and culture mission of the NRRP;
 - or Ministerial Decree of 7 February 2023 on CAM – award of contracts for the supply and hire of textile products and for the restyling and finishing service of textile products;
 - or Ministerial Decree of 7 February 2023 on CAM – award of a contract for the design of playgrounds and the supply, installation and maintenance of outdoor and urban furniture products
- supporting industrial symbiosis projects through regulatory and financial instruments;
- measures for the sustainable use of land with a view to a 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 year horizon (2022-2028).

It sets out the macro-objectives, macro-actions and targets, criteria and strategic guidelines to be followed by the Regions and Autonomous Provinces when drawing up waste management plans and provides a national survey of the facilities, addressing the gaps between the regions.

In relation to the separate collection rate, the reduction in the number of irregular landfills and the decrease in the rate of landfilling of municipal waste, it sets the target below 10 % in 2035.

The Programme also indicates the need for 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 accounts for 4.8 % of total greenhouse gas emissions in Italy and accounts for 20,2 MtCO₂ eq. in 2021, mainly due to landfill management (77 %) and waste water treatment (almost 19 %).²⁷

To date, about 29 % of the waste generated is sent to landfill (2021 tonnes of municipal solid waste and 2.963.000 tonnes of industrial waste were landfilled in 5.619.000.

²⁷ *Ispra (2023)*, ‘Technical Report on Gas Serra Emissions in the National Emissions Inventory and in the Reference Issue Scenario developed for the purposes of Prevised Monitoring 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’, *paragraph 3.7, p. 46-49*.

As a result of the development of 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 increased significantly.

Also on the basis of ISPRA data, there is a clear reduction in greenhouse gas emissions from waste incineration. In particular, they decreased by 84 % in about three decades, from 531 kt CO₂ eq. in 1990 to 85 kt CO₂ eq. in 2021. These emissions include the treatment of municipal, industrial, sanitary, waste oils and sludge in incinerators without energy recovery; emissions from the co-incineration of waste in industrial plants, the cremation of the deceased, the combustion of agricultural waste and the burning of abandoned waste are also included.

Emissions of CH₄ and N₂O from urban and industrial waste water treatment show a decrease over the period 1990-2021 as over the last thirty years there has been a gradual increase in sewage coverage and consequently in the share of wastewater sent for purification, which by 2021 covers 89 % of the population.

Table 30 Greenhouse gas emissions of waste categories, years 1990-2021

	1990	1995	2000	2005	2010	2015	2017	2018	2019	2020	2021
MT CO ₂ equivalent											
Landfilling of solid waste	13,7	16,9	19,3	19,0	17,4	15,7	15,3	15,3	15,1	16,0	15,7
Biological treatment of waste	0,0	0,1	0,2	0,5	0,6	0,6	0,6	0,6	0,6	0,6	0,6
Incineration of waste	0,6	0,6	0,3	0,3	0,3	0,2	0,2	0,2	0,2	0,2	0,2
Waste water treatment	4,7	4,5	4,3	4,2	4,1	3,8	3,9	3,9	3,8	3,8	3,8
Total waste sector	19,0	22,0	24,1	24,1	22,4	20,3	19,9	19,9	19,7	20,5	20,2

source: ISPRA, 2023

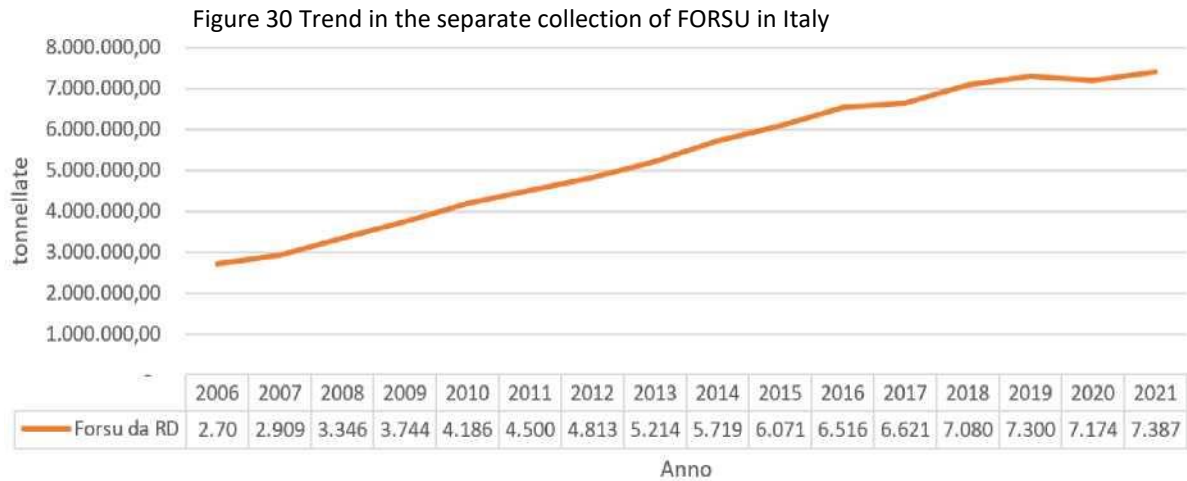
As far as civil waste is concerned, this inevitably leads to an increase in methane production, which is offset, however, by greater biogas extraction efficiency, which has begun to recover energy.

For industrial waste, on the other hand, emissions are linked to the quantity of waste produced, which in turn depends on industrial production itself: technological progress and the increasing commitment of industry to environmental issues have over the years led to a reduction in the quantity of processing water, and thus of waste produced, in certain sectors, resulting in a lower concentration of COD (chemical oxygen demand) at the discharge and, therefore, a reduction in the production of methane emitted.

The reduction of emissions in the waste sector is mainly linked to the increase in separate collection and subsequent recycling of separately collected fractions. The materials obtained from the collection and conversion of waste into new resources make it possible to save money.

emissions are significant 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, subsequent aerobic/anaerobic treatment for compost production makes it possible to convert waste that would otherwise be disposed of into a soil improver rich in organic matter into a landfill, resulting in methane being emitted into the atmosphere. In quantitative terms, the treatment of the organic biodegradable fraction of municipal waste from separate collection increased from 2.7 Mt in 2006 to 7.4 Mt in 2021. Thus, in the last 15 years, 85.3 Mt of bio-waste has been intercepted with separate collections and treated in order to produce compost, avoiding landfilling.



source: *National Waste CatastoSection, Ispra*

In the future, separate collections of bio-waste are expected to increase, partly because of the new EU obligation to collect this fraction, resulting in recycling for the production of soil improvers. The development of nearby bio-waste treatment systems will also further contribute to reducing emissions by reducing the transport of waste over long distances to centralised facilities.

In this context, in terms of quantity, and in compliance with the legislation in force, there is a gradual increase in the number of plants treating the organic biodegradable fraction of waste, the construction of which has also been supported by specific funding under the NRRP.

The treatment of residual waste fractions that are sent to sorting and stabilisation plants further contributes to reducing emissions to air. Compared to 2003 (the year in which the decree transposing Directive 1999/31/EC on the landfill of waste was issued), Italy has set up a treatment capacity for the residual fractions to cover its national needs in full. In this way, residual waste is biostabilised before being landfilled by reducing biogas emissions.

The improvement in overall waste management in relation to the composition (increase in waste sorting) and the quantity of waste disposed of in landfills, following the transposition of European Landfill Directive 1999/31/EC by Legislative Decree No 36 of 13/1/2003, has led to a reduction in the impacts associated with the waste sector. This dynamic can be encouraged, as mentioned above, by new measures to encourage the recycling of bio-waste 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 decreasing quantities disposed of in landfills.

In order to increase the efficiency and effectiveness of separate collection with a view to a circular

economy, as required at European level by both the current directives and the European regulation under negotiation, MASE, by Ministerial Decree No 360 of 28 September 2022, 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 may, in future, 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 clear and correct environmental characteristics of their packaging, while increasing consumers' awareness of the final fate of the waste. More specifically, the guidelines are the result of the work of the technical group launched by CONAI, the National Packaging Consortium, which for more than a 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 to increase consumers' awareness of the final fate of such waste. The guidelines incorporate the European Commission's recommendations on strengthening the use of the digitalisation of labels with the aim of making it easier to update information and avoid barriers to the internal market. It is a unique technical support tool in the European landscape that can be presented as a virtuous example, for the method used and for the technical content.

In order to boost the differentiated collections of PET bottles and at the same time ensure that this flow can be exploited for the manufacture of new bottles, the Ministry promoted the Mangiaplastic Experimental Programme (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 granting and granting to the municipalities of non-repayable aid for the purchase and installation of eco-compactors for the separate collection of PET beverage bottles, which can selectively recognise PET bottles and reduce their volume by encouraging them to recycle them. Of the approximately 1500 eligible applications, around 900 were accepted. The measure will be monitored for at least three years from the moment the eco-compactor is activated and will be launched in the first months of 2023.

With reference to the system of the implementing 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 undertakings which recycle waste from electrical and electronic equipment and 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 (EU) 2022/1631 and (EU) 2022/1632 of the European Parliament and of the Council of 12 May 2022 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 form for the year 2023;
- Ministerial Decree No 40 of 20 February 2023 on the updating of the groupings 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 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 animal husbandry are major sources of greenhouse gas production and air pollutants, consisting mainly of methane, ammonia and nitrous oxide.

Ammonia emissions are mainly driven by animal manure management and fertiliser use.

Nitrous oxide emissions originate from the nitrification and denitrification reactions of nitrogen present in manure, during storage and treatment of livestock waste, and of nitrogen present in soils, from 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 produced by the combustion of agricultural residues.

Methane emissions are caused by enteric fermentation of rations in the digestive system of livestock, in particular ruminants, and the decomposition of manure during storage, treatment and grazing, rice crops and the combustion of agricultural residues. At sectoral level, in the case of livestock, manure management, which includes emissions from stables, storage, spreading and grazing, cattle, pigs and poultry categories, accounts for 57 % of total agricultural ammonia emissions. More specifically, in the livestock sector, ammonia emissions are generated by microbial fermentation at the expense of the nitrogen present in manure (faeces and urine) and takes place at all management stages, from the time of excretion, during shelter to field distribution. For agriculture, on the other hand, ammonia emissions are generated by the use of organic and synthetic fertilisers.

As regards the agricultural and livestock sectors, the following actions have been identified:

- ***C. INDICATIVE NATIONAL ODICE OF GOOD AGRICULTURAL PRACTICE FOR CONTROLLING EMISSIONS OF AMMONIA***

The code, which has been included in the National Atmospheric Pollution Control Programme (PNCIA), takes into account the following aspects for the reduction of ammonia emissions:

- nitrogen management, taking into account the whole [...] nitrogen cycle;
- livestock feeding strategies;
- low-emission manure storage and spreading techniques;
- low-emission animal housing systems;
- possibilities for limiting ammonia emissions from the use of mineral fertilisers.

The Code therefore provides for mandatory measures for the mitigation and abatement of ammonia by: different fertiliser use and manure spreading and storage techniques. Optional mitigation measures can be financed through European funds linked to 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.

- ***PCOPY OF UNDERSTANDING ESTABLISHING THE "ACTION PLAN FOR THE IMPROVEMENT OF AIR QUALITY"***

The Protocol, adopted in Turin on 4 June 2019 by the President of the Council and all the Ministries responsible for the emission sectors, as well as by the MEF, provides for a series of national measures to improve air quality. The measures provided for in the Protocol cover all sectors that contribute most to air emissions 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 aimed at limiting the removal of plant residues in the open air, while creating supply chains for the recovery and energy recovery of such residues.

The twofold aim pursued by the provision, of progressively limiting the practice of reducing plant residues and, where possible, prioritising the recovery and valorisation of such residues, meets the

objective of implementing the ecological transition in the sense of making certain established practices less harmful to the environment (in this case, the practice of cutting agricultural residues) and at the same time recovering and enhancing agricultural residues by creating a chain for collecting and processing them into a product (e.g. pellets or district heating fuel) with market value.

Again, the measure will be financed through the use of the Fund established by Article 1 (498) of Law No 234 of 2021 for the implementation of the national air pollution control programme.

- ***THE IMITATION PRACTICES OF GROUPING AND FELLING PLANT MATERIAL AT THE PLACE OF LOGBOOK***

The aim of the measure is to introduce rules on the combustion of plant materials of agricultural or forestry origin at the place of production, while at the same time encouraging the recovery and exploitation of such materials by creating a chain for collecting and processing them into a product (pellets or district heating fuel, for example) with market value. The practice of cutting agricultural residues in the open air, which is widespread in the area and without control systems, is a significant source of air emissions of both climate-changing gases and air quality pollutants.

Implementation of the measure will take the form of the prior adoption of a national legislation providing for rules on the combustion of plant materials of agricultural or forestry origin at the place of production (limiting their practice, particularly in areas that are most critical to air quality), and the subsequent funding for the creation of local waste collection chains and their exploitation.

The measure will be launched in the most critical regions with regard to air quality from winter 2023 and will produce effects as from 2024. There is no end date for the intervention since it is of a legislative nature, but during the year the restrictions on reduction will only cover a few months.

NONETHELESS, *POLITHIC INGRICOLA COMUNE (PAC) 2021-2027*

The measures set out in the above-mentioned national code find a financial and implementation response in the Common Agricultural Policy (CAP) instruments, 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 strengthening of cross-compliance with direct payments subject to stricter environmental requirements;
- the obligation for Member States to introduce eco-schemes that have a positive impact on the climate and the environment, but which are optional for individual farms, in Pillar I (direct income support to 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:

- ***PIANO NFOREST ACCOUNTING COUNTRY***

In the context of Regulation (EU) No 841/2018, Italy has submitted the national forestry accounting plan, which includes the reference level for accounting for forest management, based on the continuation of sustainable forest management practices, taking into account the future impact of the dynamic characteristics of forests linked to age, so as not to limit the intensity of forest

management. This is considered essential for the development of sustainable forest management practices and thus for maintaining or enhancing long-term carbon removals.

- ***NATIONAL LEGISLATION FOR THE FORESTRY SECTOR AND ITS SECTORS' (SFN)***

The mission of the NFS will be to bring the country to extensive and resilient, biodiverse forests that can contribute to climate crisis mitigation and adaptation actions, providing ecological, social and economic benefits for rural and mountainous communities. The NFS stems from a European commitment, the EU Forest Strategy of 16 July 2021, and was published in the Official Journal on 9 February 2022, with a validity of 20 years.

- ***PUBLIC REGISTER OF VOLUNTARY AGROFORESTRY CARBON CREDITS***

Article 45 (2-quater), (2-quinquies), (2-sexies) and (2-septies) of Law No 41 of 21 April 2023 established the public register of national agroforestry carbon credits generated on a voluntary basis at the CREA. An inter-ministerial consultation round has been launched, which should lead, within 180 days, to the definition of the operational arrangements for the carbon credit register for the forestry sector alone, pending the technical details needed to define additional practices to ensure increased carbon retention capacity in agriculture. In this context, possible actions to promote initiatives to sequester CO₂ in agricultural soils and forest systems (soils, underground biomass, epigem, wood, etc.) will be assessed.

- **CROSS-CUTTING INSTRUMENTS AND OTHER MEASURES**

In addition to what is planned at sectoral level, further policies and measures contributing to the Effort Sharing objectives are set out below.

- ***AND IMPLEMENTATION OF THE REGULATION ON GAS FLUORURATED***

F-gas emissions account for 4.4 % of total CO₂ eq. greenhouse gases in 2020 and show a significant increase between 1990 and 2020. This increase is the result of several factors for different gases. For example, HFCs increased significantly from 1990 to 2020 from 0,4 to 15.9 Mt in CO₂ eq. The main sources of emissions are related to the consumption of HFC-134a, HFC-125, HFC-32 and HFC-143a in refrigeration and air-conditioning devices, together with the use of HFC-134a in pharmaceutical aerosols. Increases over this period are due both to the use of these substances as substitutes for harmful ozone gases and to the increased use of air conditioners in vehicles.

Italy has already taken 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, such as Legislative Decree No 199 of 8 November 2021 implementing Directive 11/12/2018, No 2001 (known as RED II) and the 'Termico Conto 2023'. In order to achieve the objectives of Regulation (EU) No 517/2014, Italian companies focus on research and development of new technologies in sectors using HFCs. With regard to the sources and gases identified, the F GAS database is operational, which collects and stores information on sales of F-gases (and certain equipment containing them), installation, maintenance, repair and dismantling of equipment, and close cooperation with the industry concerned has also been strengthened.

Finally, the new Regulation on F-gases, which will replace Regulation (EU) No 517/2014, is currently under negotiation.

- ***AND METHANE MISSIONS***

The issue of reducing methane emissions has become increasingly important in recent years, both with a view to the challenging European and global climate neutrality objectives and with a view to increasing the resilience of the European energy system and increasing security of supply, which have become central issues in the current international context.

Moreover, the measures to be implemented for the energy sector are already known and focus on four key points: (a) strengthening the measurement and reporting of emissions throughout the supply chain; (b) eliminate leaks through detection and repair at an appropriate frequency; (c) end widespread practices of venting and flaring by promoting the capture of otherwise dispersed volumes in the atmosphere; (D) limiting the emission footprint of methane in imports: in order to be truly effective, these measures must also be applied in fossil fuel exporting countries. In general, there are today technologies that also use artificial intelligence for these purposes, including drones and satellites. Advanced technologies capable of identifying emission hotspots and performing sensing at component or facility level, including better management of natural gas flows in networks.

The EU External Energy Strategy, published by the EU Commission in parallel with the REPowerEU plan, shows that it is possible to combine action to secure energy supply with decarbonisation objectives. In particular, the EU 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 leaks throughout the gas chain, in particular *flaring* and *venting*, creating additional liquidity on global markets while ensuring significant climate benefits.

According to estimates by the International Energy Agency, at least 46 billion cubic metres of natural gas are lost each year due to flaring and venting to 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 EU Commission also launched the “You Collect/We Buy” initiative to promote methane capture in producer countries with lower safety and environmental standards.

During the COP27 in Egypt, the European Union signed a joint declaration between countries exporting and importing 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 CO₂ emissions along the value chain, to the maximum extent possible. It also supports the development of frameworks or standards for fossil energy suppliers to provide buyers with accurate, transparent and reliable information on methane and CO₂ emissions associated with their value chains.

Italy, as the main importer of natural gas, is very careful and active in this consignment; it is among the first countries to have joined and launched together with the US and the EU the global initiative of Global Methane Pledge and many Italian companies, in the various segments of the sector, have voluntarily adhered to the international industry standards laid down in OGMP 2.0 (Oil and Gas Methane Partnership). In order to implement the GMP objectives, the adoption of the Regulation to reduce methane emissions in the energy sector is under discussion at EU level, which lays down challenging targets for monitoring and reporting emissions throughout the gas chain and for methane leak detection and repair activities.

At national level, operators in the gas supply chain, in compliance with sectoral legislation and the regulation of ARERA, and by taking part in voluntary international initiatives, have for years adopted safety standards that have led to a reduction in methane leaks, with the recovery of raw materials.

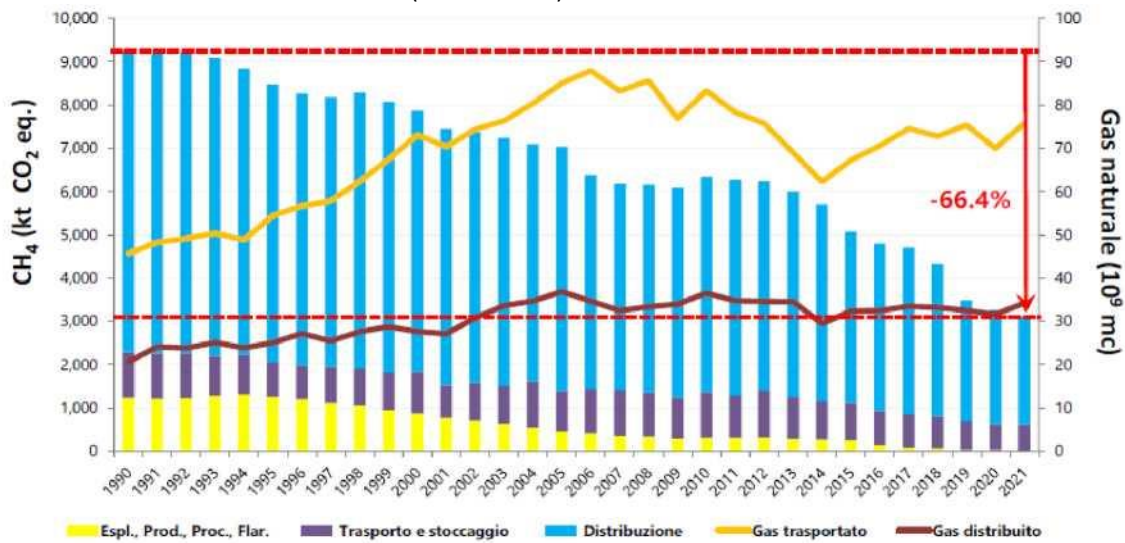
Methane emissions from the gas supply chain accounted for 6.6 % of domestic methane emissions in 2021 and 80 % of fugitive emissions, which together have been significantly reduced since 1990 as a result of numerous improvements in the transport and distribution network.

Overall, despite the fact that the development of transport and distribution infrastructure has increased considerably since 1990, as well as the flow of gas injected into the grid – almost 66 % more

from 1990 to 2021 – methane emissions from the natural gas chain in Italy decreased by 66.4 % over the same period, from 329 kt of CH₄ (8.225 ktCO₂eq) to 111 kt of CH₄ (around 2.775 ktCO₂eq) in 2021.

About 80.3 % of emissions from the natural gas supply chain derive from distribution, given the scale and scale of the networks; 19 % from transport and storage activities (and LNG regasification terminals); 0.5 % comes from domestic production of natural gas and 0.2 % from the processing of extracted gas.

Figure 31 Emissions of CH₄ (kt CO₂ eq.) in sources in the natural gas supply chain, gas injected into the grid (transmission) and distributed



Source: ISPRA report 384/2023 "Greenhouse gas emissions in Italy: reduction targets and emission scenarios"

Starting with the distribution sector, it is important to note that, since the 90s, the material from the distribution network with high emission factors (grey iron with hemp and lead joints) has continued to be replaced by materials characterised by minor leaks. In addition, steel mesh with effective cathode protection to prevent corrosion of ducts is becoming increasingly widespread. Fugitive methane emissions from the operation of natural gas networks from 1990 to 2021 were reduced by 64.2 %: from 249 kt of CH₄ (6.225 ktCO₂eq) in 1990 to CH₄ (2.228 ktCO₂eq) in 2021.

In the natural gas transport and storage sector (including regasification terminal activities) the reduction in methane emissions over the period is 43.4 %, from a value of 38 kt (950 ktCO₂eq) in 1990 to 21 kt CH₄ (525 ktCO₂eq) in 2021.

Finally, in the upstream sector for natural gas research activities in Italy, methane emissions are very low, so that they can be considered irrelevant; natural gas production activities, methane emissions between 1990 and 2021 fell sharply from the initial value of CH₄ in 1990 (750 ktCO₂eq) and in 2021 was around 0.5 kt of CH₄ (12,5 ktCO₂eq); in the same period, fugitive methane emissions from processing activities decreased from a value of 13.4 kt CH₄ (325 ktCO₂eq) to 0.22 kt CH₄ (5,5 ktCO₂eq) in 2021³².

Finally, in the upstream sector for natural gas research activities in Italy, methane emissions are very low, so that they can be considered irrelevant; natural gas production activities, methane emissions between 1990 and 2021 fell dramatically compared to the initial value, which was 30 kt CH₄ (750 ktCO₂eq) in 1990 and in 2021 was around 0.5 kt of CH₄ (12,5 ktCO₂eq); in the same period, fugitive methane emissions from processing activities decreased from a value of 13.4 kt of CH₄ (325 ktCO₂eq) to 0.22 kt of CH₄ (5,5 ktCO₂eq) in 2021³³.

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 (around 96 % by 2021) remains to be considered: preliminary

³²Source: ISPRA report 384/2023 "Greenhouse gas emissions in Italy: reduction targets and emission scenarios".

³³Source: ISPRA report 384/2023 "Greenhouse gas emissions in Italy: reduction targets and emission scenarios".

estimates of

Ispra, methane emissions linked to the gas extracted in Italy are about 40 times lower than those due to imports of natural gas entering the transport network (160 tonnes of CH₄ per billion m³ compared with 6.400 tonnes of CH₄ per billion m³)³⁰.

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.

11. Where relevant, regional cooperation in this area

With the countries with which Italy has launched the regional cooperation process, the comparison will mainly be based on the exchange of best practice on policies adopted or planned.

111. 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

³⁰. *“Guidelines for an Italian strategy on methane emissions from the natural gas supply chain” of the Working Table promoted by the Friends of the Earth in cooperation with Environmental Defense Fund.*

3.1.2 renewable energy

1. Policies and measures to achieve the national contribution to the binding EU 2030 target for renewable energy and trajectories 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 and technology specific measures³⁴

Below is a list of the main measures to achieve the renewable energy targets, broken down between the electricity, heat and transport sectors.

❖ **ELECTRICITY SECTOR**

Measures for the electricity sector will be aimed at supporting the construction of new plants and the safeguarding and upgrading of the stock of existing plants that are still potentially competitive and sustainable. Economic, regulatory, planning, information and administrative measures are calibrated on the basis of the type of intervention (new construction or reconstruction), the size of the plants and the state of development of the technologies.

In general, long-term incentive mechanisms are an efficient tool to promote the construction of new installations. In the absence of such term 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 these mechanisms should be structural and integrated with spot markets. In particular, Legislative Decree No 199/2021 provides for auctions for the fixed-term contract of new renewables, making explicit reference to the definition of quotas per area, as requested on several occasions by ARERA in some reports/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 its opinion of 3 August 2022 on the draft RES Decree 2 in which ARERA proposed the definition of quotas differentiated by source and geographical area).

Offshore wind, thermodynamic solar energy, geothermal energy with a low environmental impact and the ocean are currently considered innovative in the national context, as well as certain types of photovoltaic, such as floating and agvoltaic outputs; 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. In addition, the considerations set out in Chapter 2 on targets apply to biomass.

— ***PLANTICCOLI (TYPICALLY LESS THAN 1 MW): REGULATORY AND ECONOMIC MEASURES***

The *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 plants with generation costs closest to market competitiveness, in compliance with specific guiding criteria, including the promotion of self-consumption and the combination of plants with non-programmable renewable sources with storage systems, so as to enable sources to be more programmable.

- *Renewable Energy Community and Collective Self-Consumption*

Following up on 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 and energy communities has been launched in Italy. In particular, Decree-Law No 162/19 (Article 42a) and the relevant

³⁴ When planning such measures, Member States shall take into account the end of life of existing installations and the potential for repowering.

implementing measures, such as ARERA's Decision 318/2020/R/eel and the Ministerial Decree of 16 September 2020 of the Ministry of Economic Development (Ministry of Economic Development), laid down the procedures and conditions for activating self-consumption from renewable sources and establishing renewable energy communities, setting up a transitional framework for incentives for these configurations, which makes it possible to 'share' the electricity produced locally by new plants powered by small to medium size renewable sources (production plants of up to 200 kW shared with users underlying the same secondary cabin). The mechanism provides for the allocation of a premium rate on energy shared by the participants in the configuration, together with the return of certain components of the network services following local energy sharing. A virtual self-consumption model has been adopted which makes it possible to enhance actual widespread self-consumption without having to create new connections (except for production facilities), new electrical connections or install new measuring equipment, applying the current rules for all final customers and producers present in collective configurations.

Legislative Decree No 199/2021 provided for the updating of the transitional rules, already identifying significant areas for extension, such as the increase in the renewable power limit to 1 MW and the extension of the perimeter of participants to the primary cabin, also identified on a simplified or flat-rate basis. By Decision 727/2022/R/eel, ARERA has already adopted the provisions governing the methods for the promotion of widespread self-consumption for the configurations provided for in Legislative Decrees 199/21 and 210/21.

The expected implementation of these guidelines will result in a significant boost to the uptake of collective self-consumption and renewable energy communities, which could be envisaged as a first step towards the realisation of around 5 incremental GW by 2027.

In order to avoid inefficiencies in the development of the grid, self-consumption configurations will be promoted as a priority by building on the existing electricity grid and will also be an instrument to support the economies of small municipalities and to provide opportunities for local production and consumption of renewable energy, even in situations where self-consumption is technically difficult. In this respect, renewable energy communities will also have an important role to play in terms of local consensus for the authorisation and construction of installations and infrastructure.

Another tool for the development of these configurations is the investment M2C2 1.1 of the NRRP, which provides for specific resources (EUR 2,2 million) for the financing of renewable energy plants coupled with storage systems, incorporated into collective self-consumption configurations and renewable energy communities, in particular in municipalities with fewer than 5.000 inhabitants with a total capacity of at least 2 GW.

In other respects, the promotion of renewable energy communities will be pursued by means of information tools on locally available resources (including by using the pathway for identifying suitable areas) and on the opportunities offered by support instruments. The development of standard tools for the establishment and management of communities and for the valorisation of energy production will also be explored. Given that initial local experiences have already been launched in Italy, at the initiative of some regions and municipalities, as part of the INECP Observatory, a review of these experiences will be carried out in order to assess the possibility of developing facilitation and support measures on the basis, inter alia, of the monitoring and recognition of these experiences. In local contexts where it will be possible and affordable, the promotion of renewable thermal energy by communities will also be promoted.

Particular attention will be paid to the interrelations between renewable energy communities and citizen energy communities, which offers the possibility – in addition to producing, storing and consuming energy also from renewable sources – to provide energy efficiency services, charging services for electric vehicles and other energy services.

The latter will also be examined in order to assess the possibility of promoting forms of aggregation and cooperation for the production and consumption of renewable energy, as well as for the

provision of energy services, including within production districts.

Communities can also be an additional tool to support households in energy poverty, especially where direct interventions (e.g. with self-consumption facilities) are technically not possible.

- *Installations for single and remote self-consumption: regulatory and economic measures*

The rules on the collection of general system charges from electricity tariffs, introduced in 2018 as part of the adjustment plan referred to in the Community guidelines on State aid for energy and the environment, constitute, in themselves, general rules favouring instantaneous self-consumption.

Legislative Decree No 199/2021 also provided for the gradual evolution of the on-site exchange mechanism (which allows the network to be used as a storage), which will no longer be accessible for new plants, as it will gradually be replaced by instruments that are more aimed at promoting self-consumption, the installation of storage systems and the provision of services for the safety of the electricity system on the medium-voltage and low-voltage grid.

Another important area of development for individual self-consumption provided for in Legislative Decree No 199/2021 is the promotion of remote individual self-consumption of renewable energy. These systems involve remote self-consumption of renewable electricity by an individual final customer, without using a direct line, using the existing distribution network to connect production sites and consumption sites. It is planned to implement an implementation measure for these configurations, with operational methods similar to supporting collective self-consumption configurations and energy communities.

In all cases, the promotion of individual self-consumption will be directed primarily at distributed facilities, for which, moreover, the simplicity and automatism of the support mechanisms is preferable to other instruments, the management of which is more complex and costly.

Further tools to support self-consumption, both single and collective, will be:

- Enhanced requirements for a minimum share of renewable energy sources in new buildings or buildings undergoing major renovation, in line with the nearly zero-emissions 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 to the previous 50 %). This is a percentage valid for private buildings, while for public buildings the share has been raised to 65 %.
- Progressive and gradual extension of the requirement for a minimum share of renewable energy sources (which, as mentioned above, is currently provided only for new buildings or buildings undergoing major renovation) to existing buildings, starting with certain categories such as production sheds and tertiary buildings. As an alternative to the construction of the plant, arrangements will be considered for transferring the building right to a third party, with the renewable installation serving the building.

The latter two points are, moreover, linked to similar measures relating to thermal renewables, referred to in the specific paragraph.

As a preliminary point, it is considered that the promotion of self-consumption through the above measures could lead to an increase in renewable energy consumption of at least 1 TWh each year.

- *Other measures for small installations*

In addition to promoting 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 promote the construction of small installations that feed into the electricity grid because self-consumption is not technically and economically feasible, and finally to facilitate the simultaneous achievement of other objectives deemed relevant.

In particular, it shall mean:

- Promote the installation of photovoltaic systems on existing agricultural structures which do not fall within the definition of a building, including by introducing the concept of rural building for access to support measures;
- Allow the aggregation of small installations for participation in the procedures for access to incentives on the energy fed into the grid (see paragraph on Contracts for Difference);
- Establish specific incentive rates for cases where self-consumption is not possible, and provided that there is an accessible potential of some meaning and prospects for containing costs and incentives. Of interest is the combined production of electricity and heat from waste and residues from the agro-industrial sector, in particular through installations forming part of the production cycle of undertakings, which, in accordance with the principles of the circular economy, make it possible to value the waste itself and optimise production cycles, with a minority share of raw materials from a second harvest (in the case of biogas plants, however, advantages can also be obtained in terms of the use of digestate, which is important in areas vulnerable to nitrates). In this sense, Law No 145/2018 (subsequently updated by Law No 21/2021) extended the possibility of access to incentives, in accordance with the procedures laid down in Ministerial Decree No 23/06/2016, to electricity production plants powered by biogas, with an electrical power of not more than 300 kW and forming part of the production cycle of an agricultural and livestock undertaking, carried out by farmers, including in consortium form, whose supply is at least 80 % from waste and materials from the agricultural holdings producing them, and the remaining 20 % from their crops of second harvest and with on-site self-consumption of the heat produced, in accordance with the procedures laid down in Ministerial Decree No.
- Introduce prizes for the construction of photovoltaic systems whose modules are installed to replace asbestos-containing coverings.

In this respect, the first operational instrument for incentivising (also) small plants is the Decree of 4 July 2019, which provided for specific registry procedures for small photovoltaic systems on coverings with asbestos/eternit replacement. Most of the plants found to be in a suitable position on the reserve lists will enter into operation in the coming years.

NONETHELESS, *GPLANTS (TYPICALLY NOT LESS THAN 1 MW): REGULATORY AND ECONOMIC MEASURES*

- *Contracts for Difference to be concluded following competitive downward auction procedures*

Legislative Decree No 199/2021 provided for the continued use of proven competitive bidding mechanisms. In the expected implementation measure, consideration will be given, in order to maximise the benefits of the system, to introduce quotas differentiated by geographical areas, in order to promote synergies with the development of the electricity system and the process of identifying suitable areas. It will also consider introducing mechanisms for automatic adjustment of contracted tariffs to cope with inflation-related increases in operating and maintenance costs, where necessary.

The purpose of the tenders will be to conclude contracts for difference based on the total value of the tariff awarded following the procedure, in accordance with the ‘two-way’ criterion, assessing possible variations to the contractual framework hitherto adopted to mitigate certain risks associated with volumes and prices. In order to improve the effectiveness and efficiency of this instrument, consideration is being given, for example, to the possibility of recognising the fee payable on the basis of different profiles compared to the actual input of the plant in order to promote efficient investment and resource management solutions, as well as a more correct allocation of risks between the various actors in the system. In a first step, for example, the fee payable could be recognised on the basis of the installation’s potential inputs instead of actual net input at times when renewable

production cuts occur 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-shifting products *provided* for in Legislative Decree No 210/2021, the tariff to be paid could be recognised on the basis of *standard* profiles consistent with the requirements of the electricity system (e.g. *baseload* and/or *peakload*), with the obligation to feed renewable energy into the grid, on an annual basis, equal to a share of the contracted profile; this type of contractual structure would leave responsibility for the optimal *mix* of renewable technologies to be implemented by private investors.

This mechanism seems suitable for achieving the objectives in that it makes it possible to plan the achievement of predetermined powers, providing certainty for operators, especially with a view to the five-year programming of quotas.

This mechanism will be the main instrument to facilitate the construction of new plants, but it can also be confirmed to support the full reconstructions and upgrades of existing plants, should long-term contracts and administrative simplifications prove insufficient.

The competitive mechanisms have already been implemented in Ministerial Decree No 4/7/2019, which made it possible, through the auctions, to allocate around 4.2 GW, mainly for wind and photovoltaic installations, included in the same technology group; to this capacity is added 1.5 GW of installations below 1 MW, mostly PV installations, allocated through registers. While in auctions for installations of 1 MW or more the criterion is only economical, for installations with a high environmental value, preference is given to solutions of high environmental value, such as a specific photovoltaic quota on asbestos-substituted roofs or installation in areas of low environmental value, such as closed and restored landfills. In addition, installations coupled with charging stations are favoured, with a view to giving further impetus to electric mobility and smart and vehicle-to-grid charging technologies. Where self-consumed energy exceeds 40 % of production, there is a specific premium, which can also provide a boost to the uptake of storage systems. In addition, the aggregation of installations is encouraged by a specific priority criterion. Finally, it is possible to opt for all-inclusive tariffs of up to 250 kW.

- **Long-term contracts (PPP)**

Italy intends to promote widely the use of this instrument, in addition to contracts for difference, by means of a regulation that favours the conclusion by investors of Power Purchase Agreement (PPA) contracts with parties interested in purchasing the energy that the plant will produce over a sufficiently long period of time to ensure the amortisation of the investment needed to build a new production plant or to reconstruct or upgrade an existing plant.

Updating the provisions of the Ministerial Decree of 4 July 2019, Legislative Decree No 199/2021 provided that the GME would set up an IT board with the aim of promoting meetings between the parties potentially interested in concluding such contracts, ensuring a gradual start to long-term renewable energy contracts. The notice board was set up in 2022 and, in compliance with the legislation on the protection of personal data, provides for the obligation to record the data of contracts that are necessary to ensure maximum dissemination of the results and monitoring.

In order to give further impetus to PPPs, Legislative Decree No 199/2021 also provided for the development of an organised, voluntary market platform for long-term renewable energy trading. The PPP Platform will bring together sellers and buyers in order to provide the consumer with green energy with standard profiles and address the main barrier of “counterparty risk”. The PPP Platform will be operated by a central counterparty (e.g. GME) and provides for the exchange of physical or financial RES energy products for multi-annual delivery (e.g. 10-15 years for new RES installations, 5 years for existing RES plants), on standard profiles agreed 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 PPP Platform will provide for the greatest possible standardisation of contracts (to reduce contractual complexity), which will have to include a system of penalties to be paid in the event of failure by one of the

counterparties to withdraw or inject them, and to introduce appropriate instruments to manage counterparty risk (for example, by providing for a buyer of last resort in the event of default of the counterparty, a system of private and public guarantees, and the sharing of credit risk between different entities on the basis of specific criteria).

In addition, Legislative Decree No 199/2021 provided that, in order to give an initial impetus to the use of this type of contract, Consip, with the support of the GSE, was to establish competitive tendering procedures for the supply of energy from renewable sources to the public authorities by means of long-term electricity purchase agreements. This task was also completed in the course of 2022.

Taking advantage of the instruments implemented by Consip, a progressive obligation to supply the public administration of renewable electricity through long-term PPPs will be established, reaching 100 % coverage within five years.

As a preliminary point, it is estimated that around 16 GW of incremental power will be achieved by 2030, mainly from photovoltaic and wind power, without direct use of incentive measures; a significant part of this contribution could be facilitated by the conclusion of PPPs.

NONETHELESS, *MNONETHELESS COMMON FOR LARGE AND SMALL INSTALLATIONS*

The size of the renewables targets, together with the fact that increases in electricity production are mainly expected from photovoltaic and wind power, implies the need for surfaces to install such installations. This means that local and regional authorities need to be closely involved, taking advantage, for example, of the public debate, which has already been introduced for major investments, including energy. This tool, together with renewable energy communities, will allow greater awareness of the local communities involved, to be achieved by informing and involving citizens and local authorities well in advance of the final territorial choices. In addition to information, crowdfunding mechanisms, as well as environmental compensation measures, will be able to contribute to acceptance. In any case, support mechanisms must guide localisation choices, giving priority to installations with reduced environmental impact such as those on buildings and areas not suitable for other uses.

It is of course necessary to ensure uniformity and certainty in the timing of the authorisation process, together with a simplification thereof, and to promote greater coordination between the Member States and the regions, including through the adoption of a standardised format for the issue of authorisations at national level, with equal timing, procedures and procedures.

In particular, for large wind installations, operators will be encouraged to carry out careful preliminary assessments with local communities and economies, and give appropriate priority to upgrading and renovating obsolete plants.

These requirements also suggest the following measures:

The *sharing of objectives with the regions and identification of suitable areas for the construction of the facilities*

Achieving the renewable targets naturally requires the full involvement of the regions. One of the forms in which this 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 renewable consumption targets. In the policy cycle to 2030, the identification of regional objectives may also take different forms. One of these forms is the distribution of contributions in terms of identifying areas suitable for installation of plants, in particular photovoltaic and wind power plants.

Article 20 of Legislative Decree No 199/2021 provided that, by means of decrees of the Minister for the Environment and Energy Safety, in agreement with the Minister for Culture and the Minister for

Agriculture, subject to agreement at the Joint Conference, uniform principles and criteria are to be established for identifying areas and areas that are suitable and not suitable for the installation of plants using renewable sources, with an overall capacity at least equal to that identified by the INECP in order to achieve the objectives of developing renewable sources. The purpose of these decrees is, in particular, to define criteria to minimise the environmental impact of new installations, to define the maximum amount of land that can be used per unit of area from existing and new installations, and to identify the areas technically available, giving priority to built-up areas, brownfield sites, abandoned areas and marginal areas suitable for the installation of renewable installations. In order to ensure an adequate support service for the Regions and Autonomous Provinces in the process of identifying suitable areas and related monitoring activities, Article 21 of Legislative Decree No 199/2021 also provided for the establishment of a digital platform, established at 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 territory (including in relation to the infrastructure already built, to those authorised and under authorisation), to estimate the potential and to classify the areas and areas. For maritime areas affected by offshore wind installations, consideration will be given to launching tenders for areas already pre-identified, in order to allow for a more comprehensive development of initiatives, while at the same time simplifying the authorisation process for projects and reducing development costs. Pending the adoption of the aforementioned decrees, Article 20 of Legislative Decree No 199/2021 (as amended) already identifies the areas that can already be considered suitable for the installation of plants using renewable sources.

- Simplification of procedures

Italy has for some time taken steps to simplify the authorisation procedures, which are proportionate and differentiated according to the type of plant. However, it is intended to continue this process with a view to continuous improvement.

Ways to pursue this improvement include, for example, standardisation of models and procedures, digitalisation and exploitation of interoperability of systems.

The aim is to introduce uniform simplified procedures for the construction, commissioning and management of installations, including by extending the scope of the single model: it is a mechanism that allows, in a single procedure, to address permitting, grid 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, both for new RES plants and for the reconstruction of existing plants, may also be extended to small storage systems, as well as to plants connected to existing PODs with a capacity greater than the capacity of the plant.

The cases of use of the PAS (simplified authorisation procedure) have been extended. The numerous decree-laws simplifying legislation (e.g. Legislative Decree No 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:

- Adversarial systems with rotating modules raised from the ground, not more than 3 km away from areas for industrial, artisanal or commercial use,
- Floating installations, including water reservoirs in disused quarries or those installed to cover irrigation channels,
- Photovoltaic installations in suitable areas.

Article 19 of Legislative Decree No 199/2021 provided for the establishment of a single digital platform for the submission of single authorisation applications, using a standard authorisation model for all regions, set up and managed by GSE. The platform provides guidance and assistance throughout all stages of the administrative procedure and ensures interoperability and compliance with the 'once only' principle with IT tools for submitting applications already in operation 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 2022 provided that, for the purposes of reorganisation, simplification and digital reengineering of administrative procedures, the Government is empowered to adopt one or more legislative decrees for the recognition, simplification and identification of the activities covered by the procedure for certified notification of commencement of activity or of silence consent, as well as those for which an express title is required or prior notification is sufficient.

- ***Ad hoc tools for new plants based on innovative technologies***

For technologies that are still far from being economically competitive in the Italian context or with significant innovation potential, procedures will be launched tailored to their specific characteristics. The use of tariff instruments will be assessed in the light of the state of development, the ability to reduce costs, the potential for exploitation, the possible contribution to achieving the target, the compatibility with cost containment on bills, the improvement of environmental performance and the concomitance of other objectives. Where possible, instruments such as contributing to investment will be assessed, including through the use of specific European funds, including those for research and innovation. In this context, a support measure (called FER-2) is already being drawn up for these innovative technologies, in particular off-shore wind, solar thermodynamics, geothermal energy with reduced environmental impact, marine energy technologies and certain types of photovoltaic equipment, such as *floating outputs*, both on inland and offshore waters. There are also limited quotas for technologies that are far from competitive, such as bioenergy from waste and residues in the agro-industrial sector, in particular through facilities forming part of the production cycle of enterprises, which, in accordance with the principles of the circular economy, make it possible to valorise the waste itself and optimise production cycles, with a minority share of raw materials from second harvests.

This measure provides for competitive procedures for the allocation of available quotas, totalling around 4.5 GW. Offshore wind is expected to have the greatest impact on 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 these latter types, as mentioned in paragraph 2.1.2, the development of energy and non-energy infrastructure must be carried out in parallel, enabling the implementation of large projects in coordination with regions and TSOs.

This includes a specific NRRP measure, the M2C2 1.3 investment, which provides for EUR 0,68 billion to support the deployment of offshore renewable energy generation systems, combining technologies with high potential for development with more experimental technologies (such as wave systems), in innovative arrangements and complemented by storage systems. The intervention therefore aims to build plants with a total installed capacity of 200 MW from RES in the coming years, with the aim of producing around 490 GWh per year.

In addition, in the context of the decommissioning of platforms and connected infrastructure already used for the production of depleted hydrocarbon deposits, which are in the process of being depleted or otherwise unusable, innovative energy conversion projects, including installations for the production of energy from sources available at sea, will be promoted (Ministerial Decree of 15 February 2019 – national guidelines for the decommissioning of offshore hydrocarbon production platforms and related infrastructure). Moreover, the energy available at sea seems to be of potential interest to a number of companies, due to possible synergies with their core activities, and can therefore contribute to a gradual conversion of the same companies towards activities compatible with the objectives of the energy transition.

One of the innovative solutions that we intend to focus on is to create systems that maximise the

synergy between photovoltaic production and agricultural activity.

The NRRP includes a specific measure (M2C2.1) for the development of agrentaico. The investment measure specifically provides for: (I) the implementation of hybrid agricultural and energy production systems that do not compromise the use of land dedicated to agriculture, but contribute to the environmental and economic sustainability of the farms involved, including potentially enhancing water basins through floating solutions; (II) monitoring outputs and their effectiveness, collecting data on both photovoltaic installations and underlying agricultural production and activity, in order to assess microclimate, water saving, recovery of soil fertility, resilience to climate change and agricultural productivity for different types of crops. The objective of the investment is to fully install a production capacity of 1.04 GW, which would produce about 1.300 GWh per year, with greenhouse gas emission reductions estimated at around 0,8 million tonnes of CO₂.

Legislative Decree No 199/2021 provided for an implementing decree to grant the benefits of the NRRP measures and, in more detail, to lay down criteria and procedures to encourage the construction of agutional plants through the granting of 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 is currently being examined by the European Commission for its assessment of compatibility with State aid rules, lays down the procedures for allocating NRRP resources, in conjunction with a specific tariff support allocated through competitive auction procedures and registers.

With regard to the synergy between photovoltaic and agricultural sectors, the objective of the NRRP measure M2C1 2.2 'Parco Agrisolare' is to support investments in the construction of solar photovoltaic electricity plants in the agricultural and agro-industrial sectors, excluding land use. In particular, the measure provides for the selection and financing of measures consisting of the purchase and installation of photovoltaic panels on roofs of buildings used for the activities of the beneficiary undertakings. In conjunction with this activity, one or more complementary measures to upgrade buildings to improve the energy efficiency of structures may be carried out, such as removal and disposal of asbestos from roofs, thermal insulation of roofs and the construction of a ventilation system. Together with the construction of the photovoltaic system, support 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 are at least 30 % by 2022, at least 50 % by 2023 and 100 % by 2024, and that the projects financed include the installation of at least 375 MW of new photovoltaic installations. As of 31/12/2022, following the call for proposals and the publication of the projects accepted, both the first and fourth targets have been met.

The reinforcement *of the guarantees of origin*

The aim is to strengthen the instrument of Guarantees of Origin (GOs) by promoting greater use of these instruments, including for fishery and aquaculture products, and by assessing their recognition for all the energy produced. In this regard, Legislative Decree No 199/2021 provides that the procedures for issuing GOs are updated and that the purpose, the information given, the validity, the method of issue, the value for money, including through the exchange platform and the direct issue to the purchaser, are defined. The role of the GSE will also be defined. The implementing decree is about to be adopted.

NONETHELESS, *M – SPECIFICATION FOR SAFEGUARDING AND UPGRADING EXISTING PLANTS*

Achieving the renewable targets requires the establishment of new installations but also the maintenance and, if possible, the increase of renewable production, of existing installations, for which the guidance is to provide support mainly through measures to simplify and clarify the regulatory framework, with the use of economic support instruments only if these measures prove insufficient. Similarly, mechanisms will be introduced to safeguard the production of plants that are bankrupt or seized by the judicial authorities.

In particular, it is intended to act as follows:

- *Revamping, repowering, reversions, role of existing productions*

Without prejudice to the following paragraph concerning hydroelectric concessions, the specific non-economic measures for revamping and repowering existing plants provide for simplified authorisation procedures, setting criteria for carrying out operations with the extension of the PAS and excluding or simplifying the EIA/environmental screening; in particular, in the case of environmental assessments, the aim is to promote an approach that only assesses the impact of variations compared to the situation before revamping or repowering.

Accordingly, Decree-Law No 77/2021 provided that the works to be carried out on photovoltaic and hydroelectric installations which do not involve changes in the size, area and associated works are to be classified as non-substantial changes and notified to the municipality, even if they consist of a change in the technological solution used and irrespective of the electrical power resulting from the intervention. Furthermore, measures to be carried out on wind projects and installations and related works, irrespective of the rated power resulting from the modifications, are carried out on the same site as the wind farm and which entail a minimum reduction in the number of wind turbines compared to those already in existence or authorised, are not considered to be substantial.

Decree-Law No 17/2022 provided for the use of the municipal DILA (Declaration of Initiation of Certified Works) in relation to the execution of related works, in the case of non-substantial alterations resulting in an increase in the installed capacity and the need for further related works without an increase in the occupied area. Legislative Decree No 13/2023 granted an exemption from the EIA, until 30 June 2024, for a number of electricity installations and infrastructure, provided that they were located in areas suitable for projects to refurbish, upgrade or fully reconstruct existing photovoltaic installations, possibly including storage systems, which do not provide for a change in the area occupied and with a total power of less than 50 MW as a result of the works, and for projects to repowering existing wind turbines that do not foresee any change in the area occupied and with a total power of less than 50 MW as a result of the works.

Provision is also made for better information on the performance of the facilities provided by GSE on the basis of the stock of data acquired as part of the management of incentive mechanisms. This action will inter alia:

- encourage the deployment of innovative technologies for monitoring performance;
- identify, within homogeneous categories of installations, possible interventions to improve performance and extend the useful life;
- promote the development of a chain associated with the restoration of production performance and the extraordinary maintenance of decayed plants;
- To raise awareness among operators of actions that make it possible 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, were found not to be competitive on the market, in favour of plants that are more responsive to system requirements in the energy transition pathway. These include, for example, the conversion of biogas plants to biomethane. With this in mind, measure NRRP M2C2 1.4 'Development of biomethane, in accordance with criteria for promoting the circular economy' supports investments in the construction of new biomethane production plants and 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 2022 is to promote incentives for biomethane injected into the natural gas grid through capital support (up to 40 % of the expenditure incurred, using resources provided for in the NRRP) and an energy incentive (incentive tariff applied to net biomethane production). This option, which can be used for large plantings, seems to be more complex for smaller plants, for which, particularly in the agricultural sector, efficient forms of support will also be promoted, compatible with Community rules on State aid, 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.

With this in mind, moreover, Legislative Decree No 199/2021 provided for measures to supplement the revenues resulting from participation in the electricity market in favour of plants using renewable sources that continue to operate at the end of the period of entitlement to incentives, with particular regard to plants using renewable sources with generation costs linked to fuel supply costs, taking into account the need to contain costs in accordance with efficiency principles and in any case in accordance with the principle of a circular economy and the rules on State aid.

In the transitional period, the role of bioenergy plants can also be understood as serving the very high level of development of non-programmable renewable energy. To this end, the existing production capacity of bioliquid installations also proves to be a useful source of transitional support, ensuring support for maintaining decarbonisation trajectories. The current situation of the biomass production stock is characterised by a capacity of approximately 4.100 MW of installations in operation by 2021, of which approximately 1.000 MW are sustainable bioliquids. Given the number of potential operating hours of the bioliquid capacity of more than 4000h/a, it could act as back-up and compensate for any deviation from the installation trajectory of at least 3 GW of new PV installations. This back-up is an insurance tool that also makes it possible to compensate for a failure to build up storage systems designed for non-programmable renewables in a timely manner, since its programmability provides a built-in accumulation function; it is also a fully renewable, programmable instrument with high generation reliability, which is easily included in the existing mechanisms for maintaining the adequacy of the electricity system (see capacity market authorised by the European Commission up to the plan horizon). However, the high costs of kWh produced by bioliquids compared to the average, which call into question their competitiveness, and the need to use only bioliquid plants that comply with the sustainability requirements laid down in Article 42 of Legislative Decree No 199/2021 and which, in particular, come from national sectors, are problematic for these products. Also to be considered critical for the sector, the impact of Article 40 (1) (c) of Legislative Decree No 199/2021, i.e. that, from 1 January 2024, the share of bioliquids produced from

palm oil, empty palm oil fruit beams and fatty acids resulting from the treatment of palm oil fruits (PFAD), unless they are certified as having low ILUC risk, in accordance with the criteria laid down in

Article 4 of European Commission Delegated Regulation (EU) 2019/807.

- ***Hydroelectric concessions***

Law No 12 of 11 February 2019 converting Decree-Law No 135 of 14 December 2018 confers powers on the Regions on existing large concessions. The Law provides, inter alia, that if the Regions do not consider that there is an overriding public interest in a different use of water, which is incompatible with maintaining the use for hydroelectric purposes, they may award concessions for large hydroelectric derivations to qualified operators, on the basis of certain criteria, including: (a) the definition of the minimum energy, generation power and producibility improvements to be achieved in all the works of abstraction, supply, regulation and conduction of water and of electricity generation, processing and connection facilities with reference to national strategic objectives on energy security and renewable energy sources, including the possibility of equipping water storage infrastructure to facilitate the integration of renewable energy into the energy market; (b) the minimum levels of improvement and environmental rehabilitation of the relevant river basin, in line with the planning instruments at the scale of the river basin district pursuant to Directive 2000/60/EC (Water Framework Directive), mandatorily determining a proportion of the revenue from the allocation, to be used to finance measures in district management plans or protection plans aimed at protecting and restoring the environment of the bodies of water affected by the abstraction.

In the context of the sharing of national objectives with the Regions, as mentioned above, constant discussions will be carried out with the Regions in order to promote the efficient and proper application of these rules, so as to ensure that hydropower contributes adequately to the objectives.

Law No 118 of 5 August 2022 (Annual Law on the Market and Competition 2021) followed up on the provisions of Law No n.12/2019, regulating the procedures for the award of 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, and in any case no later than 31 December 2023. The Regions will inform the Ministry of Infrastructure in good time of the launch and outcome of the procedures for the award of concessions for large hydroelectric derivations. In the event of failure to adopt regional laws within the prescribed time limits, the Minister for Infrastructure will propose the exercise of the power of replacement, in order to initiate the procedures for the award of concessions, providing that 10 % of the amount of the concession fees will remain acquired by the State.

At national level, the availability of support instruments, where needed, will also be ensured to promote the establishment of new facilities on smaller water networks, for example by exploiting the geodetic falls of aqueducts. In addition to simplifying the procedures for repowering procedures for small hydropower plants in the event of non-substantial changes, Legislative Decree No 77/2021 revised the Guidelines for the authorisation of plants powered by renewable sources in order to exempt hydroelectric and geothermal power plants with a generating capacity of not more than 500 kW of concession power.

Italy supports greater harmonisation of the rules on hydroelectric concessions at European level.

Within the scope of the objectives of simplifying authorisations, the aim is to define, by means of State technical rules, the qualification of plant changes defined as ‘substantial’ and those defined as ‘non-substantial’ (pursuant to Article 5 of Legislative Decree No 28/2011) and, with reference to the aspects of substantial changes to hydroelectric installations, to uniquely identify plant changes that involve a revision of concessions.

- ***Minor islands as a laboratory for high levels of penetration of renewables and electrification of consumption***

Italy has already launched a process to gradually cover the needs of smaller islands that are not interconnected with energy from renewable sources. In this context, Ministerial Decree No 14/07/2017 set targets for covering consumption from renewable sources available locally for each

island, defining specific incentives, the amount of which was defined by ARERA Decision No 6/11/2018 No 558 and is commensurate with the cost of the fuel avoided. In addition, on these islands, the aim is to promote the modernisation of the electricity networks so as to allow for a high penetration of renewables and the implementation of pilot projects aimed at a high use of renewable sources through the use of storage systems, the development of electricity transport, the integration of the electricity system with the island's water system and the modulated demand on the island.

Decree-Law No 17 of 1 March 2022, as coordinated by the conversion law of 27 April 2022, provides for the updating of Ministerial Decree No 14/2/2017 on the energy transition of non-interconnected minor islands. In particular, it is planned to achieve by 31 December 2026 full coverage of the energy needs of the smaller islands that are not interconnected through energy from renewable sources. To this end, the update of the measure must provide for the conversion of fossil fuel power plants by electricity companies to renewable sources by means of investment plans including distribution networks.

In addition, the NRRP foresees an investment M2C1 3.1, called "Green Islands", for the financing and implementation of energy projects (such as renewables, electricity grid, energy efficiency), water (such as desalination), transport (cycle paths, buses and zero-emission vessels) and waste (e.g. separate collection) in small islands not connected 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 resources, it is necessary to implement at least three of the eligible types of interventions on each island. In September 2022, the ranking list containing 142 investment projects with a total value of approximately EUR 200 million in the 19 minor non-interconnected islands was approved by Directorial Decree No 219 of 27 September 2022, and will therefore continue the process of implementing the measures.

THE *THREEMEASURES FOR THE PROMOTION OF RENEWABLE ENERGY SOURCES*

– *Cohesion policies*

Cohesion policy, as further explained in paragraph 3.2, is implemented through 5 European Structural and Investment (ESI) Funds and the National Development and Cohesion Fund (CSF).

All these plans and programmes at both national and regional level, with the 2014-2020 programming period, provided for specific action lines to promote renewable sources and energy efficiency.

As part of MASE's 2014-2020 Development and Cohesion Plan (FSC implementation tool), the initiative entitled 'Energy income' is being developed, with the aim of setting up a revolving fund for the construction of photovoltaic systems in the form of self-consumption, in favour of households facing economic hardship. The scheme of the measure provides that MASE is the beneficiary of the measure and that the fund is managed and implemented by the Gestore dei Servizi Energetici S.p.A. The measure, which aims to combat energy poverty, reduce energy expenditure and promote the development of photovoltaic energy in self-consumption, will be targeted in particular at the regions of the Mezzogiorno. The mechanism provides that the beneficiary does not have to bear the initial investment cost and that the beneficiaries must (a) transfer to GSE the energy that is not self-consumed or not shared for self-consumption, (b) transfer to GSE the contribution related to self-consumed or shared energy and (c) have no access to other forms of aid relating to the same installation. The annual financial resources referred to in points (a) and (b) above shall be used for the purpose of repaying the assistance granted and shall therefore be transferred annually by GSE to the Fund. All self-consumed electricity remains at the disposal of the beneficiary. The resources allocated to the measure amount to EUR 200 million. It is estimated that around 100-180 MW of photovoltaic installations serving 3060.000 households can be installed with the above resources; additional installations may be installed in view of the scrapping of the background.

In the same direction as for the 2014-2020 programming period, the programming period 2021-2027,

as defined in the Partnership Agreement between Italy and the European Commission on the 2021-2027 programming cycle, approved by the Commission Implementing Decision of 15 July 2022. In particular, the Policy Objective 2 “A greener Europe” includes the specific ‘energy’ objective, which requires support for renewable sources to focus primarily on measures for thermal and electric self-consumption in public buildings, integrated with energy efficiency, and innovative and experimental measures (e.g. green hydrogen). The deployment of district heating and the creation of energy communities is also envisaged for the expected environmental, economic and social benefits at local level.

In the context of the ESI Funds, one of the objectives to be pursued is to promote renewable energy by supporting measures aimed at producing energy from renewable sources, including thermal energy, in the form of self-consumption (in combination with storage systems) intended for businesses. This objective is also supported by the National Research Programme for Innovation and Competitiveness for the green and digital transition 2021 – 2027, with a budget of EUR 262 million. Support for RES production is limited to high-efficiency systems in order to correct certain market distortions, excluding energy communities.

In the context of the CSF, the Fund’s resources and the Fund’s resources, which are 80 % at midday, are used on strategic objectives, divided into 12 thematic areas, including the ‘Energy’ area divided into three sectoral areas: energy efficiency; renewable energy; networks and accumulations. The priority in the renewable energy sector is (a) to promote innovative offshore wind generation projects and (b) to support clean technologies with high development potential, such as green hydrogen or other innovative technologies on storage.

Nonetheless tax deductions

Tax deductions for refurbishment of buildings, as better 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 energy.

According to the data provided by ENEA in the context of the Superbonus monitoring campaigns, as at 31 March 2023, more than 390.000 installations were supported for a total of around 2.5 GW (investments of approximately EUR 5,8 million); almost one installation for each efficient building. These facilities were associated with around 380.000 storage systems with a total capacity of around 8.5 GWh (investments of approximately EUR 5,3 million).

On the other hand, around 29.000 installations were installed within Bonus Casa for a total of 139 MW in 2021 and, in 2022, around 61.000 installations totalling 287 MW.

For the measure in question, a general reform is planned to strengthen it in response to the challenging energy and environmental objectives set out in 2030 and 2050 in the area of energy efficiency in buildings; for more details, see section 3.2.

❖ TRANSPORT SECTOR

In order to achieve the targets for the penetration of renewables in the transport sector, a number of specific measures were identified until 2021. In the first place, specific obligations to blend biofuels with fuels released for consumption were identified until 2022, based on a quota system which, among other things, rewarded advanced biofuels and biofuels from waste oils and animal fats. Secondly, fuel suppliers have been expected to meet a 6 % GHG savings target from 2020 on the total number of fuels released for consumption in that year, compared to a baseline. Finally, incentives have been identified to comply with the obligation to release biofuels through biomethane and other advanced biofuels; in 2018-2022, the production of advanced biomethane and biofuels was encouraged in order to comply with the existing obligation to blend fossil fuels with biofuels, by means of a system for withdrawing biomethane produced, with certificates of release for consumption (CIC) issued for a period of ten years. The incentive burden falls on the obliged entities (oil companies that release fossil fuels for consumption), does not affect the electricity and gas bills,

but is probably internalised in the final price at the pump of the fuel.

Subsequently, in implementation of the relevant provisions of Legislative Decree No 199 of 8 November 2021 transposing RED II, by means of a series of decrees updating the existing sectoral decrees covering the period 2022-2030, specific measures were introduced with effect from 2023.

First, the new targets relating to the obligations to release biofuels for consumption have been defined (Ministerial Decree of 16 March 2023). Specifically, there is an overall target in terms of the use of renewable sources in the transport sector, regardless of the transport sector they enter, 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 foreseen for advanced biofuels and biomethane, biofuels in petrol and pure biofuels. The scheme confirms specific reward for advanced biofuels and biofuels from waste oils and animal fats and introduces others for non-food & feed biofuels released into the aviation and maritime sectors and for biofuels released into purity. In addition, specific regulatory constraints have been introduced on the use of different biofuel production materials, such as the maximum limit on the use of biofuels produced from both food and feed crops, UCO and animal fats. Since 2024, palm oil can only be used if qualified as low ILUC risk (indirect effect due to land use change).

In addition, further incentives have been provided for meeting the obligation to release biofuels via biomethane, using the measures provided for in the NRRP (capital contribution on eligible expenditure of the investment incurred and incentive tariff allocated through downward auctions) (Ministerial Decree of 15 September 2022).

In addition, the decrees that will regulate the deployment of the guarantee of origin (GO) mechanism for the biomethane and hydrogen sectors and the revision of the sustainability guidelines and further criteria for biofuels and biomethane, RNFBO and RCF are currently being finalised. The first measure will incentivise, through a mechanism involving the issuance, recognition and cancellation of guarantees of origin of renewable energy production, the biomethane and hydrogen sector, also in implementation of the measures provided for in the NRRP. On the other hand, the second complements the existing provisions with the new requirements required at Community level to respect the sustainability of biofuels pathways and to demonstrate compliance. Subsequently, provisions will have to be made to ensure that the monitoring mechanism in force at national level and the monitoring mechanism provided for in a database that the Commission is finalising are in place.

Finally, in the next two years, the RED III Directive will have to be transposed and the (EU) aviation and maritime regulations will be implemented. In particular, the mandatory quotas for release for consumption up to 2030 for the use of RES in the transport sector will need to be updated in order to meet both the overall target set by the Directive of 29 % and the cumulative specific targets for advanced biofuels and RNFBO set by the Directive at 1 % in 2025 and 5.5 % in 2030, of which 1 % by RFNBO. In the maritime sector, measures should be taken to reduce overall emissions from ships, from 2 % to 2025 and by increasing percentages over time. These include the explicit promotion of the use of RNFBOs. In the aviation sector, however, minimum blending shares of SAF (SAF) will have to be foreseen since 2025 (2 %), increasing every 5 years (6 % to 2030).

In general, there is therefore a challenging pathway towards decarbonising the sector, which will have to be pursued with a view to technological neutrality. Indeed, we believe it is crucial to continue all possible solutions that can 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 conflict of food & feed, as well as research into and introduction of the most innovative fuel categories, such as renewable fuels of non-biological origin and recycled carbon fuels. It is a challenge that includes, for all, availability of raw materials, cost reduction, competition between end uses. The electricity sector will

also face its challenges, including, in the first instance, lowering costs and prolonging battery lives. This challenge will also include 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 achieve the objectives set out below.

For advanced biofuels, i.e. biofuels produced from lignocellulosic materials, non-food crops, agricultural and forestry residues and waste, as well as industrial waste and residues, a sub-target of around 10 % is expected. This quota will be reduced mainly through the construction and operation of biomethane production facilities, promoting investments in this field; in addition, research and development activities in the algae sector and in all technologies for conversion of biomass to advanced biofuels will be strengthened. As regards single counting biofuels, which include those produced from food & feed crops, the contribution is limited to 2.3 % of total sectoral consumption, in line with the constraints laid down in EU legislation. In particular, the contribution of palm biofuels and any other high ILUC-risk categories are expected to be cancelled. Specific attention should be paid, among the various categories of biofuels, to those that can be released into purity (without being constrained to the maximum quantity that can be blended with conventional fuel), which can therefore make a greater contribution to decarbonisation where they have characteristics that can achieve high emission savings.

As regards the contribution of RES electricity, in the road sector, new registrations of pure electric cars are expected to increase gradually in order to reach the cumulative target of around 4,3 million pure electric cars or BEV by 2030, which, in addition to plug hybrid cars, would lead to an overall value of around 6,6 million electrified cars circulating in 2030. Forecasts for the development of electric mobility are linked to the expected technological jump in batteries and will therefore be continuously monitored in regular updates; measures for the deployment of electrically powered ferries will be encouraged. For more details on e-mobility measures, please refer to paragraphs 3.1.3 and 3.2.

As regards the limit on the use of certain types of raw material for the production of biofuels (UCO and animal fats), Italy has already planned to exceed that limit; as an extension of the list of materials subject to this limit is also ongoing, the value is expected to increase to a maximum of 5 % (for more details see paragraph 2.1.2). In particular, priority should be given to the COU collected on national territory, respecting the principle of the circular economy and in line with the new objectives of the waste package. UCOS are considered to have great potential in the production of biodiesel and HVO (hydrotreated vegetable oil) as well as in the production of SAF, the use of which is made compulsory by the Aviation Regulation (EU). To this end, national biorefineries are also launching the production of HVO for aviation.

In 2030, non-biological renewable fuels (RFNBO) will contribute 2 % of sectoral consumption in 2030 (compared to the 1 % required by RED III as a minimum), mainly using hydrogen. This will be done through use in refineries or direct use in cars and buses as well as in hydrogen trains (for some non-electrified routes) or through the injection of methane into the network (currently already blended up to 2 %). Promotion measures should also be undertaken 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 appearing on the landscape, with life-cycle emissions savings of at least 70 % (e.g.: plastics collected separately or fuel obtained from the recovery of CO₂ from the steelworks). This type of fuel will certainly play a role in achieving decarbonisation, enhancing the recovery of waste from a circular economy perspective; a process will have to be taken to ensure that the individual types are classified from the point of view of production, the environment and the technical and regulatory aspects.

In general, sustainable alternative fuels, including biogenic fuels, are an effective and environmentally sustainable solution, complementing direct electrification.

The environmental benefits have been demonstrated by numerous studies, including those of the European Commission itself (e.g JEC v535). These benefits underpin the choice to support sustainable alternative fuels as an important element for the decarbonisation of the transport sector (including aviation and shipping, as set out in the current FuelEU maritime and ReFuelEU aviation regulatory proposals) are fuels of biogenic origin, from other renewable sources or from recycled carbon.

Indeed, when analysing the main benefits of biogenic fuels, it should be pointed out that some pathways have climate gas emission savings comparable to RFNBO. In addition, biofuels: (a) they can be used to a large extent in already existing infrastructure and conversion systems (for this reason they are referred to as drop-in), allowing faster intervention than other solutions; (b) they can be produced from supply chains that are already technically mature and already operated on a commercial scale (hydrotreatment and co-processing of oils and fats, production of biomethane from many sustainable matrices, lignocellulosic ethanol, fermentation of syngas, etc.); (c) do not increase pressure on critical materials for battery production, facilitating the green transition; (D) can support the implementation of a green transition on a sustainable path, including socially (*no one is left behind*).

With regard to biogenic sustainable alternative fuels, one of the key issues is the availability of raw materials. However, in the modern vision of decarbonising the transport sector, the use of alternative fuels produced from food-based raw materials (2.3 % of sectoral consumption) is limited. On the contrary, virtuous advanced alternative fuel production chains can be an enabler for more sustainable agriculture.

The example of the production of biomethane from anaerobic digestion is of particular importance for Italy. The potential for the production of biomethane from anaerobic digestion is, according to academic studies³⁶, 6,5 billion cubic metres of biomethane, to be used for uses such as transport and other industrial uses or for the production of electricity (such as biogas). This sector has the potential 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 there is a downward trend in the related agricultural area compared to the one 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 also promote land that is difficult to manage by type of soil due to a structural lack of organic matter and/or adverse seasonal climatic patterns;
- 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 size of irrigated or irrigable UAA;
- Increasing use of livestock manure in anaerobic digestion, an almost compulsory road to drastically reduce the overall impact of Italian livestock farming, while at the same time increasing the efficiency of organic fertilisation and soil fertility. By 2030, it is estimated that at least 65 % of the livestock manure produced today will be sent to biogas;
- Increasing use of high-quality agricultural residues and agro-industrial by-products managed in a virtuous manner according to circular economy principles.

❖ **THERMAL SECTOR**

In order to achieve the binding national renewable energy target, the contribution of the heat sector

³⁵³² PRussians et al. (2020). <https://publications.jrc.ec.europa.eu/repository/handle/JRC121213>

³⁶The potential contribution of advanced biofuels – Prof. Chiaromonte – Polytechnic of Turin

is crucial. National gross final heat consumption for heating and cooling in 2021 is around 57 Mtoe, representing around 47 % of total final energy consumption.

The main instruments to be used to promote the use of renewable thermal energy sources are often integrated with those for energy efficiency and are already in place. These are to:

- tax deductions for energy efficiency measures and building renovation of existing building stock, both of which are intended also for thermal renewables;
- Land account;
- mechanism of White Certificates, including the promotion of high-efficiency cogeneration;
- obligation to integrate renewable energy sources into buildings;
- contributions to municipalities for investments in energy efficiency and sustainable territorial development;
- promotion of biomethane injected into the natural gas grid;
- support measures for hydrogen;
- support for district heating.

These measures are briefly explained below with reference to the parts of interest for thermal renewables, including the corresponding development lines planned for the pursuit of the 2030 targets on thermal renewables. With regard to the measures in

common with the promotion of energy efficiency, please refer to section 3.2. for a more detailed description of the state of the art and expected trends.

In order to stimulate the renewal of old biomass thermal power plants with efficient and low emission technologies, the update that will be deemed necessary for the mechanisms described will also include, where not already established, the introduction of more stringent performance and environmental requirements for biomass heat generators. The introduction of replacement constraints for obsolete heaters and requirements for checks and periodic maintenance for biomass installations (telematic cadastre) will be considered.

Accordingly, in order to promote the best energy and environmental performance, Annex IV to Legislative Decree No 199/2021 lays down the minimum technological and performance requirements that must be met by installations for the production of thermal energy from renewable sources that require incentives of any kind.

For electrically driven and gas-fired heat pumps, a technology-neutral approach will be maintained, leaving to the market the selection of the most efficient option for each application, including the use of cooling inputs, bearing in mind that in some regions of the Mediterranean countries cooling needs prevail. Promotion mechanisms will also be geared towards facilitating the uptake of geothermal heat pumps.

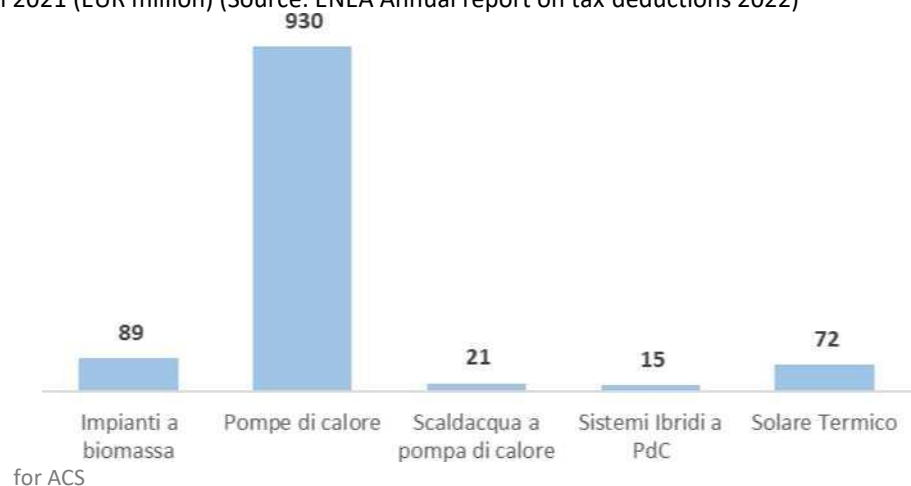
In order to facilitate the installation of solar thermal systems that can meet the demand for heat in a more flexible and effective way (e.g. by covering heating needs for buildings), the promotion of hybrid systems will be confirmed.

- **DTAX ADJUSTMENTS FOR ENERGY RETROFITTING AND RENOVATION OF BUILDING STOCK**

Under the Ecobonus, measures to install solar thermal installations, heat pumps, hybrid heat pump plants, heat pump water heaters and biomass plants are facilitated.

With regard to the installation of plants using renewable thermal energy sources, in 2021 there were around EUR 1,1 billion in investment stimulated by the measure.

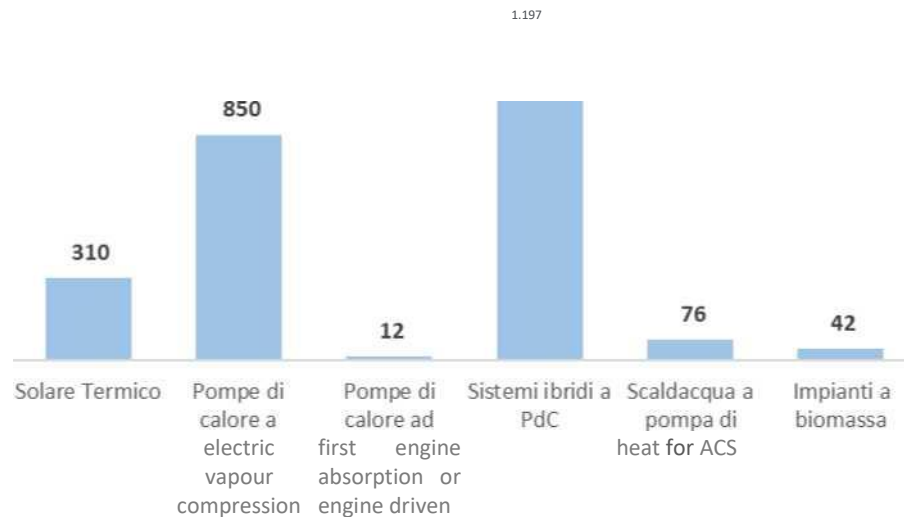
Figure 32 Investments in plants using thermal renewable sources that had access to tax deductions for energy retrofitting of buildings in 2021 (EUR million) (Source: ENEA Annual report on tax deductions 2022)



In addition to the investments linked to the Ecobonus, the so-called 'Super Ecobonus', which also allows for measures relating to plants for the production of heat from RES, should be added. For these, investments amounting to approximately EUR 2,5 million have been supported as at 31

December 2021.

Figure 33 Investments in plants using thermal renewable sources that had access as of 31 December 2021 the so-called 'Super Ecobonus' (EUR million) (Source: ENEA Annual report on tax deductions 2022)



Finally, the so-called 'Bonus Casa' also allows the installation of solar thermal systems, heat pumps, hybrid heat pump systems, heat pump water heaters and biomass generators in buildings. On the basis of ENEA data, more than 370 measures were carried out in 2021, involving the use of renewable energy sources for the production of heat.

C **ONTO ERMICO.**

The Ministerial Decree of 28 December 2012, as amended by the Ministerial Decree of 16 February 2016, introduced the so-called Termico Conto, an incentive instrument to promote the production of renewable heat and, at the same time, to allow public authorities access to energy efficiency measures in 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 measures by public authorities and private entities shall be encouraged:

- replacement of existing winter air-conditioning systems with winter air conditioning systems, whether or not combined for the production of domestic hot water, equipped with heat pumps, electric or gas, using aerothermal, geothermal or hydrothermal energy, together with the installation of heat accounting systems in the case of plants with a useful heat output of more than 200 kW; the maximum limit for access to the application for an incentive is for installations with a total post-operam rated power of up to 2.000 kW thermal;
- replacement of existing winter air conditioning systems or heating of existing greenhouses and rural buildings by winter air-conditioning systems with a heat generator powered by biomass, together with the installation of heat metering systems in the case of plants with a useful heat output of more than 200

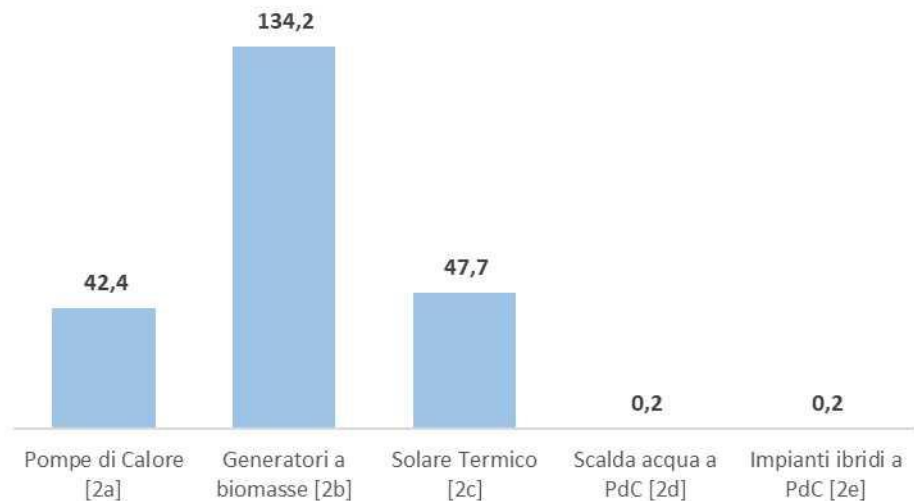
kW; the maximum limit for access to the application for an incentive is for installations with a total post-operam rated power of up to 2.000 kW thermal;

- installation of solar thermal installations for the production of domestic hot water and/or to supplement the winter air-conditioning system, including combined with solar cooling systems, for the production of thermal energy for production processes or input into district heating and cooling networks; in the case of solar field surfaces greater than 100 m², the

- installation of heat metering systems is required; the maximum limit for access to the application for an incentive is for installations up to 2.500 m² of gross installed area;
- replacement of electric water heaters with heat pump water heaters;
 - replacement of existing winter air conditioning systems with hybrid pump systems heat.

In 2021, approximately 100 applications for the installation of renewable energy installations, equivalent to around EUR 225 million invested, had access to the incentives.

Figure 34 – Estimated investments in plants using thermal renewable sources in the Conto Termico in 2021 (EUR million) (Source: GSE)



Legislative Decree No 199/2021 lays down certain lines of developments concerning the mechanism of the Conto Termico. In particular, Article 10 provides that the support scheme should also be extended to include measures for the production of heat from large renewable sources and the possible use of storage systems, by means of competitive access mechanisms; renewable energy communities, including those organised by public administrations, as well as collective self-consumption configurations, are also eligible for incentives.

Article 27 of Legislative Decree No 199/2021 lays down 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 shall ensure that a share of the energy sold is renewable. The relevant implementing decree is in the process of being finalised.

NONETHELESS, *CERTIFICATI BIANCHI*

White Certificates are negotiable securities that certify that energy savings in energy end-use have been achieved through measures and projects to increase energy efficiency.

The mechanism shall also promote the implementation of projects involving the use of renewable sources for non-electrical uses, in relation to their ability to increase energy efficiency and generate non-renewable energy savings.

White Certificates are also issued for energy savings generated by high-efficiency cogeneration plants, including renewable installations and installations connected to district heating networks.

NONETHELESS, *OBLIGATION TO INTEGRATE RENEWABLE ENERGY SOURCES INTO BUILDINGS*

Annex 3 to Legislative Decree No 199/2021, transposing the REDII Directive, identifies requirements for the integration of renewable sources in 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 systems powered by renewable sources, that 60 % of the projected consumption for domestic hot water production and 60 % of the total consumption for domestic hot water, winter heating and summer air conditioning are covered. The obligations described above cannot be met by renewable installations producing exclusively electricity, which in turn feeds devices for the production of heat with a Joule effect.

The electrical power of plants powered by renewable energy sources that must be installed on or inside the building or in their 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 ground level, i.e. the ground projection of the building gauge, measured in m²; appliances shall not be taken into account when calculating the area on the plant, but on which installations may be installed.

The obligations described 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 Directive, provided that the district heating covers the entire thermal energy needs for heating and/or cooling.

For public buildings, the percentage requirements are raised to 65 % and the mandatory power requirements must be increased by 10 %.

Where it is declared, by means of a report drawn up by an authorised designer, that it is technically impossible to comply with the obligation, it is nevertheless established that an appropriate value of non-renewable primary energy must be obtained, calculated as the sum of the winter air conditioning, summer air conditioning and domestic hot water services.

The obligation to integrate renewable energy sources into buildings, which has brought benefits with regard to improving the energy performance of buildings and the deployment of renewable thermal sources, must be made more effective in order to broaden its scope and ensure its application in all cases. To this end, Legislative Decree No 199/2021 provides that, from 1 January 2024, the obligations are to be redetermined at least every five years, taking account of technological developments. When the obligations are revised, the extension of the obligations to buildings undergoing major first-level renovation, as well as to buildings belonging to categories E2 (office buildings and similar buildings), E3 (buildings used for hospitals, clinics or nursing and similar buildings) and E5 (buildings used for commercial activities) and E (buildings used for commercial activities, and

equivalent)³⁴, with a useful floor area of more than 10.000 square metres, even if not undergoing restructuring.

In addition, it is planned to update the system of obligations by making it simpler and more 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, promoting the integration of traditional and renewable technologies, including through the use of hybrid plants. 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 in the installation of installations for the production of thermal renewable energy. In this regard, Legislative Decree No 199/2021 lays down that installations powered by renewable sources which have been built to meet the obligations, with the exception of those built for new buildings, shall be eligible for the State incentives provided for the promotion of renewable sources, including guarantee funds and revolving funds for the provision of loans at a preferential rate, 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 meet the obligations to cover the energy needs of buildings subject to first-level renovation, the possibility of a procedure for installing the share of the obligation on the part of the owner in another building, even if not owned by him, or of transfer to the local authority, which may aggregate them in order to reach shares suitable for works on public buildings, will be considered, provided that this is compatible with the constraints linked to the Directive on the energy efficiency of buildings.

On the basis of the results of the measures already described and in line with the measures for electric renewables, as well as what will be laid down in the EPBD, the pros and cons of introducing minimum share requirements for renewable energy sources will also be assessed for certain categories of existing buildings, such as tertiary buildings.

NONETHELESS, TAXES ON MUNICIPALITIES FOR INVESTMENTS IN ENERGY EFFICIENCY AND DEVELOPMENT SUSTAINABLE TERRITORIAL

Decree-Law No 34 of 30 April 2019 (Growth Decree-Law) 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 territorial development. The contribution is allocated to each municipality on the basis of its resident population on the date of 1 January 2018, as follows:

- 50.000 euro to common with people less than or equal 5.000;
- 70.000 euro to common with people between 5.001 and 10.000 inhabitants;
- 90.000 euro to common with people between 10.001 and 20.000 inhabitants;
- 130.000 euro to common with people inclusive between 20.001 and 50.000 inhabitants;
- 170.000 euro to common with people inclusive between 50.001 and 100.000 inhabitants;
- 210.000 euro to common with people inclusive between 100.001 and 250.000 inhabitants;
- 250.000 euro to common with people higher to 250.000 inhabitants.

The contributions referred to in the previous paragraph shall be allocated to public works relating to:

- energy efficiency, including measures related to public lighting, energy savings in publicly owned buildings and public residential buildings, as well as the installation of installations for the production of energy from renewable sources;

³⁴ referred to in Article 3 of Presidential Decree No 412 of 26 August 1993

- Sustainable territorial development, including measures on sustainable mobility, the adaptation and safety of schools, public buildings and municipal heritage and the removal of architectural barriers.

With effect from 2020, for the projects referred to above, the Growth Decree 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 an equal contribution to each municipality.

By Directorial Decrees of 14 May and 10 July 2019, the Ministry of the Environment and Energy Safety laid down, respectively, the amount of the contribution allocated to each Italian municipality and the arrangements for implementing the measure (eligible measures, aid payable and methods of payment, monitoring of the measure).

The 2020 Budget Law grants the municipalities, up to a maximum of EUR 500 million per year, for investments in public works in the field of energy efficiency, including measures aimed at improving public lighting, saving energy in publicly owned buildings and public housing, and installing installations for the production of energy from renewable sources. These contributions may also be used by municipalities for sustainable territorial development projects, including sustainable mobility measures, as well as measures for the adaptation and safety of schools, public buildings and municipal heritage and for the removal of architectural barriers.

NONETHELESS, *DEVELOPMENT OF BIOMETHANE, ACCORDING TO CRITERIA FOR THE PROMOTION OF THE CIRCULAR ECONOMY*

The measure ‘Development of biomethane, in accordance with the criteria for promoting the circular economy’ of the NRRP (Mission 2, Component 2, Investment 1.4) aims to support investments for 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 NRRP of EUR 1,92 million. Biomethane injected into the natural gas grid is supported through capital support (up to 40 % of the costs incurred) and an operating incentive (incentive tariff applied to the net production of biomethane).

The incentives provided for in the Ministerial Decree of 15 September 2022 may be granted to newly built biomethane production plants, whether agricultural or waste, and to reconvert to biomethane (in whole or in part) existing agricultural electricity plants powered by biogas. Biomethane produced and fed into the natural gas grid may only be used in the transport sector or in the heat sector.

NONETHELESS, *SOBSTRUCTION OF DISTRICT HEATING*

In order to tap into the potential of district heating, the tools currently available will be enhanced to facilitate the new construction and expansion of urban heat distribution infrastructure, 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/upgrading of existing networks. The measure was implemented by means of Ministerial Decree No 263 of 30/06/2022 and Public Notice No 435 of 23/12/2023. By Directorial Decree No 435 of 23/12/2022 of the DGIE of MASE, 29 projects were approved, which will generate approximately 0,073 Mtoe/year under the scheme.

❖ **MEASURES FOR THE PROMOTION OF HYDROGEN**

NONETHELESS, *ITHE 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 gradual trajectory to accelerate the development of hydrogen over three strategic phases from 2020 to 2050 (40 GW, i.e. 10Mton to 2030 and 500 GW to 2050, i.e. a share of hydrogen in the European energy mix of up to 13-14 %). The importance of the hydrogen vector is also confirmed in the report on the strategy of 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, COM (2023) 156 proposes the establishment of the European Hydrogen Bank (EHB) to promote the deployment of hydrogen through four pillars, which should be operational by the end of 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 linked to the streamlining of existing financial instruments, coordinating them and with new public and private funding, both in the EU and internationally. In particular, as part of the EHB, it is envisaged to set up a European auction system that incentivises the ‘kg’ of hydrogen produced for 10 years of operation, 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.

From the point of view of the State aid and regulatory framework, the European framework is being consolidated: indeed, all State aid frameworks (CEEAG of February 2022, TFC Russia-Ukraine and GBER of March 2023) have established aid schemes related to the production and use of low-carbon and renewable hydrogen. At the same time, in June 2023 delegated acts implementing Directive (EU) 2018/2001 entered into force, i.e. the delegated act Renewable fuels of non-biological origin – RFNBO (Article 27(3) of the Directive) and the delegated act greenhouse gas – GHG (Article 28(5) of the Directive), which define the conditions for the recognition of renewable hydrogen and the methods for calculating the emission quota linked to its production.

Moreover, of significant importance is the European Hydrogen Backbone initiative bringing together 32 European energy infrastructure operators, with the aim of accelerating Europe’s decarbonisation path by defining the key role of hydrogen infrastructure. Five pan-European hydrogen supply and import corridors were defined in the EHB Report by 2030, linking industrial clusters, ports and Hydrogen Valleys to regions with abundant hydrogen production. The backbone through Italy will enable North Africa to connect to Central Europe via the Italian interconnection points Tarvisio and Passo Gries, contributing to the European import targets set by REPowerEU.

At national level, the Preliminary *Guidelines were published at the end of 2020: National Hydrogen Strategy*, which set itself as a very challenging objective, a 2 % penetration of the hydrogen carrier in final energy demand, i.e. the installation of 5 GW of electrolyzers and the production of around 0,7 Mton/year of renewable hydrogen. At the same time, two major regions of the Mezzogiorno, Sicily (January 2021) and Puglia (December 2022), published their own strategies for promoting hydrogen, with challenging targets for 2030. Under the NRP, more than EUR 3MLDEUR of investments and proposals for two reforms to promote the deployment of hydrogen have been allocated as described below.

Finally, we would point out the letter of political support that the Ministries of Energy of Austria, Germany and Italy signed 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 from Italy (Sicily as entry point) to Austria and Germany, which, according to some preliminary estimates, can meet around 40 % of the REPowerEU renewable hydrogen import target (4Mton/year).

Considering that much of the renewable energy produced domestically comes from intermittent and non-programmable sources, such as wind and photovoltaic, and that further exponential growth in

their installation is expected to take place in 2030 and 2050, hydrogen obtained through electrically powered electrolysis processes can make an important contribution to the future national energy system. In addition to this, hydrogen produced using technologies other than electrolysis, such as waste-to-hydrogen technology, which ensures more competitive production costs by valorising non-recyclable solid waste with a view to circularity.

As an energy carrier, in addition to ensuring the decarbonisation of the hard-to-abate (HTA) and transport sectors, hydrogen will be able to enable some additional functions such as large-scale and time-consuming accumulation and the transport of large amounts of energy over long distances, supporting the development of an energy system with high levels of resilience, security of supply and redundancy of infrastructure.

NONETHELESS, *THE POTENTIAL OF HARD TO-ABATE SECTORS*

HTA sectors play a key role in Italy's industrial fabric, generating 5 % of national gross value added³⁷. As regards the emission impact, HTA sectors, with 84 MtCO₂ eq, accounted for 20 % of total direct CO₂ emissions (scope 1) at national level by 2019. 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 product produced. For these sectors, however, waste heat recovery is a very effective priority action to be implemented to reduce emissions and consumption.

A sensitivity analysis (ENEA-Confindustria study), carried out on the assumption that 20 % of the natural gas currently used for thermal purposes would be replaced by renewable hydrogen, for the same heat output, indicates a potential national demand for hydrogen of around 0,24 Mton/year. This hydrogen demand would require an installed electrolysis power of 7,2 GWe (assuming approximately 2000 hours of operation and efficiency of 60 %). In detail, excluding the refining sector, which is the one with the highest consumption of hydrogen as process gas (feedstock), the paper sector is the sector with the highest consumption of hydrogen as service gas in thermal applications, with around 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 at 20 kt/year. Finally, if we also consider the potential for the transformation from grey to green or renewable hydrogen of what is currently produced and consumed as a feedstock (approximately 366 kt/year) in the refining, petrochemical and chemical industry, the targets set in the MISE Guidelines could be achieved by almost 87 %.

The deployment of hydrogen as a lever to decarbonise industrial sectors would lead to a decrease of the current CO₂ shares from 2 % to 8 % (2019). Overall, under these conditions, 3 % of the 84 Mton CO₂ emissions emitted (scope 1) by the industrial sector would be reduced with the related ETS allowance savings.

NONETHELESS, *OLITIC PROMOTION OF GREEN AND RENEWABLE HYDROGEN*

Italy plans to achieve the national targets by 2030 through the use of the following measures, in addition to further participation in European projects.

-Incentives *for production for the use of hydrogen*

The main policy to promote renewable hydrogen will be through the tariff mechanism provided for in Article 11 (2) of Legislative Decree No 199/2021; indeed, the measure will ensure that the operating costs of the hydrogen production facilities are covered, taking also adequate account of the investment costs. Provision for the definition of a specific decree, among other things, will also be included in the RepowerEU.

The necessary assessments, including against the State aid regulatory framework, will be carried out

³⁷ Source: Decarbonising Hard To Abate sectors, Boston Consulting Group 2021

in order to consider incentivising both the production of renewable hydrogen and the production of low-emission hydrogen, including technologies other than electrolytic. In view of, on the one hand, the absence of a reference price for hydrogen given the embryonic level of market development and, on the other hand, the low efficiency of the production process for RNFBO hydrogen, the high production cost and the need to predict an additional renewable electricity power over that already installed, the measure will be directly focused on promoting the use of hydrogen in the HTA sectors, and in transport. As mentioned above, the setting of the tariff must ensure that investment and operating costs, over a period of 10 years, are covered in relation to the fossil source that is switched to, depending on the case (e.g. gas oil, natural gas, grey hydrogen).

In addition, capital grants already granted under the NRRP should also be taken into account in relation to the investment costs. As regards operating costs, however, appropriate account must be taken of guarantees of origin and ETS allowances related to renewable hydrogen, as well as additional contributions on the exemption from system charges of renewable energy used under the Ministerial Decree of 21 September 2020. Finally, technically, the hydrogen produced will have to comply with the conditions of the RNFBO and GHG delegated acts. Also on the basis of expected costs, further coverage of the measure will be assessed in the context of gas bills and excise duties on diesel.

- *Environmental Permitting*

Under Decree-Law No 13/2023, measures have already been introduced to simplify the environmental permitting of hydrogen production facilities. In line with the provisions of Article 38 of Legislative Decree No 199/2021 on urban planning, it is envisaged to introduce further simplifications for small installations. Provision for the definition of a specific rule, inter alia, will also be included in the RepowerEU.

- *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 technological 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, storage and use ready for scaling-up and already developed at medium-high TRL (TRL 6-8, applied 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, expected to be applied in 3-10 years), and finally, the long-term objectives refer to research.

border able to provide “disruptive” solutions (TRL 1-4, application time frame > 10 years).

The main technological challenges to be addressed are:

- fundamental and applied research to foster innovations and new founding technologies;
- reduce the costs of technologies 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;
- increase the resilience of the energy system by creating decentralised economies based on green hydrogen.

With this in mind, the RepowerEU provides for the definition of a specific measure.

- ***Hydrogen as a renewable energy over-generation management***

The Regulatory Authority for Energy, Networks and Environment (ARERA) has set up a fund of EUR 35 million at the Cassa per i Servizi Energetici e Ambientali (CSEA), financed by part of the CrVI tariff component, intended to encourage pilot projects to optimise the management and innovative uses of infrastructure in the natural gas sector, 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 include: innovative solutions for the production and injection into the transport network of gas produced from renewable sources; power to gas/hydrogen and innovative uses of transport networks; input of biomethane and renewable gases into distribution networks; possible uses of natural gas distribution networks as a means of optimising 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 that may hinder the development of technological innovations, product innovations 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 approval of pilot projects for incentive treatment were submitted to the Authority with effect from 15 January 2023, with a deadline for submission on 15 April 2023.

- Project scope 1: methods and tools for optimised network management (max eligible contribution 5 MEUR);
- Project scope 2: innovative uses of existing infrastructure in relation to their capacity to accommodate so-called renewable gases, including hydrogen, P2x2P applications enabling the gas system to be connected to the electricity system (sector coupling) and carbon dioxide capture, sequestration and/or utilisation (CCS, CCU) activities (maximum eligible contribution EUR 5 million);
- Project scope 3: innovation measures on regulated infrastructure in the natural gas sector aimed at increasing energy efficiency (maximum eligible contribution EUR 2.5 million).

The final ranking will be published by 15 July 2023.

Projects will last three years, trials must be completed and documented by 31/12/2026.

NONETHELESS, *HYDROGEN IN THE NRRP*

Under the NRRP, particular importance was attributed to hydrogen with 6 investments activated, totalling EUR 3,64 million and 2 reforms. All the measures undertaken are summarised below.

- **Investment 3.1: Production in brownfield sites**

The purpose of the investment is to encourage (EUR 500 million) the implementation of at least 10 hydrogen production projects in brownfield 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 for the selection of proposals under the above-mentioned Investment, with a view to management by management; all regions and autonomous provinces submitted expressions of interest. In addition, Article 33 (3) (b) of Decree-Law No 152/2021 provided that the DARA should support the regions and autonomous provinces in drawing up, in line with the lines of the NRRP, projects of particular strategic importance known as *flag* projects. In the 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 flagged projects should also cover Investment 3.1 above and that a reservation should be made in this regard from NRRP resources. The Decree of 21 October 2022 laid down the general framework for implementing the investment in question, providing, inter alia, for EUR 450 million to be allocated to hydrogen production projects in brownfield industrial areas and EUR 50 million for flagged projects. While the latter are still in the process of being defined, by 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 own notices. From January onwards, all the Regions opened the contact points and carried out an evaluation of the completed projects in almost all the regions in April 2023. According to preliminary data for 18 out of 21 regions, more than 50 projects were accepted, almost fully saturating the total budget available, more than 120 MW of electrolysers and more than 260 MW of additional renewable installations were installed, with an estimated production of around 6-7.000 tonnes of renewable hydrogen per year.

- **Investment 3.2: Use of hydrogen in hard-to-abated sectors**

The Investment aims at incentivising (EUR 2 m) 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 laid down the general framework for implementing the investment in question, providing, inter alia, for EUR 1 million to be allocated to the project of DRI SpA, in accordance with Article 1 (1-quater) of Legislative Decree No 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, providing for a reserve for particularly virtuous projects, i.e. those involving the use of hydrogen in quantities exceeding 90 % of the fossil sources before intervention.

The measure was implemented through Public Notice No 254 of 15 March 2023. The Project Submission Window is currently still open and will be closed on 30 June 2023.

- **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 establishment of a network of hydrogen refuelling stations (HRS). In October 2022, the MIMS Decree setting out guidelines for the implementation of the testing of 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 implementation of at least 40 HRS for light and heavy duty vehicles by 30 June 2026, with the aim of approaching the targets set by the Alternative Fuels Infrastructure Regulation (AFIR), which provides for the construction of HRS, capable of serving all urban nodes and points every 200 km along the TEN-T core network.

2023 the MIT published the ranking list of projects for road hydrogen refuelling stations eligible for funding. There are 36 projects with a total funding of EUR 103 million, compared to EUR 230 million.

- **Investment 3.4: Hydrogen testing for rail transport**

In March 2023, the MIT approved Executive Decree No 144 of 31/3/2023 for the allocation of the resources provided for in the NRRP for the investment in question (EUR 300 million). EUR 276 million were allocated for the construction of renewable hydrogen production, storage and refuelling facilities and EUR 24 million for the purchase of hydrogen-powered trains. For hydrogen production and storage facilities, resources will be divided as follows: Lombardy Region, Ferrovienord S.p.A., Brescia-Iseo-Edolo line (EUR 97,2 million); Government Management Ferrovia Circumetnea, Circumetnea line (EUR 15,4 million); Campania Region, Ente Autonomo Volturno s.r.l., line SMCV Piedimonte (EUR 29 million); Puglia Region, Ferrovie del Sud Est and Servizi Automobilistici s.r.l., lines Lecce-Gallipoli, Novoli-Gagliano and Casarano-Gallipoli (EUR 13,4 million); Calabria Region, Ferrovie della Calabria, Cosenza-Catanzaro line (EUR 45,1 million); Autonomous Region of Sardinia, ARST Spa, lines Sassari-Alghero (EUR 30 million), Macomer-Nuoro (EUR 30,3 million) and Monserrato-Isili (EUR 14,4 million). As regards the purchase of rolling stock, the EUR 24 million intended for this purpose were allocated entirely to the Apulia Region, and through it to Ferrovie del Sud Est and Servizi Automobilistici s.r.l., for the lines Lecce-Gallipoli, Novoli-Gagliano and Casarano-Gallipoli.

- **Investment 3.5: Research and development on hydrogen**

Please refer to section 4.6.

- **Reform 3.1: Administrative simplification and reduction of regulatory barriers to hydrogen deployment**

The reform takes place on several lines of action, all aimed at supporting the deployment of green and renewable hydrogen as a new energy carrier. Planned activities are set out below.

- issuing technical safety standards on production, transmission (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 the Interior and the Ecological Transition. The provision was implemented by updating the Ministerial Decree of 18 May 2018;
- administrative simplification for the implementation of small green hydrogen production facilities. The measure was implemented through Article 38 of Legislative Decree No 199/2021;
- regulation of 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 hydrogen refuelling stations to be set up in motorway service areas, logistic warehouses, ports, etc. by means of an agreement between the MASE and the MIT to define the refuelling areas selected along the premises of the refuelling station for the construction of H2 corridors, starting from the regions of northern Italy to the Po Valley and the logistic 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.

electrolysis plants for the production of green hydrogen is not subject to payment of general charges relating to the electricity system. In order to implement the measure, Ministerial Decree No 347 of 21 September 2021 was adopted, which laid down the general criteria for the incentive mechanism, providing, inter alia, for ARERA to issue a decision setting out the technical implementing conditions and a subsequent decree establishing the aid scheme (Decision No 557/2022/R/EEL of 8 November 2022). On the other hand, the decree establishing the aid scheme will be implemented in the context of the decree establishing the hydrogen tariff mechanism described in the following paragraphs.

- **Investment 5.2: Hydrogen**

The purpose of the Investment is to encourage (EUR 0.45 m) the construction of production facilities with a total capacity of at least 1 GW/year. Ministerial Decree No 168 of 27 April 2022 laid down the general framework for implementing the investment in question, providing for the implementation of three lines of action:

- implementation of projects relating to the construction of industrial installations for the production of electrolysers under the IPCEI Fund (EUR 0,25 million);
- implementation of further projects relating to the construction of industrial installations for the production of electrolysers, in order to achieve the target set by the investment of 1 GW/year of production capacity as 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, in June 2022, two projects were selected by MASE for the construction of electrolyser plants with a total capacity of 800 MW per year to be achieved by June 2026. A plant for the production of PEM electrolysers 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 plant for the production of electrolysers with a capacity of 300 MW per year will be carried out by Ansaldo Energia in the Municipality of Genoa.

In comparison with the other two lines of action, the implementing decrees for the submission of project proposals will be published by the end of the year.

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 cooperation on RES with neighbouring countries (Malta, Croatia, Austria, Greece and France) could be based on the sharing of offshore development projects (offshore wind, tidal, wave) and the related maritime shipbuilding sector, the opening of support mechanisms, electricity interconnections, gas pipelines and natural gas supplies. As regards the statistical transfer on which discussions have been held, all the Member States have remained possible, as it will be a need to be assessed only in progress.

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 paragraph, the numerous measures planned to achieve the objectives are of

an economic nature and therefore provide for financial support, either in the form of incentive fees paid during the operation of the plant/intervention, as is typically the case in the electricity sector, or in the form of capital grants. With particular reference to the latter, we would point out that, as set out in detail in point above, some of the measures adopted provide for support from EU funds and in particular from NRRP resources. These include, for example, agrentaic measures, agressing park, support for biomethane, support for the deployment of DH 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 assessment of the effectiveness of support for renewable electricity and its main distributional effects on different categories of consumers and investments shall be carried out as part of the monitoring of the Plan.

For many years, Italy has been promoting the construction of renewable energy plants using various mechanisms. The main promotion tool in the electricity sector is the tariff incentives managed by GSE. Almost 1,45 million agreements with private and public entities were managed in 2021. These agreements support the operation of almost 1 million renewable installations, with a total capacity of around 38 GW. The encouraged renewable energy for these plants amounts to 65 TWh. The overall burden of the incentives for electricity generation amounts to EUR 10,6 million in 2021, with the largest contribution attributable to the photovoltaic source, amounting to EUR 5,9 million. The resources to finance these incentives are taken from electricity bills, in particular from the ASOS tariff component of system charges, which for a type of household (electricity consumption assumed to be 2.700 kWh) in 2021 resulted in an annual expenditure of around EUR 60 compared to an electricity bill of around EUR 630 (in previous years the system charges had a greater impact, up to around 20 %, but in 2021 measures were implemented to mitigate system charges, such as support to households in a context of high energy prices). These costs to the community correspond to a number of benefits, including an equivalent theoretical energy saving that can be calculated at around 11 Mtoe of fossil primary energy and theoretically avoided greenhouse gas emissions estimated at around 30 MtCO₂eq (to which an additional 5 MtCO₂eq avoided by assessing the whole life cycle of energy sources and technologies can be added). Economic and employment benefits should also be further included.

v. Specific measures aimed at introducing one or more contact points, streamlining administrative procedures, providing information and training and facilitating 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 further developed. These included the ongoing support for collective self-consumption and energy communities, which provides for an existing transitional incentive framework and an already planned update of support, partly through NRRP resources. The same paragraph also describes measures to promote long-term contracts (LTAs) mainly through tools to promote matching, aggregation and mitigation of contractual risks.

With regard to the authorisation procedures, a gradual process of simplification and streamlining has been undertaken in order to speed up the installation of installations for the production of energy

from renewable sources. Moreover, since the early 2000s, the geography of competences between the bodies involved has changed significantly, with the State and the Regions having shared powers over energy and environmental issues. The main procedural steps laid down by the legislation in force for the construction of renewable installations, differentiated according to size, technological characteristics and installation areas, are: the Single Authorisation, the Simplified Authorisation Procedure, the Certified Work Initiation Declaration and the Communication to the Municipality. Please refer to section 3.1.2.i for more details on the simplification of authorisation procedures and the identification of suitable areas.

With regard to training, Italy has already adopted a training standard for the installation and extraordinary maintenance of energy plants powered by renewable sources.

As regards information, portals providing information on national incentives for renewable sources, the costs and benefits of the systems have already been introduced. Information guides, tools and simulators are already available thanks to the sharing of the important knowledge and data available from the GSE, which is responsible for managing the main support mechanisms for renewable sources, and from ENEA (which is the 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 assessment report on the national potential for the application of high-efficiency cogeneration and efficient district heating, provided for in Article 14 of the EED and drawn up by the GSE in 2021, the technical potential for using efficient district heating is estimated at around 57 TWh (approximately 6 times the current levels of development). The economic and financial potential at the time of drafting the study was estimated at at least 21 TWh, slightly more than twice the current level of penetration, mainly concentrated in the northern regions of the country. With regard to renewable sources, the economic potential has been estimated at around 3.3 TWh, which would increase by more than 35 % compared to the 2018 figure (base year for the drafting of the study).

An important contribution to the development of efficient district heating systems will be provided by Component 3 – Measure 3 of Mission 2 of the NRRP, which finances projects relating to the construction of new networks or the extension of existing networks, in terms of supplied customers, including the installations for their supply, giving priority 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) are considered to have the potential to create an overall favourable framework 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:

- *biomass availability, including sustainable biomass: both domestic potential and imports from third countries*
- *other uses of biomass in other sectors (agriculture and forestry sectors); as well as measures for the sustainability of biomass production and use*

3.1.3 other size elements

1. National policies and measures affecting the ETS sector and assessment of the complementarity and impacts on the EU ETS, if applicable

For the sectors covered by the EU ETS, coal phase-out will contribute in particular, as well as a significant acceleration of renewables and energy efficiency in processing processes, including by capitalising on the possible contribution of CSS (secondary solid fuel) and by focusing on the development of alternative green fuels such as biomethane and hydrogen in end-use and energy uses, including hard-to-abate industrial sectors. The reduction of emissions from the ETS sector will also be ensured by the implementation of CO₂ capture, transport and storage.

Thanks to the above, a target of -62 % is achieved in the EU-ETS sector, in line with the overall EU target.

Below, among the policies and measures impacting, among other things, the ETS sectors, the coal phase-out and the *ecological* transition fund are described below, although the latter is also intended, to a lesser extent, for installations outside the scope of the ETS Directive.

- **PHASE OUT OF COAL**

The objectives set out in the INECP 2019

Italy made a commitment, already before 2019, to plan the phasing out of coal-fired electricity production by 2025. In the 2019 INECP, this objective was more precisely defined, in particular as regards the conditions necessary to achieve it. The phasing-out of coal was envisaged gradually through a first significant *step* in 2021, offset not only by a significant increase in production through renewable energy, but also by a plan for infrastructure measures in flexible generation, grid development and increased storage systems. The parallel implementation of the process of decommissioning the coal-fired groups and the development of the infrastructure referred to above was deemed essential in order to achieve the result without creating problems affecting the adequacy of the electricity system and, consequently, under conditions of complete safety for the national energy system.

Although the contribution of thermoelectric generation from coal 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 cost-effectiveness of supplies. 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 portions 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 an increase in frequency variations (in terms of magnitude and speed of disruption) that need to be mitigated by services characterised by extremely rapid response times;
- the maintenance of appropriate short circuit power levels in the network nodes, which is essential to contain the severity of the voltage holes and to ensure the proper functioning of the protection systems and HVDC links.

An initial identification of the infrastructure works necessary to be able to carry out the *phase out* of coal was carried out by Terna, on the basis of established methods of analysis, and is contained

in the National Energy Strategy (SEN) 2017. In the 2019 INECP, 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 set out in greater detail, namely:

- new gas capacity for around 3 GW, of which about 50 % is mainly related to *the phase out*, in line 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 safe operation (already authorised and under construction);
- new Adriatic backbone for at least 1 GW of transport capacity;
- installation of at least 3.000 MVARs of new synchronous compensators, particularly in the south and centre-south, in order to meet the resulting needs for voltage regulation sources;
- in connection with the *phase out* of coal in Sardinia, the construction of the new Sardegna-Sicilia-Continente electricity interconnection (section Sardegna-Sicilia still to be authorised), together with new gas generating capacity or storage capacity of 400 MW located on the island, and the installation of compensators for at least 250 MVAR.

The creation of the new gas-fired generation capacity and the necessary storage systems would have been facilitated through *capacity market*, since the price signals on the spot markets were not such as to support the realisation of the new investments. The mechanism, operated by TSO Terna, should have encouraged both the realisation 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 that led to the framework described in the previous paragraph have changed profoundly over the last 2-3 years due to the criticisms of the COVID-19 Pandemic and the conflict in Ukraine, which have made it essential to adopt new funding instruments at European level (NRRPs and Repower EU) and to share the new and most challenging objectives of the FF55 package. These events, together with the occurrence of adverse climatic conditions such as prolonged summer heat waves and exceptional droughts, have forced to reassess the security conditions of the national energy system, making it indispensable to increase the levels of system resilience.

The energy system was therefore confronted with a heavy gas emergency, driven by the conflict in Ukraine and exacerbated by sudden increases in raw material and, as a result, electricity prices. 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 this regard, the Minister for the Environment and Energy Security has asked Terna to prepare and implement a dedicated programme, the recent renewal of which sets out the objective of achieving a saving of 1,8 bcm of gas between September 2022 and March 2023.

The events described above have had significant repercussions on the objectives set out in the 2019 INECP, with particular reference to the *phase out* of coal. It is therefore essential to verify in detail what has been achieved against the enabling objectives set out in the 2019 INECP and the additional measures introduced to address the problems that have arisen subsequently, in order to assess the sustainability of the objective for the security of the system.

With regard to the concrete results of the initiatives serving the objectives of the 2019 INECP, we would point out the following:

- 27 authorised electrochemical storage facilities for an overall power of approximately 1.400 MW – only a share of 240 MW (3 yards) has started;
- 4 hydroelectric pumping plants under authorisation 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 realised;
- 14 initiatives authorised for thermoelectric installations (upgrading or replacing existing turbines or the production of gas-fired thermal power units), 5 of which constitute new power stations with a total capacity of approximately 3.500 MW, 6 of which constitute upgrades for an additional capacity of approximately 510 MW and 3 concern modernisation or refurbishment without any increase in power – almost all of the activities have started, so that the authorised additional capacity of around 4.000 MW is planned to enter into operation gradually between 2023 and 2026.

With regard to the decommissioning of the coal-fired power stations, in addition to the decommissioning of the Gualdo Cattaneo – Bastardo plant (PG) (75 MW), the conversion of the La Marmora (70 MW) plant (BS) and group BS2 of the Federico II power plant in Brindisi (660 MW), the definitive take-over of groups 1 and 2 of the ENEL plant in Fusina (VE), totalling 336 MW, and the ENEL power plant in La Spezia, with a capacity of 600 MW. These sections are already out of service.

The phase out of the other coal-fired plants (Civitavecchia, Brindisi, Monfalcone, Sulcis and Fiumesanto), totalling 5.500 MW, including 1.000 MW in Sardinia, faces some difficulties as a result of the geopolitical crisis caused by the war in Ukraine, since, as stated above, for security reasons it was necessary to maximise conventional non-gas-fired generation.

Apart from the maximisation aspects, the actions already put in place and planned would still be appropriate to allow phase-out for coal-fired power plants still in operation on the mainland. In this respect, the table below shows the coal capacity that could be phased out on the Continent in the coming years.

Table 31 Decommissioning of coal capacity

Month/year	Capacity enabled to divest (MW)	Technical constraints on decommissioning
April 2024	1.480	Entry into service of the capacity of contractualised generation and accumulation CM auctions
April 2025	1.210	
January 2026	1.845	

For Sardinia, on the other hand, the development of RES, accumulating and new interconnections with the Continente (Tyrrhenian link, SACOI 3) is essential for the abandonment of coal in electricity production (a total of around 1.000 MW) and there are difficulties in achieving this target by 2025; it is therefore realistic, as stated above, to start the phase-out in the island in 2025 and complete the process in 2028. The table for Sardinia is set out below in the light of the considerations made.

Table 32 Demission of coal capacity in Sardinia

Month/year	Capacities enabled to decommission (MW)	Technical constraints on decommissioning
April 2025	445	Entry into service of contracted storage capacity in Sardinia for CM 2024 auctions
January 2028	250	Entry into operation of the first West Tyrrhenian Link cable

January 2029	265	Completion of Tyrrhenian Link link
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With regard to the new measures implemented in the period 2019-2023, in view of the average planning and authorisation times for the works, priority was given to speeding up the authorisation procedures in order to achieve the objectives and stimulate acceptance of the results by all the authorities involved. 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 plants and a simplified procedure for making minor changes to existing thermoelectric installations, with particular reference to amendments aimed at increasing their efficiency and reducing their environmental impact.

The provisions of Legislative Decree 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 initial measures to strengthen administrative structures and speed up and streamline procedures’, which provided for significant simplification of the environmental assessment procedures, providing for the exclusion of stand-alone accumulations required to provide flexibility services for the national electricity grid.

Also with regard to authorisation procedures, Law No 34/2022 laid down the procedures for authorising 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 obtaining the appropriate water concessions. More recently, with the conversion into law of the DL PNRR (Law No 41/2023), new rules were introduced for the authorisation of electrochemical accumulations, providing for a single State procedure for which MASE is responsible pursuant to Article 12 of Legislative Decree No 387/2003, for a maximum duration of 60 days, without the need to acquire the regional agreement.

As regards the instruments aimed at stimulating new investment in the sector, *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 arrangements. During 2021, in line with the criteria and methodologies laid down in Regulation (EU) No 943/2019, the new rules for the mechanism were also approved by Decree No 439 of the Minister for the Ecological Transition of 28 October 2021, with new auctions being held in early 2022. Through this mechanism, Terna supplied a total of new capacity of³⁶ just under 5 GW in the *auction capacity market 2024*, of which just under 3 GW of new gas capacity.

Overall, the power quota contracted in all *capacity market auctions* is appropriate to ensure the possibility of proceeding with phase out, throughout the national territory, should it be authorised and completed on time.

As things stand, therefore, in relation to the framework set out in the 2019 INECP, as part of the overall measures (new generation of RES, accumulations, networks, flexible generation and other network works) to be carried out for target 2030, it will be essential, in order to secure the phase-out scenario from coal, that the following enabling conditions are met:

- An increase in electricity demand in line with Terna’s current forecasts, as set out in the joint Terna Snam scenario document, in the absence of any significant increase that is currently unforeseeable;

³⁶ the new capacity involves both the construction of new plants and the upgrading of existing installations.

- increasing RES in line with the 2030 objectives described in paragraph 3.1.2;
- a development of the accumulations in line with the 2030 objectives described in paragraph (3.2);
- operating revenues of power generating modules selected under *capacity market* (2022 auctions, 2023 auctions 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 force of the measures to upgrade and strengthen the electricity grid as provided for in the RTN development and safety plans, in particular with regard to interconnections with the major

islands.

- the lack of decommissioning of gas generating facilities currently in operation (e.g. for reasons of viability);
- the absence of significant reductions in the availability of imports, in particular from the North border (e.g. widespread issues of unavailability of French nuclear capacity).

In any case, the availability of coal plants to be permanently out of service will be confirmed close to the months indicated in the tables on the basis of the actual occurrence of the assumptions described above, with particular reference to the state of adequacy of the electricity system.

- **INDUSTRIAL ENERGY TRANSITION FUND**

The fund known as the ‘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 by Law No 128 of 2 November 2019, shall be financed in accordance with Article 23 (8) of Legislative Decree No 47 of 9 June 2020, in compliance with European legislation on State aid and the rules on greenhouse gas emission allowance trading (ETS).

Specifically, the annual share of the proceeds from the auctioning of EU ETS allowances, exceeding the value of EUR 1.000 million, shall be allocated, up to a maximum of EUR 100 million for 2020 and EUR 150 million annually from 2021 onwards, to the Energy Transition Fund in the industrial sector, with a share of up to EUR 10 million allocated to financing 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, i.e. aid to compensate for indirect costs related to greenhouse gas emissions passed on in electricity prices incurred by certain undertakings in sectors and subsectors deemed to be exposed to a significant risk of carbon leakage.

‘Carbon leakage’ refers to an increased global greenhouse gas emissions scenario in which companies relocate production outside the European Union because they cannot pass on the cost increase caused by the EU ETS to their customers without losing a significant 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.

Therefore, by 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, Article 29 (2) of Legislative Decree No 47 of 9 June 2020 was implemented by laying down criteria, conditions and procedures for the use of the Fund’s resources for the compensation of indirect emission costs and pursuing three specific objectives: minimise the risk of carbon leakage of

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carbon dioxide, maintain the EU ETS objective of achieving 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 in electricity prices.

1. Policies and measures to achieve other national objectives, where appropriate

- **ADAPTATION TO CLIMATE CHANGE**

The National Strategy for Adaptation to Climate Change, adopted in 2015, set out a national picture of the impacts of climate change on environmental resources, processes and socio-economic systems in Italy and developed a national vision of the ways to be taken to address them. In implementation of the Strategy, the

National Plan for Adaptation to Climate Change (NECP) was launched, which is currently subject to the Strategic Environmental Assessment procedure. In April 2023, the public consultation phase on the draft Plan and the Environmental Report was completed. At the end of the procedure, the appropriate revisions to the Plan on the basis of the comments received are expected to be formally approved by Ministerial Decree.

The NECP provides the basis for short and long-term action, with two levels of intervention: one 'systemic', the other one under 'address'. On a systemic level, the NECP aims to build an organisational environment focused on the governance system and knowledge development. Guidance, in particular to the regional and local level, shall be carried out by means of a reference framework within which the planning and implementation of adaptation actions can be developed. First, a comprehensive framework of possible adaptation options, consisting of sectoral measures, will be implemented in the sectoral and cross-sectoral plans in the modalities that will be identified by the governance structure. In addition, two guidance documents for the definition of regional and local climate change adaptation strategies/plans are attached to the NECP.

Following the approval of the NECP, a phase will be opened to ensure that the Plan is immediately operational by launching the actions. This phase, which will be managed by the governance structure, is aimed at planning and implementing adaptation actions in the different sectors, through the definition of priorities, roles, responsibilities and funding sources/instruments, and also through the removal of barriers to adaptation consisting of both lack of access to viable solutions and regulatory/regulatory/procedural obstacles. The results of this activity will converge into sectoral or cross-sectoral plans, outlining the actions to be implemented.

In parallel to the activities aimed at approving the NECP and making it fully operational, initiatives on adaptation have been introduced to combat certain climatic phenomena already taking place in Italy.

In 2021, the 'experimental programme of measures to adapt to climate change in the urban context' was established, 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 drought.

This is the first initiative to set these objectives at national level, aimed at municipalities with a population of more than 60.000 inhabitants, aimed at supporting local planning for climate change adaptation and testing of measures to be implemented in urban areas to reduce the vulnerability of cities to the impacts of climate change that is ongoing and expected.

In particular, the programme allocates around EUR 80 million to green, blue and grey measures, as well as soft measures.

The following measures were financed:

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- urban green spaces and peri-urban reforestation;
- flooring or shading structures using reflective/low heat absorption materials;
- green roofs and walls, vertical woods, hollow shading barriers, insulation systems and natural ventilation of public buildings;
- systems for collecting and accumulating rainwater and reclaimed waste water, aiming at recycling for non-human uses;
- pedestrian areas, parking areas, squares, with removal of existing flooring and restoration of soil permeability;
- sustainable urban drainage solutions, such as multifunctional spaces or storm water collection and run-off facilities.

In addition, measures to improve knowledge and foresight capacity at local level, as well as the drafting of municipal adaptation planning tools, awareness-raising measures, training and participation at local level, are funded.

Some of the structural interventions financed by the Programme directly address the decarbonisation dimension. On the other hand, by affecting the energy efficiency of public buildings and the management of water resources, others also affect the dimensions of energy efficiency and energy 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. The interventions are expected to be completed by the end of 2024, after which their effectiveness can be assessed through the use of appropriate

indicators.

With regard to the management of water resources, with a view also to ensuring the resilience of the energy system to the increasingly frequent phenomena of scarcity of resources, the framework of the possible measures identified in the draft NECP includes, for example, measures aimed at rationalising water consumption, optimising demand management, reducing losses in distribution networks, upgrading water courses to maintain viable run-off and ecological quality in situations of variations in future thermo-rainfall systems. As regards the protection of biodiversity, it is addressed across the board in the draft NECP, as there is a framework of possible measures to protect biodiversity, in particular in the following areas: marine environments, terrestrial ecosystems, forests, soil and land.

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 the other objectives of the Plan.

As outlined in Cap 2 and Cap 4, the transport sector remains crucial for the achievement of the new and more ambitious ESR target. With this in mind, it will be necessary to identify and promote additional measures to reduce demand for mobility through modal shift of people and goods and the development of the necessary infrastructure, and to promote greater uptake of alternative modes of transport. Moreover, looking ahead, a role in driving 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 that will also cover the transport sector: the cap and trade mechanism will complement, from 2027, identified national policies and measures.

It should be noted that the issue of “biofuels” is dealt with in section 3.1.2, and that the financing of low-emission vehicles and modal shift of goods has been dealt with in more detail in section 3.2 in the context of the description of energy efficiency policies.

❖ **LOW-EMISSION MOBILITY AND INFRASTRUCTURE UPGRADING**

NONETHELESS, RVEHICLE FLEET INNOVATION

- ***Ecobonus vehicles***

The Government intends to promote a progressive reduction of diesel and petrol vehicles in order to reduce pollutant emissions and achieve the objectives of the Paris Agreement on climate change. To this end, a number of financing measures have been put in place to promote low-emission vehicles (see section 3.2 for details).

The 2020 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 2020 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 aim of the measure is to speed up the provisions of Article 18 (10) of Legislative Decree No 257/2016 (transposing the DAFI Directive) by providing that public administrations, bodies and institutions which are dependent on or controlled by them, the Regions, local authorities and operators of public utilities for the activities carried out in the provinces with high particulate matter_{PM 10} pollution, when replacing the respective fleet of cars, buses and utilities, including those for the collection of municipal waste, are required to purchase at least 30 % by 2022, 50 % by 2025 and 85 % by 2030 of electric vehicles and hybrid vehicles with external charging, methane and hydrogen, and electric or methane in the case of buses.

- ***Renewal of goods vehicles***

With a view to promoting the development of commercial vehicles powered by alternative fuels, Ministerial Decree No 221/2018 of the Minister for Infrastructure provided for incentives for 2018 for the purchase of commercial vehicles with alternative gas engines intended for the transport of goods with a total laden mass of 3,5 tonnes or more with an alternative drive system using CNG, liquefied natural gas (LNG) and electricity (full electric).

To this end, resources of around EUR 33,6 million have been allocated to initiatives for the implementation of capital investment projects for the renewal of the truck fleet of road haulage companies.

Nonetheless *fiscal measures*

The 2020 Budget Law tightens, from July 2020, the taxation of the ancillary benefit on the most polluting and newly registered company cars. The ancillary benefit decreases to 25 % for company cars with CO₂ emissions of less than 60 g/km; it remains at 30 % for those with emissions above 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 by Law No 157 of 19 December 2019 ('the 2020 tax decree'), extends the application of the super-reduced VAT rate to 4 % to the supply of hybrid and electric motor vehicles to persons with reduced or prevented permanent motor skills, to blind persons, to deaf persons and to members of their families, and to the costs of services provided by workshops to adapt these vehicles to the needs of drivers. Provision is also made for exemption from the registration tax, the provincial surcharge to the registration tax and registration duty on translating or declaratory documents.

NONETHELESS, *POTENZATION OF THE INFRASTRUCTURE*

As regards infrastructure upgrades, 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 ensure the availability of an appropriate number of publicly accessible recharging and refuelling points, in particular also to enable the free movement of alternative fuel vehicles and vessels across borders 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 electro-mobility, in particular:

- measures to facilitate the deployment of recharging infrastructure in new buildings (Article 15 (1) and (2)).
- measures to facilitate the deployment of charging infrastructure for electric vehicles;
- simplification of building permits by uniquely identifying declarations, certificates, certifications and technical documents to be submitted for the authorisation application necessary for the installation of charging infrastructure (Article 15 (4));
- introduction of an obligation for public authorities, bodies and institutions under their control, the Regions, local authorities and the operators of public utilities controlled by them, when replacing their respective fleets of cars, buses and municipal waste collection vehicles, to purchase at least 25 % CNG vehicles, 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 establishment of uniform positions in terms of regulating parking, access to internal areas of cities, measures to encourage and harmonise common measures and objectives in Italy concerning charging infrastructure networks for electricity-powered vehicles (Article 17 (2));
- measures to stimulate the installation of alternative fuels infrastructure in new and renewed fuel distribution facilities (Article 18).

In Italy, there has been a steady increase in new charging infrastructure for a number of years (around 41.000

in March 2023). However, the numbers are still unable to meet the charging needs expected in the coming years (around 183.467 pure electric cars in circulation in Italy on 31 March 2023) with full electric registrations, which are expected to grow very strongly in the coming years.

In this context, and in parallel with the work on defining 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, have been implemented in order to incentivise the deployment of charging infrastructure for fast and ultra-fast electric vehicles, also supporting the transition of the distribution network for traditional fuels, advanced biofuels and sustainable biofuels and with the ultimate aim of establishing a uniformly distributed charging network throughout Italy. The decrees, implementing Article 14 (1) (g) of Legislative Decree No 199 of 8 November 2021, lay down criteria and procedures for the grant of the above-mentioned non-repayable benefits, in order to set up – in accordance with the milestones provided for in the NRRP for the measure in question – at least 7.500super fast charging stations for electric vehicles on non-urban roads (excluding motorways) and at least 13.755 fast charging stations in urban centres. A total of EUR 359.943.750 is allocated on express roads.

spread over the three-year period 2023-2025. As regards the installations of new colonines in urban centres, the resources allocated are also EUR 353.159.625 over the three-year period 2023-2025.

In addition to the NRRP measure, which focuses on the creation of a public charging network spread evenly across Italy, a measure for private charging was also adopted in order to promote the deployment of electric recharging points for motor vehicles by paying the contribution provided for in Law No 126 of 13 October 2020 establishing a EUR 90 million fund for private entities identified by the law itself in companies of all sizes and operating in all sectors, and in natural persons operating in the arts and professions.

The Single National Platform (PUN) was also followed up by Decree No 106 of 16/03/2023 concerning the procedures for the operation of the Single National Platform of charging points for electric vehicles.

The PUN 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 budget of which was provided for in Article 45 (3) of Legislative Decree No 199 of 8 November 2021, makes it possible to carry out a survey of publicly accessible charging infrastructure, connected recharging points and their operators (CPO – 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 uptake of electric vehicles in the country and the development of a market for charging services linked to it, and for the effective planning of measures and public and private investment.

The PUN defines a 'single' national access point through which the data managed therein are made accessible for use by end-users. The PUN provides, in particular, the following basic services:

- info-mobility services for end users of electric vehicles (such as, but not limited to, geolocation of publicly accessible charging infrastructure, technical characteristics of their charging devices, as well as data on the operational status, availability for delivery of the charging service and the ad hoc prices applied therein);
- services to support economic operators;
- spatial planning and governance support services for local and regional authorities, which are useful for planning the installation, construction and operation of publicly accessible charging infrastructure.

Evolutionary lines

The EU RED III Directive, currently in the process of being approved, also provides for the introduction of a mandatory credit mechanism for renewable energy injected into transport via public charging similar to that already implemented for biofuels and biomethane (allowing Member States to extend this mechanism also to private charging, without prejudice to the ability to demonstrate that the 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 widespread 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 integrates in particular:

- regulations setting CO₂ emission performance standards for new passenger cars and new light commercial vehicles, as well as for heavy-duty vehicles;

- the legislative proposal for setting new CO₂ emission performance standards for new^{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.

The above-mentioned 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 aviation (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); these instruments 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.

❖ **MEASURES TO REDUCE DEMAND FOR MOBILITY**

In the context of activities aimed at reducing GHG emissions, incentives should be given to shift transport from private to public transport through modal shift, to soft mobility and to provide tools for mobility planning.

NONETHELESS, *MTOTALLY FOR THE PROMOTION OF MODAL SHIFT*

The *strengthening of 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 (2017 Budget Law) is to renew the LPT bus fleet by purchasing alternatively powered buses (electricity, hydrogen, methane) and the associated infrastructure network (e.g. vehicle charging facilities) so as to allow, over time, the complete replacement of vehicles currently in circulation, now at the limit of their useful life, by vehicles with a low environmental impact.

A total State allocation of EUR 3,885 billion over the period from 2019 to 2033 has been foreseen for this purpose. The resources are allocated in 3 five-year periods starting in 2019, with different ranking lists, respectively, to allocate contributions.

In addition, the 3 Directorial Decrees were issued concerning the methods of disbursement, reporting and monitoring of resources.

Table 33 Summary of measures for the delivery, reporting and monitoring of resources for strengthening LPT

Beneficiary institution	Of the period	Resources	Interministerial Decree allocating resources	DD 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
City with high pollution 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
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The National Sustainable Mobility Plan also provides for funding of EUR 100 million to support the competitiveness of companies in the public road transport sector, with a view to moving towards more modern and sustainable forms of production, with particular reference to research and development of alternative fuel methods to diesel. An additional EUR 250 million has been added with NRRP funds 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 related supporting infrastructure for a total amount of EUR 2.415 million, of which EUR 1.915 million from the NRRP and EUR 500 million under the legislation in force.

- *Progressive ban on the use of more polluting buses*

The renewal of the bus fleet was also favoured by Article 1 (232) of Law No 190 of 23.12.2014, which prohibited the use of motor vehicles in categories M2 and M3 fuelled with petrol or diesel with anti-pollution characteristics Euro 0 throughout the national territory as from 1.1.2019.

Evolutionary lines

Article 4 (3-bis) of Decree-Law No 121 of 10 September 2021 (and subsequent amendment of the Milleproroghe Decree) provided that buses used for local public transport services fuelled with petrol or diesel of the oldest emission classes should be phased out and, therefore, as of 30 June 2022, EUR 1 and, as of 1 January 2024, Euro 2 and EUR 3 petrol or diesel buses may no longer circulate. This ban resulted in a significant lowering of the average age between 2022 and 2023, from 10,41 years in 2022 to 9,73 years in 2023.

Nonetheless  *the Sustainable Mobility Fund*

Established by the Budget Law for 2022 (the allocation of funding was carried out by means of DI No 347 of 21/10/2022 and the 2023 budget law for an amount of approximately EUR 1,9 million for the period 2023-2034), the Fund, intended to support the ecological transition of the transport sector, and thus contribute to the achievement of the emission reduction targets set out in the European Commission's 'Fit for 55' package, will finance the renewal of buses.

green, 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 transformation of airports and the renewal of road transport vehicles. 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.

Nevertheless, *rapid mass transport* ◀◻▶◆♣○▶

The strategy to support local public transport plays a major role in the rapid mass transport, which involves high-capacity power systems (metro, tramways, trolleybuses and similar systems). In the light of these requirements, a significant funding programme was launched from 2017 onwards (the 2017 Budget Law provided for the establishment of the investment fund). The MIT is managing resources in the sector for some EUR 14 m, to which additional NRRP funds of EUR 2.2 m are to be added, with 240 km of network equipped for mass rapid transport infrastructure.

Evolutionary lines

In 2022, additional State resources (DI MIT-MEF 97/2022 and Ministerial Decree MIT 409/2022) for the extension and upgrading of the metropolitan network and rapid mass transport, amounting to EUR 4,8 million, were allocated in order to further promote mass rapid transport. The measures financed in 2022 (by means of the aforementioned decrees) will provide infrastructure for rapid mass transport of approximately 50 km, including 40 km of metro and 10 of tramway lines, plus two cableway installations for a length of approximately 4 km.

❖ **RAIL TRANSPORT**

In the context of rail transport, over the last few years the MIT has provided 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 % gives a total of EUR 1 million.
- FSC funds 2014-2020 Development and Cohesion Plan (PSC) – MIMS – Axis F: EUR 775 million of State funding. In this case too, co-financing by the Regions of at least 40 % of the total cost of supplies is provided for (guaranteed 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 regions of the Mezzogiorno (Table 2.B).
- FSC funds 2014-2020 Development and Cohesion Plan (PSC) – MIMS-Axis C: EUR 158,70 million of investment for the enhancement of mass rapid transport in transport in urban and metropolitan areas.
- Ministerial Decree No 164 of 21/04/2021: EUR 169,5 million of State funding from 2021 to 2033.

In addition, as part of the Plan Complementary to the NRRP, an action programme for the upgrading of railway lines and the simultaneous upgrading and/or renewal of the rolling stock was financed for an amount of EUR 1.550 million, of which EUR 278,41 million was intended for the renewal of the rail rolling stock. The resources were allocated by Ministerial Decree No 363 of 23/09/2021.

Lastly, Ministerial Decree No 319 of 09/08/2021 allocated resources for the purchase of electric or hydrogen trains to the regions and autonomous provinces of Trento and Bolzano, 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 will have to 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 maritime and rail freight transport by limiting road use to the “last mile” is a necessary measure to achieve the emissions targets for the ESR target. To date, the ‘Marebonus’ and ‘Ferrobonus’ measures are the modal shift measures. It should be noted that these measures are dealt with in detail in paragraph 3.2.

- **SOFT MOBILITY MEASURES**

In order to reduce emissions from private mobility, given the ambitious and challenging ESR targets, and the important emission contribution of the transport sector, a number of additional measures to promote soft mobility will need to be identified in order to achieve the ESR target. It will be necessary to promote investments aimed at:

- development of cycling mobility through cycle paths;
- promote shared mobility (bikes, low- or zero-emission car and motorcycle sharing);
- integration between sustainable mobility services (e.g. parking facilities for cycles or services car and bike sharing near public transport stops) and interchange parking facilities;
 - Promotion of smart working tools and reduction of working days for equal hours worked;
 - Promotion of carpooling;
 - Development of ITS (traffic management, infomobility, smart roads);

In this connection, it should be noted that the national system of tourist cycloways was financed through the 2016 and 2017 Budget Laws with national resources totalling EUR 372 million from 2016 to 2024 and that the 2 019 Budget Law established the Interurban Cycling Road Fund with a budget 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 extend the urban and metropolitan cycling network in order to meet mobility requirements while promoting the restriction of the use of private motorised vehicles and the overcrowding of public transport. For these purposes, funding of approximately EUR 137 million is foreseen for the design and implementation of cyclings and measures relating to the safety of urban cycling. On a trial basis, around EUR 4 million was earmarked for the immediate construction of cycle paths linking universities with the main railway stations, in order to encourage ‘soft’ transport modes of last mile (Ministerial Decree No 73 of 16/03/2021).

With the NRRP funds, Decree No 509 of 15/12/2021 was issued, allocating the resources allocated to municipalities of more than 50.000 inhabitants which are universities, totalling EUR 200 million, of which EUR 150 million was from NRRP funds and EUR 50 million from projects under existing legislation, to strengthen cycling mobility in urban and metropolitan areas. The measure provides for the construction of around 565 km of urban and metropolitan cycle paths by the second half of 2026.

We would also point out the following measures for MASE:

- Experimental programme between home and school at work

By Decree No 208 of 20 July 2016 of the Minister for the Environment and the Protection of Natural Resources and the Sea, the national experimental programme for sustainable home-school and work-based mobility was established, which co-finances the implementation of projects prepared by local authorities, including in an associated form, relating to a territorial area with a population of more than 100.000 inhabitants, aimed at encouraging alternative urban mobility initiatives to private cars, with a view to reducing traffic, pollution and parking of vehicles near educational establishments and workplaces. The total number of projects eligible for co-financing is 80, with a total value of approximately EUR 164 million.

— Sustainable Urban Mobility Programme

The Sustainable Urban Mobility Incentivation Programme (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 19 February 2020 of the Directorate-General for Climate, Energy and Air, is being implemented. The aim of the programme, which is aimed at municipalities with a population of at least 50.000 inhabitants, is to reduce road traffic through the creation of new cycling routes for urban commuting between home and school and work, 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 school 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, aimed at municipalities with a population of more than 50.000 inhabitants concerned by EU infringement procedures No 2014/2147 and/or No 2015/2043 for failure by Italy to comply with the obligations laid down in 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 to micro and small enterprises engaged in urban last mile freight transport 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-bike and cargo-bike assisted cargo, up to a maximum annual amount of EUR 2,000 for each beneficiary undertaking.

Evolutionary lines

MIT MEF Decree No 417 of 28/12/2022 provided for the measure 'Promotion of modal shipping and intermodality'. The resources are allocated to the regions for the financing of projects related to sharing mobility services. The resources amount to approximately EUR 45,5 million for the three-year period 2022-2024, broken down as follows:

Table 34 Allocation of resources

Year	Resources (EUR)
2022	14.923.662
2023	15.223.662
2024	15.223.662

The eligible projects are exclusively sharing mobility services, mainly electrically or muscle, complementary to local public transport services.

regional, 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 extent of the coverage area of vehicle sharing services already activated;
- Carpooling services as a measure of corporate or institutional mobility management;
- Demand Responsive Transit services;
- Other services complementary to and incentivising shared and innovative mobility services.

❖ **MOBILITY PLANNING**

‘SUMP’: PIANI URBANI FOR MOBILITÀ SOSTENIBILE

By Ministerial Decree No 444/21, the adoption of SUMP became a prerequisite since January 2023 for access to funding for both the Massa Report and Cycling. Throughout 2022, the adoption of SUMP was a reward for the possible distribution of resources relating to Massa Report Transport and cycling routes. The TPL Policy Observatory platform has become the monitoring and verification system of SUMP adoption by local authorities.

In addition to the MIT, the MITE, the MEF, the MISE, the Ministry of Tourism, the ANCI and the Regions are part of the Interministerial Technical Committee for Monitoring, as provided for in Article 4 (4) of Ministerial Decree No 397/2017, and is currently monitoring the drafting and evaluation of SUMP.

Evolutionary lines

A SUMP Vademecum has been prepared to assist the bodies in drafting/updating SUMP. This document, which describes in more detail the procedural steps needed to draw up SUMP, in accordance with the Italian and European guidelines, was sent to all members of the table as early as July 2022 to take any comments and/or additions. In September 2022, the Vademecum was shared with the PUMS Technical Table at the meeting of 27/09/2022 and then published on the Ministry’s institutional website.

NONETHELESS, LAND GUIDELINES ON BICI PLAN

In accordance with Article 6 of Law No 2 of 11 January 2018 laying down 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 cycling plans, called ‘Biciplan’, such as SUMP sector plans. The guidelines, drawn up by the working group made up of representatives of the DG for Fixed Facilities Transport Systems and Local Public Transport, the Technical Structure for Mission, the ANCI and the Italian Association for Traffic and Transport Engineering (AIIT), published in October 2020 on the MIT website, are intended to provide useful guidance and guidance for the drafting of the Biciplans, including for local authorities of all sizes wishing to equip themselves with such a tool.

These guidelines were incorporated, at least in part, into the general cycling plan approved in August 2022.

NONETHELESS, GUIDELINES FOR THE DRAFTING AND IMPLEMENTATION OF THEIR FOR COMMUTING BETWEEN HOME AND WORK (PSCL)

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 reducing individual journeys using private vehicles.

The PSCLs also aim at a more efficient distribution of users of local public transport, coordination between the start and end times of economic, work and local, urban and suburban public transport services.

NONETHELESS, *TAVOLO TECNICO SUL MOBILITY MANAGEMENT*

The technical working group on mobility management, set up at the Ministry of Infrastructure and Sustainable Mobility by Decree No 231 of 22 July 2022, which includes, in addition to the MIT, the MITE, ANCI, representatives of metropolitan cities and large and medium-sized cities, has as one of its tasks:

- consolidating the network of area mobility managers;
- propose possible amendments to Interministerial Decree n.179/2021 or indications for new legislative proposals;
- propose analyses and studies on mobility management activities at urban and metropolitan level;
- support the role of the area mobility manager in defining and implementing sustainable local mobility policies.

- THE MARITIME SECTOR

The maritime sector, which is vital for the movement of goods in the world, has been estimated to account for around 3 % of total GHG emissions. The strategy for the reduction of climate-changing gases from the maritime sector adopted in 2018 by the International Maritime Organisation (IMO), the United Nations Specialised Maritime Transport Agency (IMO), is currently under review on this issue and aimed at achieving an emission level of 50 % compared to 2008 emissions.

The new strategy to be adopted during the eightieth session of the Marine Environment Protection Committee (MEPC, the IMO's political body responsible for approving legislation in an environmental manner), which will take place from 3 to 7 July 2023 at the IMO, will entail the adoption of even more ambitious and challenging targets, aiming at reaching in 2050 a value of climate-changing gas emissions from the shipping sector as close as possible to zero or net zero. This comprehensive review of the strategy should be based on a set of instruments, including the possibility of mechanisms linked to the creation of a system for the shipping sector similar to emissions trading, which penalises greenhouse gas emissions and whose revenues will have to be directed towards supporting less technologically advanced countries to enable them to achieve their objectives.

At European level, on the other hand, the extension of the emission trading obligations for the shipping sector is accompanied by the GHG reduction requirements laid down in the proposal for a Fuel EU Regulation on the use of renewable low-carbon fuels in maritime transport and repealing Directive 2009/16 on port State control.

The proposal for a regulation has passed the trilogue stage and is now close to promulgation.

The following GHG reduction percentages have been set: 2 % from first January 2025, 6 % from first January 2030, 14.5 % from first January 2035, 31 % from 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 monitoring, reporting and surrender requirements for annual greenhouse gas emissions from each individual ship, calculated as CO₂ equivalent.

All of the above actions, as already stated, aim to reduce GHG emissions through reduction targets that aim to make the use of green technologies economically sustainable compared to the use of conventional fuels, which, on the other hand, are indirectly penalised.

As part of the proposal for a regulation referred to above, vessels calling at ports covered by Article 9 of the Regulation on Alternative Fuels Infrastructure are obliged to connect to the port's electricity grid from 1 January 2030.

For container and passenger ships, this obligation has been extended, from 1 January 2035, to ports not covered by Article 9 but 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 to allow the vessel to connect correctly to the port's electricity grid.

In order to meet the reduction commitments set out above, it is therefore necessary to implement measures enabling the reduction of GHG, which can be achieved through:

- increasing the energy efficiency of ships;
- use of new low fuel – no GHG emissions;
- use of new technological systems for capturing and sequestering GHG emissions, which are currently being tested.

In order 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-based fuels through the upgrading of production systems and the deployment of the storage and refuelling infrastructure needed for their deployment. This is an urgent need, given that zero-emission ships in 2050 will have to be built soon if not today. It is therefore important to give a clear signal quickly to the sectors involved and to ensure a firm operational framework for the investments to be made for fleet renewal; this call also comes from the stakeholders themselves, who are concerned about the current uncertainty about the future availability of fuel and infrastructure, which puts at risk the ambitions to achieve the decarbonisation objectives.

In order to achieve them, maritime transport will have 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 supply and distribution chain as a whole, 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 underlined several times at the various G20 summits since 2009. At the G20 Pittsburgh Summit in 2009, countries undertook to rationalise and eliminate inefficient fossil fuel subsidies that encourage waste in the medium term. In 2018, 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 to the G20 was reiterated in the recent G7 Communiqué in Sapporo, Japan Presidency:

73. Fossil fuel subsidies: We stress that fossil fuel subsidies are incompatible with the objectives of the Paris Agreement. Phasing out inefficient fossil fuel subsidies is a key component in achieving Article 2.1.c of the Paris Agreement. We reaffirm our commitment to eliminate inefficient fossil fuel subsidies by 2025 or earlier, and reiterate our previous calls for all countries to do so. We will report on the progress made towards achieving our commitment in 2023, building on the ongoing work at the G20, the UN, the OECD and its subsidy inventory and other relevant fora to facilitate greater transparency on inefficient fossil fuel subsidies globally, strengthen our action where necessary, and consider options for the development of joint public inventories of fossil fuel subsidies. We will also take steps to increase cooperation, discussion and sharing of best practices to eliminate inefficient fossil fuel subsidies and improve transparency at international level.

For the implementation of these commitments, Italy envisages a gradual pathway based on the identification of direct and indirect fossil fuel subsidies (e.g. tax exemptions and advantages), the assessment of the impacts of their removal (inefficiencies) and possible forms of compensation, committing to the necessary reforms.

In the long run, from an environmental point of view, all fossil fuel subsidies can be considered inefficient, as they do not internalise impacts on the environment and human health, failing to respect the polluter pays principle. In the short to medium term, however, and from a social and economic point of view, some of these subsidies are still necessary for the defence of struggling social groups or vulnerable economic sectors or more exposed to international competition. Thus, as has been pointed out by many international organisations, such as the OECD, it will be necessary to work forward on what purposes might have ceased, or under what circumstances other economic instruments can be used to help the poorer sections of the population or productive sectors deserving of support, leaving the price signal for energy products and natural resources unaffected.

In Italy, a first step in the direction of environmental reform of subsidies is the drawing up of the 'Catalogue of environmentally harmful and favourable subsidies', requested by Parliament from the Ministry of the Environment, a fact-finding document to identify those subsidies that cause harm or those that promote environmental protection. The document suggests areas for action or reform in order to achieve the objectives of the National Sustainable Development Strategy (national transposition of the 2030 Agenda SDGs) and the climate objectives set out in the Paris Agreement. It should be stressed that, as a result of the economic and competitive dynamics, the financial size of the subsidies shown in the Catalogue may not correspond to potential – or, in any event, smaller – revenues, precisely as a result of the impact of the policy adopted, which the government could collect or save if subsidies to fossil fuels were removed.

A second step is the establishment of a government mechanism aimed at the necessary assessment and prioritisation of measures to remove environmentally harmful subsidies. In 2021, Article 4 of Decree-Law No 22 of 1 March 2021 established, at the Prime Minister's Office, the Interministerial Committee for the Ecological Transition (CITE) with the task of coordinating national policies for the ecological transition and planning (without prejudice to the competences of the Interministerial Committee on Economic Planning and Sustainable Development). The CITE is chaired by the

President of the Council of Ministers (or instead of the Minister of MASE) and is supported by a Technical Support Committee: it is responsible for approving, implementing, monitoring and updating the Ecological Transition Plan (ETP) in line with the objectives and priorities set out also at European level, taking appropriate steps to overcome any obstacles and delays.

Finally, according to Article 4, the CITE is to decide on the adjustment of environmentally harmful subsidies referred to in Article 68 of Law No 221 of 28 December 2015 and, in that context, the Technical Support Committee is to carry out the tasks of the former Commission for the study and preparation of proposals for the ecological transition and the reduction of SADs (Article 1 (98) of Law No 160 of 27 December 2019).

With regard to harmful subsidies, 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 progressive elimination of environmentally harmful subsidies and the promotion of environmentally favourable subsidies, also with a view to contributing to the realisation of the ETP.

Italy, through the mapping of the Catalogue and the creation of a government mechanism allowing for a balanced assessment of policy options and the preparation of possible fiscal and public finance compensatory measures, is now in the best position to fulfil its commitment to phase out inefficient subsidies.

There are a number of avenues to be covered by the study by the public administration. Some subsidies are relatively easy to reform; some need further work; others require agreements at European level (e.g. free ETS allowances) or at global level (e.g. international aviation and maritime fuel exemptions linked to ICAO and IMO Conventions).

The revenue – the quantification of which, as stated, is dependent on economic and competitive variables – resulting from measures to reform or eliminate inefficient subsidies in the energy sector will have to compensate the economic operators who benefit from them, in order to make their reduction/elimination more socially acceptable, encouraging the search for innovative national solutions and maximising the opportunities of the energy and ecological transition in the sectors directly concerned. More generally, the optimisation of the opportunities associated with the elimination of environmentally harmful subsidies is sought as part of a broader tax reform, shifting the tax burden from labour and business to polluting activities and the exploitation of natural resources, as advocated by key international institutions.

In 2021, the CITE launched the reform process, starting with the elimination of five fossil subsidies (on the priority list identified in the 2019 INECP), as laid down in Article 18 of Decree-Law No 4 of 27 January 2022, with an annual financial effect avoided of EUR 105,9 million. This measure is a first political signal in implementing the government's commitments taken at EU and international level.

The reform process will continue in the short and medium term, reviewing 18 subsidies (Table 38) with a significant environmental impact for the Energy and Climate Plan and identified as inefficient. This process should involve the competent authorities and representatives of the citizens and businesses concerned in order to identify possible compensation.

Table 35 List of energy subsidies/subsidies to be reformed

N	Name	Reference standard	Financial effect (EUR million)			
			2018	2019	2020	2021
1	Tax reliefs on fringe benefit in favour of the worker which uses in a mixed manner	Article 51 (4) (a) of the TUIR; Article 1 (632) and (633) of Law No 160 of 27 December 2019	1.231,0	1.231,0	1.231,0	1.231,0

N	Name	Reference standard	Financial effect (EUR million)			
			2018	2019	2020	2021
	the company car (employee company car)					
2	Measure 6/92 of the Interministerial Price Committee ('CIP6')	Committee Decision 6/92 Interministerial Prices ("CIP6")	422,0	376,1	307,4	0,6
3	Gas oil and LPG used for heating in geographically or climate disadvantaged areas (mountain areas Sardinia minor 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	152,8
4	Exemption from consumption tax for lubricating oils used in the production and processing of natural and synthetic rubber	Article 62 (c) 2 TUA (Legislative Decree No 504 of 26 October 1995)	78,8	78,8	78,8	78,8
5	Exemption on 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;	52,0	52,0	5,0	5,0
6	Flat-rate deduction from business income for operators of fuel distribution facilities	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 (168) of Law No 244/2007; Article 1 (8) of Decree-Law 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
7	Reduction of excise duty on natural gas used for industrial thermoelectric purposes excluded by persons with consumption of more than 1 200 000 m ³ per year	Article 4 of Decree-Law No 356 of 1 October 2001 converted with amendment into Law No 418 of 30 November 2001 and becoming 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
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	12,6
9	Reduction of excise duty on LPG used in centralised installations for industrial use	Table A point 15 TUA (Legislative Decree No 504 of 26 October 1995)	11,3	11,8	13,0	11,8
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
11	Reduction of excise duty on motor ambulance fuels	Table A point 13 TUA (Legislative Decree No 504 of 26 October 1995)	2,4	2,4	2,4	2,4
12	Exemption from excise duty on fuel for the draining and development of flooded land in areas affected by flooding	Table A point 6 TUA (Legislative Decree No 504 of 26 October 1995)	0,5	0,5	0,5	0,5
13	Exemption from excise duty on water lifting fuels in order to facilitate the cultivation of raised 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

N	Name	Reference standard	Financial effect (EUR million)			
			2018	2019	2020	2021
14	Reduction of excise duty on fuels for the experimental testing and testing of aircraft and marine engines	Table A point 8 TUA (Legislative Decree No 504 of 26 October 1995)	0,5	0,5	0,5	0,5
15	Reduction of excise duty on natural gas used in site uses in stationary 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
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.	d.q.	d.q.
17	Preferential VAT for electricity and gas for use by agricultural and manufacturing undertakings	Table A Part III of Presidential Decree No 633/1972 (10 % preferential VAT)	d.q.	d.q.	d.q.	d.q.
18	Preferential VAT on crude mineral oils for fuel oils	Table A Part III of Presidential Decree No 633/1972 (10 % preferential VAT)	d.q.	d.q.	d.q.	d.q.
Total environmentally harmful energy subsidies (including fossil fuels) to be reformed as a matter of priority			2.048,5	2.002,5	1.852,1	1.579,7

The key points of the reform must therefore be the ‘gradual principle’ in order to give production sectors time to develop, test and implement less polluting technological and energy solutions, and the ‘compensation principle’, at least in cases where the removal 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 of 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:

1. energy efficiency obligation schemes and alternative policy measures pursuant to Articles 7a and 7b and Article 20(6) of Directive 2012/27/EU and developed in accordance with Annex II

In order to achieve the cumulative final energy savings to be achieved in the period 2021-2030 in order to meet the Energy Efficiency Directive target for the EEOS, Italy will use the obligation scheme based on the White Certificates and a set of alternative measures already implemented, which will be reviewed and enhanced in the coming years in order to ensure that the targets set are met.

In order to improve the effectiveness of 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 the promotion of energy efficiency in place and monitored to achieve the savings target referred to in Article 8 EED III (ex Article 7 EED II) are the following:

- The model of the obligation for white certificates;
- Tax deductions for energy efficiency measures and the recovery of existing buildings;
- The Conto Termico;
- The National Energy Efficiency Fund (FNEE);
- The Transition Plan 4.0 and 5.0 (formerly the 4.0 Business Plan);

The Programme for the Energy Requalification of Central Public Administration Buildings (PREPAC);

- The National Energy Efficiency Information and Training Plan (BIP);
- the Kyoto Fund;
- some NRRP measures;
- cohesion policies;
- the energy savings target for the public administration;
- The application of minimum energy performance requirements in the building environment;
- A package of sustainable mobility measures that includes:
 - the renewal of the local public transport vehicle fleet;
 - modal shift measures in freight transport (Marebonus, Ferrobonus) ○ vehicle ecobonus
 - the electrification of port docks (Cold ironing)

All the above measures, whether already in place at national level or in the start-up phase, will be briefly described in the following paragraphs, including, for each of them, an estimate of the expected savings to meet the savings targets set out in Chapter 2.2 as a whole.

The estimate of the savings resulting from the measures listed above, and contained in this chapter, is carried out taking into account the appropriations programmed in the coming years and, where not available, assuming that their operation and financing will be prolonged until 2030.

In Italy, a number of measures to promote energy efficiency have been implemented and planned, particularly in the transport sector, which may be monitored and reported on as a result of the ongoing in-depth investigations.

Reference is also made to the report annexed to the 2020 INECP, 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 a detailed discussion 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 Certificati’ mechanism, most recently governed 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 (i.e. CBs), which certify energy end-use savings made by qualified third parties (a certificate is equivalent to the savings of an Equivalent Petrolio-TEP TEP). The obligation is determined on the basis of the ratio between the quantity of electricity and natural gas distributed by individual distributors and the total quantity distributed within the national territory by all the obliged entities. Obligated entities may fulfil the obligation either by carrying out the energy efficiency projects for which CBs are recognised by the GSE or, alternatively, by purchasing the securities through trading on the CB market managed by the Energy Markets 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 updating and supplementing standardised projects. The main changes introduced include: clarifications on baseline consumption, new ways of presenting projects, introduction of integrated energy efficiency projects, reward for measures implemented in implementation of farm management systems and LCA studies. In addition, the Decree introduced new final project fiches concerning: replacement of a pump with a more efficient pump; installation of condensed air and water-condensed electric compression cooling units, replacement of fossil fuel boilers for the production of heat with Pompe de Calore; replacement of heat pumps for thermal energy production by heat pumps; new installation of compressed air production equipment; replacement of public lighting systems; replacement of luminaires by 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 updating and supplementing 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, ‘*Acquisition of hybrid vehicle fleets*’ and ‘*Purchase fleets of electric vehicles powered by renewable energy*’.

Since the White Certificates mechanism became operational (2006) until 2021, additional primary energy savings of around 28,9 Mtoe have been certified and some 57,1 million energy efficiency certificates have been recognised. The annual value of the entitlements recognised in 2021 amounts to approximately 1,1 million EEOs, or approximately 0,35 Mtoe of annual certified savings.

The trend in the submission rate of new projects has been reduced 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 %, while the reduction in the presentation rate rose again by 31.51 % between 2021 and 2022. Between 2019 and 2022, there is the highest rate of reduction of 45.18 % in projects submitted.

With regard to the sectoral distribution of the measures submitted and accepted in the three-year

period 2019-2022, there is a clear prevalence of interventions in the industrial, network, service and transport sectors.

In terms of new annual savings, valid for the achievement of the EED active policy savings target, white certificates saw savings from new interventions of 0,113 Mtoe in 2021. Preliminary data for 2022 show an increase in savings (0,162 Mtoe).

Planned evolutionary lines

The process of updating the mechanism of White Certificates is ongoing with a view, first and foremost, to strengthening the measure. Secondly, measures are being considered to ensure simplification, optimisation of methodologies for quantifying and recognising energy savings, shortening the time needed to approve, issue and offer securities on the market. These aspects of improvement are considered essential for the effective continuation of the measure in the period 2021-2030 and for overcoming the crisis resulting from the gradual reduction in the number of operations carried out under the CB mechanism, due both to the complexity of the functioning of the mechanism (access/reporting/incentive recognition phase) and by the introduction in 2018 of a ceiling on the financial compensation granted to each individual Bianco Certificate produced, set at EUR 250/TEP.

The measure to enhance the mechanism will provide for a new system for incentivising savings, based on the following criteria:

- downward auctions with the object of the economic value of the saved TEP [EUR/TEP];
- *pay as bid* criterion with constant value for the incentive period specified in the call for tenders managed by GSE;
- auctions on specific technologies, types of project, policy areas or economic sectors;
- auction base value linked to developments in CB prices, specificities of the technology or type of project, to the positive environmental externalities generated;
- access to auctions for entities supporting the investment in line with the CB mechanism;
- coverage of the costs of the mechanism under electricity and natural gas tariffs.

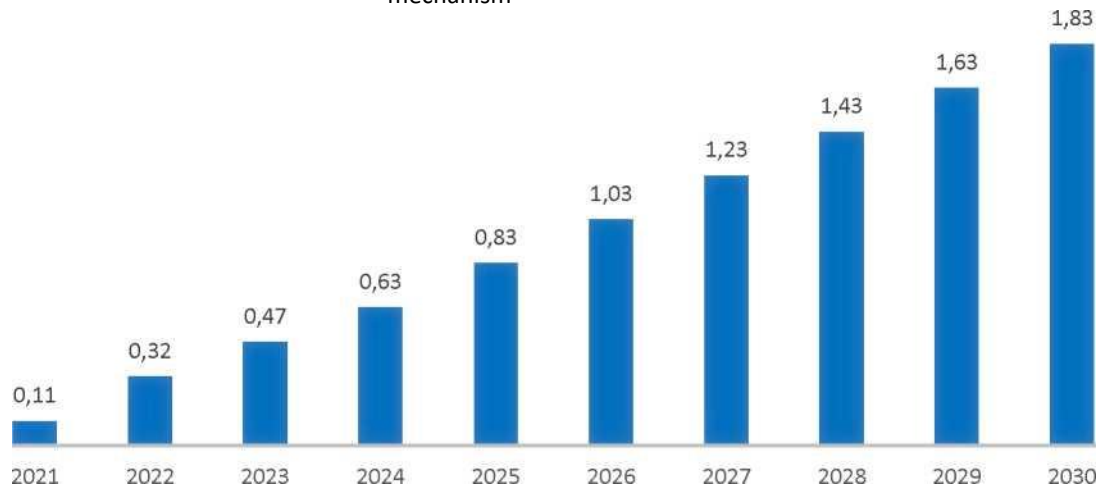
On the side of eligible interventions, the most effective promotion of those in the civil and transport sectors, including through the development of behavioural measures, will be crucial. In addition, more attention will be paid to support for operators. These aspects are relevant for the necessary improvement of the quality of the projects submitted, also to the benefit of the administrative burden borne by GSE.

Finally, an important contribution to reducing consumption is what can result from measures aimed at improving the efficiency of data centres. In this regard, the launch of a study to examine the possibility of extending the CB mechanism to such cases is under assessment.

Estimation 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 those new ones that are estimated to be generated in the following years and will continue to generate benefits until at least 31 December 2030 shall be assessed. The figure below gives an estimate of the annual generation of these savings of around 9,5 Mtoe of final energy in cumulative terms.

Figure 35 – Annual final energy savings expected from new measures promoted by the White Certificates (Mtoe) mechanism



- **TAX DEDUCTIONS FOR ENERGY RETROFITTING AND RECOVERY OF BUILDING STOCK**

In order to facilitate the renovation of residential buildings, a number of incentive measures are currently in place, adopting the tax deduction mechanism. Among these:

- **Superbonus**: recognises, until 2025, a deduction deferred over 4 years and with decreasing rates (110 %, 90 %, 70 %, 65 %) depending on the type of beneficiary, for energy and seismic deep renovation measures. The measure is financed by approximately EUR 14 million from NRRP resources (M2C2-I.2.1), approximately EUR 4,5 million from the national plan complementary to the NRRP and from national budgetary planning resources for 2021-2026. As of December 2021, the total number of certifications was 95.718, representing a total of around EUR 16,2 billion of eligible investments (EUR 11,2 billion for works already completed);
- **Ecobonus**: recognises, until 2024, a deduction deferred over 10 years and with varying rates (50-75 %) depending on the individual type of energy efficiency measure implemented. The measure is financed from national resources by budgetary planning. From 2007 to 31 March 2021, some 5,5 million operations were carried out and around EUR 53 million in investments were activated; from 2014 to 2020, the investment mobilised rate was constant and just above EUR 3MLD. In 2021 alone, more than 1 million interventions, or EUR 7,5MLDEUR of investments, were implemented;
- **Façade bonuses**: recognises, until 2024, a deduction deferred over 10 years and with variable rates (60 %) for facade and balcony refurbishment, including thermal insulation measures;
- **Home bonus**: recognises, until 2024, a deferred deduction of 50 % over 10 years for individual renovations of buildings, including energy efficiency measures;

- **Bonuses for household appliances**: recognises, until 2024, a deferred deduction of 50 % over 10 years for the purchase of high-efficiency household appliances;

- Sismabonus: recognises, until 2024, a deduction deferred over 10 years and with variable rates (50-85 %) for measures to reduce the seismic risk of buildings, also in conjunction with energy efficiency measures;
- Other bonuses: grant deductions to varying degrees (50-75 %) over 5-10 years for individual non-energy measures such as Bonus verde and Bonus for the removal of architectural barriers. In addition, until 2021 Bonus acqua and Bonus refill electricity were active.

The above deductions are also accompanied by financial support 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 challenges for the residential sector in 2030 and 2050 provided for by the new EED and EPBD ('Case Green') Directives currently being approved and by this Plan, as well as by STREPIN 2021, it is planned to implement a general reform of deductions, addressing the renovation works of existing residential buildings with an integrated and efficient approach and going beyond the current fragmentation of the various deductions currently in operation.

An integrated approach would make it possible to optimise the timescales and costs of renovating a building, promoting deep renovation measures with a view to sustainability, covering various areas: energy efficiency, production of energy from renewable sources and electrification of consumption; digitalisation of buildings and dialogue with other infrastructures such as transport; safety with regard to seismic aspects and fire protection; environmental protection with regard to the reduction of water consumption and the use of green water.

The reform of the regulatory framework will therefore cover all of the aforementioned aspects, providing various deduction rates depending on the general performance achieved by the building, which can be obtained by carrying out measures with different levels of priority. The reform should last for at least ten years in order to respond to the challenging objectives for the residential sector. In particular, it shall:

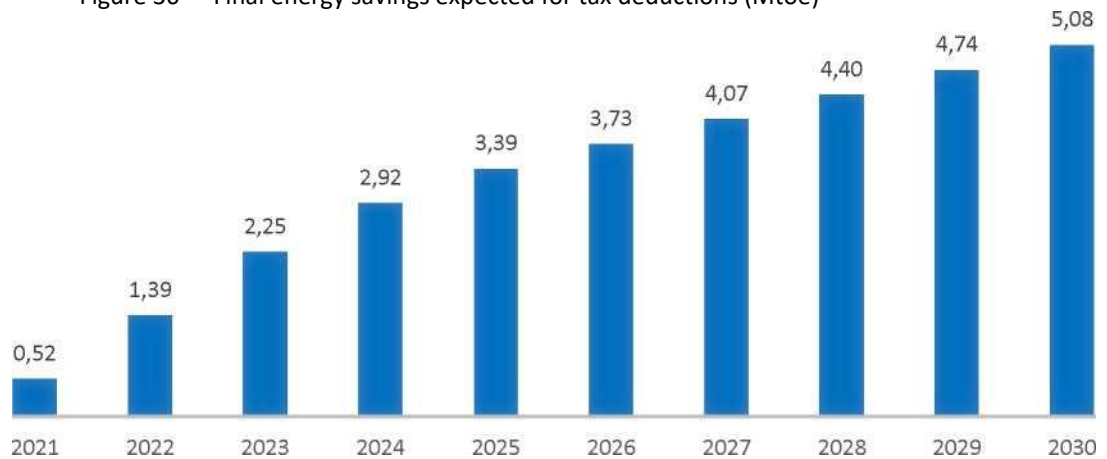
- be targeted primarily at building units subject to the requirements of the Case Green Directive (prime houses, building units with low energy class, energy poverty and public housing, etc.);
- ensure rates spread over a maximum of 10 years;
- allowing both individual and deep energy retrofitting measures (combination of several interventions);
- ensure benefits at a reduced rate for individual measures and, for deep energy retrofitting measures, few rates increasing according to the energy performance achieved, also taking into account seismic performance for high-risk areas. Energy interventions will be "drivers" compared to all other interventions, which will benefit from the same rate;
- guarantee specific all-inclusive maximum costs both for individual measures and for deep energy retrofitting measures, which are simply verified and unambiguous for the whole of the national territory;
- be accompanied by supporting financial instruments, such as low-interest financing, including full coverage of investment costs, and loan origination, with favourable conditions for people affected by energy poverty. In this context, synergies with the reform of the Energy Efficiency National Fund are also envisaged.

Estimate of achievable energy savings

The results obtained from the activation of the Facility to date have been remarkable, allowing an estimation of the savings potential of the Facility in the years to come and up to 2030. The figure below gives an estimate of the annual savings that can be achieved up to 2030, taking into account the contributions linked to the measures in force, i.e. those resulting from new investments stimulated by the reform referred to above.

The total contribution of the measure to the above objectives is around 32,5 Mtoe of final energy in cumulated terms.

Figure 36- – Final energy savings expected for tax deductions (Mtoe)



❖ THERMAL ACCOUNT

The Conto Termico is the tool made available to private individuals and the public authorities to encourage the implementation of small-scale measures to increase energy efficiency and to produce heat from renewable sources. The mechanism is governed by the Ministerial Decree of 16 February 2016, which updates the Ministerial Decree of 28 December 2012, which contributes to the achievement of the national renewable energy and energy efficiency targets.

The measures that can be promoted through the Conto Termico are aimed at upgrading the building stock through a process of transforming the building structure and plant by replacing existing elements. They work to achieve efficiency by stimulating the reduction of thermal energy requirements, the generation of the necessary energy through more efficient equipment and, finally, the use of renewable sources for the production of the thermal energy needed for end uses.

In 2021, the mechanism confirmed the positive trend in recent years, with demand volumes amounting to 25 % of all received in previous years (2013-2020). In 2021, although fewer applications were received than in the previous year, 100.074 compared to 113.498 in 2020, they received an incentive of EUR 496,1 million, an increase of 10 % compared to 2020. In 2021, there was an increase in the amounts requested for the mode of access 'on a reservation' basis by the PA, with an application for admission to the incentives of almost EUR 167 million.

In terms of new annual savings, which are valid for achieving the target of saving from active policies set by the EED, the thermal account saw savings from new interventions of 0,086 Mtoe in 2021. Preliminary data for 2022 show a slight decrease in savings (0,064 Mtoe).

Planned evolutionary lines

Although the Thermal Account started with low volumes of applications, it showed an important trend of increasing results, particularly as regards the renovation of public administration buildings

through the use of the booking tool. The Thermal Account mechanism is a suitable incentive instrument to encourage the implementation of measures to improve the efficiency of public administration buildings, both because they are denied access to tax deductions and because of the possibility of access to the incentives through reservation, which is useful not only for the possibility of granting incentives in advance of the implementation of the measures, but also because it can facilitate access to additional additional sources of financing. For this reason, it is planned to adjust the ceiling available to the PA.

The revision of the Conto Termico framework will take into account the evolutionary lines set out in national legislation and in the Memorandum of Understanding establishing the “Action Plan for the Improvement of Air Quality” signed by the competent administrations of the central State and the regions and autonomous provinces involved in the problem of exceedances of air pollutants. In particular, it is envisaged that retrofitting of private non-residential buildings will be included. Account will also be taken of the need to simplify access to the mechanism, including through the promotion and use of EPC type contracts, and of the opportunity to expand eligible interventions, such as connection to efficient district heating and cooling systems. It is also envisaged, as part of the deep renovation of the building, to promote the installation of technologies to increase the consumption of locally produced renewable energy, and in synergy with renewable energy communities.

Also in the context of the thermal account, in order to promote the use of thermal energy from renewable sources, in implementation of Article 10 of Legislative Decree No 199/2021, a study is being carried out to establish an auction mechanism to encourage installations for the production of thermal energy from renewable sources.

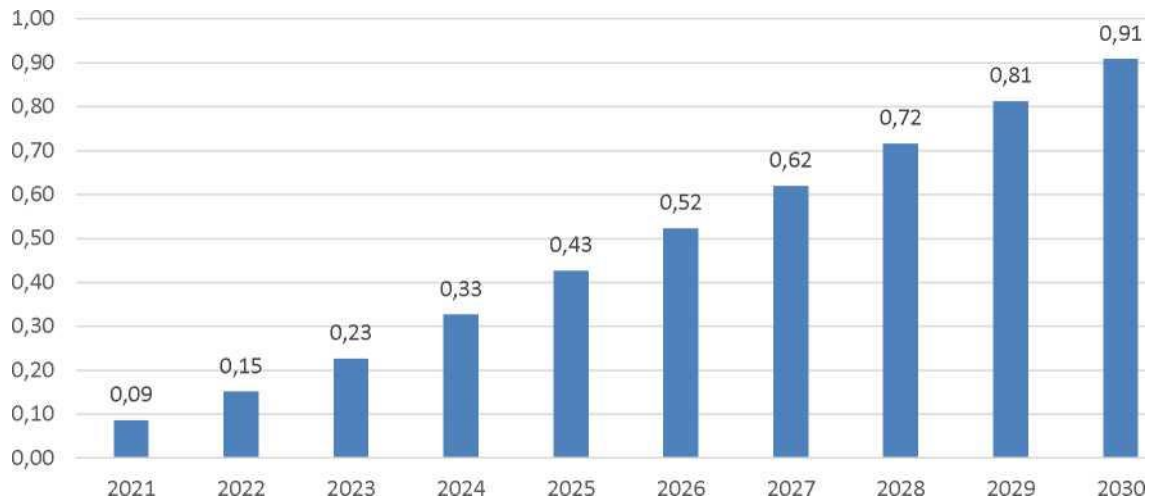
Estimate of achievable energy savings

The results obtained from the activation of the Facility to date make it possible to estimate the savings potential of the Facility in the years to come and up to 2030. The figure below gives an estimate of the annual savings that can be achieved up to 2030. The total contribution of the measure to the above objectives is around 4,8 Mtoe of final energy in cumulated terms.

Estimate of achievable energy savings

The results obtained from the activation of the Facility to date make it possible to estimate the savings potential of the Facility in the years to come and up to 2030. The figure below gives an estimate of the annual savings that can be achieved up to 2030. The total contribution of the measure to the above objectives is around 4,8 Mtoe of final energy in cumulated terms.

Figure 37 – Final energy savings expected for the land account (Mtoe)



❖ **NATIONAL ENERGY EFFICIENCY FUND**

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 is 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 guarantees and 70 % for subsidised financing, at a rate of 0.25 %.

From the start of the mechanism until 31 December 2021, 26 energy efficiency projects with a total value of around EUR 19 million, corresponding to more than EUR 33 million of activated investments, for expected savings of around 10,1 ktoe, were eligible for funding.

Planned evolutionary lines

Under the NRRP (M2C3), among the measures provided for in the 1.1 Reform *“Simplification and speeding up procedures for energy efficiency measures”* has been added to update and upgrade the FNEE (under reform 1.1c). To this end, a draft implementing decree amending the Ministerial Decree of 22 December 2017 was drawn up, introducing significant changes to the operation of the instrument. In particular, the main novelties concern:

- the possibility of granting part of the non-repayable funding (as provided for in Article 1 (514) of the 2022 Budget Law), up to a maximum of EUR 8 million per year;
- the introduction of the amendments resulting from the update of the GBER Regulation by Commission Regulation (EU) 2021/1237 of 23 July 2021
- the extension of facilitations to the transport and sustainable mobility sector;
- the introduction of simplification measures.

In addition, in order to further strengthen the instrument, cooperation with the European Investment Bank and coordination with GSE and ENEA are planned to ensure synergy between the resources of the Fund and those of the incentive instruments present in the energy efficiency landscape. In view of the update of the GBER Regulation, approved on 9 March 2023, the draft implementing decree is expected to be brought into line with the further new rules introduced.

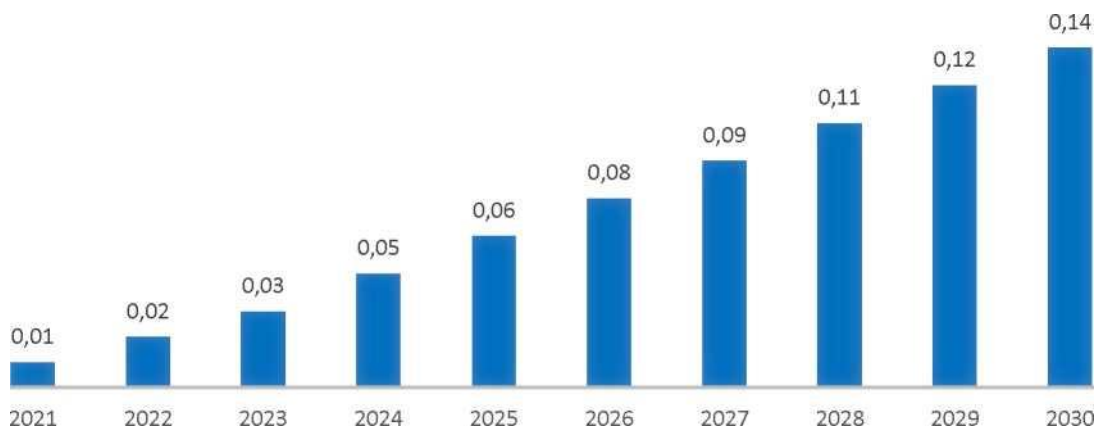
by the Regulation itself. In addition, the Guarantee Section will be activated following the consultation activity launched with the MEF.

Finally, again with the Fund's resources, provision is made for the implementation of the 'eco-loan' referred to in Article 14 (3c) of Decree-Law No 63/2013, with the aim of introducing a specific section for the provision of guarantees for the financing of energy retrofitting of buildings by credit institutions, in particular for the private residential sector. Synergies with the reform of tax deductions are also envisaged for this section.

Estimate of achievable energy savings

The Fund has been fully operational since May 2019. The following figure gives an estimate of the annual savings that can be achieved up to 2030, based on the performance of the measure as at 2021. The total contribution of the measure to the above objectives is around 0,7 Mtoe of final energy in cumulated terms.

Figure 38 – Final energy savings planned for the National Energy Efficiency Fund (Mtoe)



✦ **TRANSITION PLAN 4.0 AND 5.0 (FORMERLY COMPANY 4.0 PLAN)**

It is a measure that brings together several legislative measures to provide tax credits to stimulate business investment in innovation and sustainability, including:

- tax credit for investment in capital goods: to support and incentivise the companies investing in new tangible and intangible capital assets that are instrumental to the technological and digital transformation of production processes;
- tax credit 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 circular economy, design and aesthetic design;
- tax credit training 4.0: it aims to support businesses in the process of technological and digital transformation by creating or consolidating the skills in enabling technologies needed to achieve paradigm 4.0.

Planned evolutionary lines

From 2024 onwards, the current Transition Plan 4.0 is expected to evolve, financed for the 2020-2022 tax periods also with RRF resources and from 2023 to 2025 with purely national resources. The new measure aims to project the 4.0 Transition Plan towards paradigm 5.0, with a view strictly towards

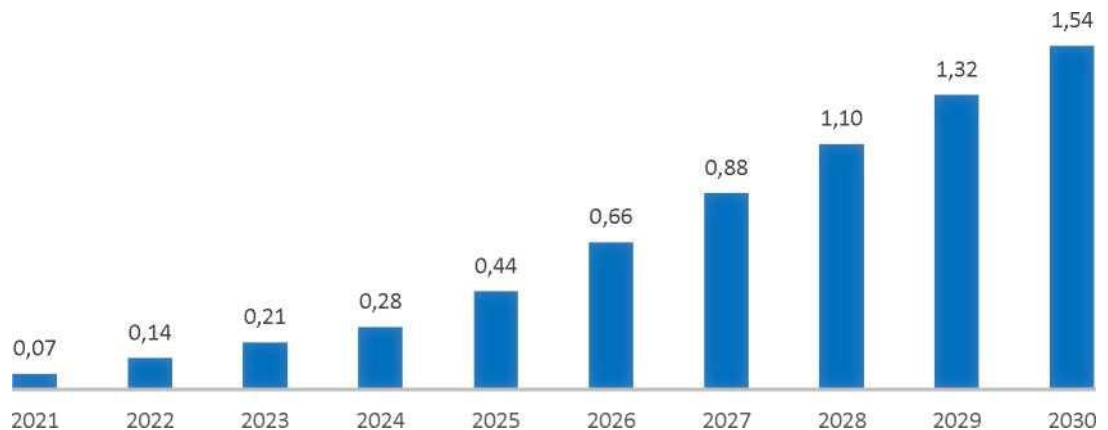
the ecological transition. The aim of the reform of the mechanism is to grant all undertakings resident in the territory of the State and permanent establishments of non-resident persons a tax credit for investments aimed at pursuing green objectives. The grant of the tax credit will be linked to the total value of the investments made and the costs incurred in the context of a certified project for the conversion and conversion of production processes in a green light. All enterprises resident in the territory of the State and permanent establishments of non-residents, irrespective of their size and production sector, will be eligible.

The measure provides for EUR 4 billion of public resources for the granting of advantages in the form of tax incentives to be determined by means of appropriate legislation. The proposed measure should be financed through Repower EU funds.

Estimate of achievable energy savings

For energy efficiency measures carried out in accordance with the 4.0 and 5.0 Transition Plan, a cumulative saving in 2030 was estimated at 6,6 Mtoe of final energy, assuming that the measures described above in the Industry 4.0 Plan, or similar, remain active until 2030.

Figure 39 – Final energy savings expected for Transition Plan 4.0 and 5.0 (Mtoe)



ENERGY UPGRADING PROGRAMME FOR PUBLIC ADMINISTRATION (PREPA) (EX PREPAC)

The objective of the programme is to achieve annual efficiency of at least 3 % of the air-conditioned useful floor 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. Projects are evaluated with the technical support of GSE and ENEA, while the funding is granted by MASE. On the other hand, the implementation phases are managed directly by the Ministry of Defence for the buildings within its remit, i.e. the Provveditorati per le Opere Pubbliche, including with the support of the Demanio Agency. The project proposals approved in the 2014-2018 period have always ensured that the objective of retraining will be achieved, and performance has been lower since 2019. Of around 260 projects approved on 31/12/2021 (around EUR 385 million of investment), 17 % are being implemented or completed.

Planned evolutionary lines

In order to speed up the implementation phase of the projects, under the NRRP (M2C3), among the measures provided for in the 1.1 Reform "*Simplification and acceleration of procedures for energy efficiency interventions*" has been included the reinforcement of the PREPAC (*under reform 1.1d*). To this end, Article 19 of Legislative Decree No 17/2022 introduced a provision according to which the

Demanio Agency may support the Interregional Public Works Provveditorates in carrying out the works, including by making use of electronic purchasing and negotiation tools.

However, in view of the fact that, in implementation of Legislative Decree No 102/2014, the measure will be in place until 2030, it is considered appropriate to reform it thoroughly, not least in view of the minimum requirement for energy retrofitting of buildings of all local public administrations and minimum annual energy savings, imposed by the EED Directive at the stage of publication. Consequently, it is envisaged to create a mechanism for allocating this obligation at regional level, maintaining central governance at MASE. The system should therefore provide for:

- a quantification of the obligations (central and regional), on the basis of a precise identification of the building stock concerned, also drawing on information from the National Portal on the energy performance of buildings;
- the establishment of a regulatory framework linking all the national mechanisms (thermal account, FNEE, Kyoto fund, white certificates) currently in force for public administration buildings, in order to maximise the use of resources;
- the requirement that all regional sector programmes should contribute to achieving the above 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 trading tools;
- setting up an incentive mechanism for interventions or types of buildings not already covered by other national measures, providing for subsidies of up to 100 % of eligible costs, mainly using the capital contribution, possibly supported for the shortfall by subsidised loans;
- the establishment of a timely monitoring system for all the mechanisms currently in place (both national and regional) affecting public administration buildings.

Estimate of achievable energy savings

For energy efficiency measures carried out in accordance with the premise, the 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 achieving the retrofitting objective laid down in Article 6 EED III.

Figure 40 – Final energy savings from the prep measure (Mtoe)

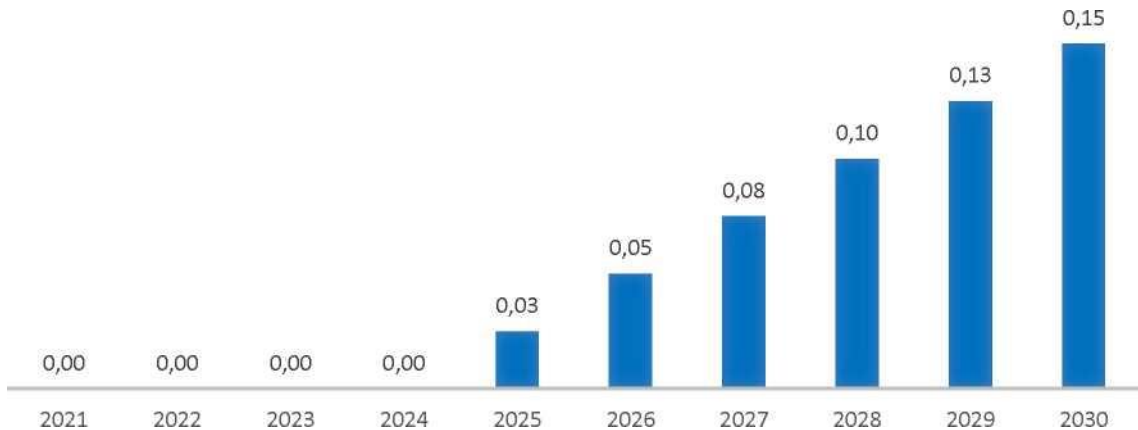


Figura 1- **INFORMATION AND TRAINING PROGRAMMES FOR ENERGY EFFICIENCY**

Article 13 of Legislative Decree No 102/2014 provided that ENEA, from 2021 to 2030, is to implement a three-year information and training programme (PIF) aimed at promoting and facilitating the efficient use of energy. At the heart of the first BIP 2021-2023 are the promotion of active incentives and the promotion of a culture aimed at upgrading buildings. The BIP provides the framework for communication and dissemination activities of the initiative: Italy in class A, 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 of the Ministry of the Environment and Energy Security (MASE) of the annual revenues from the auctions of CO₂ 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 considered on the basis of the experience gained with the BIP being implemented. In any case, the following will be guaranteed:

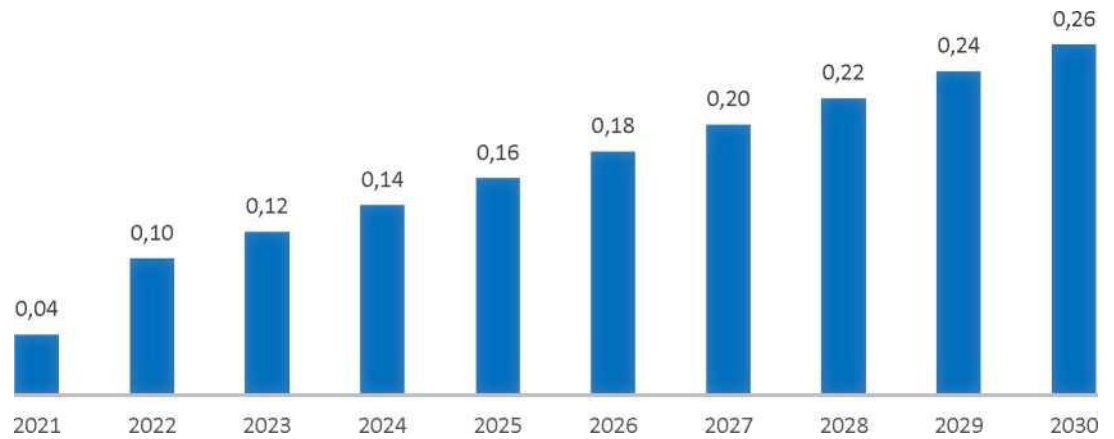
- Figura 2- the valorisation of active incentive instruments;
- Figura 3- promotion of energy efficiency in the civil sector (residential and tertiary);
- Figura 4- promoting the decarbonisation of the industrial sector through end-use efficiency, electrification of consumption and renewable gases in hard-to-abated sectors, including by capitalising on the activities carried out in the field of energy audits.

Finally, the issue of monitoring savings generated by awareness-raising policies will be deepened in order to provide ever more robust support for decisions in this area, as well as for the achievement of energy efficiency targets.

Estimate of achievable energy savings

For energy efficiency measures carried out through consumer information and training programmes, a cumulative saving in 2030 was estimated at 1,7 Mtoe of final energy.

Figura 41- Annual final energy savings expected from the information and training programme (Mtoe)



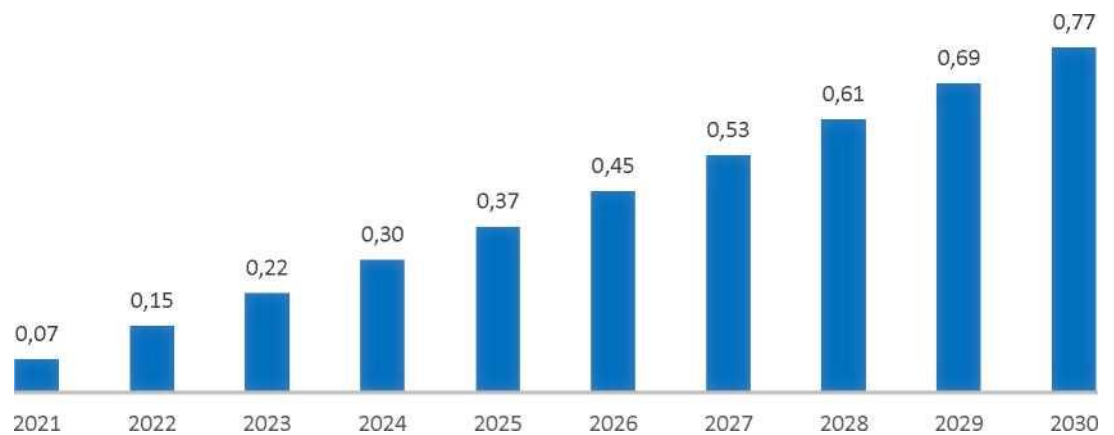
❖ **KYOTO FUND**

For the description of the measure and its main evolutionary lines, please refer to Part VIII of this paragraph.

Estimate of achievable energy savings

For energy efficiency measures implemented through the Kyoto Fund, the cumulative savings in 2030 were estimated at 4,2 Mtoe of final energy.

Figura 42- Expected annual final energy savings from the Kyoto Fund (Mtoe)



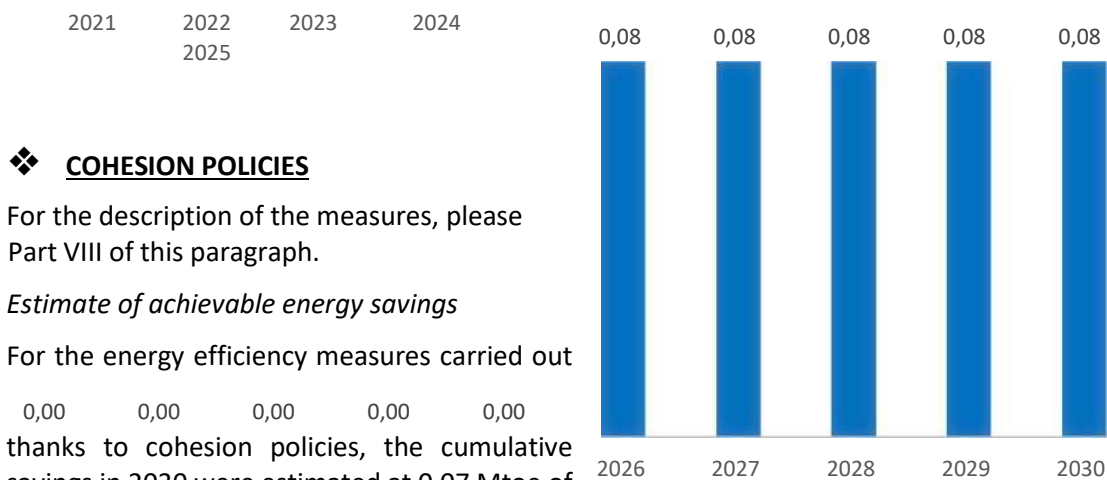
❖ **NRRP MEASURES**

For the description of the measures, please refer to Part VIII of this paragraph.

Estimate of achievable energy savings

For the energy efficiency measures carried out thanks to the NRRP measures, the cumulative savings in 2030 were estimated at 0,4 Mtoe of final energy.

Figura 43- Expected annual final energy savings from NRRP measures (Mtoe)



❖ **COHESION POLICIES**

For the description of the measures, please refer to Part VIII of this paragraph.

Estimate of achievable energy savings

For the energy efficiency measures carried out

0,00 0,00 0,00 0,00 0,00
 thanks to cohesion policies, the cumulative savings in 2030 were estimated at 0,07 Mtoe of final energy.

Figura 44- Expected annual final energy savings from cohesion policies (Mtoe)

❖ **ENERGY SAVING TARGET FOR PUBLIC ADMINISTRATION**

For the description of the energy savings target for the public administration please refer to Par. 2.2 (4) where the calculation of the target under Article 6 EED III is carried out.

Estimate of achievable energy savings

Assuming that the above target is met, a cumulative saving in 2030 was estimated at 1,19 Mtoe of final energy.

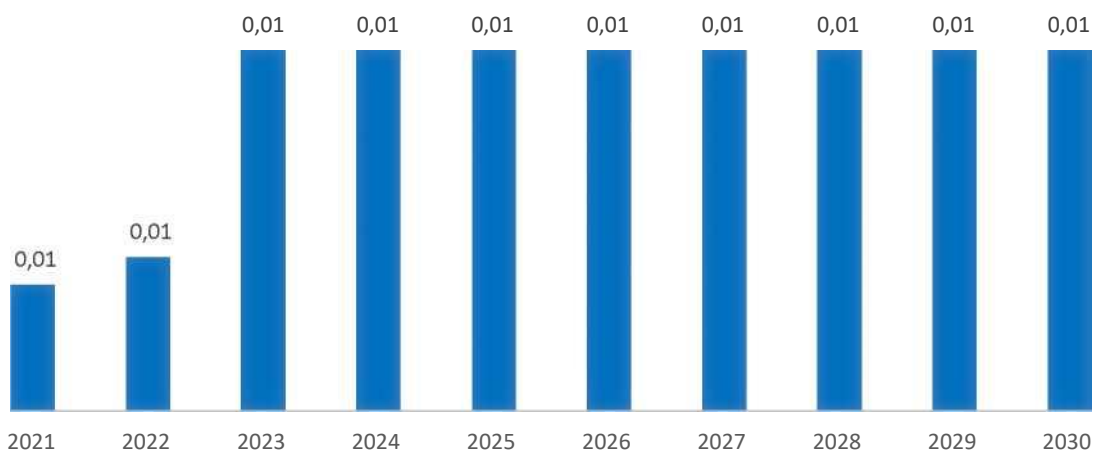
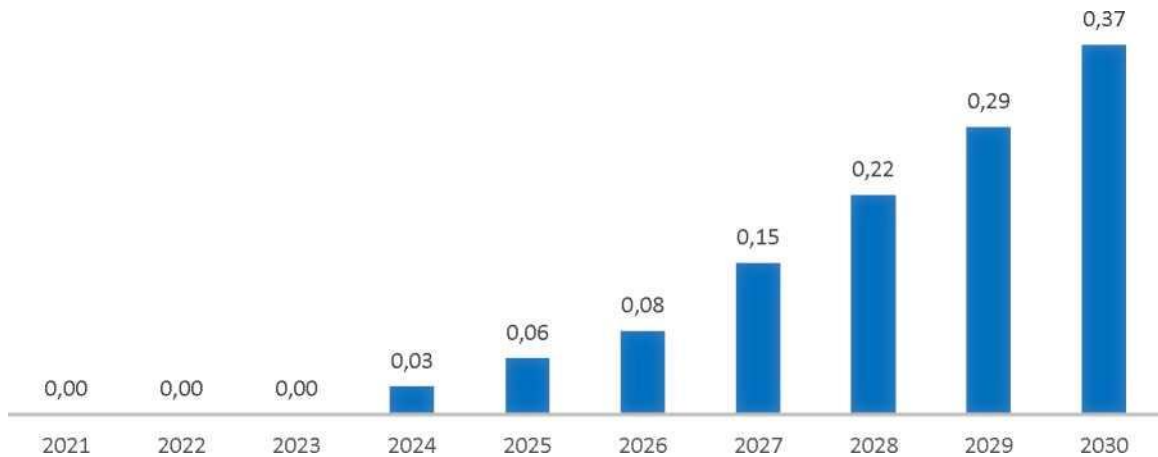


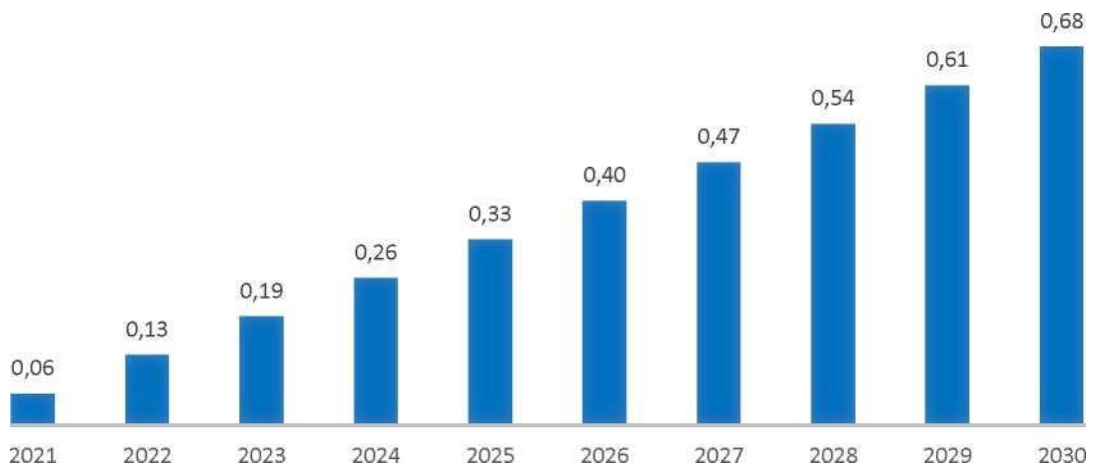
Figura 45- Expected annual final energy savings from the public administration savings target (Mtoe)



❖ **MINIMUM REQUIREMENTS**

The estimate of the energy savings resulting from the application of the minimum efficiency requirements laid down in the EPBD for existing buildings undergoing renovation, offset by the savings from the measures accessing the incentive mechanisms described in this paragraph, amounts to cumulative savings in 2030 of 3,7 Mtoe of final energy.

Figura 46- Expected annual final energy savings from minimum requirements (Mtoe)



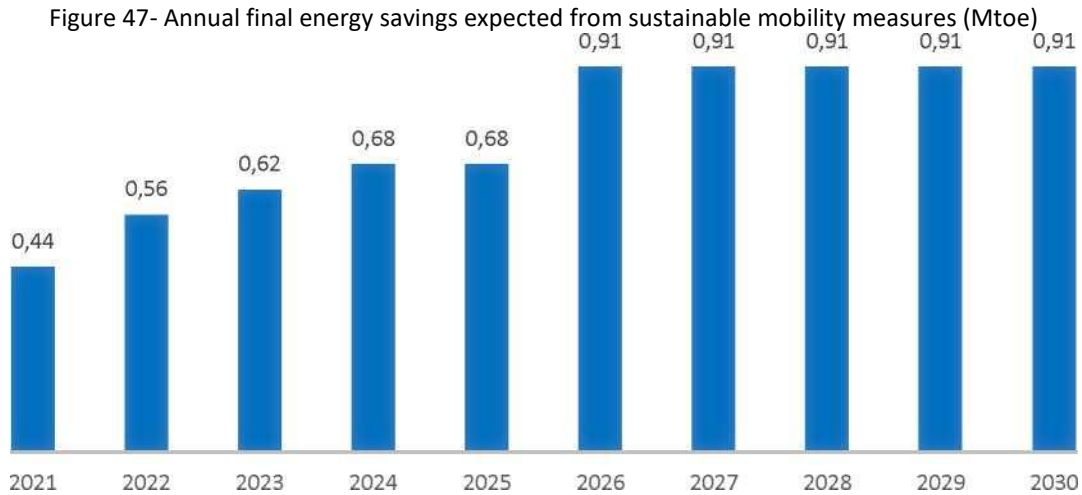
❖ **SUSTAINABLE MOBILITY PACKAGE**

There are several 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 can be found in paragraph 3.1.3 on, inter alia, low-emission mobility. This paragraph deals with two types of measures that are considered to make a significant contribution to achieving the minimum energy savings target set for the EEOS. Does it concern:

- The renewal of the local public transport fleet;
- Measures to promote modal shift in freight transport;

- The vehicle ecobonus;
- 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, there will be cumulative savings in 2030 of around 8,3 Mtoe of final energy.



Below is a brief review of the main measures included in the Sustainable Mobility Package.

❖ **RENEWAL OF THE LOCAL PUBLIC TRANSPORT FLEET**

For the description of the measure and its main evolutionary lines, see paragraph 3.1.3.

Estimate of achievable energy savings

It has been estimated that, as a result of the measures envisaged for the renewal of public passenger transport vehicles, a cumulative saving of 0,02 Mtoe of final energy will be achieved by 2030.

❖ **MODAL SHIFT IN FREIGHT TRANSPORT (MAREBONUS, FERROBONUS)**

In order to encourage modal shift in goods towards modes of transport (ship, rail) with lower energy consumption per tonne kilometre carried, two measures are in place: Marebonus and Ferrobonus.

Pursuant to Article 1 (649) of Law No 208 of 28 December 2015, the Marebonus provides for the granting of subsidies for the implementation of modal choices aimed at improving and optimising the intermodal chain, resulting in decongestion of the road network and reducing the negative externalities of freight transport through the increased use of Ro-Ro and Roe-Pax maritime services arriving at and/or departing from ports located in Italy to ports located in Italy or in Member States of the European Union or the European Economic Area.

The Ferrobonus is an incentive measure for economic operators who make transport choices in favour of combined or intermodal rail transport as an alternative to the whole 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 which use them.

rail for the combined transport of goods, originating in or arriving at the logistics hubs of the national territory or the Member States of the European Union or the European Economic Area.

Planned evolutionary lines

The Ferrobonus measure was financed by the 2021 Budget Law (Law No 178 of 30 December 2020) until 2026 and by additional funds provided for until 2030 by Interministerial Decree No 347/2022 among the categories of intervention of the ‘Fund for the Sustainable Mobility Strategy’.

The Marebonus measure was financed by the 2021 Budget Law (Law No 178 of 30 December 2020) until 2026. For the purpose of this calculation, it is assumed to be extended until 2030.

Estimate of achievable energy savings

It has been estimated that, as a result of the measures envisaged to promote modal shift in freight transport (Ferrobonus and Marebonus), there will be cumulative savings in 2030 of around 3,9 Mtoe of final energy.

❖ **ECOBONUS VEHICLES**

The measure consists of a contribution to the purchase, with or without scrapping, of more efficient and low CO₂ emission_{vehicles}. The subsidy is recognised as the lower price charged by the dealer 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 fuel-powered cars with emissions of up to 135 gr/km CO₂;
- Electric and non-electric motorcycles and mopeds of type approval class equal to or greater than EUR 5;
- Electric commercial vehicles.

Planned evolutionary lines

The measure currently includes appropriations until 2024 for the following amounts:

- Year 2021: EUR 1.148 million;
- Year 2022: EUR 630 million;
- Year 2023: EUR 630 million;
- Year 2024 640 million.

The measure is being revised in order to redeploy advanced resources in 2022 and to redirect the remaining period of application to the best possible extent, not least in the light of the contributions made by the sectoral table on automotive managed by the MIMIT.

Estimate of achievable energy savings

It has been estimated that the Ecobonus vehicle measure will lead to cumulative savings in 2030 of around 3,3 Mtoe of final energy.

❖ **ELECTRIFICATION COLD IRONING QUAYS**

This is a programme of port infrastructure measures 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 dependency on oil products and reduce the emission impact in 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 implementation of

alternative Fuels Infrastructure in the European Union. This Directive requires the deployment of a shore-side electricity supply network with the aim of completing it by 31 December 2025, with preference for TEN-T core ports 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, aims to achieve an electricity network with an installed electrical power of 682 MW divided into 34 ports, of which 32 belong to the TEN-T network. It consists of the establishment of a network of systems for the supply of electricity from the shore to ships during the mooring phase, so as to minimise the use of on-board auxiliary engines for self-generation of the necessary electricity, reducing significantly emissions of CO₂, nitrogen oxides and fine dust. The resources allocated to the ‘Cold Ironing’ measure (PNC- Inv.11) totalled EUR 675,63 million, of which EUR 326,43 million was earmarked for interventions by the regions of the south (approximately 48.32 %) and EUR 349,20 million for measures by the central and northern regions (approximately 51.68 %).

Estimate of achievable energy savings

It has been estimated that the cold ironing measure will lead to cumulative savings in 2030 of around 1,2 Mtoe of final energy.

❖ **SUMMARY OF MEASURES**

As described in the previous paragraphs, Italy proposes to achieve the final energy savings calculated on the basis of Article 8(1) EED by means of a number of key mechanisms, already activated or to be activated at national level.

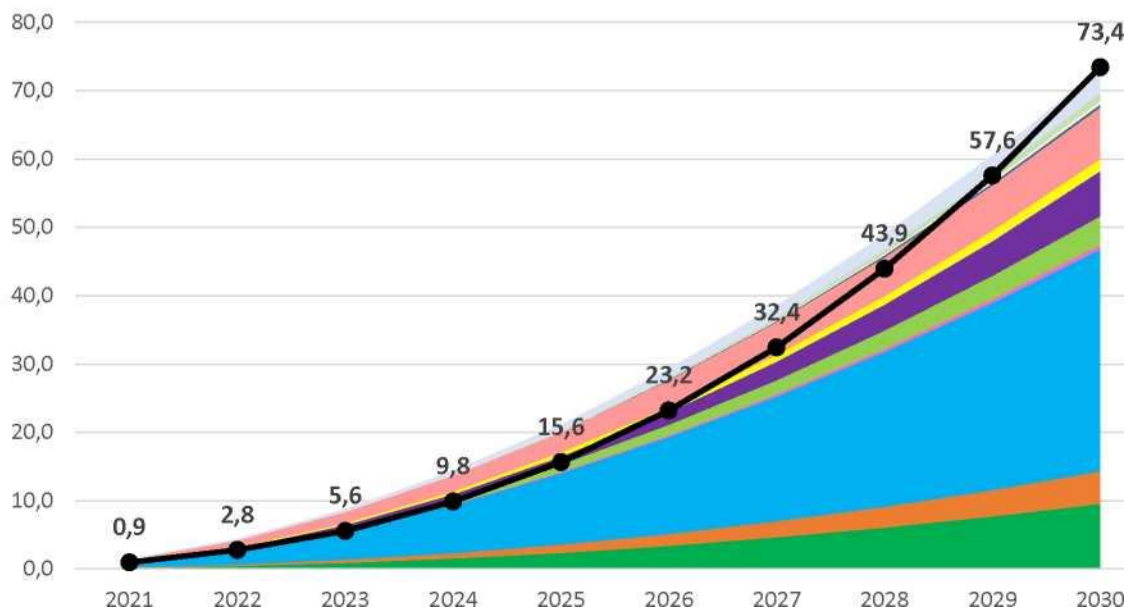
Below is a table summarising the main elements of the instruments described.

Table 36 – Summary of measures to achieve Article 8 EED targets and the main sectors targeted

Typology	Designation	Areas				Poverty efficiency
		Residential	Tertiary	Industry	Transport	
Mandatory scheme	White Certificates	X	X	X	X	
	Tax relief	X	X			X
	Land account	X	X			X
	National Fund Energy efficiency	X	X		X	X
	Business Plan 4.0		X	X	X	
	PREPA		X			
Alternative measures and	Cohesion policies	X	X	X	X	X
	Information plan and training	X	X	X	X	
	NRRP measures		X	X	X	
	Kyoto Fund		X		X	
	Saving public bodies		X		X	
	Minimum requirements	X	X		X	
	Transport measures				X	

risultati.

Figura 48 - Quadro di sintesi del conseguimento dei risparmi (Mtep di energia finale)



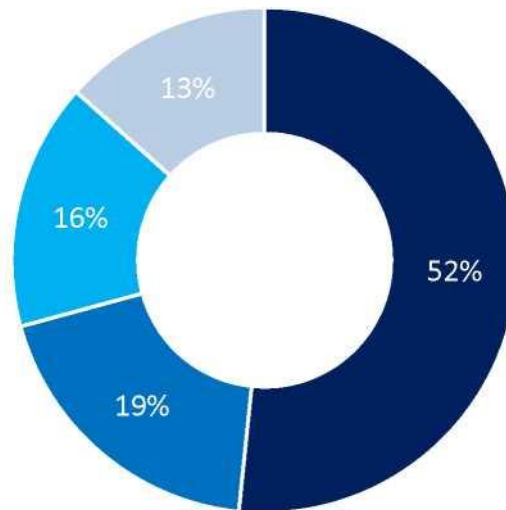
The chart below summarises the cumulative savings targets allocated to the proposed mechanisms. With a minimum final energy savings target under Article 8 EED of 73,4 Mtoe, preliminary estimates of the impact of the proposed mechanisms lead to sufficient cumulative savings to achieve the obligation. Using the annual results provided by the tested monitoring tools already in place in the 2014-2020 period, it will be possible to act in the event of an insufficient progression in savings towards the targets and to propose appropriate updates where deviations between targets are observed.

The graph below provides an indicative assessment of the sectoral breakdown of the estimated cumulative savings by 2030 from the measures described.

Figure 49- Overview of expected 2021-2030 savings from efficiency promotion measures

White certificates + HE	Land account
CHP	National Energy Efficiency Fund
Tax relief	Transition 5.0
Kyoto Fund	Information campaigns
Cohesion policies	NRRP measures
Mobility measures	PA savings target
PREPA	—Target Article 8 EED
Minimum requirements	

energy, by sector (%)



Nonetheless, Tertiary , Industry, Transport and Transport

As the graph above shows, 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 emission reduction target in the Effort Sharing sector. It will therefore be important to promote measures to reduce demand for private transport (modal shift, soft mobility), to create and improve public infrastructure, including measures to extend and modernise rail transport networks and to optimise logistics and digitise motorway management.

In order to strengthen the monitoring system for all active measures and to promote energy efficiency in all sectors, consideration will be given to the possibility of providing additional national portals, including for the industrial and transport sector, to 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 for the monitoring of national targets for energy efficiency and renewable energy integration, as well as for the development of strategies, programmes and measures to promote energy efficiency. To this end, they will also be able to provide information and promote energy efficiency by collecting best practices in the sector.

In the industrial sector, consideration will be given to putting into the system all information stemming from the ETS mechanism, white certificates, high-efficiency cogeneration, energy diagnoses and other incentives for renewable sources, including hydrogen.

Similarly, in the field of transport, the tool will be able to systematise the sectoral policies implemented by the different 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 private³⁸, including

³⁸ In accordance with Article 2a of Directive 2010/31/EU.

policies, measures and actions to stimulate cost-effective deep renovations of buildings and policies and actions to address worst-performing segments of the national building stock, in accordance with Article 2a of Directive 2010/31/EU

In accordance with 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 renovation of the national building stock' was adopted at the end of November 2020.

In implementation of the provisions of Legislative Decree No 48 of 10 June 2020 transposing Directive (EU) 2018/844 on the energy performance of buildings, updating the Ministerial Decree on minimum energy performance requirements for buildings (MiSE Decree of 26 June 2015).

For the discussion of these measures, please refer to section 2.2 (ii).

It is also planned to:

- The introduction of measures to improve the quality of energy performance certificates (EPCs) and ways to promote the purchase of high-energy class dwellings.
Promoting the adoption of demand response technologies, ICT and home automation systems that enable the monitoring and control of the performance of buildings, as also highlighted in the public consultation.
- Strengthening checks on compliance with regulations and standards.
- Improving the integration between energy efficiency rules and renewable energy sources in buildings.
In this regard, reference is made to the rules on obligations for new buildings, for existing buildings and for buildings undergoing major renovation, laid down in Annex 3 to Legislative Decree No n.199/2021.. In particular, as regards the obligations to use installations using renewable sources, new buildings, or buildings undergoing major renovations within the meaning of Legislative Decree No 28/2011, are to be designed and constructed in such a way as to ensure, through the use of systems powered by renewable sources, that at the same time the coverage of 60 % of the consumption planned for domestic hot water production and 60 % of the sum of the consumption planned for the production of domestic hot water, winter cooling and summer air conditioning is met.
- The possibility of introducing energy efficiency requirements during renovations, where justified in terms of cost/benefit ratio, and the introduction of new limits on the use of cooling systems.
- 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, for which it is planned to implement measures to increase cost-effectiveness for beneficiaries and the country system and to stimulate deep restructuring. The mechanisms for promoting interventions in public administration buildings will also be strengthened, which will have to play an exemplary and leading role for the entire economic sector.

Simplification of administrative procedures, control and enforcement of the measures implemented, strengthening and upgrading the ESCo model, communication and awareness-raising actions, improving the monitoring and accounting system for results and supporting research and innovation are also key factors for the success of the measures mentioned.

Consideration will be given to systematising, at national level, all meteorological data held in various ways by public and/or research bodies and by continuous meteorological data detection and certification campaigns, with the aim of building a solid database for the implementation of simulation and energy certification models for buildings under dynamic conditions.

Finally, both the adjustment of the duration of the heating season on the basis of updated meteorological data and the introduction of a heating 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 models³⁹

Article 14 (4) of Legislative Decree No 102/2014 transposing the EED provided for the improvement of the EPC contract 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 Contract Code as a result of 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 doing so, the legislator recognised that the public interest in energy efficiency, as well as having a beneficial environmental impact by reducing climate-changing emissions and reducing energy dependency, is a driver for economic growth. However, although the proposed model is addressed to public administrations to facilitate contracting to promote energy efficiency in the buildings they occupy; it aims to encourage the involvement of private operators (ESCO, credit institutions, etc.), with a view to generating economies of scale, transparency and certainty as to the results to be achieved, there is still a low uptake of this contractual instrument.

In order to cope with the difficulties of implementation and to facilitate their dissemination, a dedicated working group has been set up at the initiative of the Ministry of Economic Affairs and Finance – General National Accounts Department, within the framework of the Inter-institutional Working Group on Private Public Partnership Operations, which involves key institutions such as the National Agency, ISTAT, Anci, MASE, MIMIT and the Department for Economic Policy Planning and Coordination of the Prime Minister’s Office to define the minimum technical, economic and legal conditions that can facilitate the use by public administrations of this type of contract. In this regard, provision is made for the publication of a ‘Standard Energy Performance Contract for Public Buildings’ format, which could guide and support public administrations in using this contractual instrument, which could affect not only the performance of the technical services required but also the economic and financial management of the administration concerned. Confirming the key role of the EPC, we would point out 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 making 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 being carried out to ascertain whether it is appropriate to provide for an obligation for the PA to adopt the EPC contractual model as a necessary and uneliminable requirement for access to incentive measures. In this regard, public authorities that use this type of contract, by minimising or even eliminating investment costs and transferring the risk to the private partner, will not have to record the costs of the measures in the balance sheet. The leverage effect of the EPC is therefore capable of stimulating, with particular reference to the PA, a considerable number of measures that can generate significant savings (for example, the age of the 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 administration and the exemplary role that the public system should play, the inclusion of mandatory savings clauses in energy service contracts signed by the public authority will be defined.

In addition, with regard to the legal obligations on energy efficiency, penalty and reward mechanisms will be provided for managers/officials in charge of building management.

It is also considered appropriate to strengthen certain enabling factors, which are key to triggering private

³⁹ In accordance with Article 18 of Directive 2012/27/EU.

investment in order to achieve the energy efficiency targets:

- Structure and monitor the process of qualification of operators in the sector, with particular reference to ESCOs;
- Simplify the authorisation process for access to incentive mechanisms;
- Strengthen activities to monitor compliance with standards and regulations.

Finally, Parliament is currently discussing the ‘CantierAmbiente’ D.L., which requires all public administrations to appoint a green manager, with the aim of ensuring the correct implementation of environmental legislation within the administration to which it belongs, as well as 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 systems⁴⁰, consumer information and training measures⁴¹, and other measures to promote energy efficiency⁴²)

❖ **PUBLIC PROCUREMENT**

Public Procurement plays a leading role in the process by which public authorities procure goods, services and works. Its proper implementation, through, for example, the use of Green Public Procurement (GPP), the use of energy performance contracts (EPC) and the digitalisation of purchasing procedures (e-procurement), can make a decisive contribution to sustainability and the adoption of efficient choices in public contracts. There is a close link between public procurement and the environment, sustainability and energy efficiency.

⁴⁰ In application of Article 8 of Directive 2012/27/EU

⁴¹ In accordance with Articles 12 and 17 of Directive 2012/27/EU

⁴² In application of Article 19 of Directive 2012/27/EU

In this regard, the National Recovery and Resilience Plan provided for the reform of the Contract Code as an essential objective; this revision resulted in the approval of a new code of contracts, Legislative Decree No 36 of 31 March 2023.

The main novelties of the new Code are: (1) the definition of a set of general principles expressing values and evaluation criteria, including the principle of result, the principle of trust and market access, which are, moreover, the criteria for the interpretation of individual legislative provisions; (2) the digitalisation of the entire life cycle of public contracts or the phases that relate to the planning, design, publication, award and execution of public contracts.

In the specific area of energy efficiency, national legislation lays down, for purchases by central public authorities, compliance with specific minimum requirements, while, more generally, for all contracting authorities and contracting entities, it provides for the inclusion in 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 achieving the objectives of the Action Plan for the Environmental Sustainability of Consumption in the Public Administration Sector (i.e. 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 that public authorities express when purchasing goods and services, can promote the growth of a green and efficient market, through:

- the inclusion of environmental preference criteria in the public administration's procurement procedures as part of the most economically advantageous tender;
- the possibility of considering environmental labelling schemes as means of proof for verifying environmental requirements;
- the possibility of considering certifications of environmental management systems as evidence to verify the technical capacities of suppliers for the proper performance of the public contract.

Moreover, through its demand for goods, services and works, Public Procurement has the capacity to influence the market by supporting the development and uptake of products and services with low environmental impact and high energy efficiency, which can be achieved by updating and increasing the number of existing CAMs with clear benefits in terms of efficiency and energy savings.

Finally, Public Procurement, through the 'Innovation Partnership' instrument provided for in Article 75 of the new Code of Contracts, can play a key role in promoting technological innovation, encouraging research and development for the creation and marketing of new products and services with 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 application of the Innovation Partnership would allow PAs to develop innovative products and services that are not yet available on the market, allowing them to subsequently make purchases and the resulting equipment/services. The benefits of using the innovation partnership would therefore enable 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.

❖ **NATIONAL PORTAL ON THE ENERGY PERFORMANCE OF BUILDINGS**

As a result of 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 both to promote knowledge of the national building stock, in terms of size, energy consumption and energy performance, and to offer support activities to citizens, businesses and public authorities in order to stimulate the implementation of energy retrofitting of their buildings. The portal is also intended as a tool to support the main stakeholders in the construction sector in order to meet the objectives set out in 2030 of this Plan, as well as the Long Term Strategy and the Renovation Wave, which provide for the complete decarbonisation of the civil sector by 2050.

Ministerial Decree No 304 of 4 August 2022 provided for the portal to be developed and managed by ENEA and laid down the procedures for its operation in terms of both the provision of the service and the management of information flows, while at the same time defining forms of cooperation and coordination between the administrations or bodies holding databases, the data of which must be fed into the portal for the proper provision of the services governed by that Decree.

One of the services to be provided by the Portal is that of a national one-stop-shop or one-stop-shop, as well as data processing services both customised on your property and aggregated for statistical and study purposes. In particular, the Decree provided for the Portal to provide information and technical support, useful to the MASE and the Joint Conference, for the monitoring of national targets for energy efficiency and the integration of renewable energy into buildings and for the development of strategies and programmes to promote energy efficiency in buildings.

The entry into operation of the first functionalities of the portal was also included in the reforms (under reform 1.1a) of the 1.1 reform 'Simplification and acceleration of procedures for energy efficiency measures' 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 large enterprises and energy-intensive businesses, in accordance with Annex 2 to the Decree, as obliged to carry out a periodic energy audit from 2015.

ENEA shall set up and manage a database of undertakings subject to energy audits and carry out the checks that must verify that the diagnoses comply with the requirements of the Decree, by selecting a sample of at least 3 % of the total, in addition to checking all the diagnoses carried out by internal auditors within the undertaking.

In 2021, the third year of the compulsory second cycle of diagnosis, as was the case in 2020, the number of diagnoses received by ENEA was significantly lower than in 2019, the first year of the second cycle, as most companies had already carried out the diagnosis in 2019. In fact, a total of 629 energy audits were uploaded to the ENEA portal by 469 companies. Of the 469 companies, 174 declared themselves "large enterprises", 271 "energy-intensive businesses", 24 companies both "large enterprises" and "energy-intensive businesses".

The potential measures to be carried out at the premises of the obliged entities identified in the energy audits sent to ENEA in December 2021 are more than 1.800 and relate to 448 undertakings, of which 290 are energy-intensive; there are 317 (130 companies).

The measures carried out resulted in final energy savings of 2,8 ktoe/year and primary energy savings of 19,3 ktoe/year.

❖ **INVITATION TO TENDER**

The 'Parks for Climate' programme, established, involves the 23 national parks in Italy. The objective

of the Programme is to achieve the objectives of reducing CO₂ emissions, mitigating and adapting, and protecting and enhancing biodiversity in line with the United Nations 2030 Agenda, the European Biodiversity Strategy 2030 and sustainable development policies. The measures provided for in the Programme include projects to improve the energy efficiency of public buildings, the construction of small-scale renewable energy production facilities, low ecological impact mobility services and infrastructure, and sustainable forest management.

The programme is divided into three years and, with regard to energy efficiency measures for public buildings available to park bodies (Typology II), a budget of EUR 27 million has been allocated for 2019; additional resources were allocated for the years 2020 and 2021.

❖ **CALL FOR “INNOVATIVE INTEGRATED PROJECTS FOR NON-INTERLINKED SMALL ISLANDS”**

By Directorial Decree No 340 of 14 July 2017, the Minori Islands Programme was established to implement integrated measures aimed at reducing greenhouse gas emissions, promoting low-emission transport modes and implementing measures to adapt to the impacts of climate change in the non-interconnected smaller Italian islands.

EUR 15 million has been allocated to the implementation of the programme, including EUR 4,5 million for the implementation of measures to improve the energy efficiency of public buildings.

To date, the first measures are expected to be completed in 2023.

❖ **REQUIREMENT FOR RENEWABLE INTEGRATION IN NEW OR RENOVATED BUILDINGS**

The topic, which is transversal to the issues of efficiency and renewables, is dealt with in the sections of this chapter dealing with electric and thermal renewables.

❖ **HEATING AND COOLING**

In the heating and cooling sector, the provisions on air-conditioning systems will be updated with the specific aim of progressively replacing highly emitting installations (such as diesel boilers and inefficient biomass installations) with low emission and high-efficiency technologies.

Measures will therefore be stepped up to ensure compliance with regulations and standards, by increasing monitoring of the operating hours of heating systems in order to verify that there are no anomalies in relation to usage limits.

The introduction of new limits on the use of cooling systems will then be assessed by defining constraints (e.g. days of use, times, minimum temperatures) to be provided in relation to the reference climate zone.

In this context, the development of efficient district heating and cooling will also be promoted in order to exploit the remaining 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, provision is already made for an implementing measure for Law No 172/2017, which provides for aid for measures on cogeneration plants which result in 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 consumer awareness and active role, using, for example, home automation, network digitalisation and smart metering technologies, which will be promoted by appropriate means. The implementation of the provisions already laid down in Legislative Decree No 102/2014 on systems for measuring and billing energy consumption in the residential sector will be completed and, where appropriate, enhanced, in order to provide consumers with accurate and

timely information on their own energy consumption, which is necessary to promote corrective or other more efficient behaviour. To this end, the growing digital connectivity (ultra-wideband) and the development of applications for remote control of dwellings will be exploited to the best possible extent, also favouring a different role for electricity and gas sellers, who will be able to develop commercial propositions aimed not only at selling the commodity but also at offering consumption management services.

Finally, in implementation of Article 27 of Legislative Decree No 199/2021, as of 1 January 2024, an obligation to increase the renewable share of energy sold in the form of heat for heating and cooling will be introduced for companies selling quantities exceeding 500 TEP per year.

❖ **STREET LIGHTING.**

In the context of the PA, it is intended to structure an energy efficiency programme first and foremost from public lighting. In this sector, the programme will provide for a set of measures aimed at local administrations, aimed at speeding up a process already under way to replace light sources and at installing consumption monitoring systems, while reprogramming more efficiently the hours of use.

In this regard, the 2018 Budget Law established that public administrations 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. Firms involved in the implementation of the measures may benefit from the aid granted from the revolving fund for business support and investment in research, where EUR 300 million has been allocated for the grant of subsidised loans.

❖ **COOPERATION BETWEEN CENTRAL AND LOCAL AUTHORITIES ON ENERGY EFFICIENCY**

A specific governance model will be launched which, without prejudice to the centrality of the State, will encourage the active contribution of all central public administrations, the Regions and Municipalities to the achievement of national energy efficiency targets, through:

- ❖ continuous improvement of energy efficiency instruments implemented at national and local level, for example by reorganising energy efficiency measures in order to achieve greater coordination, eliminating overlaps and competitiveness (ERDF ROP – FNEE – Conto Termico);
- ❖ monitoring, valorising and supporting initiatives at central and local level and the results obtained.

A particularly useful tool in this regard has been the burden sharing of the renewable energy target, expressed as a share of consumption, in order to also stimulate regional and local energy efficiency measures. The new INECP Observatory will focus more explicitly on energy efficiency.

v. Where applicable, description of policies and measures to promote the role of local energy communities in contributing to the implementation of the policies and measures referred to 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 infrastructure⁴³

The regulation of infrastructure tariffs will include the energy efficiency parameter for the purpose of remunerating operators.

⁴³ In accordance with Article 15(2) of Directive 2012/27/EU

vii. Regional cooperation in this area, where appropriate

With the countries with which Italy has launched the regional cooperation process, the comparison will mainly be based on the exchange of best practices on the policies already adopted in Italy that have attracted interest in the 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 allocated to 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, priority will be given to 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 increase collective mobility, in particular by rail, including road to rail freight transport. It is recalled that the five investment priorities of the EU include those aimed at achieving a greener and carbon-free Europe.

Some of the main financing measures, including through resources made available by the Union, also dedicated to the promotion of energy efficiency, are described below.

❖ **COHESION POLICIES**

With a view to increasing economic and social development and reducing disparities and disparities between territories, the Member States of the European Union and the European Commission shall promote a cohesion policy, structured for seven-year programming cycles defined in the general guidance document (Partnership Agreement). This policy is implemented through 5 European Structural and Investment (ESI) Funds, managed jointly by the European Commission and the Member States (most of the national co-financing takes place with the National Revolving Fund for the implementation of Community policies) and through the National Development and Cohesion Fund (CSF). Where resources are available from the revolving fund, these resources are committed by means of complementary operational programmes (COP), which are intended to reinforce the actions covered by the programmes financed by the Structural Funds. In order to make the programming of the national resources of the FSC for central administrations, the regions and autonomous provinces and the Metropolitan cities, the development and cohesion plans (CSPs) have been introduced.

All these plans and programmes at both national and regional level, under the 2014-2020 programming period, set out specific action lines to promote energy efficiency, renewable sources and 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 buildings and facilities or for public, residential and non-residential use and integration of renewable sources’ of the Partnership Agreement 2014-2020, EUR 320 million was allocated to the National Operational Programme Enterprise and Competitiveness 2014 – 2020. As a result, the 2022 C.S.E. public notice ‘Municipalities for Sustainability and Energy Efficiency’ was published, which provides for 100 % capital financing of energy efficiency measures in municipal buildings, using the Consip M.E.P.A. instrument.

Under POC 2014-2020, the programme “Energy and Territorial Development” was established, which provides, for specific objective 4.1, for the implementation of energy efficiency measures on public

buildings, including public lighting, in the smaller islands of the middle-day regions. The resources initially allocated (EUR 16 million) were supplemented in 2020 with EUR 234 million for energy efficiency measures in buildings and public facilities located in disadvantaged areas of midday. Projects must be completed by 31 December 2026. To date, the first measures, all located in the small, non-interconnected islands of the middle-day areas and financed for an amount of EUR 9 million, are expected to be completed in 2023.

Under PSC 2014-2020 of the Ministry of the Environment and the Protection of Natural Resources and the Sea, resources from the FSC Operational Plan 2014-2020 were pooled and, with regard to policy area 04.01 '*Energy efficiency*', approximately EUR 94 million was allocated for capital financing of up to 100 % of the eligible costs of energy efficiency projects in public buildings and for public use. The measure is implemented through CIPE Decision No 55 of 01/12/2016, which approved the FSC Operational Plan 2014-2020 for which the Ministry of the Environment and the Protection of Natural Resources and the Sea was responsible; the measures are planned to be implemented by 2025 and will lead to a reduction in annual primary energy consumption of around 11.6 GWh/year, i.e. 0,001 Mtoe/year of primary energy. To date, the first measures are expected to be completed in 2023.

The Partnership Agreement between Italy and the European Commission on the 2021 programming cycle was approved by Commission Implementing Decision on 15 July 2022. This agreement consolidated the orientations 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 defined by the UN 2030 Agenda for Sustainable Development and national and regional sustainable development strategies. Among the objectives to be pursued is 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 programme, including: home automation; public housing to combat energy poverty; premises; enterprises' production facilities; 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 in buildings with high energy absorption, promoting deep renovation and seismic safety. However, detailed programming has not yet been finalised; please refer to the report in Annex III to Regulation (EU) 2018/1999 on the Governance of the Energy Union for the hypotheses of measures and financial needs for which they are responsible.

With regard to the FSC 2021-2027, we confirm that the measures will be implemented using the SGP, through the implementation of measures relating to the 12 thematic areas that characterise the current CSPs; among these projects, Theme 04 '*Energy*' is to carry out energy efficiency, renewable energy, grid and energy storage projects.

❖ **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 Budget 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 reduced rate (0.25 %) and has an initial allocation of EUR 635 million. Specifically, from 2015 to 2018, EUR 350 million from the Fund was earmarked for the energy upgrading 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 school call has awarded funding for the energy efficiency of more than 200 buildings (EUR 105 million of investments). Of these, 124 projects have been completed, totalling around EUR 50 million in investments. All funded projects achieved the minimum objective of

improving two energy classes, with average savings achieved in the order of 42 %.

Planned evolutionary lines

In order to respond to the challenging targets for the public sector in 2030 and 2050 set out in the new EED and EPBD Directives under approval and in this Plan, as well as in STREPIN 2021, a reform of the Fund is envisaged as part of the RepowerEU. In particular, provision is made for:

- the establishment of a fund for the decarbonisation of public buildings along the management model of the current Kyoto Fund;
- increasing the financial envelope, by supplementing the remaining resources currently available (around EUR 250 million) with additional funds from the REPowerEU programme, totalling EUR 800 million;
- the creation of a blending facility/non-repayable fund reserved for all public administrations (e.g. local authorities, public authorities, regions) to facilitate their energy efficiency investments.

In order to maximise the effectiveness of the use of the resources available, and to ensure that a certain degree of scrapping of the instrument is maintained, it is planned to adjust the share of non-repayable financing 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 subsidised loan.

- **ENERGY EFFICIENCY INVESTMENTS UNDER THE NRRP**

Mission 2 ‘Green Revolution and Ecological Transition’ was introduced as part of the NRRP, specifically aimed at promoting ecological transition measures, including those falling within the scope of ‘Energy efficiency and renovation of buildings’, as referred to in Component 2; this component has been allocated more than EUR 15 million, plus additional investments in other missions and components.

- ***RIFORMA 1.1: SIMPLIFICATION AND SPEEDING UP THE PROCEDURES FOR IMPLEMENTING MEASURES FOR ENERGY EFFICIENCY***

The reform is structured around four lines of action:

- Make the National Building Energy Efficiency Portal operational;
- Strengthen the activities of the Information and Training Plan for the civilian sector;
- Update and strengthen the Energy Efficiency National Fund;
- Accelerate the implementation phase of the projects financed by the PREPAC programme.

NONETHELESS, *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/upgrading of existing networks. The measure, implemented through Ministerial Decree No 263 of 30/06/2022 and Public Notice No 435 of 23/12/2023. The projects approved by Directorial Decree No 435 of 23/12/2022 of the DGIE of MASE were approved and 29 projects were approved, which will generate approximately 0,073Mtoe/year.

NONETHELESS  ONLY ERDI V (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 and intended for the 13 municipalities of the

19 non-interconnected minor islands, is intended to implement integrated projects on energy and water efficiency, sustainable mobility, waste cycle management, circular economy, renewable energy production and various applications for end uses, to be completed in the first half of 2026. Specifically, it is planned to carry out projects to improve the energy efficiency of public buildings, amounting to EUR 17 million, as well as measures aimed both at the construction of renewable energy installations (EUR 47 million) and at ensuring the continuity and security of the electricity grid in order to promote the integration of energy produced from renewable sources (EUR 33 million).

NONETHELESS, *INTERVENTS FOR THE ENVIRONMENTAL SUSTAINABILITY OF PORTS - GREEN PORTS (M2C2-I.1.1)*

The investment (EUR 270 million) aims to make port activities sustainable and compatible with port urban contexts by financing measures aimed at improving efficiency and reducing the energy consumption of port facilities and activities.

THE *THREE ENERGY EFFICIENCY MEASURES (NOT MANAGED BY MASE)*

- School building replacement and energy renovation plan (M2C3-I.1.1): the purpose of the investment (EUR 800 million) is to progressively replace part of the obsolete school building stock, involving 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 to improve the energy efficiency of 48 judicial buildings, enhancing their historical heritage, while at the same time ensuring seismic safety and technological efficiency. The measure is currently being implemented and will ensure an expected saving of 0,7 ktoe/year of primary energy under the scheme.
- Improving energy efficiency in cinemas, theatres and museums (M1C3-I.1.3): the Investment (EUR 300 million) aims to improve the energy efficiency of buildings linked to the cultural/creative sector.
- Measures for the resilience, enhancement of the territory and energy efficiency of municipalities (M2C4-I.2.2): the investment (EUR 900 million) aims to increase the resilience of the territory through a heterogeneous set of measures to be carried out in urban areas. The work will cover the security of the land, the safety and adaptation of buildings, energy efficiency and public lighting systems.
- School building safety and upgrading plan (M4C1-I.3.3): the purpose of the investment (EUR 3,9 million) is to secure some of the school buildings, while also promoting a gradual reduction in energy consumption.
- National Innovative Programme for the Quality of the Housing (M5C2-I.2.3): the investment (EUR 2,8 million) is intended to create new public housing structures, to reduce housing difficulties, with particular reference to existing public assets, and to revitalise degraded areas, focusing mainly on green innovation and sustainability, including energy efficiency. The investment estimates that there will be around 16.500 housing units, with expected savings of 40 %.

3.3 energy security dimension⁴⁴

1. Policies and measures related to the elements set out in point 2.345

The main measures envisaged to ensure the adequacy and maintenance of safety standards in the electricity system, gas and petroleum products can be traced back to the following measures:

❖ **GAS SECTOR**

DIVERSIFICATION OF LNG SUPPLY SOURCES

Given the increased uncertainty brought by the continuing Russian-Ukrainian conflict, Italy is actively pursuing a strategy of diversification and increasing LNG supplies (which currently cover around 20 % of domestic gas needs), through LNG supplies from new routes, in particular: up to 3,5 GSM³ from Egypt, up to 1,4 GSM³ from Qatar, up to 4,6 GSM³ progressively from Congo, and approximately 3,0-3,5^{GSM³} from supplies under negotiation from other countries (such as Angola, Nigeria, Mozambique, Indonesia).

The new potential resulting from route diversification also depends on the deployment of new national regasification infrastructures, based on floating units (FSRUs) and on maximising the use of existing LNG terminals. In particular, with regard to 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 type regasification plant entered into operation in the port of Piombino with a regasification capacity of 5 billion cubic metres per year. This will be complemented by an additional FRSU type facility off the Ravenna coast by the end of 2024 for an additional 5 billion cubic metres per year for which the necessary permits have already been issued. With regard to the upgrading of existing plants, 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 (including Gioia Tauro and Porto Empedocle) and Sardinia.

In addition, other significant projects to increase LNG supply infrastructure to be used in its liquefied form for heavy goods transport by road and sea, as well as for industrial users not connected to the methane pipeline network, should be reported.

In detail, in addition to LNG storage depots (of which there are 15 projects under authorisation or advanced FASA construction projects) and the implementation of already authorised LNG depots (such as Oristano, Porto Marghera and Brindisi), the Panigaglia and Livorno regasification terminals are also developing to be able to offer Small Scale services for ship bunkering (Livorno for vessels with a minimum capacity of 7.500 m³ and with a bunkering capacity of approximately 900 m^{3/h}). The possibility of offering reloading services also appears to be possible for both of them.

⁴⁴Policies and measures reflect the first principle of energy efficiency

Consistency⁴⁵ should be ensured with preventive action plans and emergency plans under 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 under Regulation (EU) 2018/2001 [as proposed by COM (2016) 862 on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC]

- **AMODIFICATION OF THE FUNCTIONS OF THE TRANSMISSION NETWORK AND THE GAS STORAGE SYSTEM**

Given the scenarios set out for this plan and the objectives to be achieved above, 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 gas transit needs through Italy in order to supply the adjacent European markets create new needs for the development and maintenance of the gas transport infrastructure system in full efficiency.

Together with these new needs, it should also be borne in mind that changing global energy environment will lead to a need for greater resilience and flexibility of the absolute performance of the system in order to be able to cope, in addition to adverse events, with rapid weather variations that can influence RES energy production. Since its establishment, the national natural gas system has been providing 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, we believe that the gas system will have to continue to provide flexibility, daily tip and seasonal coverage.

However, the analysis cannot disregard more in-depth hourly and local adequacy assessments with a dynamic review of the related gas flows. Actual gas consumption for the thermoelectric sector depends on the volatility of residual heat demand, which is determined by:

- actual plant production and possible non-modelled intermittences (situations of absence/excess of wind, momentary clouds, periods of particular drought);
- the location of renewable generating facilities;
- The deployment and localisation of storage systems.

These considerations should also be taken into account in the possible decision to build new high-efficiency open-cycle gas-fired thermal power plants for balancing the grid (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 becomes essential to increase transport capacity from the points of entry to southern Italy and to be able to fully exploit it by means of the 'Adriatica route', to create the conditions for upgrading the southern corridor via TAP (Trans Adriatic Pipeline), to upgrade the storage system and to encourage the development of new renewable gas production plants, in particular biomethane.

As a result of the increase in gas imports from Algeria, caused by the reduction of Russian gas flows from Austria, and with the launch of the TAP pipeline, the daily transport capacity currently finds a bottle neck in the network at the level of central Italy, which is why this transport capacity will have to be enhanced by the construction of the 'Adriatica Line', which will include a new backbone up to the grid node near Minerbio, Emilia Romagna and a thrust centre near Sulmona; similarly, reinforcements of the physical reverse flow capacity of the Italian network to the points of interconnection with the European network (Tarvisio to Austria and Passo Gries to France and Germany via the Swiss network), currently amounting to 40 million Smc/g, will be planned.

During 2022, TAP, which entered into operation in 2020, was used to its full capacity and was also crucial to compensate for the decrease in Russian gas imports. In order to create the conditions for upgrading the Southern Corridor through TAP (Trans Adriatic Pipeline), promoting an increase in capacity from the Azerbaijan supply route by an additional 10 billion m³ per year, an incremental capacity process is under way to verify the interest of gas market operators in making investments to increase transport capacity with limited infrastructure measures on the national territory.

In order to ensure an adequate upgrade of the national natural gas system to the new environment, it is crucial to upgrade the storage system, with the development of new facilities that will allow for a more flexible and resilient system, including in scenarios for maximising off-takes through proven injection processes that allow for higher peak performance of the system during the winter period. In particular, the measures may include the development of new deposits, in some cases already technically verified, and the possibility of managing some sites already in operation in excess of the original pressure of the deposit.

Indeed, it is important to keep the focus on the resilience of the Italian system, exposed during the winter period to strong increases in peak demand which in the late 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 rationing 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 transmission network would make it possible to offset the decline in domestic production of fossil methane and contribute to security of supply; the scenario for the development of biomethane from sustainable biomass by 2030 is estimated at around 5,7 billion cubic metres per year.

NONETHELESS, REVISION OF THE RISCHI, PIANO A P REVENTIVA AND PIANO'S DIALYSIS DOCUMENT EMERGENCY

The Risk Analysis is the main document to identify the technical, economic, social and geopolitical problems most likely to happen to the Italian gas system. This document is provided for in Regulation (EU) 2017/1938 and, given the need to move away from Russian gas supplies, is important in assessing a reorganisation of the energy supply mix. It will have to be assessed in the light of the challenges facing the national energy system in the short term, such as increasing renewables and phasing out coal and fuel oil from the electricity generation mix. The risk analysis is being updated and is expected to be finalised before the winter 2023/2024 season.

The Preventive Action Plan (PAP), on the other hand, 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. In addition to the national dimension, the PAP also complements the European dimension, including assessments resulting also from comparison with Member States sharing the same supply routes. The Preventive Action Plan is also being updated and will have to take into account both the changed international supply situation and the numerous infrastructure development and diversification measures being implemented.

As provided for in Regulation (EU) 2017/1938, the Emergency Plan (EP) for the Italian natural gas system, already updated last year, will have to be updated with the introduction of the addendum containing the plan to reduce the consumption of the national natural gas system (prepared in implementation of Regulation (EU) 2022/1369, as a further consequence of the increased risk linked to the instability of gas supplies from Russia). The EP establishes the conditions for triggering the three different crisis levels that may arise due to unfavourable conditions, defines the type and methods of implementing measures to deal with crisis situations, and identifies the companies and operators in the gas and electricity sector responsible for implementation. It should be pointed out that the EP was initially designed to deal with crises of short duration, whereas now, including through the addendum on consumption reduction, it envisages measures to deal with longer periods of crisis, taking stronger action also on the demand side (e.g. voluntary reduction of consumption by industrial

customers), as well as on maximising supply (peak shaving with LNG and 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. Such 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 is unable to supply its protected customers. Italy has, at present, signed a solidarity agreement with Slovenia and today with 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 fossil-fuel-based development will take time and the maintenance of a state-of-the-art domestic downstream oil industry will ensure the necessary reliability, sustainability and security of supply.

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 by 2030, including:

- To encourage the conversion of Italian refineries to biorefineries, in line with the increasingly ambitious EU targets and the increase in domestic demand for advanced biofuels used both in blend with fossil products and in purity. For this action, many of the existing refineries will be able to reconvert, even partially, into biorefineries for the production of biofuels for use in purity, some in a comprehensive way, and others in a modular way, to accompany the decarbonisation process, so as to eliminate the share of processed fossil products in favour of bio-based products. Specific objectives are already foreseen in this direction.
- Encourage the deployment of co-processing plants within refineries in order to further develop the production of advanced biofuels for both road transport and aviation with SAF – Sustainable Aviation Fuels. For this action, the first authorisation is being issued for the construction of a co-processing plant, within the refinery in San Martino di Trecate (NO), for the processing of vegetable oil resulting from the processing of waste from the production of esterified palm oil belonging to the category of ‘acid oils’, in order to store it and to replace the mixture of fuel oil loaded at the existing plant;
- Support the re-use of industrial sites through conversion to storage or other productive investments, also with a view to safeguarding employment levels.

Further actions to be implemented concern support for research and the industrialisation of both RFNBO and RCF synthetic fuel production processes within refineries to accompany biofuel production and to provide the market with 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 CCSU facilities in refineries. Another key action to be implemented is to focus on installations 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 EU initiatives aimed at increasing the list of raw materials suitable for the production of 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 refining industry, with the aim of enabling the market to have products with high environmental compatibility produced according to the highest environmental standards.

Finally, it should be pointed out that increasing the availability of biofuels 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, so that part of the obsolete car fleet currently circulating on petrol can be renewed in the environmental sense.

❖ **ELECTRICITY SECTOR**

A *MANAGEMENT OF THE SAND LETTRICAL SS-S-S PLAN*

The objective of the Electronic System Safety Plan (PESSE) is to avoid uncontrolled interruptions of the electricity service that would cause social and economic hardship for society. Given the increase in extreme events, the current defence plans need to be updated with the aim of limiting disruptions through protection, preventive control and corrective control solutions for the effective management of emergency situations.

From a medium- to long-term perspective, it is considered necessary to adopt methodologies based on risk analysis at programming and operational level that take into account forecasting uncertainties to identify effective mitigation actions to avoid or limit disruptions, including with a view to greater cross-border coordination of safety and emergency management measures. The security plan will also need to be integrated and coordinated with the network expansion plan in order to identify the best mix of measures to increase resilience to extreme events.

NONETHELESS, *INCREMENT OF THE REXILIENCE*

Improving the reliability of an electricity system, as well as improving its performance against ordinary events, requires increasing its resilience by identifying criteria and ways to minimise disruption 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 classic approaches that do not consider multiple failures.

Among the measures to be implemented to improve the resilience of the electricity system, the objective of network operators (TSOs and DSOs) is to adopt analytical methodologies that take into account all the risks arising from the occurrence of multiple contingencies, so as to identify the most useful and effective measures to improve the resilience of the system at all management stages and for all relevant threats, also considering hydrogeological threats, which are proving particularly critical and which are expected to cause significant disruptions in the future.

Risk analysis covering threats and their probabilities, already applied in the design of the network development plans for resilience, is an element on which to work at all levels and stages to improve resilience. This requires consideration of the link between causes and effects, i.e. between threats, faults, contingencies and impacts on the service of the electricity system and therefore:

- modelling the quantitative link between causes of disturbances and contingencies, by extending the classic definition of risk;

- identify and select contingencies based on environmental/meteorological conditions, in the short or long term, to enable the safety of the system to be assessed also against possible extreme events;
- assess the impacts on the system;
- identify the most effective risk mitigation actions in the short and long term at both preventive and corrective levels to improve the resilience of the system.

Correspondingly, the objective to be pursued is to identify and apply:

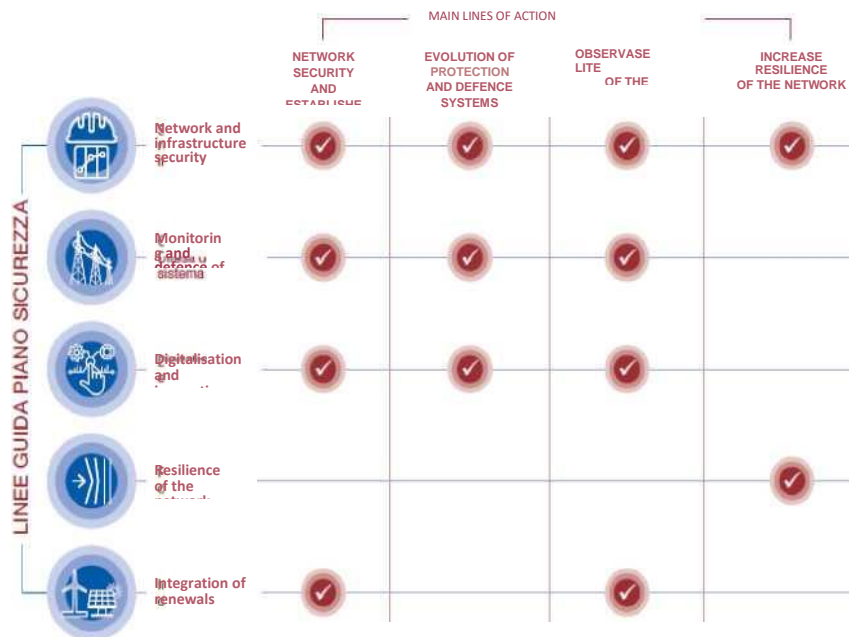
- passive measures aimed at improving the ability of the infrastructure to avoid disruption in the face of threats, preventing and minimising the impact of threats through:
 - (1) the introduction of redundancy, which reduces the vulnerability of the network infrastructure by, for example, increasing the number of connections in order to strengthen the mesh size;
 - (2) the strengthening of components and the use of protection barriers, which reduce the vulnerability of components, preventing threats to damage the network infrastructure;
- Active (smart) measures to minimise disruption by 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 manner by adopting both passive and active solutions for the defence of the system.

NONETHELESS, *PNETWORK DEFENCE AND ADOPTION OF MEASURES FOR CONTINUOUS TECHNOLOGICAL ADAPTATION*

The safety plan, drawn up annually by Terna and with a four-year time horizon, sets out the measures that must be taken to guide the ecological transition, ensuring the safety and stability of the network's operation. The plan identifies a number of measures to be taken that are necessary to achieve the safety objectives. The four action lines of the Plan develop in line with the main objectives, as shown in the figure below.

Figure 50- Safety Plan. Action lines and guidelines



The five main objectives (security, control, digitalisation, resilience and RES integration) will also need to be confirmed in the next defence plans, which will need to be adapted and adjusted to take account of the progressive decommissioning of the national coal thermal park and the progressive increase in production from renewable sources, the share of which will be further increased compared to the 2019 INECP.

Further analysis will have to be carried out in order to assess the possible countermeasures to be taken in the event of changes to the network set-up due to the increasing impact of distributed generation and the possible occurrence of network degradation. To this end, the plans will need to be integrated and coordinated among operators in order to improve the resilience of the system, by adopting 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 the time needed to resume service, which require coordination with the main actors involved (local authorities, civil protection, road managers, etc.) and the availability of available resources.

Both the National Transmission Network Manager and the distributors are required to submit resilience plans identifying the areas and lines at risk and the priority actions to be taken to improve the resilience of the network infrastructure. These plans will have to consider both passive and active solutions.

NONETHELESS, MCAPACITY MARKETS

The measure (Ministerial Decree of 28 June 2019), initially approved by the Commission in 2018 and then in 2019 in the subsequent version with new emission limits for participating installations, 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 ones, to cover Terna’s needs expressed on the basis of a long-term *assessment* updated annually. The measure serves to promote long-term, efficient, flexible and less polluting investments, with a view to decarbonising the sector and ambitious renewables penetration targets by 2030.

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 correct price signals to guide market entry and/or exit choices in the medium to long term.

NONETHELESS, *NUOVI INSTRUMENTS FOR MAINTAINING INSTALLATIONS IN OPERATION*

The existing *capacity market* mechanism will need to be integrated

to stimulate the implementation of a series of technical improvements to the traditional thermoelectric sector, so as to ensure its availability even in extreme climatic conditions, such as those that occurred 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 thermal power stations is the adaptation of their water-cooling systems. This solution, for thermoelectric power plants built close to water courses, is based on the replacement/integration of the current water cooling system with air evaporative towers and/or air capacitors, which ensure the operation of thermal power plants even in extreme climatic conditions, characterised by severe heat waves and low flow rates in water courses.

. In parallel to the *capacity market*, the provisions of 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 decommissioning but which is still necessary to ensure the adequacy of the electricity system, while minimising the burden on final consumers, should be followed up.

NONETHELESS, *NUOVI INSTRUMENTS FOR SYSTEM FLEXIBILITY*

Small distributed resources, such as electric vehicles, heat pumps and residential storage, 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 electricity system management.

The distributed resources can already participate in the ancillary services market 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 encourage the technological innovation needed, together with the appropriate regulatory instruments, to reduce the costs of their participation in energy markets, making them competitive with large traditional resources. Further research is needed in this area, but promoting standardisation of communication processes, technologies and protocols could be the key to removing the technological and economic barriers that have a negative impact on the effective participation of these resources in the markets to date.

A further step will be to amend the Italian network code, making it possible for these resources to participate in the energy markets in a structural way 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 very security of the grid, 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 futures.

NONETHELESS, *MINONETHELESS FOR THE DISSEMINATION OF ACCUMULATIONS*

As regards the development of storage capacity, Legislative Decree No 210/2021, followed by ARERA Decision 247/2023, states that the storage capacity necessary for the system must be developed through fixed-term contract mechanisms managed by Terna.

In more detail, the supply will have to cover newly built storage capacity, according to regular auctions and capacity quotas by area. As a result of these auctions, the holders of the contracted storage capacity will be

awarded an annual remuneration for the entire long-term time horizon provided for in the auctions, in return for the obligation to build the facility and make available to Terna the new storage capacity built, in order to (i) enable third party market operators on the energy markets and (ii) make it available on the MSD.

This capacity will have to be supplied progressively through sequential auctions. In this way, the needs procured through each auction will be sized in such a way as to take account of the expected evolution of new renewable capacity, both in terms of quantity and distribution between the 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 as well as capturing any reduction in the costs of electricity storage technologies that we will be able to experience in the coming years).

NONETHELESS, *CYBERSECURITY*

As regards cyber security measures, in accordance with Regulation (EU) 2019/941 of the European Parliament and of the Council of 5 June 2019, the Electricity Risk Preparedness Plan has been updated, providing for national and regional measures to prevent and/or respond to any electricity crisis.

Within the Plan, a cluster was dedicated to cyber-attack risks, in which risks to be addressed such as ‘malicious attacks and fuel shortages’, ‘rare and extreme natural disasters’ and ‘simultaneous incidents’ were envisaged, specifying the operational tasks relating to risk preparedness planning and management, to be delegated to the National Transmission Network Manager, as well as a plan of measures to manage and respond to a possible system crisis. Those scenarios were 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 were developed in line with the regional crisis scenarios, and were consolidated downstream of a consultation with the regulatory authority, the TSO, the distribution system operators deemed to be significant and the associations of categories relating to production.

The plan must be updated in accordance with the terms laid down in European legislation.

ii. Regional cooperation in this area

❖ **CROSS-BORDER COORDINATION**

Regional cooperation arrangements and procedures have been identified within the Risk Plan in order to ensure coordination between Member States and TSOs to prevent risks to the electricity system.

In this system, the operator of the national transmission network 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 inter-regional adequacy assessments (Short Term Adequacy Analysis-STA) in order to identify possible risks at European level within a weekly timeframe.

In the event that adequacy risks are identified, a regional process is launched, aimed at finding possible solutions to minimise the risks by means of countermeasures coordinated bilaterally between other TSOs, including the activation of a Critical Grid Situation (CGS).

The countermeasures used to resolve the critical situation may be as follows: removal of network maintenance work affecting border lines, reassessment of transfer capacity, preparation for energy emergency delivery.

If the adequacy problems 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 to neighbouring TSOs for the period of time when the uphill or descending reserve purchased in the Dispatching Services Markets 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 be requested exceptionally in case of security breaches or other adequacy concerns.

There are mutual assistance contracts in place between the French, Swiss and Slovenian TSOs in the event of an emergency.

Outside the Region, these contracts were signed between Terna and TSOs of 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 period, as defined in the Partnership Agreement between Italy and the European Commission approved by Commission Implementing Decision of 15 July 2022, as part of Strategic 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. This is supported by the National Research Programme for Innovation and Competitiveness for the green and digital transition 2021 – 2027, with a budget of EUR 800 million. Objective 2 also provides for the creation of new infrastructure to mitigate and adapt to climate change and the adaptation of existing traditional infrastructure, including the landfill of electricity networks to which the Regional Operational Programmes contribute.

Under the 2021-2027 FSC, in addition to energy efficiency and renewable energy, networks and storage are also planned within the 'Energy' thematic area. In the area of networks and accumulations, in complementarity with the NRRP, which favours upgrading

of the distribution network, the FSC shall also include the improvement of the effectiveness and performance of electricity transmission and storage systems by: modernisation of networks, and distributive networks (smart grids), whether transmissive, 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 the mainland). The role of storage is crucial to stabilise transmissive networks and optimise the balance between the different time profiles of electricity demand and supply. In this context, pilot projects for the use of low-enthalpy geothermal energy for industrial and civil heating can be assessed and supported under the Fund.

3,4 dimension of the internal energy market⁴⁵

3.4.1 Electricity infrastructure

I. Policies and measures to achieve the interconnectivity target referred to in Article 4(d)

❖ **ELECTRICITY SECTOR**

The Terna 2023 Development Plan, in line with previous plans, identifies opportunities for developing interconnection capacity with the electricity systems of neighbouring countries. An examination of signals from foreign markets and 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 with Greece and possibly other countries Balkans where significant development of renewable energy sources and increased maturity and integration of wholesale markets are achieved.

The development of interconnection capacity with North Africa may also be of strategic importance, with a view to increasing the integration of the Mediterranean countries with the European market. In this context, the Italy-Tunisia interconnection cable – ELMED⁴⁶ (or tunita) project – provides an additional tool to optimise the use of energy resources. The project is included in the list of Common Interest Projects (PCIs), having demonstrated positive effects in medium and long-term scenarios for Italy, Tunisia and other EU Member States.

In order to promote the indicators set out in Communication COM (2017) 718 final (and referred to in the heading of the paragraph), account has been taken of the⁴⁷ interconnection projects listed in the table below and defined in the context of ENTSO-E's Ten-Year Network Development Plan (ENTSO-E), i.e. the projects planned by Terna in its National Transmission Network (PdS) development plans.

⁴⁵ Policies and measures shall reflect the energy efficiency first principle.

⁴⁶ December 2022, the European Commission has informed us that the interconnection project between Italy and Tunisia has received the largest amount of EUR 307,6 million from the Connecting Europe Facility (CEF), the European Union's fund for the development of projects aimed at improving Community energy infrastructure.

⁴⁷ For the purpose of calculating the targets, only interconnections with EU Member States and Switzerland (as a country interconnected only with EU Member States) should be considered, as recommended by the Expert Group on electricity interconnection targets. Therefore, interconnection projects with Montenegro and Tunisia remain excluded from the calculation.

Table 37 – Interconnection projects planned in the PdS that can contribute to the achievement of interconnection targets
[Source: Terna]

Frontier	Project ID PdS/TYNDP	Project name
IT – AT	100-I/26	Reschenpass project (220 kV Nauders – Glorenza)
	—/210 *	Mlach ml – Somplago
	204-P/375	220 kV Interconnector Italy – Austria
	252-P/—	At Dobbiaco interconnection – Austria
IT – CH	—/250 *	MI Castasegna – Month
	—/174 *	MI Greenconnector project (HVDC Verderio – Sils)
	167-P/—	Valchiavenna rationalisation
IT – FR	301-P/299	HVDC SACOI3
IT – YES	200-I/150	Interconnection Italy – Slovenia (removal of existing network limitation)
	—/323 *	MI Zaule – Dekani
	—/324 *	MI Redipuglia – Vrtojba
IT-TN	601-I/29	Italy-Tunisia interconnection (ELMED)
	—/283 *	ML TUNUR
IT-MT	—/1085 *	MI Malta-Italy
IT-GR	554-P/1112	HVDC GRITA 2
IT-ME	401-S/28	HVDC Italy-Montenegro (MONITA2)

* Merchant Line project not owned by Terna

The development of further interconnection projects, in addition to those under consideration here, must take account of the long timescales resulting from the need to establish agreements between States and between TSOs and to complete the authorisation, construction and commissioning processes, while also addressing possible local objections.

There remains an interest in investigating further interconnection projects, provided that they are technically and economically feasible and in line with the objectives of decarbonisation and market integration. .

ii. Regional cooperation in this area⁴⁸

As already pointed out in the previous paragraph, discussions and cooperation with neighbouring countries are ongoing with a view to implementing the energy infrastructure network, improving national and European security of supply.

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 impacts in

⁴⁸Other than the PCI Regional Groups established under Regulation (EU) No 347/2013.

medium and long-term scenarios for other Member States, which is why it is included in the list of projects of common interest (PCIs), in accordance with Regulation (EU) No 347/2013.

In August 2022, Terna, in response to the Authority's request (ARERA) to find appropriate financing instruments to partially cover investment costs, applied for the Italy-Tunisia interconnection project for access to EU EU funds under the Connecting Europe Facility (CEF) programme, the European Union project for the development of projects aimed at improving Community energy infrastructure. In December 2022, the European Commission informed us that the interconnection project between Italy and Tunisia received the largest amount of EUR 307,6 million from the CEF Fund, compared to the EUR 850 million planned for its implementation.

Further European funding concerns both the Tyrrhenian link and the enhancement of SACOI, through Repower EU funding.

- **GAS SECTOR**

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 the existing interconnections, in line with the SNAM development plan, aimed at increasing the centrality of the Italian system in its role as a link between the resources of the Mediterranean and the Southern Corridor and the European markets, which provide economic and security benefits for the country and at the same time increase exports to those systems that will need gas to replace that which previously came from Russia:

- strengthening the overall import capacity at the same time as the points of entry located in southern Italy by means of the 'Adriatica line' with the aim of increasing imports from North Africa and Azerbaijan;
- reinforcement of the transport capacity of the entry point of Melendugno (without increasing the total contemporary capacity of the system), which will be implemented following a successful conclusion of the ongoing incremental capacity process;
- increased total export capacity to Austria and Northern Europe;
- strengthening LNG imports through the construction of the two new regasification plants at Piombino and Ravenna and the assessment of possible new terminals in southern Italy;
- creation of export capacity to Malta;
- increased domestic production capacity of both natural gas and biomethane;
- renewal and upgrading of the storage system.

❖ **OIL SECTOR**

Oil interconnections

As already pointed out 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, crossing the Alps, connects 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

❖ **ELECTRICITY SECTOR**

The measures to promote the upgrading and improvement of the electricity transmission network, to be implemented in line with TERNA's 10-year development plan, shall be based on the following actions:

— **SVILUPPI INTERNAL NETWORK**

Terna has planned a series of measures to ensure that congestion between market areas is overcome, 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 works on the same route or adjacent to an improvement in operating performance, i.e. to enable them to operate 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 realised, including the use of underground/submarine cable technology and innovative AC solutions.

This will also need to be complemented by investments in distribution networks, which are increasingly affected by the deployment of small and medium-sized plants.

NONETHELESS, PIANIFICAZIONE DELLA SVILUPPO DELLA RETE NAZIONALE DI TRASMISSIONE

The implementation of the works necessary to achieve the energy policy objectives in the planned timeframe inevitably requires a sharp acceleration of investment in the energy sector and even more so in the electricity sector. Investments that will have to be channelled, to a large extent, into the development of new RES capacity, accumulations and transmission and distribution networks, to be carried out through a coordinated approach, in order to make the system as a whole more efficient. In order to achieve the Community objectives, it is necessary to provide for accelerated and simplified authorisation procedures for both network development works and the connection of renewable installations. Moreover, the development of RES in line with policy scenarios cannot be dispensed with by means of fixed-term contracts (e.g. RES auctions), which ensure that they are implemented and reduce their development costs. With regard to network works, it will be important to facilitate permits for repowering operations on the primary network (RTN) involving "extra performance" (e.g. increasing current flow rates) for the same environmental impact. Further details on the simplifications of the authorisation procedures can be found 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, Terna's 2023 Development Plan identified a new connection standard at the voltage level of 36 kV for generation plants with a capacity of up to 100 MW to be connected to the RTN. The new standard 36 kV connection solution makes it possible to provide the connection to the RTN at a voltage level more appropriate to the average size of the production facilities requiring the connection, while at the same time removing them from the authorisation complexities brought about by the construction of a stall of 150.

132 kV. In particular, the new standard connection solution requires that each production plant is directly connected to a 36 kV voltage stall, which performs the function of a network plant for the connection with a conventional capacity of 100 MVA.

THE DEVELOPMENT OF STORAGE SYSTEMS FOR SAFE AND EFFICIENT MANAGEMENT OF THE RTN

The accumulations must be 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 No 210/2021, which transposes Directive (EU) No 944/2019 at national level, not only recognises accumulations as essential for the integration of RES and curbing overgeneration, but also provides for the definition of a long-term supply system based on competitive, transparent auctions carried out by Terna and aimed at minimising the burden on final customers. The needs of the new storage systems are set out in paragraph 2.3.

A PROTOTYPE PROCCIO TO FACILITATE THE IMPLEMENTATION OF INNOVATIVE PROJECTS ON ENERGY NETWORKS

Establishment of a regulatory framework enabling innovation projects, including by means of a dedicated fund and, where appropriate, the granting of transitional derogations from the rules in force, to enable operators to test innovative solutions on the ground and on a prototype basis, providing for appropriate cost recognition mechanisms. Network operators will be particularly involved, through the use of a new system innovation approach that also involves the commercial parties to develop new business models, including in the downstream stages of the strictly electricity supply chain, and by means of testing carried out on an ad hoc basis. An example of this is the pilot projects launched by ARERA to encourage the participation of distributed resources in the dispatching services market.

NONETHELESS, AND THE RATIONALE FOR RECOGNISING INFRASTRUCTURE COSTS ON THE BASIS OF THE SERVICE PROVIDED TO USERS

Gradually and gradually moving beyond the current cost recognition approach, differentiated between operating costs and capital costs, in favour of an integrated approach aimed at strengthening investment selectivity criteria and efficient use of infrastructure, which has always been at the heart of regulatory action, identified by the Regulation for Expenditure and Service Objectives (ROSS).

This approach will be adopted by ARERA in accordance with a step-by-step approach with a first phase aimed at defining the criteria for recognising costs geared 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, consisting of an analysis of the industrial plans that will have to be discussed and validated with the regulator both in terms of volumes and service targets and in terms of the cost of the same service (ROSS-integral). The new accreditation criteria will first be implemented, starting from the next regulatory period.

In particular, the new integrated approach focuses on: realistic forecasts and development plans based on the actual future needs of the customers of the service; incentives to improve the level of performance, in terms of efficiency, cost-effectiveness and quality of service; removal of any regulatory barriers to the development of innovative solutions.

❖ GAS SECTOR

The situation since 2021, characterised by the high volatility of natural gas prices and, subsequently, by the tensions triggered by the conflict between Russia and Ukraine, has significantly altered the

way in which the Italian transmission system is used, which have historically predicted a significant flow of gas entering the north-east through the Tarvisio Entry Point.

New infrastructure utilisation dynamics see an increase in imports from the South with up to 100 % of existing capacity used for limited periods of time and an increasing contribution from LNG Terminals. This could take on a structural dimension in the medium term, also in view of the guidelines and decisions taken both at Community and national level, which provide for the possibility of reducing Russia's energy dependence to zero through increased gas supply from other suppliers and the progressive development of renewable gases to support the energy transition. The issues relating to the new dynamics of infrastructure use are in addition to those already present on the gas transmission and storage system concerning the need to upgrade and maintain efficient 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 operators' development plans, which are described below.

NONETHELESS, *SDEVELOPMENT AND ADAPTATION OF THE GAS TRANSMISSION SYSTEM*

The transport system will need to be developed with the aim of increasing import capacity from interconnection points with North African countries and Azerbaijan. To this end, it will be essential to build the Adriatica route, which, by increasing the transport capacity of the south-north system, will make it possible to use the full capacity of the southern Italian import points. The development of the TAP transmission system and the resulting development of the Italian infrastructure will also be of great importance, in order to make a capacity of up to 18 billion m³ year available from Azerbaijan.

The gas transmission system will also have to increase its transport capacity to the other countries of the European Union, in particular by increasing its transport capacity to the countries of Central Eastern Europe and in particular to Austria. In the context of ensuring the energy security of other countries, the interconnection project of Sicily with Malta is also recalled.

In addition to the development of new capacity, it is necessary to plan and carry out the works necessary to maintain existing gas pipelines and compression plants, in order to ensure the 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 levels, and improving environmental protection levels by reducing greenhouse gas emissions.

NONETHELESS, *SDEVELOPMENT AND ADAPTATION OF THE REGASIFICATION SYSTEM*

As described in the previous paragraphs, the Ministry of the Environment and Energy Safety is actively pursuing a strategy to diversify and increase supplies of LNG both through active policies of agreements with producer countries and by increasing regasification capacity through the authorisation of two floating regasification units (FSRU), operated 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 more 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 one for Adriatic LNG, which is studying further steps of capacity increase, is in the process of being defined.

Small 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, allowing to seize the

opportunities of the globalised LNG market. In this context, plans for coastal depots and small volume LNG regasification plants (SSLNG), to be carried out in Sardinia and on the Adriatic coast (Ravenna and Porto Marghera), as well as projects for the unloading of LNG from small methane vessels, storage and subsequent loading onto bettoline vessels (bunkering) and cryogenic tankers for the refuelling of household and/or industrial customers and fuel refuelling stations, are being authorised and evaluated at MASE.

In particular, in Sardinia, in implementation of the 2019 INECP, the gas infrastructure configuration was defined by the Prime Ministerial Decree in order to achieve the objective of phasing out coal-fired power plants.

In order to provide consumers with the necessary level of security, fairness and continuity of supplies, the possibility of linking coastal depots under construction and authorisation to regasification terminals operating in Italy, which are in the process of being equipped with a reloading system carried out by the TSO, and the possibility of adopting a system linking the price of the raw material to the PSV are being defined. In this connection, we would point out the plan for the OLT LNG Toscana regasification terminal, which, in addition to the activities currently carried out by the terminal, provides for the implementation of a small scale service for the unloading of LNG in small vessels that will supply coastal and bunkering depots in Italian ports and throughout the Mediterranean, and for the Panigaglia LNG terminal to set up a truck loading service.

In addition to the projects relating to the development of new regasification capacity, it is necessary to carry out works to maintain and modernise existing terminals, especially those which have been operating for longer periods, in order to ensure their efficient operation, in line with the latest technologies.

THE DEVELOPMENT AND UPGRADING OF THE GAS STORAGE SYSTEM

The need to increase security of supply, while ensuring adequate flexibility to 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 both by 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 efficiently with the following objectives:

- maintain the performance of the storage system against its physiological decay resulting from its use over time;
- adapting 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 on the storage system, for example by drilling new shafts, the gas treatment system, replacing the most critical tools or improving their performance, and finally the gas compression system, for example,

by inserting electrocompressors that can abate the emissions of climate-changing gases while also ensuring a backup in case of malfunction of existing turbochargers.

NONETHELESS, *S*DEVELOPMENT OF BIOMETHANE

The fight against climate change – the consequences of which are becoming increasingly evident – and growing tensions on international markets make the deployment of renewable gases increasingly urgent and strategic in the light of the need to accelerate the decarbonisation path and reduce Europe’s energy dependence. In this context, the development of biomethane can play a central role, not least with a view to promoting an economy based more on sustainability and circularity in the use of resources in the context of sectorial integration.

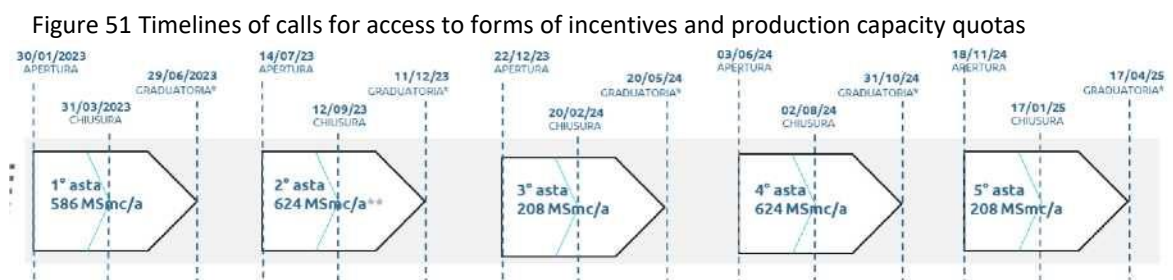
In this regard, the REPowerEU Commission has recently doubled the Community target for biomethane production, bringing the European target for production to 35 billion cubic metres by 2030 compared to what was initially foreseen in the Fit-for-55 initiative, which on the same date indicated a total volume of around 17 billion cubic metres. This objective implicitly defines targets for Italy far higher than those previously considered.

With this in mind, it is considered appropriate to provide for the adoption of support mechanisms to promote the construction of biomethane production plants and to reduce unit costs and speed up the development of the capacity needed to achieve the targets set out above.

In this regard, the Biomethane Decree published in the Official Gazette on 26 October 2022 and the relevant implementing rules drawn up with the support of the GSE and approved by an approval decree on 13 January 2023 are intended to provide support to the biomethane sector by:

- a capital contribution of 40 % of the eligible costs of the investment incurred, up to the maximum eligible investment cost;
- a production incentive, with differentiated tariffs based on plant costs;
- annual power quotas made available in order to exploit the potential of retrofitting existing biogas plants and the emergence of new production.

Please find below the timelines for invitations to tender for access to the forms of incentive and the respective quotas for production capacity made available through appropriate competitive procedures.



NONETHELESS ULATERAL LNG NETWORK DEVELOPMENTS

Legislative Decree No 257 of 16 December 2016 transposing the DAFI Directive laying down implementing rules for Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure, provides, in Article 6, for the supply of natural gas for transport, that an appropriate number of LNG refuelling points for inland waterway vessels or sea-going vessels are to be put in place by 31 December 2025 at maritime ports and by 31 December 2030 at inland waterway ports.

LNG fuelled on the TEN-T core network. The same article provides that an appropriate number of LNG refuelling points, including combined with CNG (compressed natural gas) refuelling points, accessible to the public at least along the Italian sections of the TEN-T core network to ensure the circulation of LNG heavy-duty vehicles, taking into account current demand and its short-term development, shall be implemented by 31 December 2025, with a gradual development. In Italy, the TEN-T core network has around 3.300 km of road, divided into 3 main corridors:

- Axis Palermo – Naples – Rome – Bologna – Modena – Milan – Verona – Brenner.
- Axis Genoa – Milan – Chiasso and Genova Voltri – Alessandria – Gravelona Toce.
- Asse Frejus – Turin – Milan – Bergamo – Verona – Padua – Venice – Trieste.

In recent years, as a result of the great development of the number of heavy duty vehicles powered by LNG – currently around 2.000 on Italian roads – a large number of liquid methane road distributors have been set up and entered into operation (there are currently 59 plants in operation in Italy and a further 41 are planned, according to Federmethane).

ii. Regional cooperation in this area⁴⁹

With regard to regional cooperation in the field of energy infrastructure development, in addition to the cooperation activities already set out in paragraph 1.4, we would also point out that European electricity system operators cooperate fully in defining the energy scenarios (ENTSO-E/ENTSOG Scenario Report) and the European Development Plan (Ten-Year Network Development Plan) 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 on the new list of projects of common interest (PCIs), that is to say, among the infrastructure measures with positive effects on European countries, which make it possible to integrate EU markets, diversify energy resources and help put an end to energy isolation.

In addition, many projects of European significance are being assessed for funding through the EU REPOWER programme and other funding programmes that the European Union is implementing with the Member States as a result of the pandemic crisis.

⁴⁹ Interventions other than PCIs of the regional groups established under Regulation (EU) No 347/2013.

3.4.3 market integration

1. 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 energy sources and increasing participation in the markets of the different resource categories, shall include:

- the policy framework set out in the INECP approved in 2019;
- the national framework transposing the European Commission’s Clean Energy Package 2019, with particular reference to Directives 2001/2018 and 944/2019 and Regulation No 943/2019, concerning the promotion of renewable sources and the integrated electricity market;
- From the ongoing review process regarding the rules on the integrated natural gas market, with a focus also on the development of the market and infrastructure for the deployment of hydrogen and renewable gases;
- The ongoing update of the Integrated Text on Electricity Dispatching (TIDE), which is being finalised after the second consultation (document for consultation 685/2022/R/eel), reforming the dispatching activity, aimed at ensuring the security 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, and the gradual reduction in the use of programmable installations;
- From the ongoing revision of the EU regulations and directives on the integrated electricity market geared towards the development of futures trading and greater consumer protection so that prices better reflect the benefits of increased penetration of renewable energy sources.

This includes the following measures:

❖ EXCEEDING THE SINGLE NATIONAL PRICE (PUN) AND DEVELOPING EUROPEAN MARKET COUPLING

In order to achieve greater 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, it will be assessed whether, from 2025, the PUN has been exceeded by means of a gradual path outlined in Legislative Decree No 210/2021, in view of the implications for the entire market design and the commercial chain. Once the PUN is exceeded, offers for purchase on the day-ahead market will be valued at zonal prices and meet the objective of promoting price signals to the final consumer, which could serve the development of *demand response*.

Consideration will also be given to the appropriateness of any measures to protect the consumers most exposed to this amendment and, given the importance of the PUN as a benchmark for forward trading, appropriate replacement indices for market participants will be introduced.

However, the assumption that the PUN is exceeded does not mean that GME’s calculation of a reference price for electricity traded within the wholesale electricity market cannot be safeguarded, in line with the calculation of the single national price, in order to promote the development and transparency of the markets.

❖ **DEVELOPMENT OF FUTURES MARKETS FOR THE PROMOTION OF INVESTMENTS IN RENEWABLE GENERATION CAPACITY**

Measures will be taken to promote the development of PPPs, addressing barriers to entry which still make participation in these schemes difficult; in this regard, market-based instruments will be introduced to promote both supply-side and demand-side aggregation, so as to facilitate the participation of small entities that would individually have greater resistance and/or difficulty in ensuring compliance with the requirements and commitments set out in 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, the GME has already set up an information sheet with the aim of facilitating the meeting between the parties interested in concluding the aforementioned agreements, which is the starting point for the further strengthening of centralised market instruments. Finally, Article 16a of Decree-Law No 17/2022 provided for the greater integration of renewable sources into the market, including the involvement of GSE as the counterpart of new long-term contracts for renewable electricity with both producers and consumers.

Two-way or CfD contracts as a contract instrument with the renewable generation capacity system are a crucial tool to ensure that decarbonisation objectives are pursued.

The CfD tool can have significant benefits in terms of price stabilisation over time, providing the renewable producer with certainty of revenue streams in the medium term, allowing the project to be bankable, and the consumer to protect against price volatility in *spot* markets.

In order to improve the effectiveness and efficiency of this tool, 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 the 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 the consumer and without compromising the security of the electricity system. In this connection, it should be borne in mind that minimising costs for the system requires consideration to be given, first of all, to the different market value associated with the expected production profiles of the various 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 the assignees, will have to evolve with the dual aim of efficiently allocating risks and responsibilities between the system and private investors and to better integrate renewable capacity into the dynamics of *spot markets*. In particular, it will assess:

- ❖ the introduction of automatic tariff adjustment mechanisms to cope with rising costs and risks related to inflation;

the possibility of recognising the tariff 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 more correct allocation of risks among the various actors in the system. In a first step, for example, the fee payable could be recognised on the basis of the installation's potential inputs instead of actual net input at times when renewable production cuts occur 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-shifting products *provided* for in Legislative Decree No 210/2021, the tariff to be paid could be recognised on the basis of *standard* profiles consistent with the requirements of the electricity system (e.g. *baseload* and/or *peakload*), with the obligation to feed renewable energy into the grid, on an annual basis, equal to a share of the contracted profile; this type of contractual structure would leave responsibility for the optimal *mix* of renewable technologies to be implemented by private investors.

- **DEVELOPMENT AND OPENING OF THE ANCILLARY SERVICES MARKET**

The growth of intermittent renewable sources will increase the need for flexibility of the system itself, which can be met by ensuring the availability of an adequate volume of flexible resources ready to provide services to the transmission system operator.

Therefore, a regulation of dispatching and supply of services by the transmission system operator will be defined in the direction of promoting the ever-increasing participation of resources, not only generation, depending on the ability to provide services, with particular attention to the flexibility needs of the system. To this end, the main areas of intervention are:

- encourage equal competition between production and consumer units on the services market, based on the principle of technological neutrality;
- eliminate as far as possible and useful to 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;
- enable them to provide services at an aggregated level, considering that small units often do not have sufficient skills to participate individually in organised markets.

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 growing share of energy from renewable sources, the following measures are essential:

❖ **DEVELOPMENT OF UTILITY SCALE STORAGE CAPACITY**

With a view to integrating renewables expected in 2030, Legislative Decree No 210/2021 introduced a measure for the development, through market mechanisms, of new storage capacity, on the basis of needs broken down by areas drawn up by Terna and approved by the Ministry of the Environment and Energy Safety (MASE), subject to the opinion of the regulatory authority. The development of storage systems according to a market model is linked to the reorganisation of the market design, in line with the reform launched by the European Commission and still under way, aimed, inter alia, at promoting flexibility in the system, providing for the introduction of market products (*time shift options*) in order to meet the need for flexibility in the system, enhancing the different value of energy over time and ensuring more efficient management of the phenomenon of overgeneration from non-programmable renewable sources.

❖ **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, most recently by the Regulatory Authority of the Integrated Text on Diffuso Self-Consumption, which has rationalised the various possible schemes and regulated the valorisation 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, will be strengthened through the aggregation of new entities aimed at managing,

primarily for 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* to trigger further support and assistance services, including for local authorities concerned, to set up new collective participatory entities. In this regard, as also stated in paragraph 3.1.2, support for the development of these configurations is 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 *vehicle to grid*. In 2020, a first phase of implementation was launched on the basis of the Ministerial Decree of 30 January 2020 and the subsequent regulation of ARERA as part of the projects launched under Decision 300/2017, which introduced mechanisms and new rules for participation in the markets for electric vehicle charging systems services, and provided for specific measures to rebalance the payment of general system charges.

Subsequently, these mechanisms will be applied extensively in order to promote the deployment of technology for integration between electric vehicles and the electricity grid; prior impact assessments will be carried out to take into account the results of the trial 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 THE ROLE OF DISTRIBUTORS (DSOS)**

The energy transition will increase the resources connected to the distribution network. For example, the growth of solar PV in the residential sector and distributed accumulations will play an important role in achieving *energy and emission targets*. Similarly, consumers themselves will play an increasingly active role in the energy market, from *consumers* to *prosumers*.

In this context, Legislative Decree No 210/21 provided, in the context of a *central dispatch* model, for a more active role for DSOs by regulating:

- the manner in which electricity distribution system operators shall cooperate with the transmission system operator in order to extend, in an efficient and secure manner for the system, the participation of entities equipped with generation, demand and storage facilities connected to the distribution networks they operate, including through aggregators, in the energy, ancillary services and balancing services markets;
- experimenting with a system of self-dispatching at local level, by means of a system of premiums and penalties that incentivises electricity producers and final customers to balance their positions by offsetting consumption with local production, while respecting network security constraints.

ARERA has launched, on the one hand, a mechanism that will allow local network constraints expressed by distributors to be taken into account in the supply processes of global flexibility services in the market for dispatching services in a dynamic manner and to guarantee the coordinated and secure operation of the energy transmission and distribution networks. 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 that of a neutral facilitator for Terna's procurement of global ancillary services. In the future, it is crucial to continue with the trials in order to improve the

coordination arrangements between TSOs and DSOs. According to the current approach in Europe and Italy, a model in which the balancing market is operated solely by the TSO will have to be maintained, with DSOs being given a ‘facilitator’ role in the dispatching of 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 global and, where efficient, local ancillary services markets.

- **DEVELOPMENT OF AGGREGATION IN SERVICES MARKETS AND BALANCING**

Legislative Decree No 210/2021 strengthened the right of consumers to create aggregations (generation facilities, also together with storage systems and demand units) to access the services markets that the TSO needs to resolve any congestion, facilitating better integration of energy from renewable sources and supplying the necessary reserve margins.

To this end, it will be crucial to 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 operating perimeters:

- BRP is the entity in whose name the marketing of the amount of energy in the energy markets is registered, including the responsibility for taking a balanced position, failing which the economic consequences thereof will be applied;
- the BSP is responsible for carrying out the movements resulting from the provision of ancillary services to which the entity has committed itself with the network operator.

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 the selection of resources.

- *v. Policies and measures to protect consumers, in particular the most vulnerable and, where applicable, energy poor, and to improve the competitiveness and competition of the retail energy market*

- **COMPLETION OF LIBERALISATION OF RETAIL MARKETS**

The process of liberalising the retail market in electricity and natural gas has been implemented in recent years with the adoption of the legislative and regulatory acts provided for in Law No 124/2017, which brought about the end of the protection schemes for small enterprises (since 1 July 2021) and, more recently, for micro-enterprises (since 1 April 2023).

In this regard, liberalisation of the final market for the sale of electricity and natural gas to household customers will be completed in implementation of the aforementioned legal provision. 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, procedures will be carried out by 10 January 2024 for the selection of suppliers of the so-called phased protection service, a tool for the transition to the free market so as to ensure continuity of supply to household customers other than vulnerable customers who will not have chosen a supplier on the free market by that date. By the same date, ARERA will have to identify measures to overcome the regulated price regime for vulnerable household customers in accordance with the Union regulatory framework. Vulnerable customers in the electricity sector were specifically identified by Legislative Decree No 210/2021 transposing Directive 944/2019.

Similarly, on 10 January 2024, the regulated price regime for household customers in the natural gas sector is expected to be exceeded.

These actions will contribute to:

- prevent operators from exercising market power and strengthen the *unbundling* rules, which today see a competitive advantage for sellers 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;
- give certainty to the consumer and reduce the proliferation of incorrect information.

- **CONSUMER PROTECTION TOOLS AND MEASURES**

A number of consumer measures are planned 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 Purchaser's website, which makes available to each consumer, in compliance with *privacy* law, the data of their electricity and gas users relating to the register of their supply contract and historical consumption data, using the information obtained from the Integrated Information System. Looking ahead, consideration will be given to how best to make this data available also to third parties designated by the consumer, as well as through the Tender Portal, in order to enable the consumer to compare the same offers on the basis of his own consumption profile. Accessibility to historical and daily consumption data can also be promoted through new digital solutions. With regard to digitalisation, a further perspective is on the deployment of *smart home* tools. *Switching*, steering and activating/deactivating supply, including delinquency, will be increasingly efficient thanks to the Integrated Information System;
- Register of suppliers of electricity and natural gas: in order to carry out their activities, all electricity sellers must be included in the list of electricity sellers, which has 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)). The list of natural gas sellers will be reformed in order to strengthen the deterrent effect of the list against unfair behaviour by operators and to harmonise, both in terms of requirements and management, the gas list with the similar operational instrument in the electricity sector, in order to better protect final customers. Suppliers will have to comply with specific criteria, arrangements, technical, financial and good repute requirements for inclusion and retention on the list;
- Regulation of Last Application Services: rationalisation of the rules governing the selection of operators, the conditions for providing 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: instruments to protect vulnerable electricity and natural gas customers will be developed in application of the provisions of Article 11 of Legislative Decree No 210/2021 and Legislative Decree No 176/2022 respectively, by introducing offers under *standard* contractual and service conditions defined by ARERA which operators are required to offer to such customers;
- other measures: provision will be made for checks and penalties for misconduct and for strengthening the tools for comparing offers (already present, by ARERA and the Single Buyer). An important role will be given to information campaigns with the aim of raising final customers' awareness and increasing the consumer's knowledge of the multiple tools that the market offers to promote its active role, in particular to accompany the final stage of the market liberalisation process.

- **EMERGENCY MEASURES TO TACKLE THE CRISIS**

Several measures have been introduced to support households and businesses during the energy crisis resulting from the Russian-Ukrainian conflict. These measures were introduced as an emergency and were the result of a more general reflection on the need to identify possible replicable measures to be taken in order to deal with any recurrence of potential problems. These include:

- rescheduling of energy bills for final customers: the measure provides that final customers may request their suppliers to pay their energy bills in instalments and, in order to support the liquidity needs of sellers resulting from these instalment plans, they have access to State-guaranteed credits;
- reduction of tariff charges: the measure involves reducing or reducing the tariff components to cover the so-called system charges that finance public policies for users in general, or reducing the value added tax on natural gas for households;
- strengthening energy bonuses for individuals in conditions of economic distress or severe health conditions requiring the use of life-saving electrical equipment, both in terms of increasing the compensation and increasing the ISEE threshold for access to 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);
 - or in implementation of Regulation (EU) 2022/1854, a maximum limit of EUR 180/MWh is laid down to apply to the market revenues of producers or their intermediaries, obtained from the production and sale of electricity from renewable sources and from the other types of sources identified in that Regulation.

- **MEASURE IN FAVOUR OF ENERGY-INTENSIVE BUSINESSES**

The evolution of market prices for energy has made it increasingly convenient to invest in new renewable generation capacity, even though a need to stabilise revenues and reduce market risk remains (and is likely to grow in the future with the adjustment of the generation mix). This need can be met – in addition to CFDs – through PPAs with industrial entities, if not through the direct construction of renewable energy installations by intensive energy consumers, thus also contributing to the decarbonisation of the industry. This is a virtuous path that should be promoted. This can be achieved by devising energy release mechanisms that provide for the transfer by the system of renewable energy to industrial customers who undertake to build new renewable capacity (directly or via PPA) in a timely manner and to return the renewable energy anticipated by the system to them in time. The measure in favour of energy-intensive businesses introduced by the Ministerial Decree of 21 December 2017 to support the competitiveness of productive sectors exposed to international competition will also be reformed in accordance with the new Community guidelines on State aid for climate, environment and energy 2022, strengthening the obligations of companies to adopt efficient behaviour in line with decarbonisation objectives. The measure in favour of energy-intensive businesses introduced by the Ministerial Decree of 21 December 2017 to support the competitiveness of productive sectors exposed to international competition will also be reformed in accordance with the new Community guidelines on State aid for climate, environment and energy 2022, strengthening the obligations of companies to adopt efficient behaviour in line with decarbonisation objectives.

- **PROSUMER TOOLS: THE SELF-CONSUMPTION PORTAL**

To encourage the development of photovoltaic self-consumption, GSE has developed a dedicated IT tool: the Photovoltaic Self-Consumption Portal. The main objective of the portal is to facilitate and support the launch of photovoltaic projects geared towards self-consumption through a simulator, a guide on self-consumption, FAQs, maps and good examples.

Being aware of the benefits of self-consumption, the consumer can test its usefulness for his particular case. The portal allows personalised simulations for individuals, businesses and public authorities. The analysis carried out via the portal shows the correct size of the facility 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 pricing⁵⁰

❖ **ELECTRICITY AND GAS MARKET: SMART METER**

New *smart meters* will play an important role in providing all the comprehensibility and monitoring elements useful to consumers.

In the electricity sector, the replacement of existing digital meters *with second-generation smart meters* is considered essential to convey products, services and services to be included in new models of distributed generation and consumption, 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 consumers. In 2019, the rules were updated (Decision 306/2019/R/eel) for the three-year period 2020-2022 and in 2022 for the three-year period 2023-2025, including planning of the timetable for the large-scale commissioning of 2G meters for all distribution companies with more than 100.000 customers (corresponding to 98 % of the country's withdrawal points), which include the following steps:

- the launch of the deployment plans for 2G *smart metering* systems shall be carried out by 2022;
- the bulk replacement phase of existing meters should be completed by 2026 (for 95 % of the meters, the same percentage as used for the first generation). A *target* of 90 % of replacements is also planned for 2025.

In the context of dispatching, in line with the plans for activating the new 2G meters, the mechanisms for the profiling of off-takes and inputs for small users and installations may be gradually exceeded using the actual measures made available by the new meters for the purpose of defining the physical consignments of the dispatching service.

In the gas sector, the transition to smart measuring systems is continuing to be *completed* (Decision 669/2018/R/GAS), making it possible from the outset to provide solutions with higher functionality where the cost differential is limited or in any case lower than the expected benefits, with the following timescales:

- For distribution undertakings with more than 200.000 final customers, 85 % in service by 31 December 2020;
- For distribution undertakings with a number of final customers between 100.000 and 200.000, 85 % in service by 31 December 2021;
- For distribution undertakings with a number of final customers between 50.000 and 100.000, 85 % in service by 31 December 2023;

⁵⁰ In accordance with Article 15(8) of Directive 2012/27/EU

— Gradual extension of replacement objectives to smaller operators.

❖ **DISTRIBUTION OF OFFERS OF DYNAMIC PRICE ELECTRICITY SUPPLY CONTRACTS**

In implementation of the provisions of Legislative Decree No 210/2021, rules will be introduced concerning the right of consumers who have a smart meter to conclude, upon express request, a dynamic price contract, i.e. an electricity supply contract that reflects the change in the price on spot markets, on express request, with each supplier with more than 200.000 final customers. It is also envisaged that ARERA may adopt, also on the basis of the results of market and supply monitoring, mechanisms to steer the gradual pricing of components of supply contracts, other than electricity, following a dynamic logic, while reducing fixed quotas, taking into account the need to promote demand response and energy efficiency in end uses.

3.4.4 energy poverty

1. 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 into 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 different instruments relating to the different types.

Firstly, it should be noted that, in order to improve the coordination of existing objectives and measures between the various institutional stakeholders, the National Energy Poverty Observatory, provided for by Legislative Decree No 210/2021, has been operational since 2022.

The National Observatory is a collegiate body with 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. To carry out its tasks, the Observatory relies on technical support from the Energy Services Manager (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 stakeholders concerned with 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 entities and bodies representing stakeholders;
- carrying out study, analysis and technical support activities 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 the phenomenon of energy poverty at national level;
- support for cooperation within similar European institutional bodies;
- development of criteria for identifying the number of households in energy poverty;
- promoting the exchange of experience and information with the regions, other relevant central and local administrations, research organisations and 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 the design and monitoring of the effectiveness of measures and the integration of the various actions in the field of public policy in order to comprehensively combat the phenomenon of energy poverty, seeking to overcome the fragmented nature of the measures and resources allocated.

The Observatory will therefore be the institutional forum in which the various initiatives relating to analysis, measurement/monitoring, information⁵¹ and combating energy poverty, starting with those set out in this plan, should be developed in a comprehensive manner. In that regard, the

⁵¹The Decree provides, *inter alia*, that the results of the Observatory's activities are to be disseminated on the Ministry's website.

Legislative Decree No 210/2021 provided for the development, on the basis of analyses by the Observatory, of a national strategy to combat energy poverty.

- **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 designed to reduce energy expenditure by households: these are the social bonuses for electricity and natural gas, which are aimed at families facing economic hardship.

Bonuses are paid by means of a discount on bills, with an amount differentiated according to the number of members of the household and, for gas only, according to the type of use and the climate zone. The indicator for identifying the number of beneficiaries of this measure is the ISEE (Equivalent Economic Situation Indicator), which is used at national level to also access other subsidised social benefits. 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 value of the ISEE must be below EUR 9.530⁵² which increases to EUR 20,000 for households with at least 4 dependent children (thresholds modified for 2023, as indicated below). In order to avoid distortive effects on consumption and to maintain an incentive to save energy, the discount on bills shall be fixed uniformly for all households of a given type, irrespective 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 granting social bonuses due to economic hardship have undergone a profound transformation since 2021 in implementation of Decree-Law No 124 of 26 October 2019 (converted, with amendments, into Law No 157 of 19 December 2019). From a mechanism based on consumer demand, which required an application to be submitted to the municipality of residence, we moved to an automatic mechanism that does not provide for any request from those entitled to receive the bonus, based on the interoperability of the INPS and SII databases, which allowed more households affected by energy poverty to be intercepted and led to a significant increase in the bonuses paid: beneficiaries increased from one third of beneficiaries (800 thousand) to 2,5 million. In 2022, the bonuses paid increased further as a result of extraordinary government interventions.

Table 38 – Electricity and gas bonuses 2019-2022 (in millions) [Source: ARERA – AU]

Year	Electricity bonus	Gas bonus	Total bonuses paid	Annual% change
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, that is to say, in the poorest group, supporting the bonus mechanism's ability to effectively identify the target of the most economically disadvantaged households. Bonuses have a strong redistributive effect: in the fifth poorest, the benefit is highest and amounts to up to 4 % of household income and more than 85 % of expenditure

⁵² inflation update of the 2023 ISEE threshold.

overall, it is intended for households in the first two fifths of equivalised income. Relative to household income, the benefit is higher in the first fifth.

In order to contain the increase in raw material prices and to protect the most troubled households, some extraordinary measures have been taken since 2022. First, a total of EUR 2,81 billion of public resources was allocated in 2022 to strengthen and extend the range of beneficiaries of the electricity and gas social bonuses. As from the second quarter of 2022, the ISEE threshold was increased to EUR 12,000 for all eligible households 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 introduced not specifically aimed at customers in poverty, but at the entire range of consumers, including zero system charges in the case of electricity supplies (reduction in the natural gas sector), reduced VAT on natural gas supplies and the provision of instalment plans for utility bills.

It should also be noted that, in addition to measures to combat energy poverty, Legislative Decree No 210 of 8 November 2021 also laid down, 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 as vulnerable the household customers listed in paragraph 2.4.4.

The Decree also provides for the definition of a specific 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, these provisions on vulnerable customers were also extended to the natural gas market.

The framework thus introduced is consistent with the Communication from the Commission on guidance to Member States for the update of the National Energy and Climate Plans 2021-2030, where it is expected that all vulnerable and energy poor consumers must be guaranteed access to essential services at affordable prices. Moreover, the proposal for a 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' times (e.g. price rises). In addition, such customers should be provided with a universal service of 'high quality', distinct from that for other types of customers.

- **MEASURES TO SUPPORT ENERGY EFFICIENCY AND THE DEPLOYMENT OF RENEWABLE SOURCES**

Energy efficiency⁵³, 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; here is only a focus on energy efficiency measures that have a specific impact on reducing energy poverty.

This includes, for example:

⁵³All measures in this area are described in more detail in the section on the energy efficiency dimension, in particular paragraph 3.2.

- tax deductions for the energy retrofitting of buildings ('Ecobonus'): this instrument was first extended to households in energy poverty, by means of the option of assigning credit to incapacitated persons (2017 Budget Law), and subsequently provided for the extension to the Autonomous Institutes for Social Housing/Social Housing (2018 Budget Law);
- the National Energy Efficiency Fund, which provides financing at a preferential rate or guaranteed by the State for energy efficiency measures carried out by companies and public authorities, it also includes measures to improve the energy efficiency of public housing;
- the Conto Termico, which provides incentives for energy efficiency in the public administration and for the production of thermal energy from renewable sources. This mechanism also allows support for measures to improve the energy efficiency of public housing. Between 2021 and 2022, more than 3.700 social housing interventions were carried out with Conto Termico (out of a total of around 187 interventions supported by the mechanism). Out of a total of more than EUR 540 million recognised by the Conto Termico, EUR 9,2 million was allocated to social housing.

These measures will be reinforced in line with the evolutionary lines identified in Chapter 3.2, also taking into account the proposal for a revision of the EU Energy Efficiency Directive currently being adopted which requires Member States to achieve a share of the required cumulative end-use energy savings among consumers affected by energy poverty, 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 proposal 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 applicable, people living in social housing, to alleviate energy poverty.

In particular, one of the most complex issues already highlighted in the 2019 INECP is that of people living in unowned dwellings.

Indeed, available data show that the majority of poor households do not live in owner-occupied homes but in third party dwellings (rented or usufruct homes) and that the incidence of absolute poverty is higher among rented households.

In 2021, poor rented households accounted for 45.3 % of all poor households, with an absolute poverty rate of 18.5 %, compared with 4.3 % of those living in owner-occupied dwellings. In this context, the push for energy efficiency measures is very weak.

Table 39 – Household tenure by poor households – Year 2021 [Source: ISTAT]

Type of use of the dwelling	% of households in poverty
<i>Rent</i>	45 %
<i>Property</i>	41 %
<i>Usufruct and free use</i>	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 improve their energy consumption through behavioural changes. The proposed revision of the Directive requires Member States to provide financial and technical support for measures to reduce poverty.

tenants' energy, taking into account the costs of such measures and their accessibility for owners and tenants, overcoming the split of interests between owners and tenants.

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, as well as technical assistance on 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 energy sources and energy efficiency include energy income: this is a public incentive for low-income households to install photovoltaic panels on homes, with a contribution of up to 100 % of expenditure, with the aim of reducing the cost 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 for Economic Planning and Sustainable Development and an allocation of EUR 200 million since 2022, transferred from the Development and Cohesion Fund to the National Energy Income Fund.

Shared energy configurations, in particular renewable energy communities (CERs) described in paragraph 3.1.2, may also be included among the instruments that can help alleviate energy poverty. CERs can bring economic and social benefits to poorer households or in rural and remote areas.

The NRRP also takes into account this function of CERs; for example, investment 1.2 is intended for public administrations, households and micro-enterprises in municipalities with fewer 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 at securing the necessary resources to install at least 2.000 MW of new power generation capacity in distributed configuration.

In the light of the above, the importance of greater institutional cooperation between the various national and local authorities responsible for the interaction between energy poverty measures, housing policies and efficiency in public and private buildings becomes even more evident, and it is no coincidence that the discussion initiated by the National Energy Poverty Observatory also goes in this direction. In this context, attention will also be paid to actions aimed at overcoming the problems in collecting data and mapping local situations resulting from the incomplete and highly heterogeneous operational, regional and local databases and the specificities of the various public and private building sectors.

Finally, a measure which concerns 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 for the development of energy towards a system based on renewable sources (both electricity and thermal) on the smaller, non-interconnected islands. Specifically, provision is made for an all-inclusive 'basic tariff' on the energy fed into the grid, and a premium on self-consumption, i.e., for thermal RES solutions (solar heating systems, solar cooling, heat pumps, etc.), remuneration in a single payment, partially reimbursing the costs incurred and differentiated for the various types of plant. Decree-Law No 17 of 1 March 2022, as coordinated by the conversion law of 27 April 2022, Article 9 (1ter) and (1 quater) provides for the updating of Ministerial Decree No 14/2/2017 on the energy transition of small islands that are not interconnected with the objective of achieving by 31 December 2026 full coverage of the energy needs of the smaller islands that are not interconnected by means of energy from renewable sources.

- **FURTHER PLANNED DEVELOPMENT LINES**

- ***FORMATION, INFORMATION, TUTORING***

Optimisation of consumption behaviour with a view to reducing bills, as well as energy efficiency,

even more so for vulnerable customers who are less aware of the opportunities available, involves both digital authorisation tools and training tools. Through the European project ASSIST (Support Network for Household Energy Saving), which ran from 2017 to 2020 (with the participation of the Single Buyer), which involved around 8.500 consumers, Italy defined a virtuous model to support consumers in difficulty.

The results of the project include the definition of the role and tasks of the Domestica Energy Tutors (TED), which is a single point of reference, with integrated expertise, which consumers in energy poverty or vulnerable can consult on all issues related to their energy consumption, through training, networking and support for 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 bodies.

In terms of information and training, it is also important to recall the Energy Efficiency Information and Training Plan, described in Chapter 3.2.

- ***OLITHICLOCAL AUTHORITIES TO COMBAT ENERGY POVERTY***

Experience with energy poverty demonstrates the effectiveness of measures taken by local authorities (municipalities, regions) in the context of national policies. Local actions, thanks to direct knowledge of the context and conditions of families in the area, are effective and comprehensive, including through targeted initiatives. Successful initiatives, which can be applied more widely, include at least the following:

- development of a free audit service for households in poverty, with energy audits and support to access 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;
- reclaiming abandoned buildings, upgrading them from an energy point of view, and allocating them at reduced rent to households most in need;
- subsidised loans for installing photovoltaic panels for shared consumption;
- communication campaigns, at local level, to encourage virtuous 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 those measures should take initiatives to promote the participation of vulnerable customers in the communities themselves, so that they can access the environmental, economic and social benefits provided by 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 enhanced in order to disseminate models of participation promoted by local authorities.

3.5 research, innovation and competitiveness dimension

1. 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 subsequent 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 in the field of electric system research, initiatives in the hydrogen sector, which directly involve businesses, cybersecurity and the construction of Hydrogen Demo Valley at the ENEA Research Centre of 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 referred to in Chapter 2.5. In addition to research and innovation activities, the focus will be on transferring new technologies to the economic fabric of the country with the help of new emerging actors in the energy landscape, such as living labs and start-ups.

The priority technology areas referred to in Chapter 2.5 will then be implemented through the following instruments/policies:

- Mission Innovation;
- Horizon Europe programme;
- Electrical system search post 2024;
- Innovation fund;
- other measures and policies.

Table 40 – Technology and tools/policies

	Mission Innovation	Horizon Europe programme	Electrical system search	Innovation fund	Other policies
Energy storage	X	X	X		X
Renewable sources	X	X	X		X
Hydrogen	X	X	X	X	X
Renewable fuels		X	X		X
Nuclear energy	X				X
CCSU		X		X	X
Technologies of network and	X	X	X		
Critical raw materials and advanced materials;	X		X		X

- **INSTRUMENTS/POLICIES IN THE SHORT TERM (UNTIL 2024)**

-ELECTRICAL SYSTEM ICERCA

Electrical system research focuses on fundamental research into energy technologies and materials with TRL 1 – 4. On the basis of the strategic evaluations carried out, the discussions with the

the main stakeholders in the research and the results of the public consultation have identified two priority objectives on which to concentrate financial resources, amounting to EUR 210 million:

- decarbonisation; and
- digitalisation and network evolution.

Under some themes of strategic interest, “Integrated Projects” will be carried out, with a complex scientific structure and a parallel collaboration between research bodies and universities, with the ultimate aim of accelerating the selection of technologies and processes that can help achieve emission reduction objectives at competitive costs. Please find below a summary of the Integrated Projects.

- *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 reducing the costs of Balance of System (BoS) linked to the area occupied by the PV system, to study possible solutions for the integration of PV 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 in the field of electrochemical accumulation is carried out on current dominant technology (advanced Li-ion batteries – Gen. 3b), both on the most attractive technologies for stationary applications, such as redox flow and Na-ion, and on the most innovative technologies, to systematically explore the possibilities of electrochemical accumulation technologies beyond 2030 (Gen. 4 and Gr. 5).
- *Hydrogen technologies*. Under the project, the 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 network balancing function, such as long-term storage and long distance hydrogen transmission and distribution infrastructure.
- *Cybersecurity of energy systems*. Potential threats may relate to the production-transmission-distribution chain, to communication networks or to computer networks. The adoption of new IT/OT/IoT digital technologies in networks enabling flexibility services entails an evolution of cyber security measures. Three main drivers characterise the digital transformation of energy systems: (I) ensuring the security of new energy communications technologies; (II) preserving the resilience of the electricity system; (III) harnessing the potential of big data and artificial intelligence technologies to support cybersecurity.

NONETHELESS, *AND ELECTRICITY SYSTEM RESEARCH ACTIVITIES RELATED TO DECARBONISATION*

- *Frontier materials for energy use*. The proposed activities focus on recovery of waste heat, in the form of electricity, development of materials and technologies for building components for the energy sector through additive manufacturing and sustainable, low-energy catalysts.
- *Highly efficient 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 electric carrier into end uses*. The core aims of the project are: (a) overseeing and developing processes and technologies for energy transition, electric vehicle energy supply systems, complex heat pump systems; (b) facilitating the introduction of technologies, processes, systems and organisational and management models through advanced IT technologies.

- *Electricity from the sea.* The main objective of the project is the construction and installation at sea of a full-scale offshore prototype capable of converting wave into electricity. The prototype called PeWEC (Pendulum Wave Energy Converter) will be installed on the island of Pantelleria.
- *Solar thermodynamic.* 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 ACTIVITIES RELATING TO THE 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 problems, innovative technological and architectural solutions need to be identified and developed in order to increase the flexibility of the electricity grid, and methodologies for defining efficient planning interventions ensuring 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 system processes, by processing as much information as possible; the second dedicated to innovative processing technologies and architectures that provide widespread access to shared scalable computing resources.
- *Energy from renewable sources and integration into the territory.* A key element of the energy transition is the use of renewable energy sources in every possible production sector. The approach to the development of technological solutions must be interdisciplinary and should cover the planning and management tools of the energy system, 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, we highlight the 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 fleet is closely linked to the evolution of the electro-energy system and therefore innovative forms of integration need to be developed. Research activities are aimed at functionality and services that can deliver cross-sectorial benefits of greater sustainability.
- *The user at the heart of the energy transition.* The electricity and renewable market directives of the Clean Energy for All Europeans Package create a new role for end users, who must become increasingly active not only in the production and self-consumption of energy from renewable sources, but also in implementing energy efficiency pathways and providing ancillary services to the transmission and distribution grid.
- *Support for adjustment: market developments; innovation in network design and management.* The following activities will be implemented: support for the evolution of electricity market regulation; 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 increasing them significantly, pose a new challenge to all actors in the energy system. The objective of research is to provide tools to improve technologies, economy and sustainability, to develop innovative technologies, to design new rules and business models.

❖ **INSTRUMENTS/POLICIES IN THE MEDIUM TERM, UP TO 2030****NONETHELESS, *MISSION INNOVATION***

Under the new programming of Mission Innovation (MI 2.0), the future funding, quantified for the three-year period 2023 – 2026 at approximately EUR 500 million, will support the two missions to which Italy has joined, namely the Green Powered Future Mission (GPFM) and the Clean Hydrogen Mission (CHM). Joint cross-cutting activities will also be envisaged to amplify the impact between the above-mentioned Missions. As the MoU is a public-private partnership, the specific activities are identified through a comparison with the business sector, which is already in place. A further possibility is to use the programme's funds also to finance advanced nuclear research, as regards the Divertor Tokamak Test Facility (DTT) project, and the research on SMRs and AMR on molten lead cooling technology of Generation IV reactors.

The *Green Powered Future Mission (GPFM)*

The GPFM aims to build an ambitious technological pathway to integrate up to 80 % of the share of energy from renewable sources for the next decade. The GPFM is a public-private partnership co-led by China, Italy and the United Kingdom and made up of MI member countries, companies and international organisations, bringing together previous activities *on smart grids* and the entire sector of renewables and accumulations. National research bodies are involved in R & D in cooperation with private companies.

The organisational structure *of the Mission* has three pillars of research and innovation:

- Pillar 1 – Cost and reliable variable renewable energy;
- Pillar 2 – System Flexibility and Market Design;
- Pillar 3 – Data and digitalisation for the integration system.

In 2022, the *Action Plan was presented, which* outlines the milestones of the programme and launches upcoming international actions such as the *Five Demos for Five Continents* initiative, which provides for the implementation of Demo on the five continents and close cooperation of the member countries of the *Mission*.

- *Clean Hydrogen Mission (CHM)*

The overall objective of the *Clean Hydrogen Mission* is to reduce the costs of clean hydrogen for the end-user to 2 \$/kg by 2030. This will be achieved both by supporting research, development and innovation activities and through the implementation of at least 100 *Hydrogen Valley*, which will have to act as aggregator units for the growth of hydrogen-based ecosystems. The CHM has three pillars:

- Pillar 1 – Research & Innovation;
- Pillar 2 – Demonstrators and *Hydrogen Valley*;
- Pillar 3 – Regulatory framework enabling the development of hydrogen.

NONETHELESS, *PROGRAM HORIZON AND EUROPE*

Horizon Europe is the EU's main 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 with it significant novelties, including:

- the establishment of the European Innovation Council, to support breakthrough innovations throughout the lifecycle, 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 correlation between European R & I. These include:

○ *"100 climate neutral cities by 2030"* 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;

○r *'mission adaptation to climate change'* to support at least 150 European regions and communities towards climate resilience, promote the development of innovative solutions to adapt to climate change and encourage regions, cities and communities to lead the transformation of society;

- a strengthening of 'open science policy' policies;
- a new approach to more ambitious and strategic partnerships;
- the definition of a new contractual model to be applied in all directly managed European programmes financed under the Multiannual Financial Framework 21-27.

These partnerships 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 has provided for specific research calls (EUR 210 million – also co-financed by MiMIT) for the period 2022 and 2023. These calls for proposals addressed to the electricity and heat production sector, as well as to industry, include accompanying activities to foster the sharing of strategic knowledge and maximise the impact so as to accelerate upscaling, replication and market uptake of cost-effective clean energy technologies. Under the DUT 2022-2027, the MUR will finance (EUR 49 million of which EUR 32 million is also co-financed by MiMIT) transnational R & D projects in line with the three objectives of the programme, implemented by the following measures:

- *Districts in Energy Positiva (PED) Transition Pathway*: the aim of the measure is to support urban transition through innovative solutions for the design, large-scale deployment and replication of DPEs, with the mission of having at least 100 DPEs by 2025;
- *15-minute City (15minC) Transition Pathway*: the measure aims to support the transition that it addresses sustainable urban mobility by improving accessibility and connectivity, starting at neighbourhood level.
- *Circular Urban Economies (CUE) Transition Pathway*: the measure aims to support the transition of planning and design of inclusive urban spaces and an urban economy based on regeneration and circularity.

NONETHELESS, *ELECTRICAL SICERCA POST 2024*

The programming of Electricity System Research in the period 2025-2030 will consolidate the most promising technologies launched in 2022-2024 and include the priority technology areas referred to in Chapter 2.5.

NONETHELESS, *INNOVATION FUND*

The Fund currently supports 4 projects located in Italy, which will be able to contribute to the decarbonisation of industries for an overall reduction in GHG emissions of around 25.2 Mt CO₂ equivalent in the first 10 years of operation. The total contribution from the Fund to Italy is EUR 126,9 million, compared to a total amount of project costs of EUR 334,5 million. Further initiatives may be considered in relation to the topic of carbon capture and utilisation (CCU) and CO₂ capture and geological storage (CCS).

Table 41 – List of selected Innovation Fund projects in Italy

Acronym	Title	Sector	Start date	Project phase	Beneficiaries	Innovation Fund grant (EURmillion)	Expected GHG emission avoidance (tCO ₂ eq)
Large Scale						117,7	25,043,106
TANGO	Italian PV Gigafactory	Solar Energy	01/01/2021	Preparation	EGPI	117,7	25,043,106
Small Scale						92	121,731
DrossOne V2G Parking	Large scale vehicle to grid system with integrated storage: thin EV batteries and their fast response to address grid services, currently provided by highly-pollution-gas plants	Intra-day electricity storage	01/05/2021	Construction	F2MeS	16	63,432
H ₂ Valcamonica	Green hydrogen for the decarbonisation of Valcamonica	Hydrogen	01/01/2022	Preparation	'A2A	44	42,295
PIONEER	Airport sustainability second life battery storage	Intra-day electricity storage	01/01/2022	Preparation	Snam spa	31	16,004

THE *THREEMEASURES AND POLICIES*

In order to promote and implement research in priority technological areas not covered by the previous instruments, specific policies and incentive measures will be defined, using both national and Community funding. In particular, the technology domains will be:

- **HYDROGEN: Italian** project candidate for projects of common interest (PCI) and, in the thematic area of cross-border hydrogen transport networks. The project jointly involves Germany and Austria and will contribute to the creation of a European hydrogen transport network, providing an opportunity for the decarbonisation of Italian and European industrial clusters, in line with the achievement of the 2050 climate targets;
- **CCS:** the two projects currently under investigation for Italy are candidates for projects of Common Interest (Projects of Common Interest)

the Member States concerned to draw up a ‘*plan for the development of infrastructure for the storage and transport of carbon dioxide across borders*’. The projects, with the joint participation of France and Greece respectively, will contribute to the creation of a European transport and storage network for CO₂ and represent an opportunity for the decarbonisation of Italian and European industrial clusters, in line with the achievement of the 2050 climate targets;

Nuclear: Italy has always been at the forefront of nuclear innovation and, in particular, in the conceptualisation, engineering and qualification of passive safety systems for nuclear applications. To date, passive and in-built safety is widely exploited in most of the SMR and AMR concepts, with the aim of simplifying design requirements, reducing associated costs and improving nuclear safety. Most of the potential SMR/AMR can therefore be authorised only if several units are produced in series, possibly in the same area and on the basis of an established chain. Advanced nuclear technologies can be classified into 2 groups:

- Small Modular Reactors (SMR), taking advantage of the mature technology of the current LWR fleet (Generation III or III +), but on a small scale, in a loop type configuration or in an integral configuration (all primary circuit components installed in the reactor vessel);
- Advanced Modular Reactor (AMR), derived from fourth generation technologies, using new cooling systems (e.g. liquid lead) or innovative fuels to deliver better performance, new functionalities (cogeneration, hydrogen production, nuclear waste management solutions) and potentially a step change for higher competitiveness, economy, sustainability, passive safety and reliability, as well as proliferation resistance and physical protection.

Based on the above experience, ENEA, Ansaldo Nucleare, SIET and many other Italian industries and universities continuously contribute to the development of many SMR/AMR concepts, including:

- Nuward (EDF, France), which has an exchange with SIET, ENEA and Ansaldo Nucleare for experimental validation in Italy;
- Rolls Royce SMR (United Kingdom), who has an exchange with SIET, ENEA and Ansaldo Nucleare for experimental validation in Italy;
- ALFRED, an EU prototype for an AMR based on Gen-IV Lead-cooled Fast Reactor (LFR), supported by the international consortium FALCON (led by Ansaldo Nucleare, and based on ENEA technology), which has funds for the construction of an experimental plant worth EUR 20 million and which has planned to obtain an additional EUR 120 million from the Romanian Government in 2023;
- LFR-AS-30, AMR developed by start-up newcleo, based on ENEA technology, and whereas there is more than EUR 50 million in private investment in ENEA infrastructure;
- Westinghouse LFR, for which Ansaldo Nucleare and ENEA supported, together with other Italian industries, the construction of various experimental facilities under the AMR UK programme.

In the general context of European and international cooperation, ENEA, Ansaldo Nucleare, the Italian industry and universities support the development of innovative nuclear systems that offer greater safety, sustainability and economic competitiveness, with a view to reducing the radioactive waste generated by the facilities.

Italy, through ENEA, supports the implementation of the DTT (Divertor Tokamak Test Facility) through the Divertor Tokamak Test facility Upgrade (DTTU) project, proposed in response to the Public Notice for the submission of project proposals No 3264 of 28 December 2021 ‘Research Infrastructures’ under the NRRP.

With regard to merger, the DTTU project aims to study advanced solutions for DEMO (Demonstration Fusion Power Reactor), the first demonstration fusion power reactor, which plays a crucial role in the European research agenda. A key challenge for the development of this technology is to manage the high power loads located on the divertor, the system for the dissipation of residual heat of plasma.

To this end, the European Fusion Roadmap provided for the development of a dedicated experimental device, the Divertor Tokamak Test (DTT), to integrate and address all physical and technological problems relating to power discharge. The proposal submitted by ENEA consists of three working groups (WP) on machine upgrades (WP1), HPC Cresco system upgrades for modelling activities (WP2) and Remote Handling plant (WP3), for a total investment of EUR 55 million.

- **Wind:** with regard to wind energy, the objectives set out in Chapter 2.5 will be achieved through the following R & D activities:
 - *for floating wind turbines:* (a) floating wind platforms (developing a national industry, optimising hydrodynamic loads and reducing costs), also with a view to multi-use renewable technologies; (b) solutions for low-impact anchor lines; (c) next generation turbines optimised for the context of the Mediterranean Sea; (D) systems for controlling and optimising electricity production also in relation to the possible environmental degradation of blades; (e) digital twin and augmented reality models for greater reliability and cost reduction in design and maintenance processes; (f) floating or fixed electrical substations and 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 area of System Research
 - *for on-shore wind:* (a) optimisation of the aerodynamic performance of existing turbines to maximise power for the same area of the occupied rotor; (b) the development of a re-blading industrial supply chain; (c) the development of turbines adapted to Italian weather conditions and integration into inhabited areas (including mini and micro wind turbines); (D) new recyclable materials; (e) analysis of the impact on the electricity grid in the 2030 installed power increase scenarios; (f) development of preaching 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 lines of activity and energy technologies identified are in line with those of the EETS Plan, thus complementing MASE's activities.

- *National Research Programme (NRP) 2021-2027.* Within the framework of this programme, the priority lines of research are:
 - renewable sources: energy storage (mechanical, thermal, electrical, chemical) and European and intercontinental 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.
- *Three-year plan of activities of the OGS 2022-2024.* One of the main lines of activity in the Plan is the study of carbon dioxide storage 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 project (Hydrogen Storage In European Subsurface), which involves the identification of potential underground hydrogen storage sites in Europe. It also carries out research into the assessment of geothermal resources at high and low enthalpy and the environmental impact of their industrial exploitation.
- *Activities carried out with the university system.* Among the main activities under development or implementation, covering almost all the priority technology areas listed in Chapter 2.5, are: renewable gases and hydrogen, storage systems, digitalisation of networks, CCS, e-mobility.

- *Three-year energy plans of universities, research bodies and institutions of higher artistic and musical training (AFAM).* In the context of the RepowerEU, a reform is being drawn up with the aim of drawing up three-year energy plans and subsequent implementation (by 2026) by universities, research bodies and institutions of the High Art 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

MASE and MUR are responsible for coordinating the EETS Plan in Italy. Italy has decided to supervise all the working groups set up to prepare the Implementation Plans (IPs) for key actions. The national contact points of each working group have in turn set up 'consultation groups' composed of representatives of industry, research and academia, able to provide qualified input to IP drafting. The Italian delegation operates both through plenary hearings of the main players in the public and private R & D sector and through bilateral meetings. Until 2021, it was also able to rely on the support of the Italian 'Enlarged Board' of Horizon 2020 Energy, which was attended by around 120 members of companies, research bodies, universities, ministries and regions, which normally met 2-3 times a year.

The intensive work leading to the establishment of the Implementation Plans has seen Italy particularly active in cooperating with the other Member States to identify priorities and indications of financing 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 under the Horizon Europe programme.

After a period of considerable fragmentation, Italian research on energy technologies is evolving towards a more coordinated framework of initiatives, also supported by alignment with the EETS Plan and the Horizon 2020 Programme. The Italian research system has a good international positioning, showing that it is ready to grasp all the most innovative international insights. The evolution of European research can make a positive contribution to the process of rationalising research objectives by valorising and finalising the various

national competences in the field. However, the national research system must be able to rapidly update priorities, guidelines and competitiveness assessments in the energy technology sector and enable the country to make an effective contribution to the future choices to be made under the European EETS Plan, while also protecting industrial competitiveness and enhancing its 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 & D 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

As already mentioned, Italy considers the Horizon Europe Programme 2021-2027 to be a priority instrument in supporting research projects in the field of climate and energy in the coming years.

The country's achievements under the Horizon 2020 programme, as set out in paragraph 4.6, were more than satisfactory. In the first two years of Horizon Europe programme, however, some critical issues have been highlighted by national operators, which will require a higher level of attention in the approach to the Programme in the coming years. In particular:

- Horizon's strong competitiveness due to the general reduction of incentives for national research in many Member States, which has led to excessive demands;
- the innovation of the format, with many calls distributed throughout 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 shows interest, as already shown in the early part of this chapter and in Chapters 2.5 and 4.6, are Innovation Fund and IPCEI.

Italy has focused heavily on participation in Mission Innovation through the mobilisation of significant resources, which for the coming years will be able to support the development of pilot and demonstration projects, with the achievement of medium-high TRLs. Effective coordination between the 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 energy, ENEA coordinates and participates in a number of European projects (EURATOM) in the field of new generation nuclear fission, thus making use of its know-how, sharing research infrastructures, calculation methodologies and codes, safety approach, technology, and fully integrating its R & D activities into the SNETP.

In the field of nuclear fusion, ENEA acts as Programme Manager of the European Fusion Programme by coordinating, as Head Research Unit (HRU), the activities of the Italian team (made up of the main industrial entities, research bodies and universities involved in the sector) in the EUROfusion consortium, which manages the economic resources made available by EURATOM for nuclear fusion research.

SECTION B: ANALYTICAL BASIS⁵⁴

4 STATE OF PLAY AND PROJECTIONS WITH EXISTING POLICIES AND MEASURES 55 56

4.1 Projected evolution of main exogenous factors influencing energy system and GHG emission developments

This paragraph describes the assumptions and methodology for constructing the scenarios developed in support of this Plan.

Any scenario analysis is built around some “key variables” which synthesically 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, the evolution of GDP and sectoral added values, demographic trends and projections of international fossil prices and CO₂ emission allowances on the ETS market are particularly important.

In the course of 2021, the European Commission finalised the update of the new European Reference Scenario through the PRIMES model, which made available details on *key drivers*. In addition, as part of the monitoring mechanism referred to in the Governance Regulation for greenhouse gas projections, the European Commission provided in June 2022 new data on the main macroeconomic and demographic drivers, on the basis of which the source dataset was updated, in order to better

reflect the effects of the pandemic in the short term and to introduce some of the spill-over effects, particularly in terms of international prices, of the ongoing conflict in Ukraine.

i. Macroeconomic forecasts (GDP and population growth)

The table below shows the evolution of the population and GDP between 2020 and 2040 in the scenarios carried out. Compared to the assumptions used in the development of the scenarios contained in the previous version of the Plan, it is particularly clear that the population has been shrinking since 2020, with more than one and a half million people in

⁵⁴ See Part 2 for a detailed list of parameters and variables to be reported in Section B of the Plan.

⁵⁵ 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 implemented policies and measures 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 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

⁵⁶ 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.

less. There were almost 3,5 million fewer people in 2030 and around 6 million in 2040, compared to the plan adopted in 2020.

Table 42 – Evolution of population and GDP

	2020	2025	2030	2035	2040
Population (million)	59,2	60,0	59,9	59,7	59,4
GDP (EUR 2015)	1.678.490	1.779.762	1.809.218	1.869.219	1.975.428

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 AVs, source ISTAT, are expressed in EUR million (chain-linked values, reference year 2015), while the expected annual average growth rates (%) were drawn up using the details provided by the European reference scenario, which was finalised in 2021, as well as the GDP trend recommended by the European Commission.

Table 43 – Evolution of Sectoral Added Values [Source: historical values: Eurostat, compiled from Eurostat and PRIMES]

	NACE codes	2020 (EUR 2015 million)	2025	2030	2035	2040
Agriculture	A	31.444	33.806	33.757	33.760	33.766
Construction	F	64.303	71.401	72.709	73.131	74.004
Services	GTU + AND	1.072.592	1.212.570	1.236.365	1.284.621	1.369.952
Energy and mining sector	D + B + C19	32.832	32.187	32.412	32.473	32.678
Industry	C (excluding C19)	224.916	260.484	261.831	267.307	276.866

ii. Sectorial changes expected to impact the energy system and GHG emissions

The different industrial sectors follow different growth dynamics. The following table shows the annual average growth rates of VA of the main industrial sectors used for the scenarios. The data have always been produced by developing the parameters recommended by the European Commission in 2022 and the detailed data of the European Reference Scenario.

Table 44 – Evolution of the added values of the main industrial sectors [Source: from the preparation of the parameters recommended by the European Commission in 2022 and detailed data of the European scenario of reference]

Sector	%	%	%	%
	20-25	25-30	30-35	35-40
Iron and steel	7.28 %	– 0.06 %	–	– 0.04 %
Non-ferrous metals	7.52 %	0.00 %	–	– 0.03 %
Chemicals	2.09 %	0.16 %	0.10 %	0.22 %
Non-metallic minerals	3.60 %	0.24 %	0.07 %	0.17 %
Pulp, paper and printing	2.89 %	0.09 %	0.06 %	0.14 %
Food, Drink and Tobacco	2.40 %	0.25 %	0.11 %	0.23 %
Textiles	3.78 %	– 0.36 %	–	– 0.20 %
Engineering	2.91 %	0.15 %	0.88 %	1.42 %
Other industries	2.72 %	0.09 %	0.04 %	0.08 %
Food, Drink and Tobacco	2.40 %	0.25 %	0.11 %	0.23 %

iii. Global energy trends, international fossil fuel prices, EU ETS carbon price

With regard to international fossil fuel prices and CO₂ emission allowances in the ETS market, reference has also been made to the parameters recommended by the European Commission under the monitoring mechanism set out in the Governance Regulation for greenhouse gas projections.

Table 45 – Evolution of international prices of energy commodities and ETS allowances [Source: European Commission]

Year	Oil	Gases (NCV)	Coal	ETS allowances
	EUR/GJ	EUR/GJ	EUR/GJ	EUR/TCO ₂
2020 *	6,4	3,1	1,6	24
2021 *	10,5	15,1	3,8	54
2022	15,4	33,2	5,3	75
2023	15,4	24,0	4,2	77
2024	15,4	14,6	3,2	78
2025	15,4	13,2	3,1	80
2030	15,4	11,3	3,1	80
2035	15,4	11,3	3,1	82
2040	16,3	11,3	3,3	85

* Data 2020 and 2021 are the annual average of the daily value

iv. Technology cost developments

As early as 2016, a Technical Working Group (TWG) was set up under the Presidency of the Council, bringing together different skills and professionalism to put the various knowledge into a system and valorise in an interactive and flexible way. Entities such as MASE, MEF, MIT, RSE, ENEA, ISPRA, CNR, Banca d'Italia, Istat, Centro Studi Confindustria, University, Terna, Snam and GSE participated in this technical working group. One of the results of this working group was, for example, the creation of a catalogue containing a technical and economic analysis of the energy technologies available, both supply and end-use, which would help to advance the decarbonisation of the Italian energy system. This database, which is continuously updated, 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 state of technology costs, GSE plays an important role, which, under Article 48 of Legislative Decree No 199/2021, is required to 'record the current costs of technologies and the production costs of energy carriers, to be shared with RSE, ENEA and ISPRA for their respective research and scenarium activities'.

4.2 Decarbonisation dimension

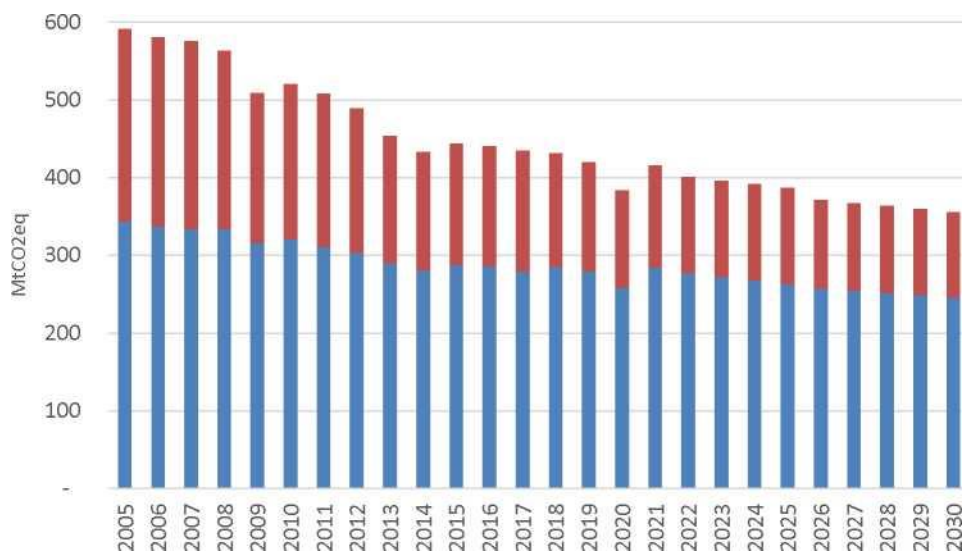
4.2.1 Greenhouse gas emissions and removals

i. Trends in current GHG emissions and removals in the EU ETS, Regulation (EU) 2018/843 and LULUCF sectors and different energy sectors

The table below summarises the projections of greenhouse gas emissions up to 2030, with the related European targets for ETS and ESR emissions, according to the baseline emissions scenario under current policies (i.e. taking into account the effect of the policies adopted throughout 2021).

Against the expected reduction in total emissions from 2005 to 2030 of around 235 MtCO₂eq, ETS emissions are expected to fall by around 137 MtCO₂eq (more than 55 %) and ESR emissions by 98 MtCO₂eq (around 28.5 %).

Figure 52 – ETS and ESR GHG emissions (Mt CO₂eq), historical years and baseline [Source: ISPRA]



Note: the graph shows the breakdown before the amendments to Directive 2003/87/EC introduced by Directive (EU) 2023/959.

The measures currently in force therefore appear to be more effective in terms of reducing ETS emissions, mainly by increasing renewables in the electricity generation mix. However, in order to promote a reduction in climate-changing emissions in the Effort Sharing sectors, *a change in generation, if not accompanied by a change in consumption in terms of the size or vectors used, leads to limited benefits.*

Indeed, for the sectors covered by the Effort Sharing Regulation, the reference scenario shows that, also as a result of the changed post-COVID-19 situation linked to the economic recovery and behavioural change following the pandemic, and the significant and profound changes in the geopolitical context, despite the adoption of the measures provided for in the NRRP, emissions do not reach the previous reduction target of -33 % by 2030 compared to 2005 levels. Much more demanding and ambitious is 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 %.

in the civil and transport sectors, as shown by the data for 2021, the last year for which definitive statistics are available: Italian emissions exceeded the annual allocations (AEA), defined under the ESR Regulation, by 10,9 MtCO₂eq.

Table 46 – National GHG emissions and European targets (Mt CO₂eq), historical and baseline
[Source: ISPRA]

	1990	2005	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
Total emissions	523	594	418	403	399	394	389	374	370	366	363	359	325
ETS emissions *		248	132	125	124	124	124	114	113	112	111	110	noneth
ESR emissions		344	284	277	272	268	263	257	254	251	248	246	none
ESR targets * *			273	269	259	250	241	249	235	221	207	194	none
Difference from objectives			+ 10,9	8	13	18	22	8	19	30	41	52	N/a

* Considering the scope of the Directive before the adoption of Directive (EU) 2023/959. National aviation emissions are not included.
* * *indicative targets, targets will be specified by specific rules to be adopted at European level. The estimate was based on the criteria set out in Regulation (EU) 2023/857 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030.*

For the LULUCF sector, the current policy scenario requires the emission neutrality objective to be met by 2025, as laid down in Regulation (EU) 2018/841; the sector's removals in 2030, according to the -34,9 MtCO₂eq scenario, are close to the LULUCF target of -35,8 MtCO₂eq in the Fit for 55 package.

Table 47 – National LULUCF GHG emissions and European targets (Mt CO₂eq), historical and scenario reference [Source: ISPRA]

	1990	2005	2021	2025	2030	2035	2040	2021 2025	2026 2030
Emissioni-Assorbimenti LULUCF	- 3.5	- 35.6	- 27.5	- 33.9	- 34.9	- 29.6	- 36.5	- 33.9	- 34.9
LULUCF accounting*	nonet	nonethel	nonethel	nonethel	nonethel	nonethel	nonethel	- 97.6	- 34.9
LULUCF targets								0	- 35.8
Distance to LULUCF targets								- 97.6	+ 0.9

* For the period 2021-2025, the LULUCF Regulation provides for the reporting of removals and emissions from the LULUCF sector and the accounting of LULUCF categories⁵⁷

⁵⁷ *managed forest land* (Forest land returned to forest land), *Afforested land* (land converted to forest land), *Deforested land* (Forest land converted to other land uses), *Managed cropland*, land converted to cropland, cropland converted to other land uses, *Managed grassland* (*Grassland remaining grassland*), Cropland converted to grassland, Wetland converted to grassland, Settlements converted to grassland, Other land converted to grassland, 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)

The data show a strong reduction in emissions from 2005 to 2015 and a subsequent decrease at lower emission reduction rates. The reduction that took place in 2020, due to the COVID-19 pandemic, and the subsequent upturn in 2021 due to the recovery in activity is evident. This development is due to

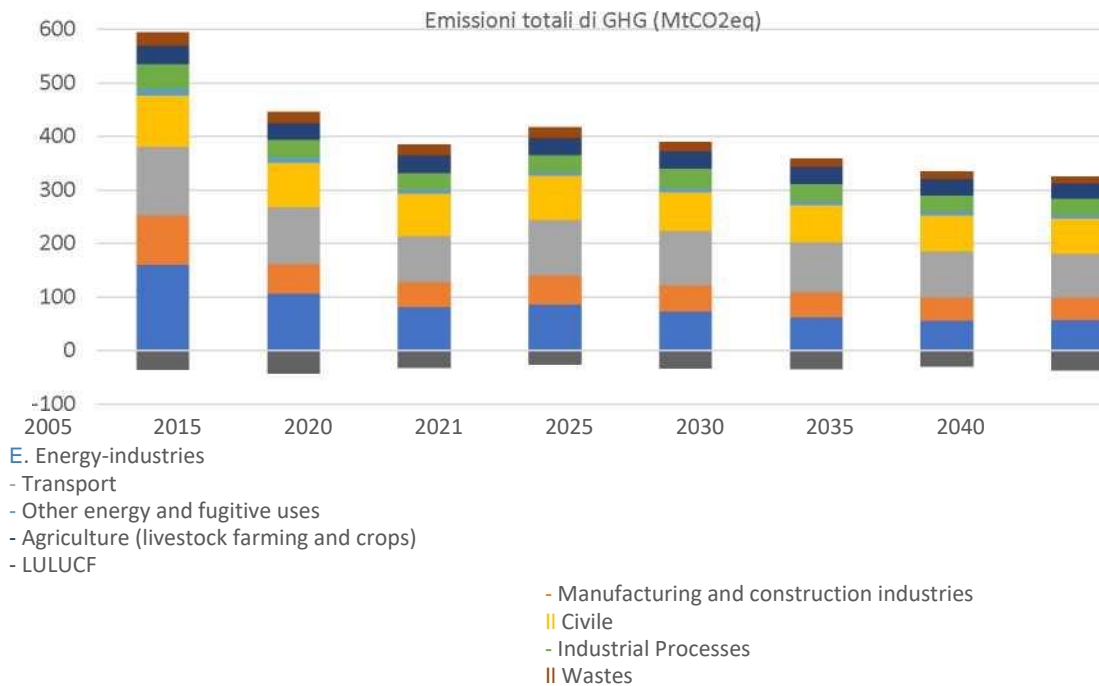
many factors, some structural factors and other quotas. The most important are:

- higher share of renewable energy in primary consumption than expected following the strong development of photovoltaic production and the uptake of biomass for heating;
- increasing the efficiency of electricity generation, with many combined cycle plants powered by natural gas coming into operation, in many cases CHP plants, accompanied by a gradual decommissioning of obsolete steam plants powered by fuel oil;
- reduction of transport consumption due to the joint action of higher 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;
- increasing the efficiency of energy end-use appliances.

The table and graph below show the scenario projections up to 2040. Emissions shall be broken down by sector.

Table 48 – Greenhouse gas emissions broken down by sector (Mt CO₂eq), historical and baseline [Source: ISPRA]

GHG emissions, Mt CO₂eq.	2005	2015	2020	2021	2025	2030	2035	2040
From ENERGY USE, of which:	488	360	300	333	303	278	259	254
Energy industries	160	106	82	86	73	61.78	56	57
Manufacturing industries and	92	56	46	54	49	47.05	43	42
Transport	128	107	87	103	102	93.10	87	82
Civil	96	82	79	83	71	69.09	67	66
Other energy and fugitive uses	12	9	7	6	8	7	7	7
By OTHER FONTI, of which:	106	86	85	85	86	80	75	71
Industrial processes	47	33	31	32	37	33	30	29
Agriculture (livestock and crops)	35	32	33	33	32	32	31	30
Waste	24	20	20	20	17	16	14	12
Total (excluding LULUCF)	594	446	385	418	389	359	334	325
LULUCF	- 36	- 44	- 33	- 27	- 34	- 35	- 30	- 37



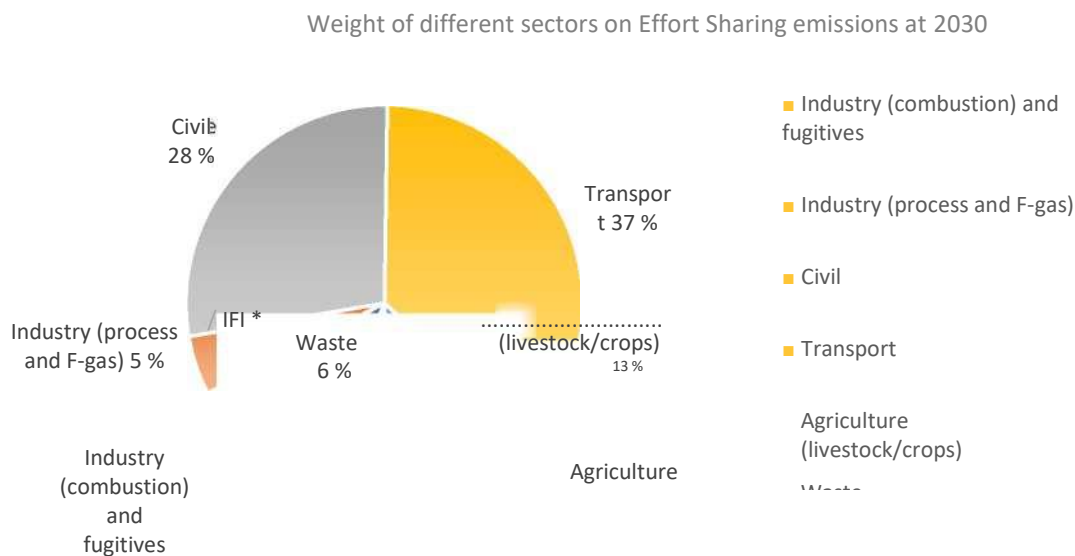
The sectoral analysis over the period 2021-2030 shows that:

- there is a very significant reduction in emissions in the energy industries (-29 %), mainly due to the reduction of emissions from the electricity sector. Emissions in this sector are directly linked to fossil fuel power generation. The significant growth of renewable electricity production and the increase in thermal efficiency since 2008 have contributed to the reduction of emissions in historical years. The reduction in emissions in 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 fall by 10 %, due to increased transport demand and weak modal shift policies;
- in the civil sector, emissions have fallen by 17 % mainly due to efficiency gains and the phasing out of the most polluting fuels; lifestyles and temperature trends, especially winter, also play a crucial role;
- emissions from industry, as far as energy consumption is concerned, show a significant contraction in the period 2005-2015 (around -40 %) partly as a result of the economic crisis and partly due to the structural change in activity and the increase in efficiency of production processes, the effects of which are also evident in the reduction of emissions in the projection years. In fact, in the period 2021-2030, emissions from the industry sector fell more slowly (-13 %), even when production recovered in the post-pandemic period;
- as regards industrial processes and F-gases, there is a substantial stability of emissions in the face of a productive recovery, the lack of reduction is due to the lack of effective technological solutions to contain non-energy emissions;
- emissions from waste show a high rate of reduction from 2021 to 2030 (-21 %) mainly due to the decrease in waste going to landfills.

- agriculture shows a rather stable trend over the period 2021-2030, the measures already in place have little impact on the sector whose total emissions do not decrease significantly;
- as regards LULUCF, the year 2021 is characterised by a very low level of removals; however, the baseline scenario returns a framework with decreasing net removals. This result reflects a substantial maintenance of forest absorption capacity and the halt of urban expansion, also against the background of an increase in emissions in agricultural and forage areas (in particular as a result of fires).

The figure below shows a focus on the weight of the different ESR sectors in the baseline scenario. It is clear from the graph that transport and civil continue to be the dominant sectors in terms of emissions and for which additional policies and measures will need to be adopted.

Figure 54 – Greenhouse gas emissions by sector as a percentage of the total Effort Sharing by 2030 in the scenario of reference [Source: ISPRA]



The table below shows national emissions (without LULUCF), by type of gas, in terms of CO₂eq. CO₂ accounts for more than 80 % of total emissions. It is worth noting, however, that although 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 in F-gases is mainly due to the implementation of the specific European Regulation governing their use.

Table 49 – Greenhouse gas emissions from 2005 to 2040, disaggregated by gas (Mt CO₂eq), historical until 2021 and baseline scenario [Source: ISPRA]

GHG emissions, Mt CO₂eq.	2005	2015	2020	2021	2025	2030	2035	2040
Carbon dioxide	502	362	303	337	315	291	272	268
Methane	55	49	48	47	45	42	39	37
Nitrous oxide	26	17	17	17	17	16	16	15
F-Gas (HFCs, PFCs, SF ₆ , NF ₃)	11	18	17	16	13	10	6	5
TOTAL	594	446	385	418	389	359	334	325

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 by technology in each of these sectors

For several years, renewable energy sources have played a major role in the Italian energy system and have been widely used 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 are calculated by applying the RED I methodology for the years up to 2020, the RED II methodology, as amended by the so-called RED III, for 2021. RES energy amounted to just under 23 Mtoe in 2021, representing a share of total gross final consumption of 19.0%; the share of the thermal sector in the RES total is 49%, and the share of the electricity sector and the transport sector is 44% and 7% respectively.

Table 50 – Total RES share (ktoe) (*) [Source: GSE]

	2017	2018	2019	2020	2021
Numerator – RES energy	22.000	21.605	21.877	21.900	22.934
Gross electricity generation from RES	9.729	9.683	9.927	10.176	10.207
Final RES consumption for heating and cooling	11.211	10.673	10.633	10.378	11.176
Final consumption of RES in transport	1.060	1.250	1.317	1.346	1.552
Denominator – Total gross final consumption	120.435	121.406	120.330	107.572	120.506
Total RES share (%)	18.3 %	17.8 %	18.2 %	20.4 %	19.0 %

(*) Data for the period 2017-2020 are calculated using the methodology set out in RED I; therefore, they do not perfectly compare with the 2021 figure, calculated using the methodology laid down in RED III.

❖ **ELECTRICITY SECTOR**

In 2021, electricity production from RES, calculated using the calculation criteria set out in RED I and RED III (standardised water and wind production, etc.), is just below 119 TWh; the impact on gross internal consumption of electricity is 36.0%.

Table 51 – Electricity RES share (TWh) [Source: GSE]

	2017	2018	2019	2020	2021
Numerator – Gross electricity output from RES	113,1	112,6	115,5	118,4	118,7
Water (normalised)	46,0	46,8	47,1	48,0	48,5
Wind (normalised)	17,2	17,9	19,1	19,8	20,3
Geothermal energy	6,2	6,1	6,1	6,0	5,9
Bioenergy (sustainable)	19,3	19,1	19,5	19,6	19,0
Solar energy	24,4	22,7	23,7	24,9	25,0
Denominator – Gross internal consumption of electricity	331,8	331,9	330,2	310,8	329,8
FER-E share (%)	34.1 %	33.9 %	35.0 %	38.1 %	36.0 %

❖ THERMAL SECTOR

Consumption of RES in the heating sector amounted to around 11,2 Mtoe in 2021; annual variations are mainly linked to changes in temperatures and changes in plant equipment. Over the past five years, the share of RES in total national heat consumption has always been around 20 %; the largest contribution is made by solid biomass uses (mainly firewood and pellets used in the residential sector) and heat pumps.

Table 52 – Share of RES heat sector (ktoe) [Source: GSE]

	2017	2018	2019	2020	2021
Numerator – RES energy	11.211	10.673	10.633	10.378	11.176
Gross RES heat production	957	950	997	983	862
Final RES consumption for heating and cooling	10.254	9.723	9.636	9.395	10.314
– of which bioenergy (sustainable)	7.265	6.780	6.779	6.564	7.171
– of which solar	209	218	228	236	247
– of which geothermal	131	128	131	120	115
– of which heating space energy and ACS	2.650	2.596	2.498	2.475	2.498
– of which ambient energy for cooling	–	–	–	–	283
Denominator – Gross final consumption in the thermal sector	55.823	55.359	53.979	52.023	56.710
FER-H share (%) *	20.1 %	19.3 %	19.7 %	19.9 %	19.7 %
Waste heat used through district heating networks	–	–	–	–	9
FER-H share with waste heat (%)	–	–	–	–	19.7 %

*It is clarified that the FER-H share calculated for 2020 according to RED III criteria is 20.09 % without taking waste heat into account and 20.10 % when considering waste heat; this value constitutes the basic level against which the targets for the thermal sector are assessed.

❖ TRANSPORT SECTOR

The evolution of the RES target for transport, as shown in the table below, is developed using the calculation criteria set out in RED I (until 2020) and RED II, as amended by RED III. Sectoral RES energy consumption in 2021 amounted to 3,3 Mtoe; the relative

impact on overall consumption, calculated by applying the premium coefficients shown in the table (including as denominator, as a precautionary measure), is 8.2 %.

Table 53 – RES share for transport (ktoe) [Source: GSE]

	coeff. RED I	2017	2018	2019	2020	coeff. RED III	2021
Numerator – RES energy		1.992	2.434	2.890	2.810		3.335
Advanced double counting biofuels	2	7	65	403	408	2	538
Non-advanced double counting biofuels	2	350	520	571	536	2	800
Single counting biofuels	1	703	665	343	402	1	214
Renewable share of electricity on the road	5	2	3	4	6	4	13
Renewable share of electricity by rail	2,5	159	167	163	135	1,5	156
Share of electricity renumbered in other modes	1	166	168	172	154	1	158
Denominator – Gross final consumption in transport*		30.728	31.774	31.946	26.178		40.754
FER-T share (%)		6.5 %	7.7 %	9.0 %	10.7 %		8.2 %

* The calculation criteria of the RED Directives are different. RED I considered only petrol, diesel and electricity in all forms of transport, while RED II, as amended by RED III, covered the whole transport sector including international shipping and international aviation.

ii. Indicative development projections with existing policies for 2030 (with a perspective up to 2040)

In terms of RES development over the period 2025-2040, the following tables show the evolution to current policies of the overall RES quotas and in the electricity, heat and transport sectors respectively. In the trend to 2030, RES contribute 26.6 % of gross final energy consumption, an increase of about eight percentage points from 19.0 % in 2021 (historical figure). Looking ahead to 2040, the RES share increases further to 32.5 %.

Table 54 – Total RES share 2025-2040 with existing policies and comparison on 2021 (ktoe) [Source: RSE]

	2021	2025	2030	2040
Numerator – RES energy	22.938		25.616	30.198
Gross electricity generation from RES	10.207	10.849	13.737	18.657
Final RES consumption for heating and cooling	11.176	13.084	14.289	15.212
Final consumption of RES in transport	1.552	1.683	2.172	2.713
Denominator – Total gross final consumption	120.506		116.829	113.572
Total RES share (%)	19.0 %	21.9 %	26.6 %	32.5 %

❖ **ELECTRICITY SECTOR**

Under current policies, the contribution in the electricity sector is expected to reach 13,7 Mtoe by 2030 for RES generation, i.e. 160 TWh, with 48.9 % coverage of gross electricity consumption with renewable energy, compared to 36.0 % in 2021 (historical figure). Looking at individual sources, the significant technically and economically viable residual potential and the reduction of photovoltaic and wind costs suggest that these technologies will also grow in line with current policies. Within the same time horizon, additional hydroelectric and geothermal production is considered to grow, while bioenergy has been significantly reduced due both to

the absence of incentive schemes and to competition with biomethane production promoted by the NRRP. Looking ahead 2040, the share of electric RES increases to 66.0 %.

Table 55 – RES share in the electricity sector 2025-2040 with current policies and comparison with 2021 (TWh) [Source: RSE]

	2021	2025	2030	2040
Renewable production	118,7	126,2	159,8	217,5
Water (normalised)	48,5	47,5	46,9	46,9
Wind (normalised)	20,3	26,5	38,8	56,3
Geothermal energy	5,9	7,2	7,4	7,5
Bioenergy	19,0	7,0	9,1	10,2
Solar energy	25,0	38,0	57,5	96,7
Denominator – Gross internal consumption of electricity	329,8	325,9	326,6	327,1
FER-E share (%)	36.0 %	38.6 %	48.9 %	66.0 %

❖ THERMAL SECTOR

The thermal sector also plays an important role in the development of current renewables policies: in absolute terms, it is expected that around 14,3 Mtoe of RES in the heating and cooling sector will be reached by 2030, mainly linked to the increase in the renewable component of annual heat pumps. As of 2030, solar thermal, geothermal and bioenergy systems⁵⁸ (totalling 9,5 Mtoe), heat pumps (3,7 Mtoe) and CHP heat (1,0 Mtoe) are used in the heat sector. By 2030, the share of thermal RES reached 26.8 % compared to 19.7 % in 2021 (historical figure). Looking ahead to 2040, the share of thermal RES increases by up to 29.2 %.

Table 56 – RES share in the heating sector 2025-2040 with current policies and comparison with 2021 (ktoe) [Source: RSE]

	2021	2025	2030	2040
Numerator	11.176	13.084	14.289	15.416
Gross RES heat production	862	978	1.055	1.348
Final consumption of RES for heating	10.314	12.106	13.234	14.069
of which bioenergy	7.171	8.067	8.841	9.169
of which solar	247	339	451	568
of which geothermal	115	200	199	202
of which ambient energy from	2.782	3.500	3.743	4.130
Denominator – Gross final consumption in the thermal sector	56.710	55.050	53.345	52.866
FER-C share (%)	19.7 %	23.8 %	26.8 %	29.2 %

❖ TRANSPORT SECTOR

In the projections for current policies, account is taken of the new targets set by the RED II Directive, which provides for a specific target in the transport sector of 14 % for 2030 (an obligation that Member States must pass on to fuel suppliers). In the transport sector, a RES share of 16.5 % (calculated in accordance with the criteria laid down in the RED II Directive) was reached

⁵⁸Including biomethane and biogas

in 2030, due to an increase in electricity consumption for road and rail transport and more significantly biofuels. Looking ahead 2040, the share of RES in the transport sector is growing by up to 21.9 %, with a significant contribution also from biomethane and the emergence of hydrogen.

Table 57 – RES share in transport 2025-2040 with existing policies and comparison with 202 – criteria for calculation set according to RED II rules (ktoe) [Source: RSE]

	coeff. RED II	2021	2025	2030	2040
Numerator – RES energy		3.335	3.760	5.349	7.536
Advanced double counting biofuels *	2	538	698	1.148	1.521
Non-advanced double counting biofuels	2	800	650	668	701
Single counting biofuels	1	214	325	334	350
Renewable share of electricity on the road	4	13	67	182	399
Renewable share of electricity by rail	1,5	156	139	242	422
Share of electricity renumbered in other modes	1	158	250	269	340
Hydrogen from renewables	1	0	9	22	141
Denominator – Gross final consumption in transport		33.349	32.520	33.392	35.039
FER-T share (%)		10.0 %	11.6 %	16.0 %	21.5 %

(*) Includes advanced biomethane

(***) RED II covers all energy consumption by road and rail with the exception of LPG.

The RED III Directive, which was approved at Community level in 2023 but has not yet been transposed into national legislation, changes the methods for calculating the RES share of transport. More weight is given to hydrogen, but overall makes it more challenging to achieve the targets, as gross final consumption includes consumption of all transport segments, including international shipping and aviation. The share of RES in the transport sector according to RED III stood at 14.2 % by 2030 and grew to 19.8 % by 2040.

Table 58 – RES share in transport 2025-2040 with existing policies and comparison with 2021 – criteria for calculation set according to the rules of RED III (ktoe) [Source: RSE]

	coeff. RED III	2021	2025	2030	2040
Numerator – RES energy		3.335	3.876	5.524	8.146
Advanced double counting biofuels	2	401	340	442	520
Non-advanced double counting biofuels	2	800	785	779	793
Single counting biofuels	1	214	236	234	238
Advanced double counting biomethane	2	137	313	695	1.021
Renewable share of electricity on the road	4	13	67	182	399
Renewable share of electricity by rail	1,5	156	139	242	422
Share of electricity renumbered in other modes	1	158	250	269	340
Hydrogen from renewables	2	0	9	22	172
Denominator – Gross final consumption in		40.754	41.001	41.621	43.936
FER-T share (%)		8.2 %	9.5 %	13.3 %	18.5 %

(*) RED III covers the whole transport sector including international navigation and aviation international,

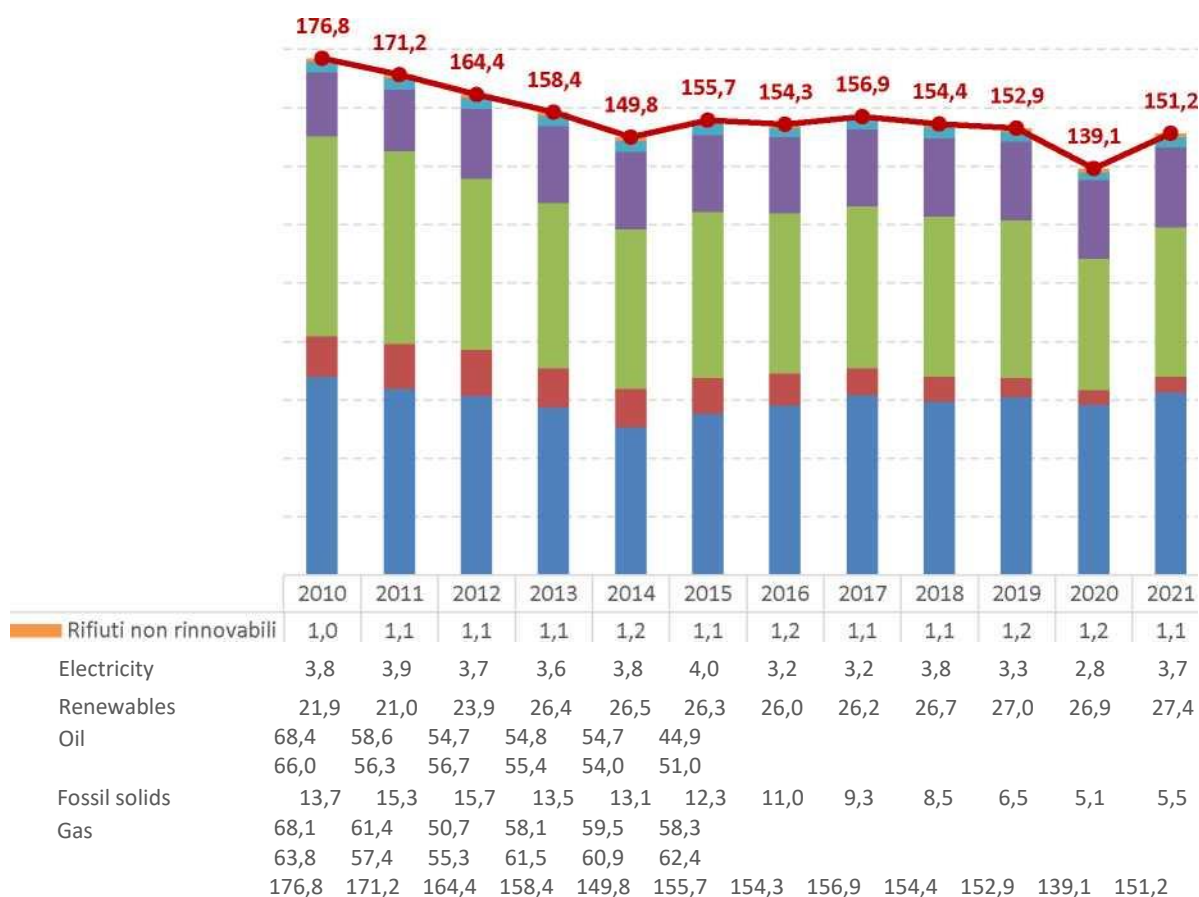
43 dimension of energy efficiency

I. Current primary and final energy consumption in the economy and per sector (including industry, residential, service and transport)

The Italian energy system has changed profoundly in recent decades; the development of natural gas in the early 2000s was followed, especially since 2010 (Figure 54), by rapid growth in renewable energy sources and a gradual reduction in oil and coal products, with significant effects both in terms of combating climate change risks and of security and diversification of energy supplies.

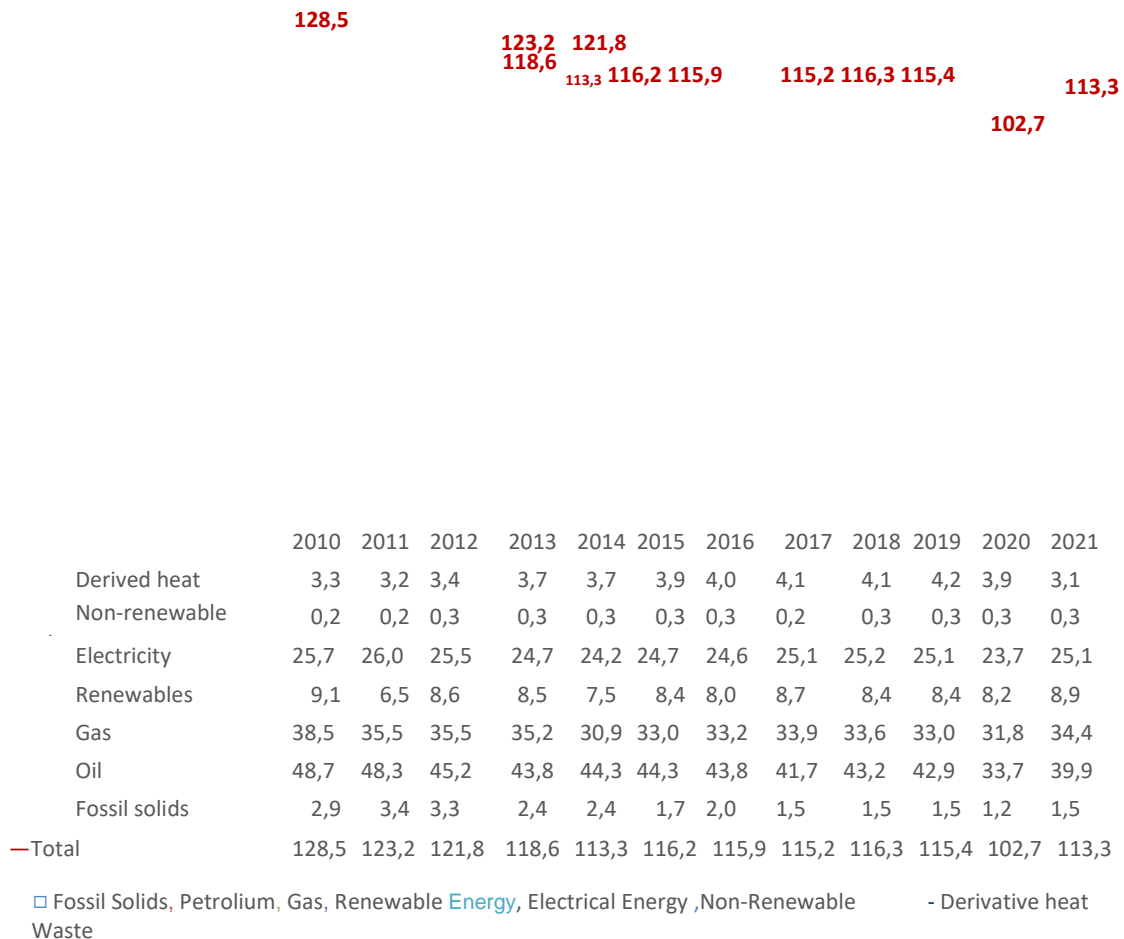
In 2021, according to Eurostat data, gross domestic energy consumption in Italy amounted to around 151 Mtoe⁵⁹, a considerable increase compared to 2020 (heavily affected, as we know, by the effects of the COVID-19 pandemic), but a decrease of 1,7 Mtoe compared to 2019 (-1.2 %) and almost 6 Mtoe compared to 2017 (-3.6 %). The latter fall mainly in the use of petroleum products (-8.0 %) and solid fuels (-40.7 %), while consumption of renewable sources (+ 4.6 %), gas (+ 1.4 %) and electricity (+ 13.3 %) increased.

Figure 55 – Evolution of Gross Domestic Consumption by Source (Mtoe) [Source: Eurostat]



Final energy consumption in 2021 has, in recent years, been similar to that of Gross Domestic Consumption. The figure for 2021 (113,3 Mtoe) was recovering from 2020, but fell (by 2-3 percentage points) compared with the previous five-year period. Again, the contraction mainly concerns petroleum products, while renewable energy, electricity and gas are on the rise.

Figure 56 – Evolution of final consumption by source (Mtoe) [Source: Eurostat] 60



The figure below shows the final sectoral consumption recorded in 2021 broken down by energy source. It is noted that most final consumption is concentrated in the transport sector (36,8 Mtoe, 33 % of total final consumption); residential (31,9 Mtoe, 28 %) followed by industry (26,4 Mtoe, 23 %).

Gas and electricity remain the predominant energy sources in industry (around 75 % of total consumption), residential (71 %) and mainly tertiary (93 %). The use of petroleum products is concentrated mainly in the transport sector (83 % of the total), where, on the other hand, the role of renewable sources (biofuels) is gradually increasing.

⁶⁰ reference is made to the energy final C values calculated by applying the criteria established for the monitoring of energy efficiency targets. It should also be noted that the renewable item includes biofuels blended with fossil fuels, while it does not include biomethane fed into the grid or energy from heat pumps.

Figure 57 – Final energy consumption by source and sector, year 2021 (Mtoe) [Source: Eurostat]

	Industry	Residential	Tertiary	Agriculture	Transport
TOTAL	26,4	31,9	15,1	3,0	36,8
- Fossil solids	1,5	—	—	—	—
- Petroleum	2,2	1,9	0,6	2,2	33,0
- Gas	8,9	16,8	7,1	0,2	1,4
E. Renewable	0,5	6,7	0,2	0,1	1,4
- Electrical energy	11,0	5,8	6,9	0,6	0,9
- Non-renewable waste	0,3	—	—	—	—
- Derivative heat	2,0	0,7	0,3	0,0	—

With regard to the energy efficiency of final consumption, the cumulative energy savings achieved by active policies (within the meaning of Article 7 EED) over the 2014-2020 period are reconstructed by ENEA at around 23 Mtoe; these savings are mainly associated with tax deductions (45 % of the total) and the mechanism of White Certificates (36 %). Looking at 2021 alone, it can be seen that the weight of deductions from overall savings remains broadly unchanged (45 %), while the weight of initiatives to promote sustainable mobility increases significantly (to 29 %) and that of white certificates falls to 11 %.

Table 59 – Energy savings from active policies under Article 7 EED (Mtoe) [Source: ENEA]

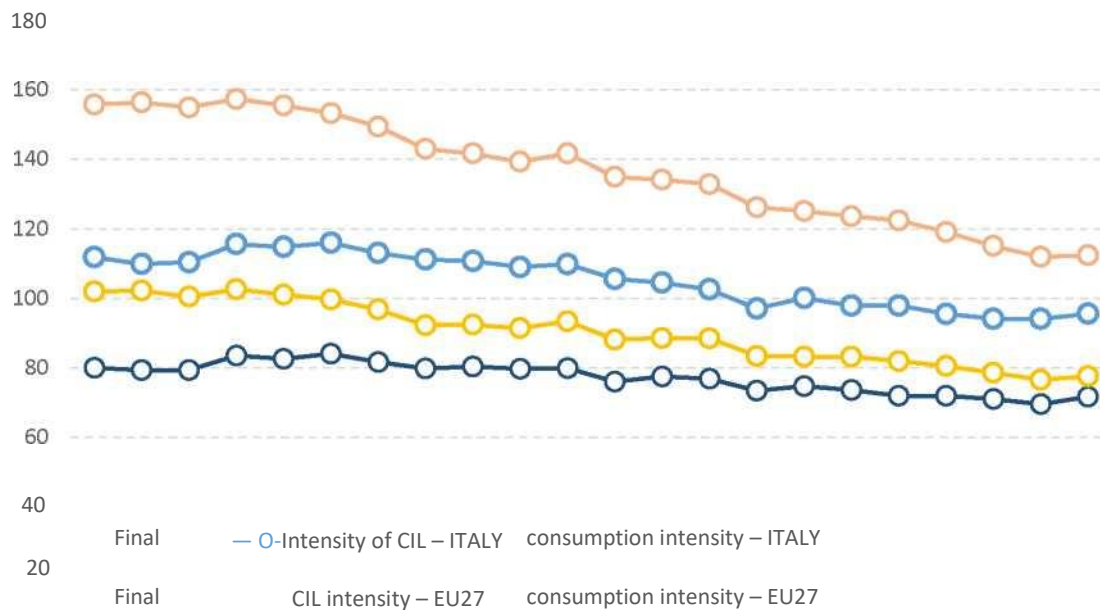
	Cumulative savings 2014-2020	2021
White certificates	8,39	0,12
Thermal account	0,62	0,08
Tax relief	10,40	0,52
National Energy Efficiency Fund	0,00	0,01
Transition Plan 4.0	1,83	0,07
Cohesion policies	1,11	0,01
Information campaigns	0,41	0,00
— Sustainable mobility	0,48	0,33
Total	23,24	1,13

❖ ENERGY INTENSITY AND ENERGY EFFICIENCY

Energy intensity, measured in terms of energy consumed per unit of economic wealth produced (GDP, chain-linked volumes, reference year 2010), is a robust indicator of economic and energy efficiency. Eurostat data show that Italy is characterised by one of the lowest energy intensity in terms of wealth produced in the main European countries.

The intensity calculated by reference to primary energy and that calculated for final consumption follows rather similar trends. The chart below shows, in particular, how the European average intensity calculated using both approaches decreased significantly to levels that Italy had had since 1990 in 2020-2021.

Figure 58 – Final consumption and gross inland consumption per unit of GDP – Years 2000-2021 [Source: Eurostat]

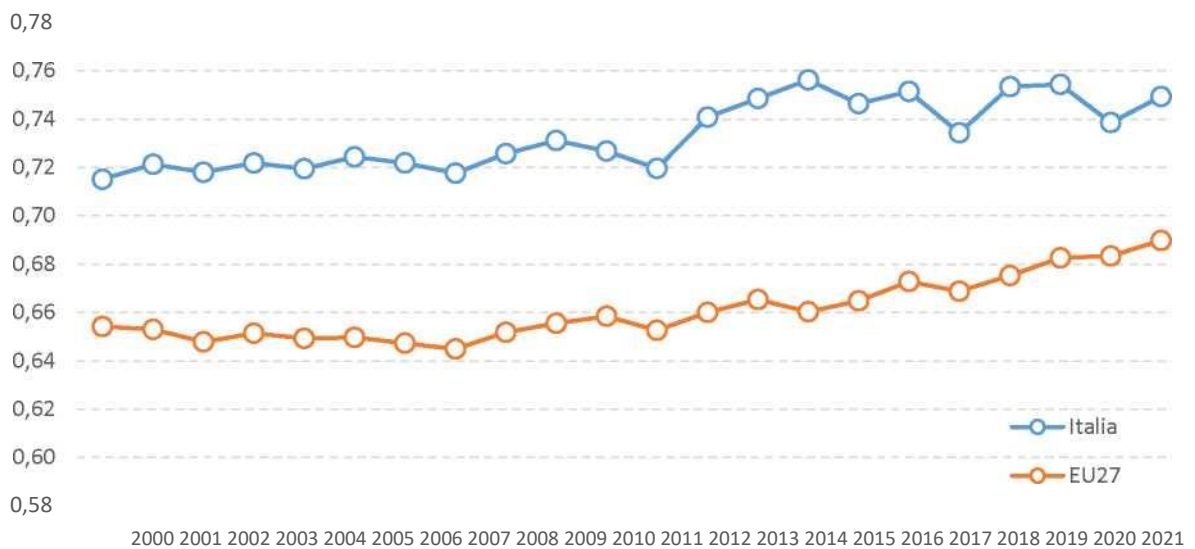


With regard to energy efficiency, Italy historically shows higher values than the average for other European countries, which translates into a greater effort needed to achieve significant energy savings than in other economies where specific consumption is historically higher and more compressible.

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 increase in efficiency, 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; in the following years, however, there is a trend increase in the ratio, due to both an increase in the share of final electricity consumption and an increase in the efficiency of fossil fuel transformation.

Since 2000, the ratio between final and primary energy consumption in Italy has been around 0,715 to 0,756 averages, while in EU27 the average observed is 0,66.

Figure 59 – Final consumption per unit of gross inland consumption, Years 2000-2021 [Source: Eurostat]

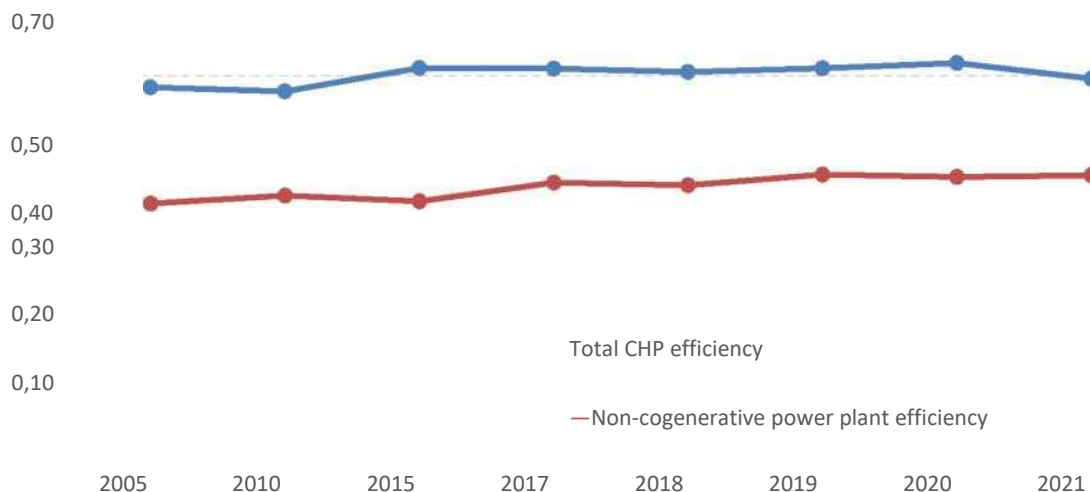


❖ ELECTRICAL TRANSFORMATION EFFICIENCY

Data on energy consumption and production of electricity and useful heat from 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 trend in the efficiency of the national thermal power park for cogenerative and non-cogenerative power plants. In particular, in 2021 the electricity efficiency of cogenerative power plants, including heat production, was 60 % and non-cogenerative power plants 46 %.

Figure 60 – Efficiency of the national thermal power park [Source: Eurostat]
(Ratio between nergyproduced and energy content of the fuels used)



The efficiency gains observed for cogenerative power plants between 2010 and 2015, mainly linked to the prevailing operation of the combined cycle and condensation cogenerative sections of

significant size and efficiency, appear to be particularly significant.

It is noted that the conversion efficiencies recorded in the most recent years are higher than those recorded in the period 2005-2010; efficiency gains are particularly significant for CHP plants in the period 2015-2020, for non-CHP plants in the period 2017-2021.

ii. Current potential for the application of high-efficiency cogeneration and efficient district heating and cooling⁶¹

In accordance with Article 14 of the EED, in 2021 the 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 heat demand analyses for 2018 showed a technical potential for using district heating of approximately 57 TWh (approximately 6 times the current levels of development), mainly concentrated in the northern regions of the country.

The economic and financial potential, assessed in the light of the sustainability of the DH initiative under market and regulatory conditions observed at the time of the analysis, amounts to almost 21 TWh, slightly more than twice the current level of penetration; almost half of this potential can be attributed to gas CHP technology (including also potential waste heat recovery from existing thermoelectric power plants).

The Reference Scenario projections indicate that, under existing policies, the heat delivered by efficient district heating networks would be 10 TWh in 2030.

⁶¹ In accordance with Article 14(1) of Directive 2012/27/EU

Figure 61 – Comparison of current DH level, technical potential, financial potential and Reference scenario at 2030 (TWh)

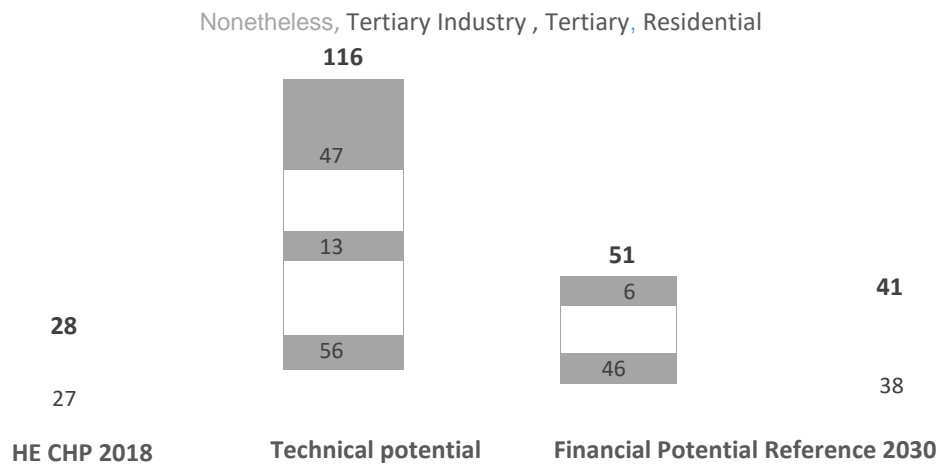


With regard to high-efficiency cogeneration, in 2018 there were a total of 35.5 TWh of HE CHP heat, largely attributable to industry (75 %), followed by cogenerated heat for DH (20 %) and tertiary (5 %), while residential buildings were negligible. In terms of sources, gas is largely predominant in consumption (95 %). The technical potential, to be interpreted as a theoretical maximum demand for cogenerable heat on the basis of purely technical conditions, was 116 TWh (excluding district heating network installations), of which 56 TWh in industry, 47 TWh in residential areas and 13 TWh in services.

The economic and financial potential has been developed by taking into account a percentage of activation of the technical potential, defined on the basis of the economic viability of the initiative under market conditions and regulatory conditions valid at the time of the analysis; it amounts to 51 TWh of useful heat, of which about 89 % in industry and around 11 % in the service sector, while the contribution of residential residents is also negligible.

According to the Reference scenario, by 2030, under current policies, the useful heat from HE CHP would amount to 41 TWh.

Figure 62 – Comparison between the current level of HE CHP (excluding CAR-DH), technical potential, financial 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)⁶²

Table 5.1 shows historical data for 2021 and projections for policies in force in 2025-2040 in terms of gross domestic consumption (CIL), primary and final energy consumption, broken down by sector and source. In addition, the projection of consumption for non-energy uses is shown.

There is a gradual reduction in energy intensity⁶³ (Figure 5.1), as well as an increasingly important role played by renewables to the detriment of fossil fuels.

⁶²This 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.

⁶³Energy efficiency measure of the economic system, understood as the amount of energy needed to produce a unit of GDP. It is calculated as a ratio between CIL and GDP.

Table 60 – Primary and final energy consumption (for each sector); projections 2025-2040 in the scenario of reference, historical data 2021 EUROSTAT (Mtoe)

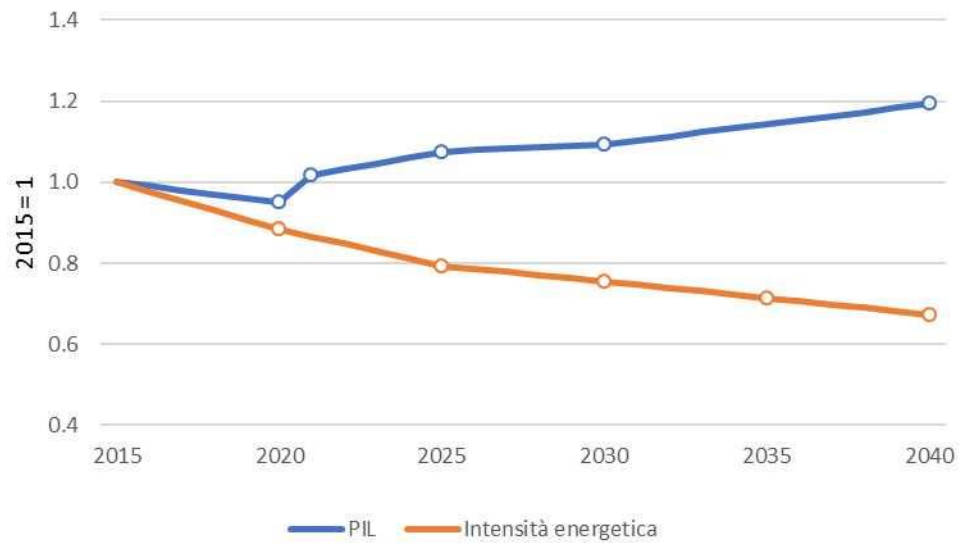
Reference scenario	2021	2025	2030	2040
Gross inland consumption ¹	151,2	141,2	136,6	132,9
Solids ²	6,7	3,3	3,3	2,6
Petroleum products	51,0	47,4	46,1	42,9
Natural gas	62,4	60,0	51,4	47,0
Renewables	27,4	26,8	32,2	38,2
Electricity	3,7	3,7	3,7	2,3
Primary energy consumption ³	145,3	134,2	130,0	126,1
Final energy consumption ⁴	113,3	111,7	109,1	109,1
detailed by sector	113,3	111,7	109,1	109,1
Industry	26,4	25,9	25,0	24,8
Residential	31,9	29,6	28,8	28,4
Tertiary	15,0	16,1	15,8	15,7
Transport	36,8	37,5	37,0	37,6
Agriculture	3,3	2,7	2,6	2,5
details by source	113,3	111,7	109,1	109,1
Solid	1,8	1,9	2,1	1,8
Petroleum products	39,9	38,8	37,1	35,6
Natural gas	34,4	31,2	28,8	29,0
Electricity	25,1	25,2	25,2	25,7
Heat	3,1	4,4	4,3	4,3
Renewables	8,9	10,3	11,7	12,7
Final non-energy consumption	5,9	7,1	6,7	6,8

¹ indicator 'Gross inland consumption (Europe 2020-2030)' which includes international aviation and excludes ambient heat and international shipping.

² including the share of non-renewable waste and iron and steel gas.

³ primary consumption excludes non-energy uses included in gross domestic consumption.

⁴ indicator 'Final energy consumption (Europe 2020-2030)'.

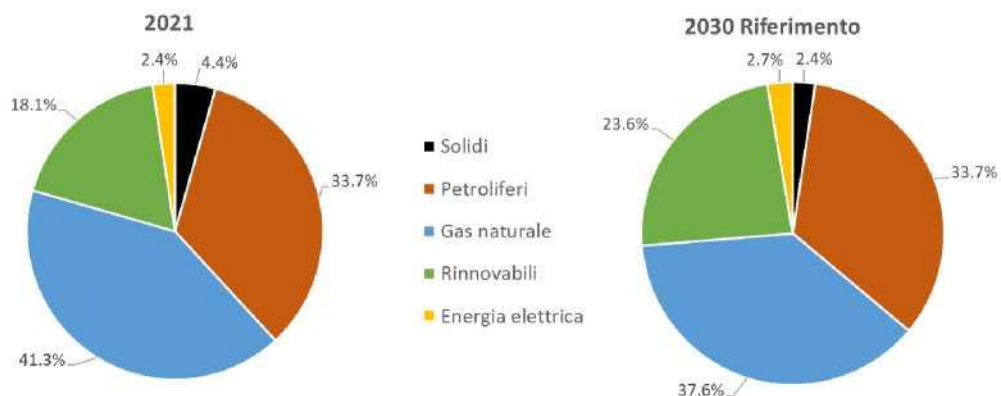
Figure 63 Comparison of the projected energy intensity with GDP⁶⁴ over the period 2015-2040

The evolution of primary energy needs is the result of a number of processes relating to different topics:

- The progressive energy efficiency and technological innovation of new devices which progressively replace the most obsolete ones;
- The largest share in consumption of thermal renewables, electricity (electrification) and biofuels and therefore a different fuel mix in end uses;
- The gradual decarbonisation process in terms of both increased RES penetration in the consumption (e.g. ETS) and generation (e.g. electricity generation) sectors

In terms of the primary energy mix in 2030 compared to 2021, the weight of fossil fuels is decreasing, with particular reference to natural gas, which still remains the main source, while increasing the consumption of renewable sources (Figure 5.2).

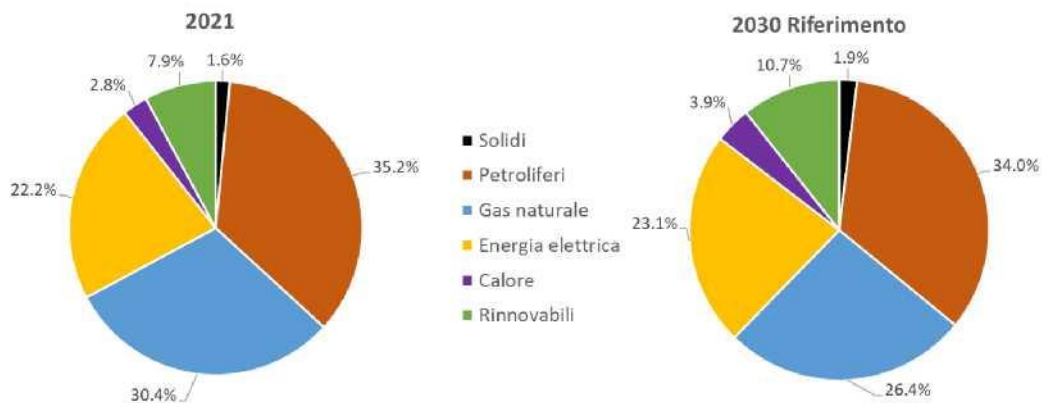
Figure 64 Comparison of the primary energy mix 2021 and 2030 (Reference scenario).



The general considerations already expressed for the dynamics of the primary energy mix also apply to the final consumption mix (Figure 5.3). The trend is a decline in the share of gas and petroleum products to the benefit of renewables and, to a lesser extent, derived heat.

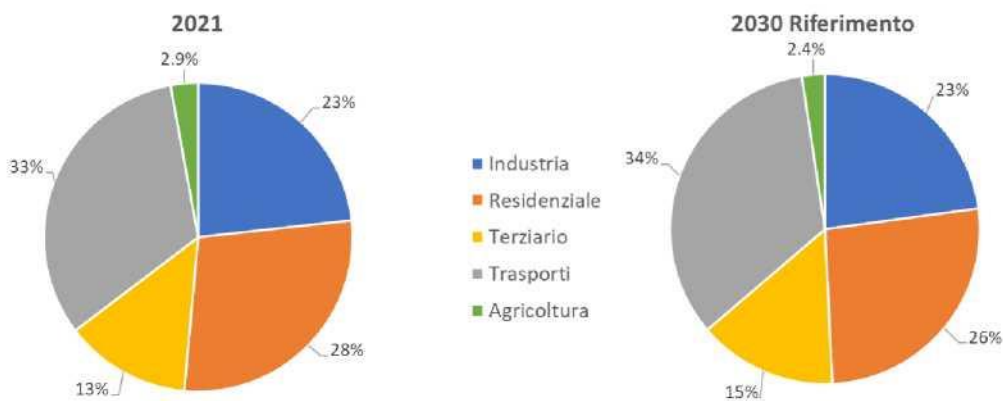
⁶⁴ chain-linked values 2015

Figure 65 Comparison of the final energy mix 2021 and 2030 (Reference scenario).



At sectoral level (Figure 5.4), by contrast, the final energy consumption mix remains almost unchanged at 2030 compared with the last year at the end of the year (2021). There is a slight decrease in the energy weight of the residential and industrial sectors, offset by increases in transport and the commercial sector.

Figure 66 Comparison of consumption breakdown of end-use sectors 2021 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 “Methodology for calculating cost-optimal levels of minimum energy performance requirements (Directive 2010/31/EU Art. 5)”⁶⁵ sent to the Commission in August 2013 provided the results of these calculations and comparisons with the corresponding requirements. 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 novelties introduced in the update are presented in the following paragraph⁶⁶. For a detailed description of the comparative methodology, please refer to the 2013 report referred to 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 the hypothesis of non-intervention in 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.
- Definition of a new use among 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 (2101-3000 degree days).
- Assessment of the energy performance of reference buildings using the semi-steady-state calculation method according to the new UNI/TS 11300 series. 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:
 - Climate data refer to 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;
 - 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).

⁶⁵<https://ec.europa.eu/energy/en/content/eu-countries-2013-cost-optimal-reports-part-2>

⁶⁶ 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>

- 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 continuous evolution of the legislative framework in this area and the short time horizon of some of them, in accordance with the Regulation, which leaves the Member State free choice.
- 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, for climate zones B (climate with mainly summer demand) and E (mainly winter demand), the methodology analysed the following types of buildings:

- RMF (Monofamiliar Residential): dating back to two moments of construction, 1946-1976 and 1977-1990, and consisting of buildings of 1 and 2 floors;
- RPC (Residenziale Piccolo Condominio): dating back to two moments of construction, 1946-1976 and 1977-1990, consisting of 3-storey buildings;
- RGC (Great Condominio Residential): dating back to two moments of construction, 1946-1976 and 1977-1990, consisting of buildings of 4, 6 and 8 floors;
- Office (Office buildings): dating back to two periods of construction, 1946-1976 and 1977-1990, consisting of 2-storey buildings and 4-5 floors;
- SCU (Schools): dating back to the time of construction 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 E2⁶⁷) were considered: the results are shown in Table 22 (residential), Table 23 (offices) and Table 24 (schools), which present cost-optimal values up 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 buildings also differentiate them for certain typological-constructional characteristics: for example, the PRC code defines a residential building with the 'small multi-apartment building' (RPC) but the RPC E1 and RPC E2 building differ by year of construction, S/V ratio, dispersed surface, heated volume and other, factors leading to the assessments set out in Table 22, Table 23 and Table 24⁶⁸.

⁶⁷E1 indicates a building from the period of construction 1946-1976 and E2 a building from the period 1977-1990.

⁶⁸For 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 61 – Minimum overall cost, relative optimal annual primary energy value, primary energy global non-renewable STATE OF FATTO, global non-renewable primary energy scenario COST-OPTIMAL and CO2 COST-OPTIMAL emission_{savings} of reference residential buildings

	CODE BUILDING	Overall cost	Optimal value EP	Global non-renewable primary energy DE FACTO STATUS	Global non-renewable primary energy COST-OPTIMAL	Saving COST-COST-OPTIMAL carbon dioxide emissions
		[EUR/m ²]	[kWh/m ²]	[kWh/m ²]	[kWh/m ²]	[KgCO ₂ /m ²]
ZONE CLIMATE AND	RMF_E1	498	90,6	500	79	84,2
	RMF_E2	311	89,5	290	79,2	42,2
	RMF_NO	575	97,7	—	26,9	—
	RPC_E1	335	127	325	106	21
	RPC_E2	243	103	160	55,2	16,2
	RPC_NO	419	102	—	42,6	—
	RGC_E1	355	118	295	101	18,6
	RGC_E2	212	73,5	140	59,6	13,1
	RGC_NO	363	75,3	—	40	—
	ZONE CLIMATE B	RMF_E1	310	102	225	90,2
RMF_E2		270	92,8	105	82,2	4,6
RMF_NO		477	120	—	34,8	—
RPC_E1		242	79	160	55,2	21
RPC_E2		185	54,3	118	37,2	16,2
RPC_NO		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_NO		320	85	—	45,2	—

Source: STREPIN March 2021

Table 62 – Minimum overall cost, relative optimal annual primary energy value, primary energy global non-renewable STATE OF FATTO, global non-renewable primary energy scenario COST-OPTIMAL and CO2 COST-OPTIMAL_{Emission} savings of reference office buildings

	CODE BUILDING	Overall cost [EUR/m ²]	Optimum EP value [kWh/m ²]	Current overall non-renewable primary energy consumption [kWh/m ²]	Global non-renewable primary energy COST- OPTIMAL [kWh/m ²]	Saving COST-COST-OPTIMAL carbon dioxide emissions [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_NO	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_NO	468	112	—	69,9	—

Source: STREPIN March 2021

Table 63 – Minimum overall cost, relative optimal annual primary energy value, primary energy global non-renewable STATE OF FATTO, global non-renewable primary energy scenario COST-OPTIMAL and CO2 COST-OPTIMAL_{Emission} savings of reference school buildings

	CODE BUILDING	Overall cost [EUR/m ²]	Optimum EP value [kWh/m ²]	Global non-renewable primary energy STATE OF DONE [kWh/m ²]	Overall non-renewable primary energy consumption in the COST-OPTIMAL scenario [kWh/m ²]	Saving COST-COST-OPTIMAL carbon dioxide emissions [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.: roof 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 dating back to the period 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

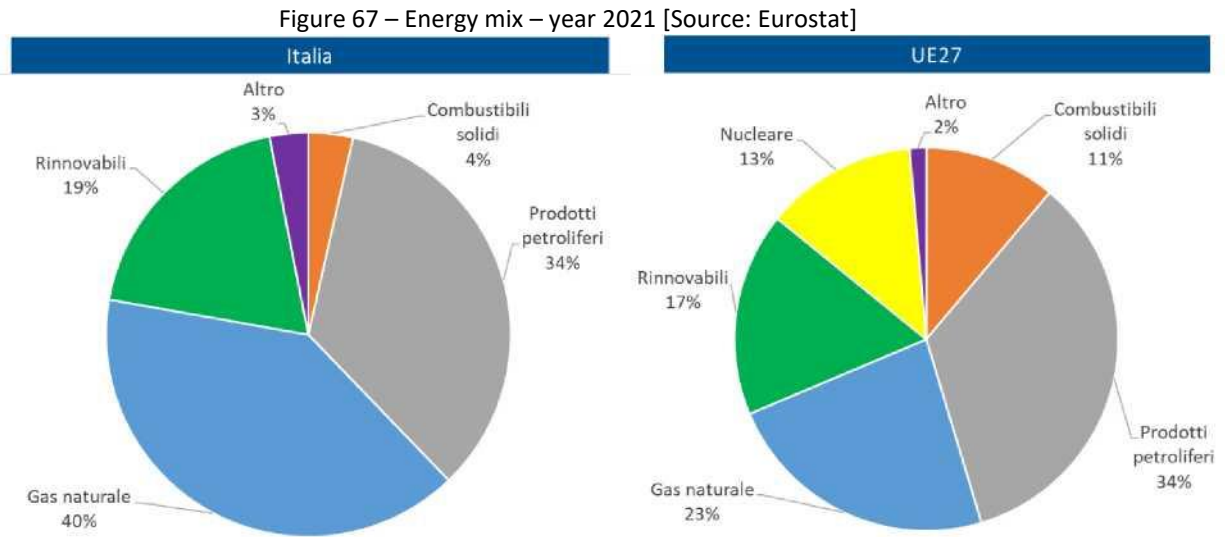
residential sector, the percentage of energy consumption from renewable sources ranges from 50-70 % for new buildings to 10-20 % for existing ones. By contrast, offices have coverage of 40-50 % for new buildings and 15-20 % for existing ones. Lastly, school buildings have a significantly different consumption 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.

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 a territory's energy needs (represented by gross availability of energy⁶⁹), is shown – with reference to 2021 – in the graph below, together with a comparison with the EU27 average (Eurostat data).



There are significant differences between the Italian energy mix and the average EU27 energy mix. In Italy, natural gas plays a relatively very significant role (40 % of the total compared to an EU27 average of 23 %), while the use of petroleum products is in line with the European average. The use of solid fuels is significantly lower, that of higher renewables.

These characteristics are, of course, linked to the dynamics of domestic production and imports of the different sources. In the five-year period 2017-2021, national production of energy sources remained within the range of 36,7-37,5 Mtoe (Eurostat data). The different sources show mixed developments: the contraction in natural gas (-42.5 % in 2021 compared to 2017), in particular, is offset by increases in both petroleum products (+ 17.3 %) and renewable energy sources (+ 4.2 %); domestic production of solid fuels is not significant.

⁶⁹ According to Eurostat conventions, the energy dependency ratio on imports is calculated by reference to Gross availability of energy / gross availability of energy, which is slightly different from other items referred to in the previous paragraphs (e.g. Gross Inland Consumption/ Gross Domestic Consumption).

Table 64 – Domestic energy resources 2017-2021 (ktoe) [Source: Eurostat]

	2017	2018	2019	2020	2021
National production	36.667	37.342	36.910	37.480	36.676
Solid	—	—	—	—	—
Petroleum products	4.456	5.091	4.708	5.856	5.228
Natural gas	4.536	4.462	3.931	3.287	2.608
Renewables *	27.675	27.790	28.271	28.336	28.840

* Includes transport biofuels, biomethane and the share of non-renewable waste.

With regard to net imports of energy products, an overall contraction of -7.8 % was observed between 2017 and 2021. Again, the differences between the different sources are significant: compared to 2017, compared to reductions in imports of coal (-42.6 %), petroleum products (14.6 %) and renewable sources (-6.8 %; these are mainly woody biomass), with increases in natural gas (+ 3.0 % compared to 2017 and + 8.1 % compared to 2020) and electricity (+ 13.3 %).

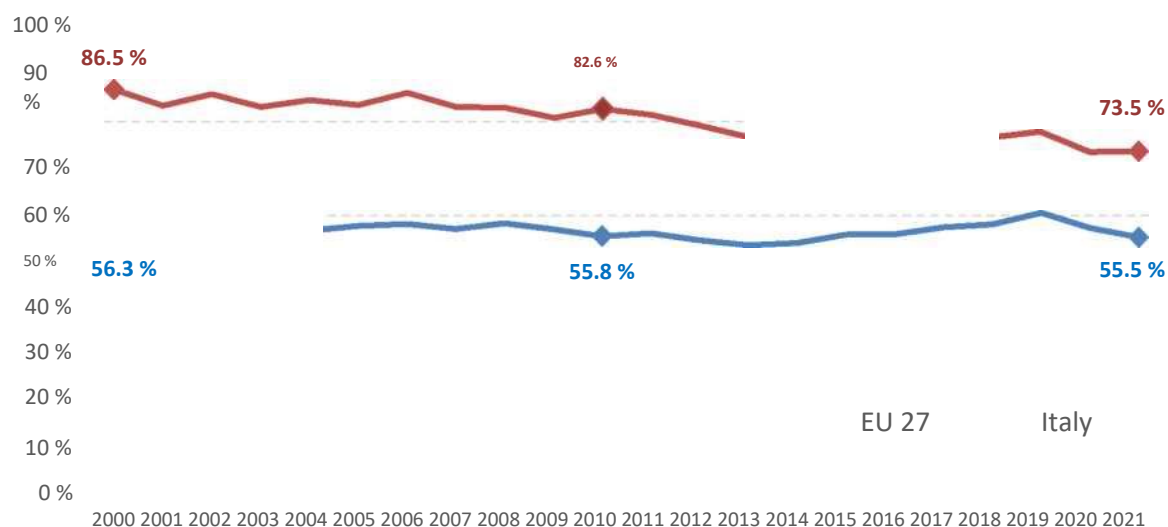
Table 65 – Net imports 2017-2021 (ktoe) [Source: Eurostat]

	2017	2018	2019	2020	2021
Net imports	124.564	121.920	122.492	105.799	114.850
Solid	9.360	8.622	6.387	4.739	5.374
Crude oil and petroleum	52.824	51.634	52.437	42.008	45.121
Natural gas	56.820	55.268	57.936	54.117	58.519
Electricity	3.247	3.775	3.280	2.769	3.679
Renewables *	2.312	2.622	2.452	2.165	2.156

* Includes biofuels for transport.

Finally, with reference to the indicator of Italy's degree of dependence on imports of energy products, it can be seen that the value recorded in 2021 is high both in absolute terms (73.5 % of demand is covered by imports) and in relative terms (this figure is around 18 percentage points higher than the EU27 average); this condition may expose the Italian energy system to risks in terms of security of supply, as evidenced, for example, by the recent periods of geo-political and market turbulence.

Figure 68 – Import energy dependency index (%) [Source: Eurostat]



On the other hand, by extending the analysis to developments over the last two decades, it can be seen that some relatively recent phenomena (in particular, the gradual growth of RES and the fall in energy intensity) have led to a gradual and significant decline in Italy's dependence on imports of energy products from foreign countries: indeed, the share of national energy needs met by imports fell by around 13 percentage points, from 86.5 % in 2000 to 73.5 % in 2020 and 2021.

ii. Projections of development with existing policies and measures at least until 2040 (including for the year 2030)

The following tables show projections for production, net imports of energy products and energy dependency over the period 2025-2040 to current policies.

In the medium to long term, in terms of energy mix, RES have a greater role to play, to the detriment of contributions from other sources, although combined with a decrease in gross energy supply⁷⁰.

With regard to national production, there is an overall increase due exclusively to the contribution of RES (+ 40 % in 2040 compared to 2025 levels, i.e. + 11 Mtoe produced, mainly as a result of photovoltaic and wind technologies), while the volume produced and the share of oil and natural gas products decreased.

As regards imports, the contraction is also confirmed in the medium and 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 reduction in volumes for natural gas (-11 Mtoe imported in 2040 compared to 2025, corresponding to a negative change of 19 %) and petroleum products (-4 Mtoe imported, or -10 %).

As a result of the dynamics of imports and domestic production by source and product type, energy dependency falls in the long term from 75.1 % in 2025, 70.9 % in 2030 and 66.6 % in 2040.

⁷⁰ Gross energy availability is calculated as the sum of national production, net imports, changes in inventories and products subject to recycling and recovery.

Table 66 – Domestic energy resources, projections 2025-2040, baseline scenario (ktoe)

	2025	2030	2040
National production	36.431	41.096	46.124
Solid	—	—	—
Petroleum products	4.272	4.128	3.856
Natural gas	3.254	2.564	1.734
Renewables * *	28.905	34.404	40.534

* Includes transport biofuels, biomethane and the share of non-renewable waste.

Table 67 – Net imports, projections 2025-2040, baseline scenario (ktoe)

	2025	2030	2040
Net imports	109.870	100.220	91.969
Solid	3.044	2.361	1.838
Crude oil and petroleum products	44.687	43.277	40.325
Natural gas	57.225	49.579	46.089
Electricity	3.712	3.715	2.220
Renewables *	1.415	1.544	1.804

* Includes biofuels for transport.

Table 68 – Energy Deployment, projections 2025-2040, Reference Scenario (%)

	2025	2030	2040
Energy dependence	75.1 %	70.9 %	66.6 %

4.5 Dimension Internal energy market

4.5.1 Electricity interconnectivity

i. Current state of interconnection level and major interconnectors⁷¹

At present, interconnection capacity is mainly located on the northern border of the country (4 lines with France, 12 with Switzerland, 2 with Austria, 2 with Slovenia). The total on the northern border is 7 tern at 380 kV, 9 baits at 220 kV, 3 tern at 150/132 kV and an HVDC connection to France.

There is also a direct current link with Greece, one linking Sardinia and the peninsula with Corsica (SACO12) and one linking the peninsula with Montenegro. Sardinia is also connected to Corsica by means of an alternating current cable. A 220 kV double circuit cable connects Sicily with Malta.

Figure 69 – Map of existing interconnections [Source: Terna – 2023 Development Plan]



The total value of the trading capacity on the northern border for the year 2023 is between 8.000 MW and 10.135 MW in import and between 4.010 MW and 4.895 MW exported in⁷².

⁷¹ With reference to existing transmission infrastructure charts of transmission system operators (TSOs)

⁷² Source: NTC values in import direction on the Italian borders – YEAR 2023

Table 69 – Consistency of external interconnection lines

Station Italy	External Station	Voltage (kV)
Camporosso	Trinité Victor (FR)	220
Venaus	Villarodin (FR)	380
RONDISSONE	Albertville (FR)	380
RONDISSONE	Albertville (FR)	380
Pioassco§§§§§§§§§§§§§§§§	Grand'Ile	320 DC
Pallanzeno	Greenhouse (CH)	220
Bridge	derivaz. Water (CH)	220
Valpelline	Riddes (CH)	220
Avisè	Riddes (CH)	220
Bulciago	Soazza (CH)	380
Musignano	Lavorgo (CH)	380
Cagno (*****)	Mendrisio (CH)	380
Month 1	Gorduno (CH)	220
GORLAGO	Robbia (CH)	380
S. Fiorano	Robbia (CH)	380
Tirano (*)	Campocologno (CH)	150
Villa di Tirano	Campocologno (CH)	132
Soverzene	Lienz (AT)	220
Tarvisio (*)	Greuth (AT)	132
Redipuglia	Divaccia (SI)	380
Padriciano	Divaccia (SI)	220
Galatina	Arachthos (GR)	400 DC
Codrongianos/Suvereto	Lucciana (Corsica)	200 DC
Codrongianos/Suvereto	Lucciana (Corsica)	200 DC
S. Teresa di Gallura	Bonifacio (Corsica)	150
Ragusa	Maghtab (Malta)	220
Villanova	Lastva (ME)	500 DC

§§§§§§§§§§§§§§§§Private bipole Interconnector L. 99\ 09 of the HVDC Pioassco Grande Ile project. The second bipole is expected to enter into operation in 2023.

*****Merchant Line

Table 70 – Interconnection capacity [Terna data processing]

Of the period	Frontier	Winter [MW]		Summer [MW]	
		Peak	Off Peak	Peak	Off Peak
Import					
Monday – Saturday	France	4.485	4.338	4.044	3.817
	Switzerland	4.572	4.036	3.747	3.424
	Austria	325	305	280	265
	Slovenia	753	641	534	494
	Total Northern border	10.135	9.320	8.605	8.000
	Greece	500	500	500	500
	Montenegro	600	600	600	600
	Malta	200	200	200	200
Sundays and	France	4.338	4.338	3.817	3.817
	Switzerland	4.036	4.036	3.424	3.424
	Austria	305	305	265	265
	Slovenia	641	641	494	494
	Total Northern border	9.320	9.320	8.000	8.000
	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	100	145	80	100
	Slovenia	660	680	620	645
	Total Northern border	4.565	4.895	4.010	4.460
	Greece	500	500	500	500
	Montenegro	600	600	600	600
	Malta	200	200	200	200
Sundays and	France	2.160	2.160	2.055	2.055
	Switzerland	1910	1910	1660	1660
	Austria	145	145	100	100
	Slovenia	680	680	654	645
	Total Northern border	4.895	4.895	4.460	4.460
	Greece	500	500	500	500
	Montenegro	600	600	600	600
	Malta	200	200	200	200

ii. *Need to increase foreign transmission capacity (also for 2030) 73*

As part of the planned interconnection works, a 220 kV connection on the Italy-Austria border (Reschenpass project) is being set up with an expected date of entry into operation 2023.

In addition to a new project at an advanced stage of authorisation with Austria, the complete refurbishment of the Sardegna-Corsica-Italy Continental Italy link SACOI 3 (replacing the current SACOI 2) and the Italy-Tunisia submarine connection are under authorisation; the new interconnection between Italy and Greece (Grita 2) is at the planning stage.

⁷³ with reference to national network development plans and regional investment plans of TSOs



In addition, the first HVDC hub of the Piossasco-Grande Ile project became operational in November 2022. In 2019, the new Italy-Montenegro HVDC interconnection entered into operation with an exchange capacity of 600 MW.

The list of projects for the development of interconnection with foreign borders, identified by Terna in the 2023 Development Plan, is set out below.

In the implementation phase:

- Italy-France HVDC connection (Piossasco – Grand’Ile): high-voltage terrestrial cable in direct current (HVDC), with a rated power of 2x600 MW, between the two power stations in Piossasco (Piedmont) and Grand’Ile (Savoia). The second cluster is expected to enter into operation in the course of 2023, at the end of the testing phase, while the first cluster was completed in November 2022 in accordance with the objectives set out in Law 99/2009;
- link 132 kV Prati di Vizzi/Brennero (IT) – Steinach (AT), in synergy with the local distributor. It is expected to enter into operation in the course of 2023.

At authorisation stage:

- link Italy – France, SACOI 3 ‘Sardegna-Corsica-Italia Continentale’ replacing the current SACOI 2, which has now come to the end of its useful life;
- connecting Italy – Tunisia, a project of strategic importance for the electricity transmission system in the Mediterranean basin, which will provide an additional tool to optimise the use of energy resources between Europe and North Africa.

At design stage:

- electricity line 220 kV Interconnection Italy – Austria: reconstruction of the current 220 kV power line between Italy (Soverzene) and Austria (Lienz).

At the planning stage:

- new interconnection with Greece (Grita 2): new HVDC connection to increase the exchange capacity between the two countries;
- New interconnection with Switzerland associated with the wider project of nationalisation of Valchiavenna.

In addition to the first hub of the Piossasco-Grand’Ilé HVDC interconnection (on the Italy-France border) and the first hub of the HVDC interconnection MON.ITA. (on the Italy-Montenegro border) projects are currently foreseen in accordance with the objectives of Law 99/2009:

- Interconnection 220 kV Nauders (AT) – Glorenza (IT) on the Italy-Austria border;
- Interconnection – Italy-Slovenia – Existing 380/220 kV network optimisation on the Italy-Slovenia border.

Figure 71 – Interconnection projects under Law 99/2009 [Source: Terna – 2023 Development Plan]



In addition to the above-mentioned projects planned by Terna, the initiatives of private entities (reg./14/2009), known as merchant lines, have been taken into account, in order not to overestimate interconnections and to avoid overburdening the area.

However, in the case of authorisations granted, few merchants have been carried out, which ultimately represents a factor of uncertainty. Among the merchant lines, there are projects on the northern border between Italy and Switzerland, France and Austria, while to the south of the peninsula there are projects with Malta and Tunisia.

4.5.2 energy transmission infrastructure

i. Main characteristics of the current transmission infrastructure for electricity (RTN)

The national transmission network as of 30 June 2022 has a network extension of over 68.000 km of lines and cables and around 900 stations (source: Terna, Development Plan, 2023). The network is characterised by a predominantly longitudinal development. The zone structure, the corresponding transit limits and the details of the connecting lines between zones are shown in the figures below.

In recent years, the north-west area has seen an increase in production compared with regional demand, owing to the simultaneous effect of the spread of distributed generation and the decline in consumption. This phenomenon exacerbates the problems of transport from north-west to north-east, as it is combined with high imports of power from the border (Switzerland and France) and hydroelectric production.

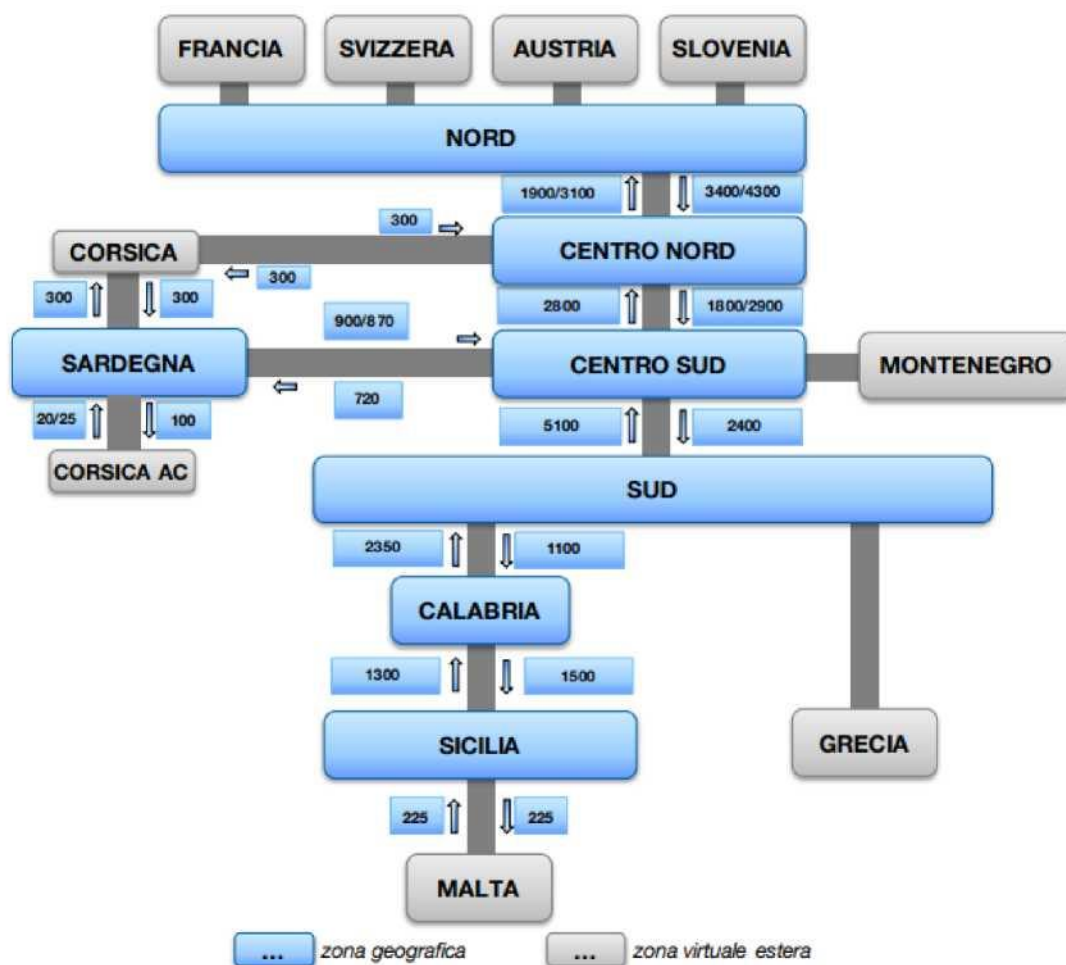
The high and very high voltage network in the north-east of the country has problems linked to seasonality (periods of high hydraulic power) and low level of interconnection and knitting. The 400 kV network consists of a large ring that closes to the west at Dugale station (VR) and to the east at Redipuglia station (GO). As structured, the electricity grid in question is highly unbalanced at the Redipuglia node, which flows power from the Slovenian border.

In the southern area, 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 transits in the south, centre-south, affecting the main routes of the southern primary transmission network, creating congestion on the primary networks under certain operating conditions. Particular problems are encountered on the 380 kV connections of the Adriatica dorsal and along the 380 kV lines from Calabria to the north.

As regards the territory of the two large islands, in Sicily the power system is supplied by a partly old thermal park, concentrated mainly in the east and south-west of the island, and by numerous RES installations located mainly in south-west and centre-eastern areas (mainly wind turbines); in particular, the distribution of the power park module makes the Sicilian system extremely unbalanced and is in fact critical for the full integration of the new renewable generation.

In Sardinia, the electricity system is very sensitive to network disruptions caused by budgetary imbalances, which poses a risk to system security, as the state of the power park module in the island and the low inertia of the system (also linked to the reduced interconnection with the mainland's electricity system) expose the Sardinian network to the risk of disruption.

Figure 72: Values of transit limits between market zones, winter case [Source: Terna, Limit values of transit between market zones, rev. 29, December 2022]



customers (ARERA source, 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 as at 31 December 2020 states 2.336 primary cabins and 447.250 secondary cabins for a processing power of 110.353 MVA and 85.066 MVA respectively⁷⁴.

The main drivers that determine (and above all) the evolution of the distribution network are identified in the following:

- distributed generation (generation facilities connected to the MT and BT networks),
- deployment of electric heat pumps for heating and cooling,
- Electric vehicle charging infrastructure.

According to the Authority's monitoring as⁷⁵ at 31 December 2020, around 952.000 distributed generating installations, of which around 935.000 are photovoltaic generation, are connected. The total gross efficient power is 34.1 GW, of which about 20 GW of photovoltaic generation and about 7 GW of thermoelectric generation. The total gross production is 70.95 TWh, of which 53.6 TWh from renewable sources with 22.8 TWh of PV. As of 31 December 2021,⁷⁶ there are more than 1 million PV installations with a power of less than 5 MW (below 6 MW installations are usually connected in distribution⁷⁷) with a total capacity of 20.3 GW; there are 205 installations above 5 MW (part of which is connected in distribution), with a total capacity of 2.3 GW.

By 2021, there were around 20,3 million heat pumps⁷⁸ for heating with an installed heat output of around 120.3 GW. With regard to space cooling, there are around 22,0 million plants with an installed thermal input of 136.3 GW.

For electric vehicles, as of 31 December 2021, a total of 136.754 vehicles are registered, of which 49 % BEV and 51 % PHEV, while there are around 26 public recharging points distributed over 13.223 charging infrastructure. 17 % of recharging points have a power of up to 7 kW in alternating current, 77 % up to 43 kW in alternating current and the remaining higher direct current power⁷⁹.

From these numbers it is clear that heating and cooling consumption already makes a significant contribution to the load today and typically peak days correspond to warmer or colder days⁸⁰.

The interventions planned by distributors have limitations on the future evolution of the system. The plans are three-yearly and therefore do not cover the full time horizon. Moreover, the plans contain only the most economically significant interventions, typically primary cabins and portions of the grid at medium voltage. However, new distributed generation and load plants have significant impacts mainly on the low voltage grid, which is not analysed in detail. For example, the 2021 e-distribution development plan (PdS) includes, for the three-year period 2021-2023, 253 interventions on primary cabins, of which around 90 81 are for the construction of new primary cabins. In addition, the request for connection to the national transmission network of around 75 primary installations has been formalised, mainly for the next generation of distributed connection. The e-distribution PdS is particularly significant in this respect, since it serves the areas with the highest penetration of distributed generation (the other operators serve, with some exceptions, mainly urban centres).

⁷⁴https://www.e-distribuzione.it/content/dam/e-distribuzione/documenti/e-distribuzione/Piano_di_Developd_ofe_sector_di_EDistribut_2021_2023.pdf

⁷⁵ <https://www.arera.it/it/docs/22/703-22.htm>

⁷⁶https://www.gse.it/documenti_site/Documenti%20GSE/Rapporti%20statistici/Rapporto%20Statistico%20GSE%20-%20ERF%202021.pdf

⁷⁷ <https://www.ceinorme.it/strumenti-online/norme-cei-0-16-e-0-21/>

⁷⁸ https://www.gse.it/documenti_site/Documenti%20GSE/Rapporti%20statistici/Rapporto%20Statistico%20GSE%20-%20ERF%202021.pdf

⁷⁹<https://www.motus-e.org/analisi-di-mercato/dicembre-2021-le-auto-elettriche-raddoppiano-nel-21-il-governo-le-leave-awakent-heid-che-gia-ci-sono/>

⁸⁰ <https://www.terna.it/it/sistema-elettrico/dispacciamento/dati-esercizio>

⁸¹https://www.e-distribuzione.it/content/dam/e-distribuzione/documenti/e-distribuzione/Piano_di_Developd_ofe_sector_di_EDistribut_2021_2023.pdf

Turning to the next three main distributed energy operators (ARete, Unareti and IRETI), a total of 17 new primary cabins are expected in their SOPs, not counting the upgrading of the AT/MT transformers. The development plans show that the planned interventions are driven by several drivers: load growth, generation connection, remote control needs, resilience, loss reduction and voltage quality.

iii. Projections of RTN expansion needs until at least 2040 (including for 2030) 82

The Terna 2023 Development Plan identifies a number of priority development measures, including two connections with abroad (new HVDC Italy-Greece 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 congestion and capacity constraints;
- increased safety and reliability in metropolitan areas;
- increased quality and safety.

The details of the measures are set out below, indicating the state of play.

- **REDUCTION OF CONGESTION BETWEEN MARKET AREAS**

- 400 kV power line “Calenzano – Colunga” to increase the exchange limits on the section north – centre north;
- 400 kV power line ‘Foggia – Villanova’ to increase the exchange limits in the south – centre south and to promote the production of plants from renewable sources in the south;
- 400 kV power line ‘Montecorvino – Avellino – Benevento’ to increase the exchange limits on the south – centre south and to reduce the constraints on the Rossano production centre, as well as to promote the production of plants from renewable sources;
- upgrading of the northern Calabria network, which together with the cross-section of Calabria contributes to reducing the constraints for the Rossano production centre and for production from renewable sources in Calabria;
- HVDC Centre South and Centre North to increase the security of operation of the electricity system between the market areas South Central North and North-North Centre, ensuring greater regulatory capacity, as well as to encourage additional renewable generation expected.
- The HVDC Continente-Sicilia-Sardinia connection (Tyrrhenian Link) to increase the safety of the electricity system on the islands by connecting them directly with the mainland, ensuring greater regulatory capacity, as well as to facilitate the integration of the new generation expected from renewable sources on the islands.
- Hypergrid: five new electric backbones to increase transport capacity between areas and facilitate the integration of the new RES quota. The five backbones are:
 - Central Link
 - HVDC Milan – Montalto
 - Ionian dorsal – Tyrrhenian: HVDC Priolo – Rossano – Montecorvino – Latina

⁸² with reference to national network development plans and regional investment plans of TSOs

- Adriatica backbone: HVDC Foggia – Villanova – Fano – Forlì
- Sarda dorsale: HVDC Fiumesanto – Montalto (Sapei 2) and Sardinian Link

- **REDUCTION OF INTRA-ZONAL CONGESTION AND CAPACITY CONSTRAINTS**

- 400 kV power line between Milan and Brescia to reduce congestion on the section between the north – west and north – east of the country;
- rationalisation of the Piave Valley media network in order to reduce congestion and encourage production from renewable sources;
- 400 kV power lines ‘Paternò – Pantano – Priolo’, ‘Chiaramonte Gulfi – Ciminna’ and ‘Partanna – Ciminna’ for greater fungibility of resources in Sicily and between Sicily and the mainland, 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 the AAT and AT Torino, Genoa, Florence, Rome and Naples networks, in order to reduce congestion affecting the safety and reliability of the primary networks serving areas with a high concentration of users.

- **INCREASED QUALITY AND SAFETY**

- 132 kV “Elba-Continent” power line to ensure adequate levels of safety, continuity and efficiency of the local service;
- upgrading of the 150 kV network in the Sorrentine Peninsula for the quality and continuity of the supply service of the local AT grid, characterised by high load density.
- interventions on the AT network in the Ragusa area and in the Catania area to improve the safety of supply of loads in the areas, which are characterised by many PCs in antennas and industrial loads sensitive to the phenomenon of tension holes/microinterruptions.

In addition to the above, please find below the preliminary updated representation of transmission capacity planned at European level in ENTSO-E’s Ten-Year Network Development Plan (TYNDP)²⁰²⁴, which is currently being prepared.

The final representation will be available upon completion of the new TYNDP currently foreseen in 2023-2024.

⁸³ <https://tyndp.entsoe.eu/>

Table 71 – Exchange values according to ENTSO-E Ten-Year Network Development Plan (TYNDP) 2024

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	5572	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 expansion of distribution networks until at least 2040 (including for 2030)

In the scenarios for the development of the national energy system, the growth of some types of load and distributed generation are particularly important: both of course have an impact on distribution networks. With regard to the consequent impact on distribution, general considerations can be expressed, although the specific interventions may change depending on the characteristics of each network and the territory served.

For urban distribution networks, the increase in load, especially in terms of power connected to the network, is particularly significant. The increase in peak power consumed is more related to summer conditioning, winter heating, charging of electric vehicles and to a lesser extent electrification of other end-uses. For these load-density networks, interventions on primary cabins and departures on MT lines do not fully reflect network development needs as these interventions are generally planned taking into account rather large conservation margins. In addition, they are tele-controlled network elements.

as a result, they are better able to cope with an increase in the load⁸⁴. Moreover, the contemporaneity factors of the different loads tend to be contained and network components in the vicinity of the primary cabin do not suffer significantly from localised load increases. On the other hand, other network components, such as MT/BT cabins⁸⁵ and BT lines, are more susceptible to an increase in load, especially when caused by the electrification of end-uses which is often characterised by high power (e.g. electric vehicles), high load concentrations (e.g. renovation of a multi-apartment block with full electrification) or high contemporary factors (e.g. summer conditioning).

Considering, for example, secondary cabs, the three distributors mainly serving urban areas (Arete, Unareti and IRETI) in their development plans foresee actions in the coming years on around 3.500 secondary booths out of a total of around 23.200. In these cases, the most critical conditions are mostly reached during summer heat waves: high temperatures and the contribution of the conditioning load cause greater overload problems. It is therefore clear that the increase in heat pumps for summer air conditioning and electric vehicles will lead to a worsening of the existing conditions (even under the same climate conditions). Moreover, even during winter periods, even though the operation of the networks is favoured by low temperatures, the use of electric heating systems combined with the increase in electric vehicles may cause new problems. Finally, measures to strengthen networks in urban areas are particularly difficult: while the laying of lines is relatively simple, even if it requires particularly complex and costly excavation processes especially in historic centres, the construction or upgrading of secondary booths may in some cases be impossible due to the lack of physical space for the new premises.

On the contrary, in industrial or rural areas distribution networks are more constrained by the increase in distributed generation, in particular photovoltaic generation. Generation in these cases results in different impacts from the load: very often, generation facilities are of a significant size and are connected in medium voltage, including via dedicated lines connected directly to the primary cabin, and the main actions are linked to the installation of new primary cabins to be able to collect the generation and transmit it to the transmission network (as is evident from the e-distribution PdS). In cases of medium load density networks (e.g. residential area with hatched villages), high penetration of distributed generation can cause problems at all voltage levels. Finally, in high load densities, local generation usually brings benefits by reducing peak load, and vice versa, production peaks are also compensated in low load situations. It is therefore clear that there is synergy in urban networks suffering from heat waves.

The possible impact of electric vehicles, which is uncertain because of the lack of experience of network operators on their behaviour, especially given that many of their consumption is *behind the meter and therefore not directly monitored by distributors, is another phenomenon that needs to be explored further in the assessment of distribution networks*. Moreover, the trajectory for mobility development, understood not only as a level of deployment and energy carrier, but also as a territorial distribution, types of charging infrastructure and user habits, is very uncertain. The most significant aspects were identified through scenario surveys. As regards slow reloads for non-household users, the problems expected are mainly linked to the overlap of the morning *baseline* peak with the peak charging of cars travelling to jobs⁸⁶. For household charges, however, the problems are caused by the overlap of the evening peak with the vehicle charging peak of those returning home in the same time slot⁸⁷. Charges for other types of utilities (e.g. Local public transport) are more dependent on the characteristics of the distribution network and charging requirements⁸⁸ (e.g. in storage and via *cable chargers*). The impacts increase as the nominal power of recharging points grows, especially for medium and high-power public infrastructure⁸⁹. However, electric vehicles also have the

⁸⁴<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>

⁸⁵ https://orca.cardiff.ac.uk/id/eprint/146419/1/IMRJ_7308_20211230_V1.pdf

⁸⁶https://www.researchgate.net/publication/341454431_Cross-Country_Comparison_of_Hourly_Electricity_Mixes_for_EV_Charging_Profiles

⁸⁷ <https://www.sciencedirect.com/science/article/pii/S014206152100140X>

⁸⁸ <https://open-research-europe.ec.europa.eu/articles/1-156>

⁸⁹<https://www.rse-web.it/rapporti/evoluzione-del-sistema-energetico-urbano-e-impatti-attesi-sulle-infrastrutture-results-and-recommendations/>

considerable advantage that the charging process can be controlled in a relatively simple way, allowing absorption to be modulated also according to the needs of the system⁹⁰. This allows a number of strategies to be put in place to reduce the impact on the electricity system and in particular on the distribution network. As regards job charges, they can be coordinated, including with the pre-existing load, so as to minimise the impact on the network⁹¹. Workplace charging and, more generally, daytime charging have the advantage of being able to be coupled with photovoltaic generation, reaching the benefit of reduced grid stress (mutual compensation between load and generation)⁹². With regard to domestic charging, a simple solution is to defer or postpone charging at night, when the load has its minimum daily load⁹³. Another interesting solution is to install storage systems coupled also to distributed generation facilities, which could allow less grid upgrades⁹⁴. With regard to public charges, there are important systems for coordinating charging processes⁹⁵ (especially for longer stops) or, again, the installation of storage systems⁹⁶, which would also have the advantage of reducing the nominal power of stations and thus avoiding the installation of a customer cab for off-take in MT. Finally, the coordination of the installation of recharging points with network operators should be mentioned⁹⁷.

In order to enable distribution networks to manage the connection of additional loads and generation, smart control solutions or the installation of dedicated equipment, such as storage systems in secondary cabs rooms may be considered (in this regard, reactive power control functionality for voltage regulation in rural networks is recalled). There are many solutions proposed in the literature⁹⁸, but it is often difficult to quantify its benefits. Indeed, a comprehensive analysis⁹⁹ of the latter in relation to the related costs, which must take into account multiple factors (e.g. remuneration and cost of flexibility) 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 coordination between TSOs and DSOs for the provision of ancillary services¹⁰⁰.

There are few studies available in the literature that can provide reliable figures on 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 lowering national or regional scenarios to the scale of distribution networks. An Eurelectric study estimates Italy¹⁰¹ to invest around 30 billion in distribution networks between 2020 and 2030 in a scenario with an increase of 42 GW of generation and 6 million electric vehicles. Of these EUR 30 billion, around 6 billion are driven by electric vehicles and EUR 3.3 billion by generation. The rest are mainly investments related to the digitalisation and modernisation of the network: the latter item of expenditure is particularly significant, mainly due to the ageing of the infrastructure. Indeed, the same study estimates that by 2030 around 50 % of BT lines will be over 40 years old: the need to modernise the network can therefore be an opportunity to rethink planning in the light of the new scenarios. A sharp increase in global investment, almost 100 %, is also foreseen by the IEA¹⁰², but the data are not broken down by geographical area and therefore it is not possible to extract the specific

⁹⁰IEA *Grid Integration of Electric Vehicles A manual for policy makers*.

⁹¹Zachary Needell, Wei Wei, Jessika E. Trancik, *Strategies for beneficiary 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,

⁹²Bosisio, Alessandro & Iannarelli, Gaetano & Greco, Bartolomeo & Morotti, Andrea & Pegoiani, Andrea & Cirocco, Alessandro & Cavalletto, Luca. (2023). *Urban e-Hubs for charging electric vehicles*. 108 – issue 11/12. 20-28.

⁹³[https://www.irena.org/-](https://www.irena.org/-/media/files/IRENA/Agency/Publication/2019/Sep/IRENA_EV_Smart_Charging_2019.pdf?rev=ce97a59bf5314and1d7bdcaa72fa88)

[/media/files/IRENA/Agency/Publication/2019/Sep/IRENA_EV_Smart_Charging_2019.pdf? rev = ce97a59bf5314and1d7bdcaa72fa88](https://www.irena.org/-/media/files/IRENA/Agency/Publication/2019/Sep/IRENA_EV_Smart_Charging_2019.pdf?rev=ce97a59bf5314and1d7bdcaa72fa88)

⁹⁴ <https://www.mdpi.com/1996-1073/16/1/557>

⁹⁵ <https://www.rse-web.it/rapporti/fornitura-di-servizi-alla-rete-tramite-veicoli-elettrici-in-ricarica-soluzioni-tecniche-remuneration-management-nel-caso-applicatio-di-flotte-aziende/>

⁹⁶ <https://www.mdpi.com/2079-9292/9/6/939>

⁹⁷ <https://www.arera.it/it/docs/23/173-23.htm>

⁹⁸ <https://bridge-smart-grid-storage-systems-digital-projects.ec.europa.eu/>

⁹⁹ <https://ses.jrc.ec.europa.eu/smart-grid-cost-benefit-analysis>

¹⁰⁰ <https://www.arera.it/allegati/docs/21/352-21.pdf>

¹⁰¹ <https://www.eurelectric.org/connecting-the-dots/>

¹⁰² <https://iea.blob.core.windows.net/assets/a72d8abf-de08-4385-8711-b8a062d6124a/WEO2020.pdf>

information for Italy.

An RSE study assessed¹⁰³ the additional costs in the scenario with around 50 GW of installed PV generation capacity and 6 million electric vehicles, estimating the largest investments 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 can vary from 3,3 to almost EUR 11 billion under scenario assumptions and *smart grid penetration*. These values are to be considered in addition to distributors' *investments as usual* (varying over time but usually more than 1,2 billion per year¹⁰⁴), so the result, albeit lower, is in the same order of magnitude as the Eurelectric study. It should be borne in mind that uncertainties remain in the scenario: if the penetration of charging infrastructure is higher in more urbanised areas, where the load is already high and jointly increased due to heat pumps, the impact may also be significant locally.

❖ **SMART GRID STRENGTHENING (NRRP M2C2-I2.1)**

As part of the NRRP, Mission 2 'Green Revolution and Ecological Transition' was introduced and Mission 2 'Strengthening and digitalising network infrastructure' provided for Investment 2.1 'Smart grid reinforcement' 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 encourage electrification of energy consumption (e.g. electric mobility, heating with heat pumps). Approximately EUR 3.6 m was allocated for the implementation of the measure with the aim of reaching approximately 4.000 MW Hosting Capacity and increasing the capacity and power available to at least 1.500.000 users to support the electrification of energy consumption.

Ministerial Decree No 146 of 6 April 2022 laid down 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 grid capacity to host and integrate further distributed generation from renewable sources; EUR 2,6 million to increase the power available to utilities and encourage electrification) to public electricity distribution concessionaires, in the form of a non-repayable contribution of up to 100 % of the eligible costs, for the implementation of measures on both the electricity network 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 the Environment and Energy Safety, providing that interested parties may submit project proposals under the two above-mentioned quotas (hosting capacity and electrification of consumption).

By the deadline of 3 October 2022, 25 integrated projects and two projects aimed at electrification of consumption had been submitted. On the basis of the total budget of the call, 22 projects have been accepted for funding. As of 30 June 2026, the Hosting Capacity will be increased to approximately 9.800 MW and the number of inhabitants affected by electrification measures will be 8,5 million.

❖ **MEASURES ON CLIMATE RESILIENCE NETWORKS (NRRP M2C2-I2.2)**

As part of the NRRP, Mission 2 'Green Revolution and Ecological Transition' was introduced and Mission 2 'Strengthening and digitalising network infrastructure' provided for Investment 2.2 'Interventions on climate resilience networks' to increase the resilience of the distribution network, to extreme weather events (wind/falling trees, ice, heatwaves, floods and hydrogeological risks) and to reduce the likelihood of prolonged interruptions in electricity supply and limit the negative social and economic consequences for the areas concerned.

Approximately EUR 0,5 billion has been allocated for the implementation of the measure with the aim of improving the resilience of at least 4.000 km of the grid of the electricity system in order to

¹⁰³ <https://www.rse-web.it/rapporti/confronto-tecnico-economico-delle-alternative-di-sviluppo-al-2030-della-rete-di-distribuzione/>

¹⁰⁴ <https://ieeexplore.ieee.org/document/9241121>

reduce the frequency and duration of supply disruptions due to extreme weather conditions.

Ministerial Decree No 150 of 7 April 2022 laid down 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 measures on the distribution network), in the form of a non-repayable contribution of up to 100 % of eligible costs, to the concessionaire of the electricity transmission network and to the concessionaires of the electricity distribution network to carry out measures aimed at increasing the resilience of at least 4 000 km of the electricity network to extreme weather events, reducing the likelihood of prolonged interruptions in electricity supply and limiting the negative social and economic consequences for the areas concerned.

On 20 June 2022, Public Notice No 117 was published with a view to obtaining expressions of interest in carrying out measures to improve the resilience of the electricity transmission network to extreme weather events and Public Notice No 118 for the presentation of draft measures aimed at improving the resilience of electricity distribution networks.

Pursuant to Notice No 117, 10 projects were submitted by 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 were eligible for aid affecting approximately 6.593 km of the network.

4.5.3 electricity and gas markets, energy prices

1. Current situation on electricity and gas markets, including energy prices

❖ **ORGANISED WHOLESALE ELECTRICITY MARKETS**

The architecture of the Italian wholesale electricity market currently focuses on the following three segments:

- Energy markets, shared between spot and forward markets, where operators exchange electricity with each other;
- The market for dispatching or MSD split between the ex-ante MSD and the Budget or MB market, where the system operator purchases the services necessary to ensure the security 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 eventually supplies the capacity necessary to ensure the adequacy of the electricity system.

-ENERGY MARKETS

In Italy, the Energy Markets Operator (GME) is the entity which, in accordance with Legislative Decree No 79/1999, is responsible for organising and managing the energy markets, divided between the Energy Fit Market (MPE) – itself organised in the day-ahead market (MGP) and the Infragiornaliero Market (MI) – and the Electricity Market at Termination (MTE).

The purpose of the GMP is to negotiate energy with reference to 24 hours on the day of delivery: it is managed through hourly auctions where accepted bids are valued at the marginal equilibrium price (*system marginal price*). The MGP is a market organised on a zonal basis, where market areas represent portions of the transmission network with limited exchange 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 separate market (*market splitting*). While the offers accepted for sale are valued at each hour at the relevant zonal price, the offers accepted for purchase and referring to consumption units are valued at each hour at the single national price (PUN), defined as the average of the zonal prices weighted by the value of zonal purchases, net of purchases of pumping equipment and foreign areas. In this market, GME acts as a central counterparty for operators.

The MI is also a zonal market consisting of a continuous trading session (XBID), organised *in* zonal order books, divided by three marginal equilibrium price auctions with progressive closing hours, in which both offers for sale and purchase are valued at the zonal price; in this market too, GME acts as a central counterparty for operators.

GME is also the entity identified as NEMO within the meaning of Commission Regulation (EC) No 2015/1222 ('CACM Regulation'). As part of the integrated market design developed in recent years under the CACM Regulation, on the border between Italy and Slovenia, between Italy and France, between Italy and Austria and between Italy and Greece, daily interconnection capacities are now allocated, both in relation to the *Giorno Prima* market and the Infragiornaliero Market, through the *market coupling* mechanism. This mechanism simultaneously carries out the implicit allocation of daily physical transmission rights *and the clearing* of energy bids and offers. In 2021, Italy joined the interconnected European Infragiornaliero Market project, which was continuously negotiated with complementary auctions to enhance capacity, allowing contracting up to one hour before the actual delivery of energy for 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 context of the WB6 Western Balcan project aimed at promoting the launch of regional *coupling* in the Balkan area on the basis of experience gained.

As regards the forward market, MTE consists of the negotiation of futures contracts with an obligation to deliver and collect energy. Trading takes place on a continuous basis and covers two types of contracts, *baseload* and *peakload*, which are negotiable with monthly delivery periods (three products quoted simultaneously), quarterly (four products quoted at the same time) and annual (one product).

Operators can sell and purchase energy not only through the organised market of GME, 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 (PCE), which allows operators considerable flexibility in optimising their portfolio of contracts, including bilateral contracts concluded on brokering platforms.

NONETHELESS, *M MARKET FOR DISPATCHING*

The MSD, organised on the basis of the criteria and conditions laid down by ARERA, concerns Terna's supply 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 scheduling phase (ex ante MSD) and the Balancing 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 trading in the MSD is that of a discriminatory auction, where each accepted bid is valued at its own offer price (*pay as bid*). The rules on dispatching are currently being reviewed by ARERA with the aim of ensuring the security of the electricity system in an efficient manner, including in the current rapidly changing environment, characterised by the increasing uptake of non-programmable renewable sources and distributed generation, as well as by the gradual reduction in the use of programmable installations.

With reference also to the MSD, Italy participates in the ongoing European integration process. Since 2021, a platform for the integration of balancing markets and, more specifically, for the exchange of reserve services, of EU countries has been in place. In addition, in order to implement the new trading arrangements resulting from Italy's accession to the European intraday market, in a manner consistent with Terna's centralised dispatching, changes have been made to the organisation of the services market in order to coordinate it more closely with the results of the intraday market, with specific restrictions on units authorised to provide services to remain within specific dispatched power ranges defined by Terna.

NONETHELESS, *MCAPACITY MARKET*

In addition to the electricity and dispatching services markets, a capacity market is also in place in Italy, aimed at ensuring, in the interests of technological neutrality, the adequacy of the system in relation to a set objective, through the creation of new capacity and the maintenance of existing capacity in full efficiency: not only generation but also *demand*

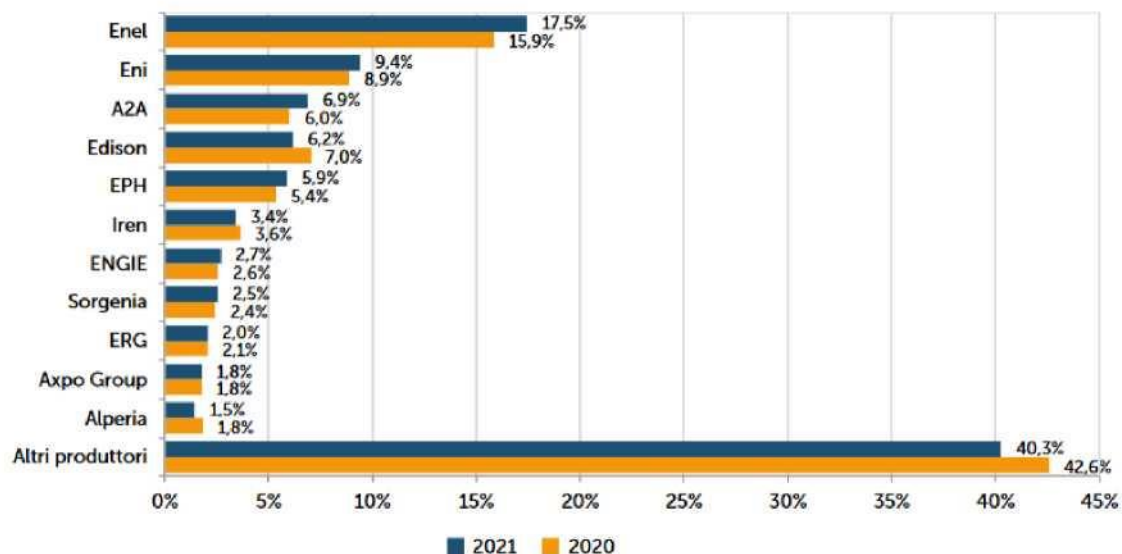
response and storage systems. ‘Adequacy’ means the ability of the system to meet the electricity needs in accordance with safety and quality of service requirements. An electricity system may be considered adequate if it has sufficient resources in terms of generation, storage, *demand response* and transmission capacity to meet the expected demand for electricity with a reasonable degree of confidence.

This market is operated by Terna, which regularly organises auctions with different delivery periods for contracted capacity (1 year for existing capacity and 15 years for newly built capacity), on the basis of a framework drawn up by Terna. The rules are based on criteria and conditions laid down by ARERA and approved by MASE, in compliance with Community legislation. The conduct of the auctions is based on the medium- to long-term adequacy analysis that Terna carries out annually. The allocation of capacity contracts as a result of auctions, in return for obtaining a premium, must ensure that this capacity is offered on the electricity and dispatching markets for the duration of the delivery obligation and must return to the system any positive difference between the prices obtained on those markets and a predefined *strike price*.

NONETHELESS, *DQUALITATIVE SYNTHESISEDATI ON GENERATION ANDWHOLESALEMARKETS*

Compared with gross production of 286 TWh, the contribution of the main producers is shown in the chart below.

Figure 74: Contribution of the largest groups to gross national production: comparison 2020-2021 [Source: ARERA]



The Herfindahal – Hirschman (HHI) index for gross generation of 560 is up from 2020, when it was 496.

In 2021, there was an increase in electricity consumption as a result of the economic recovery following the most critical phase of the COVID-19 pandemic, which led to an increase in volumes traded on GMP compared to 2020, which reached 290.4 TWh, thus returning broadly in line with the annual average for the period 2015-2019. By contrast, the liquidity of the GMP has reached an all-time high since the launch of the power exchange, reaching a value of 76.2 %.

The PUN, like other European *day-ahead market* prices, has seen unprecedented increases, driven mainly by generation costs (in particular: the cost of natural gas PSV: EUR 47,2/MWh; of CO₂: EUR 53,6/ton) and also supported by a pick-up demand.

The average annual Italian electricity price in 2021 thus reached a historical record of EUR 125,5/MWh, after the trough in 2020, as a result of a rise from EUR 60,7/MWh in January to EUR 281,2/MWh in December. Interestingly, in the almost vertical growth recorded in the last quarter of the year, there was also a *pattern of clean spread spread (CSS)*, which jumped from slightly above EUR 10/MWh to EUR 37,6/MWh (October to December average).

Figure 75: Evolution of the PUN and its determinants [Source:

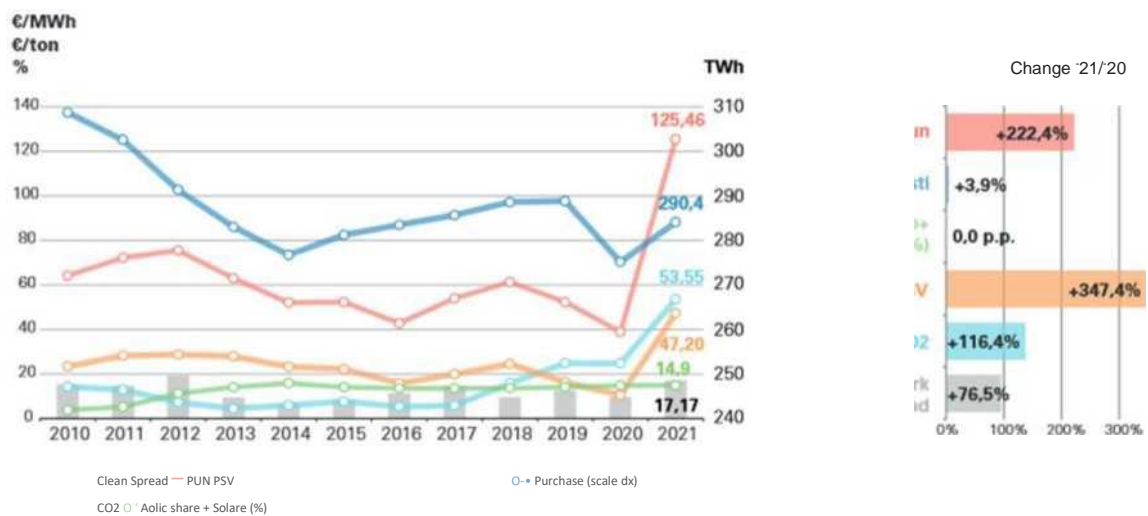
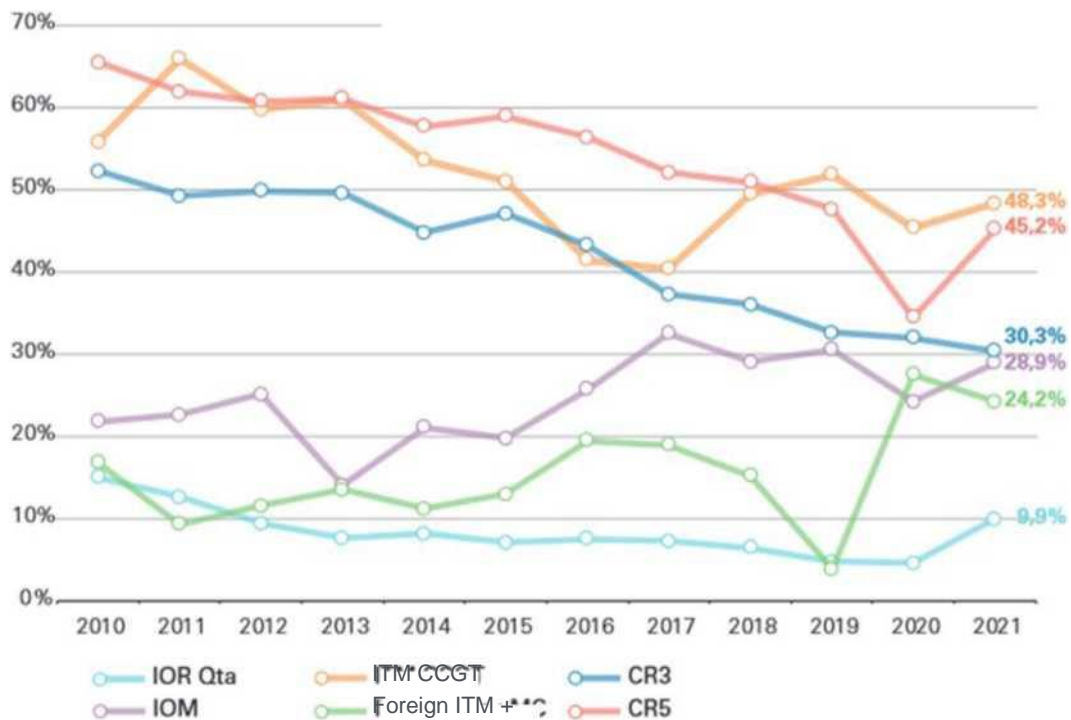


Figure 76: Competitiveness indicators at aggregate level [Source: GME]



As regards the capacity market, three auctions have taken place to date, two at the end of 2019 and one in 2021, covering the delivery periods 2022, 2023 and 2024. The needs for subsequent auctions are being assessed. Below are the summary data of the supply of functional capacity to the adequacy achieved so far.

360

Table 72 – Summary of the results of the capacity procurement auctions

	2022	2023	2024
Capacity on 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 flow-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: international	EUR 33.000/MW/y	EUR 33.000/MW/ye	EUR 33.000/MW/ye
New deployment capacity: volume	1.8 GW	4 GW *	3.8 GW **
New deployment capacity: international	EUR 75.000/MW/y	EUR 75.000/MW/ye	EUR 70.000/MW/ye

* Of which 0.5 GW authorised and 3.5 GW to be authorised

https://download.terna.it/terna/Rendiconto%20EsitiAsta%202023_8d78adbacbbe508.pdf

** of which 1.5 GW authorised and 2.3 GW to be authorised

https://download.terna.it/terna/Mercato_Capacit%C3%A0_Rendiconto_esiti_Asta_madre_2024_8da140f8874afcd.pdf

- **WHOLESALE MARKETS FOR NATURAL GAS**

Imports and purchases at the Virtual Exchange Point (PSV) were the most frequent ways in which gas wholesalers source the material before they sell them.

PSV is a virtual *hub* operated by Snam Rete Gas, i.e. 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 in centralised markets.

With regard to the latter, the gas exchange was launched in Italy since 2010, in which GME acts as a central counterparty to the transactions concluded by operators. In this market, now called MGAS, authorised operators can buy and sell quantities of natural gas spot.

The MGAS consists of:

- Spot gas market (MPGAS), consisting of all of the following markets:
 - o Day before gas market (MGP-GAS). Negotiations on the MGP-GAS shall take place in the manner of continuous trading and, for the system gas supply compartment (AGS compartment) only, the session of which takes place on gas day G-1, in accordance with auction trading arrangements. For MGP-GAS negotiations, which take place under continuous trading arrangements, gas bids are selected for the three gas days following the trading session. For trading in the AGS compartment, which takes place in accordance with auction trading arrangements, gas buying and selling bids relating to the day-gas following the trading session are selected.
 - o Intra-day gas market (MI-GAS). Negotiations on the MI-GAS shall take place in the form of continuous trading and, for the system gas supply compartment only (AGS compartment), the session of which takes place on day G, in accordance with auction trading arrangements. For the MI-GAS negotiations, which take place under continuous trading arrangements, gas buying and selling offers relating to the day gas corresponding to the day on which the trading session is opened are selected. For trading in the AGS compartment, which takes place in accordance with auction trading arrangements, gas bids are selected for gas buying and selling from the same day as the trading session.
- Market for Locational Products (MPL). The MPL shall be conducted in the manner of auction trading. The MPL sessions are held only at the request of Snam Rete Gas. On that market, Snam Rete Gas supplies from authorised users quantities of gas necessary to manage physical needs located within the balancing zone or any expected deviation between total network inputs and off-takes.
- Organised market for the trading of Gas in Storage (MGS). The MGS shall be conducted in the manner of auction trading. Offers for the purchase and sale of gas in storage may be negotiated on MGS by authorised users and by Snam Rete Gas.
- Gas Termination Market (MT-GAS). The MT-GAS shall be conducted in the manner of continuous negotiation. MT-GAS organises a large *number of order books*, each for each type of tradable product, covering different delivery periods, in which bids to buy and sell gas are selected.

Compared with gross consumption in Italy of almost 76.000 million sm³ m, around 3.300 million sm³ relates to national production thus distributed among the various operators.

Table 73 – National natural gas producers

Group	Quantities	Share	Group
ENI	2.256	69.5 %	ENI
Royal Dutch Shell	519	16.0 %	Royal Dutch Shell
Edison (Energiean PLC)	257	7.9 %	Edison (Energiean PLC)
Gas Plus	89	2.7 %	Gas Plus
Other	128	3.9 %	Other
TOTAL	3.248	100 %	TOTAL
Production (Ministry of Ecological Transition)	3.343	/	Production (Ministry of Ecological Transition)

Source: ARERA, Annual Energy Sector Survey

Imports in 2021 amounted to around SM3 million.

Table 74 – Main importing operators (2021)

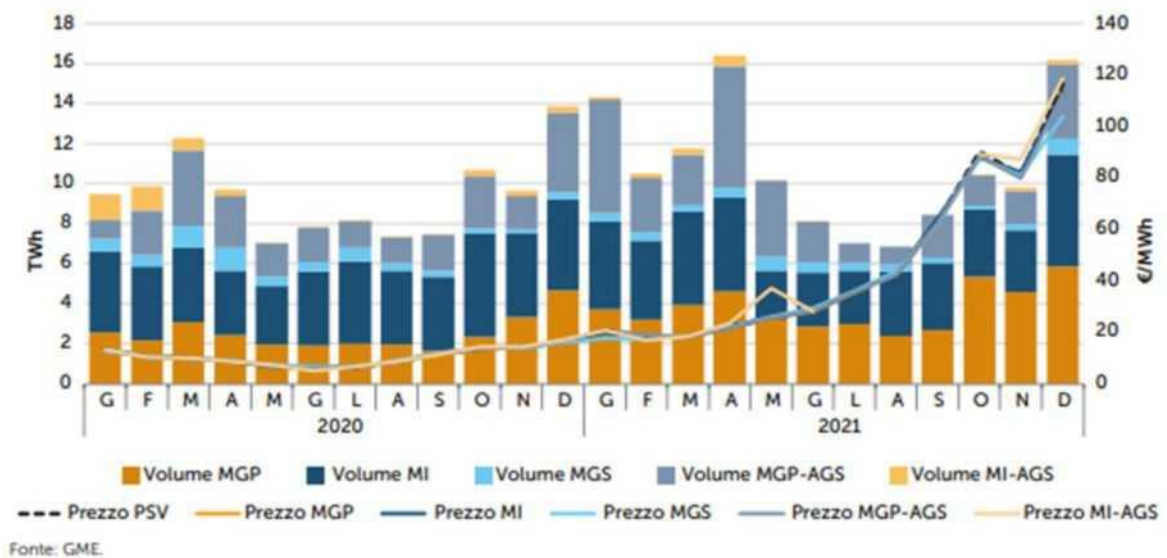
Social name	Quantities	Share	Rank in 2020
ENI	34.341	48.4 %	1°
Edison	11.113	15.7 %	2°
Azerbaijan Gas Supply Company Limited	5.914	8.3 %	46°
ENEL Global Trading	5.898	8.3 %	3°
Shell Energy Europe Limited	4.755	6.7 %	4°
Gunvor International	2.114	3.0 %	6°
DXT Commodities	1.239	1.7 %	5°
Axpo Solutions	982	1.4 %	39°
Engie Italia	687	1.0 %	/
Gazprom Italy	545	0.8 %	8°
A2A	533	0.8 %	7°
MET International	303	0.4 %	15°
Vitol	283	0.4 %	30°
IREN Mercato	254	0.4 %	12°
Danske Commodities	247	0.3 %	13°
HERA Trading	226	0.3 %	10°
Ascotrade	200	0.3 %	14°
ENEL Energy	171	0.2 %	9°
Gazprom Marketing and Trading Limited	127	0.2 %	32°
Uniper Global Commodities	122	0.2 %	18°
Other	926	1.3 %	/
TOTAL	70.981	100 %	/
of which: imports from European exchanges	2.004	2.8 %	/
Imports (Ministry of Ecological Transition)	72.995	/	/

Source: ARERA, Annual Energy Sector Survey

Negotiations in the MP-GAS consolidate growth in 2021 over the previous four years and rise to an all-time high of more than 12.000 million sm³ (+ 15 % in 2020), equivalent to 16 % of total demand on an annual basis.

With regard to price developments in the markets managed by GME in 2021, the relationship between volumes and prices in the various sectors is shown below.

Figure 77 – – Volumes and prices of gas markets



- **RETAIL MARKET FOR ELECTRICITY AND NATURAL GAS**

For the evidence on the retail market, please refer to the data contained in ARERA's report, which can be found in the following link <https://www.arera.it/it/docs/22/490-22.htm> and the subsequent update <https://www.arera.it/it/docs/23/030-23.htm>.

As regards the final market for electricity and natural gas, the process of overcoming the regulated electricity and natural gas price regime is being completed. In the electricity sector, the transition to the free market has been improved, following the assignment of the service to Tutele Gradali (transition facility 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 above 15 kW, as from 1 July 2021;
- for micro-enterprises and all final customers other than household customers, as from 1 April 2023.

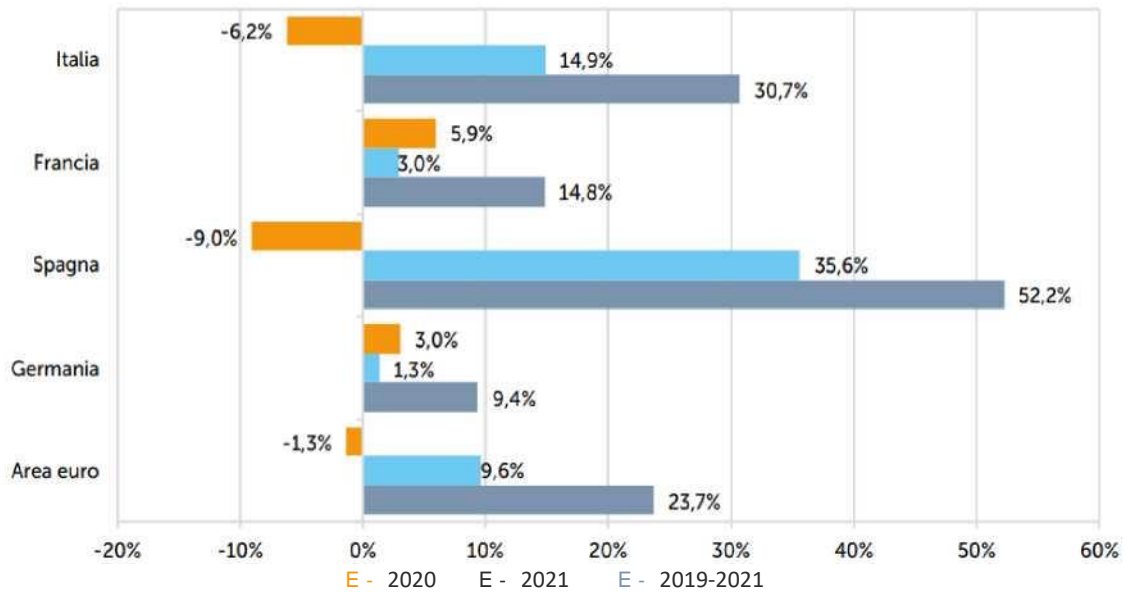
Only domestic customers who have not made an independent choice of supplier on the free market remain in the so-called Maggior Protection Service. In 2024, the deadline for overshooting regulated price systems for both electricity and natural gas shall also be set for household customers.

Vulnerable customers were also identified, not only on the basis of economic conditions, but also on the basis of health, age, particular housing conditions, covering both the electricity and natural gas sectors. As a form of protection, the regulatory authority sets out the contractual and economic conditions reserved to them, based on market prices, which all sellers are required to offer to vulnerable persons.

Despite the improvement and the measures taken in recent years, Italy still maintains a *gap* with other European countries as regards 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.

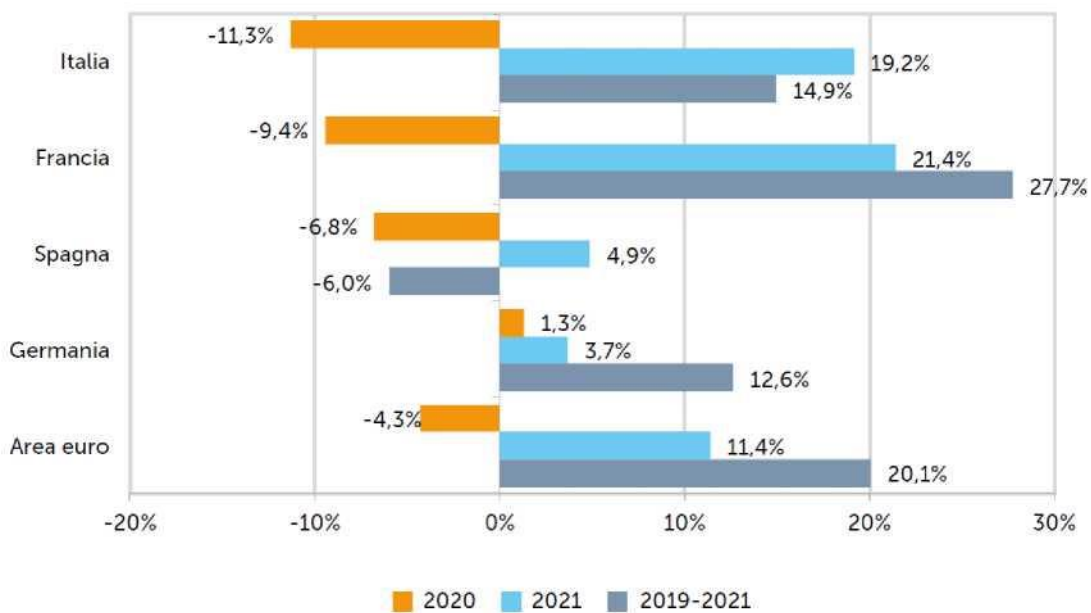
This trend is also confirmed in recent developments: looking at the following chart, it can be seen that the increase in electricity prices for households in Italy in 2021 compared to 2020 (14.9 %) is more pronounced than the euro area average (9.6 %), where there are very different situations: very small increases in Germany (+ 1.3 %) and France (+ 3 %), while on the other hand Spain shows an increase (35.6 %) more than twice that of Italy. Similar assessments are made when looking at the last three years as a whole (i.e. 2019, 2020 and 2021), where Italy shows an increase (30.7 %) significantly above the euro area average (23.7 %) and France (14.8 %) and, above all, Germany (9.4 %), while Spain is on the contrary, with a significant increase (+ 52.2 %) and more than twenty points higher than the Italian one.

Figure 78 Changes in electricity prices for households in the main European countries [Source: ARERA Annual Report and Eurostat – harmonised index numbers of consumer prices]



As with the electricity price, the evolution of the gas price for Italian households can be assessed in comparison with the main European countries, using the harmonised consumer price indices collected by Eurostat (Figure 77). This analysis shows that in 2021, gas in Italy increased significantly (19.2 %) in Italy than both the euro area average (10.6 %) and its three main countries (France, 4.9 %, Spain, 3.7 %, Germany, + 11,4). Taking into account the overall price changes over the last three years (2019,2020 and 2021), Italy is moving more closely, with an increase (14.9 %) slightly higher than that of Spain (+ 12.6 %) but lower than the euro area average (18.7 %) and Germany (+ 20.1 %), while France is on the opposite trend, which shows a fall (-6 %) over the three-year period.

Figure 79 – Changes in natural gas prices for households in the main European countries [Source: ARERA Annual Report and Eurostat – harmonised index numbers of consumer prices]



This *gap* was even sharper with the effects of the energy crisis that began in late 2021 (exacerbated by the

2022 Ukrainian Russian war): in this regard, several emergency measures were adopted in 2022 to counter the effects of rising energy prices on bills in order to support households and businesses.

II. Projections of development with existing policies and measures at least until 2040 (including for the year 2030)

The pursuit of *the* objectives of decarbonisation, energy security and integration of renewable energy sources is realistically achievable only if account is taken of the need for reinforcement of both the transmission and distribution networks, with a view to as integrated and coordinated as possible.

As regards the national transmission network, the Development Plan submitted by Terna in 2023 identifies the priority measures for the integration of renewable energy sources needed to achieve European objectives, in particular for the electricity system.

First of all, the increase in production from renewable sources, which has a greater impact in the southern regions, leading to an increase in power flows from the south to the north, requires reinforcement of the sections concerned. It is therefore necessary to develop a system capable of supporting progressive decarbonisation, increasing integration of renewables and interconnection with the electricity systems of neighbouring countries in order to ensure increasing energy security, through the possibility of mutual assistance between interconnected systems.

In addition to the works already planned such as the HVDC Contiente-Sicilia-Sardinia (Tyrrhenian Link) and the HVDC Southern and Central North (Adriatic Link), the Development Plan provides for the new Hypergrid project, consisting of five electric backbones, which will use direct current (HVDC) transmission technologies to meet the objectives of transition and energy security. One of the main expected benefits is the doubling of trading capacity between market areas.

The implementation of the works needed to achieve the energy and climate policy objectives within the planned timeframe inevitably requires a strong acceleration of investment in the energy sector, to be carried out by means of a coordinated approach between all the actors involved, in order to make the system as a whole more efficient.

4.6 research, innovation and competitiveness dimension

1. 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 been developed as a matter of priority under the following instruments:

- Mission Innovation;
- Horizon 2020;
- Electricity system research 2019-2021;
- Importer Projects of Common European Interest;
- NRRP.

– **MISSION INNOVATION**

Italy has joined the multi-stakeholder initiative *Mission Innovation* (MI), 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* (JUs) were launched, representing the main technology sectors on which it was decided to focus investments. Italy joined all the JUs, with a co-leader role, with China and India, for IC # 1, focusing on *smart grids*. Italy's participation in the activities of the JUs involved the main public actors in energy research.

The new phase of the initiative, *Mission Innovation 2.0*, was launched in 2020. A major novelty is the creation of 7 new missions, which will replace the 8 *Innovation Challenges*, by merging and complementing the thematic areas of research. Italy is co-leader with China and the UK in the *Green Powered Future Mission*, which brought together activities on *smart grids* (IC # 1) and the entire RES and accumulations sector. Italy has also joined the *Clean Hydrogen Mission*, in light of the increasing role of the hydrogen carrier at national and global level.

The first available funds, amounting to 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:

- The *IEMAP (Italian Energy Materials Acceleration Platform)* platform, designed, developed and implemented by integrating existing technologies, identifies itself as an advanced tool for identifying, analysing and synthesising new materials for the energy sector. The Operational Plan of Activities is structured around three lines of research: (a) batteries, (b) electrolyzers; (c) photovoltaic;
- *Hydrogen Demo Valley*– the aim of the investment is to establish a research hub for the development of the Italian hydrogen supply chain. *Hydrogen Demo Valley* at ENEA's Casaccia Research Centre is designed to become an experimental centre for the production, transport, accumulation and use of hydrogen, to accelerate research and innovation and to bridge the gap between laboratory scale and industrial level. The test centre will be made available to universities, research institutes and businesses to test innovations and monitor their next steps towards industrialisation;
- *Smart Grid (micronetworks and smart, multi-fouling and integrated systems, to accelerate the energy transition)* – The project aims to develop, implement and test advanced conceptual models for the operation of distributed multi-vector (thermal and electrical) energy systems with a *smart grid* perspective and in a real and representative environment, in order to tap the potential for network integration between the different sectors.

MI research projects are characterised by medium TRLs (5-8), whose implementation is planned to be carried out closely with companies, in the various operational phases. Among the tools used, the implementation of Pilot and Demo has a priority role, with the aim of setting up innovative and experimental facilities to validate technological solutions that have developed in previous research phases.

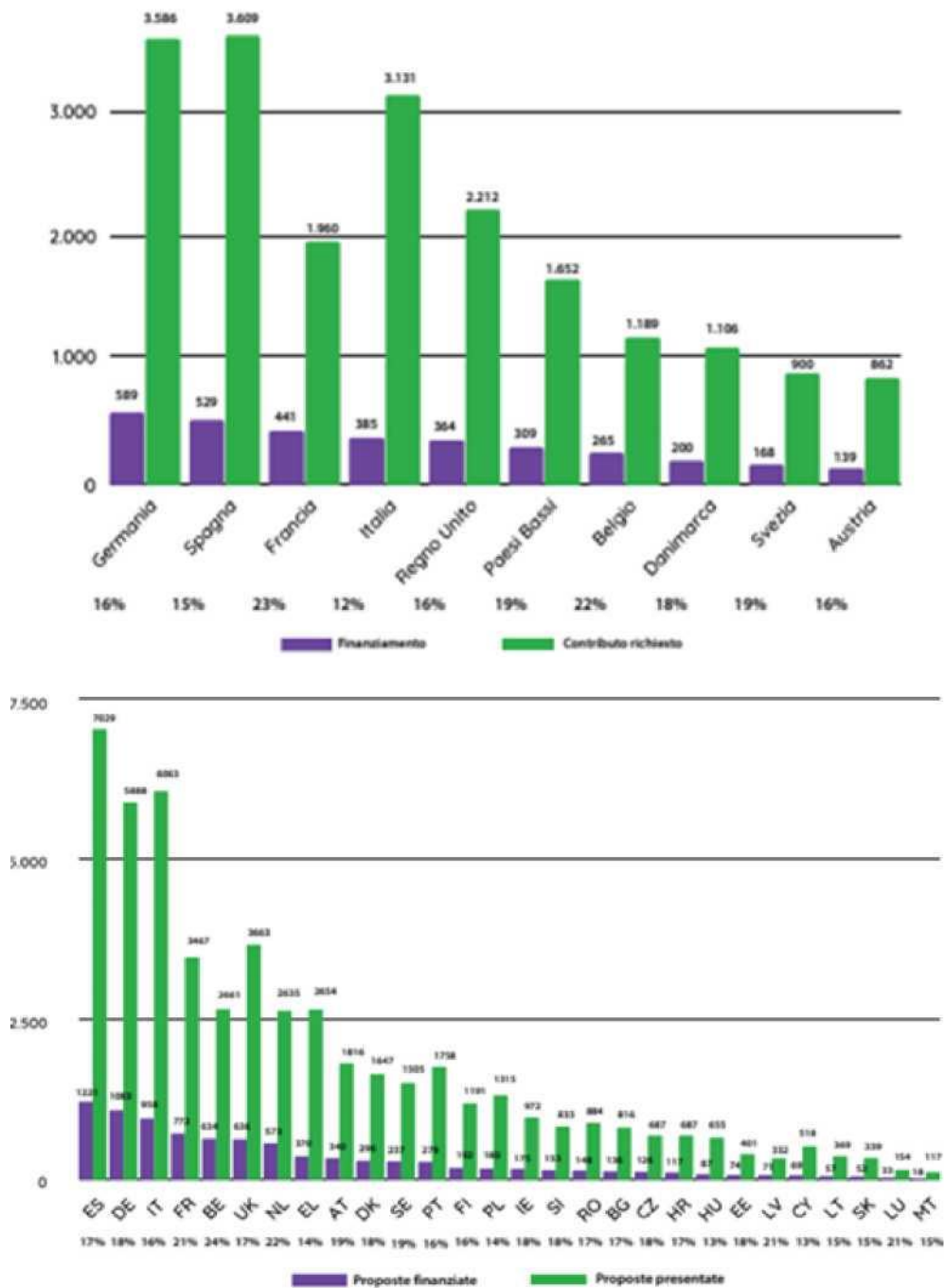
In support of the MI initiatives, the Fund for Investment and Infrastructure Development was established by the 2017 Budget Law, refinanced by the 2018 Budget Law and Law No 58 of 28 June 2019, which authorised expenditure of EUR 10 million for each of the years 2019 and 2020 and EUR 20 million for 2021.

❖ **HORIZON 2020**

Horizon 2020 is the European Commission's scientific research and innovation funding instrument, with a budget of around EUR 80 m and a duration of 7 years (2014 to 2020). The funds allocated are managed directly and are aimed at funding 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.

Italy's participation in the energy calls for proposals under the previous Horizon 2020 programme has been effective, with the presence of Italian partners and coordinators, in over 6 proposals, obtaining funding with a success rate of around 16 % and ranking as a third European country in 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, involving high-quality human resources and intensive cooperation between research bodies and businesses, with constant alignment with the technological priorities of the EETS Plan, which has enabled 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 the Italian participation in terms of funding are outlined.

Figure 80 – Results of Italian participation in Horizon 2020 calls



At national level, further measures implemented and supplemented by Horizon 2020 are:

- *Innovation agreements*: encourage industrial research and experimental development projects aimed at the creation of new products, processes or services or at 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*: encourages research and development projects aimed at bringing about 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.

- **ELECTRICITY SYSTEM SEARCH 2019-2021**

The “Electrical System Research” (RdS) is the tool, promoted by MASE, to support research and development activities aimed at technological innovation of general interest to the electricity sector. The instrument shall set 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 Electrical System Research Plan for the three-year period 2019-2021 with an estimated budget of EUR 210 million.

The activities were carried out under the two general objectives, relating to technologies and the electricity system, set in line with the EETS Plan and participation in Mission Innovation.

Technology research projects have helped to develop and oversee product and process technologies and services necessary for the energy transition; in relation to the electricity system, research projects have been developed to facilitate the introduction of technologies, systems and organisational and management models for the energy transition and security.

- **IMPORTANT PROJECTS OF COMMON EUROPEAN INTEREST (IPCEI)**

The IPCEI *Important Projects of Common European Interest* Fund was established by Article 1 (203) of Law No 145/2018 and intervenes 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 foster the sharing of knowledge, expertise, financial resources and economic actors in the European Union in order to achieve radical innovation objectives of major technological and productive importance, with a shared effort by the private and public sectors of the Member States to deploy actions of common interest in the context of strategic value chains for European industry.

Italy has joined the following IPCEI programmes: (1) batteries; (2) hydrogen; (3) CIS (Cloud Infrastructure and Services).

NONETHELESS, IPCEI BATTERIE

The initiative was supported by the awareness that the battery market is growing strongly, driven by the automotive sector, which is increasingly oriented towards electricity-powered solutions, and by the stationary storage sector, with the increasing need for flexibility and security of the electricity system in order to increase the share of non-programmable renewables connected to the grid. The general framework, also in view of the decarbonisation objectives of the European Green Deal, entails a high strategic risk for all Member States: without European battery production and a European value chain, the energy and mobility sectors would become dependent on non-European technologies and components.

The two IPCEI Batteries projects (‘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 involve projects and activities ranging from raw material extraction to battery cell and battery pack manufacturing, final application and recycling and disposal in line with the principle of circular economy and sustainability.

In the context of these projects, national companies are placed in the various WPs that relate to the whole value chain.

IPCEI on Batteries: it provides for the involvement of 8 countries and funding of EUR 3,2 million. For Italy, 5 companies participate in the entire upstream-midstream-downstream production chain and resources totalling EUR 473,35 million are mobilised.

IPCEI EuBaTin: it provides for the involvement of 12 countries and funding of EUR 2,9 million. For Italy, ENEA and the Bruno Kessler Foundation participate on the research front, as well as 12 companies along the entire production chain upstream-midstream-downstream; a total of EUR 533,6 million is mobilised.

NONETHELESS, *IPCEI IDROGENO*

By joining the initiative, the aim is to contribute to the decarbonisation of the national economy by supporting the substitution of fossil fuels with hydrogen, through the development of an entire set of innovations in hydrogen production technologies and along the entire value chain.

Hy2Tech: in July 2022, the European Commission approved the Hy2Tech project, bringing together 35 partners from 15 Member States, with a total funding of EUR 5,4 million and national funding of approximately EUR 1,0 million. Italy participates with 6 industrial projects and 2 R & D projects submitted by research organisations (ENEA and Bruno Kessler Foundation). The participation of Italian partners in the IPCEI Hy2Tech project will enable Italy to take advantage of the considerable opportunities arising from the use of hydrogen in the various application sectors, such as industry, transport, civil and residential, in relation to the latter in blending with natural gas.

Hy2Use: on 21 September, the European Commission announced the approval of the second IPCEI on hydrogen Hy2Use, which brings together 35 projects from 13 Member States. The total public support is EUR 5,2 million; the national contribution amounts to approximately EUR 500 million. Hy2Use involves 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 the integration of hydrogen in the industrial processes of multiple 'Hard to Abate' sectors. There are 4 Italian companies involved with their own projects.

Projects for two other hydrogen IPCEIs are also being pre-notified: *Hy2Infra* and *Hy2Move*, respectively, relating to infrastructure and transport, where a total of four Italian initiatives are present.

In the light of the above, we would like to highlight further initiatives included in the context of the RepowerEU and MIMIT management, relating to *Hy2Infra*. In particular, the initiatives are aimed at the deployment of renewable hydrogen production systems in specific geographical areas, as well as the deployment and/or potential of hydrogen transport infrastructure to build interconnected hydrogen clusters at European level (hydrogen backbone). The projects of the undertakings concerned (SNAM, Energie salentine, SAIPEM) were pre-notified to the European Commission as part of the procedure for authorising the State aid provided for for IPCEIs. The measure provides for EUR 1,4 million of public funds and EUR 3,6 million of private financing, with an expected entry into operation by 2030.

- *IPCEI-CIS*

The objective of IPCEI-CIS (Cloud Infrastructure and Services) is to design and deploy the first European open, secure, distributed multi-provider, scalable and highly energy efficient cloud-edge continuum infrastructure in order to increase the innovation potential of digitalisation and data exploitation. Cloud infrastructure will enable industries and research organisations to access, use seamlessly, process and store data by connecting centralised cloud services with those where data is generated, at the so-called edge boundaries. Interoperable platforms, distributed software environments and specialised interconnectivity services will make the infrastructure transparent and foster the resilience and technological leadership of European industries, 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 with 12 participating countries. For Italy, two research organisations (ENEA, FBK) and 5 industries are involved.

- **THE NRRP – INVESTMENT 3.5 RESEARCH AND DEVELOPMENT ON HYDROGEN (M2C2)**

As part of the NRRP (M2C2), Investment 3.5 “*Research and Development on Hydrogen*” was introduced to support research and development focused on hydrogen in four strands: (1) production of green hydrogen; (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, by which:

- an agreement was concluded with ENEA (EUR 110 million) for the latter to carry out the research activities detailed in the ‘Operational Research Plan’ (ROP) in 2022-2025;
- two calls were published (Public Notices Nos 4 and 5 of 23 March 2022) respectively for the selection of projects on fundamental research activities carried out by research bodies 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 drawn up 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*. The research activities aim at improving the performance of the currently available electrolytic technologies and at supporting 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 target the optimisation of existing technologies and the development of 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 are aimed at developing and optimising new *stack* materials, components and architectures in order 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 bodies and universities and 56 industrial research projects (EUR 126 million).

- **OTHER MEASURES**

The following are additional policies and instruments put in place by Italy and already implemented in the field of research.

- *Iper and super-depreciation*: measure (MIMIT management) aimed at supporting and incentivising companies that invest in new equipment, tangible and intangible assets (software and IT systems) for the technological and digital transformation of production processes;

- *Capital goods ('New Sabatini')*: measure (MIMIT management) aimed at facilitating companies' access to credit and increasing the competitiveness of the production system. The measure supports investments to purchase, including leasing, machinery, equipment, plant, productive capital goods and hardware, as well as software and digital technologies. The 2020 Budget Law provided for the allocation of a specific financial envelope within the resources for low environmental impact investments by SMEs;
- *Tax credit*: measure included in the National Industry 4.0 Plan and aimed at stimulating private R & D spending to innovate processes and products and ensure the competitiveness of businesses. The measure grants a tax credit of 50 % on incremental R & D expenses, up to a maximum of EUR 20 million per year per beneficiary. The instrument was from 2023 to 2025 with a budget of 55.2 MEUR/year;
- *Energy cluster*: measure (MUR management) approved in 2017 and aimed at establishing public-private research partnerships (around 90 public and private entities) aimed at pursuing priority technological trajectories at European, national and regional level to support the achievement of the targets set in terms of research planning in the SET-Plan, PNIEC 2019, National Research Plan, Smart Specialisation Strategy (S3), Industry 4.0 and Mission Innovation;
- *Proceeds from CO₂ auctions (Legislative Decree No 30/2013)*: measure aimed at financing experimental development activities, in particular through first-of-a-kind 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 aviation and an ENAC research project for the production of alternative fuel from microcellular algae;
- *National Innovation Fund*: the measure (management of Cassa Depositi e Prestiti), with a the budget provided for by the 2019 Budget Law of approximately EUR 1 billion is intended 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 companies with generalist, vertical or fund-of-funds, supporting start-ups, scaleups and innovative SMEs;
- *Prototype approach to facilitate the implementation of innovative projects on energy networks*: measure (ARERA management) aimed at establishing an enabling regulatory framework for innovative projects. Network operators will be particularly involved. They are called upon to adopt a new system innovation approach that also involves commercial parties to develop new business models in the downstream stages of the chain and experiments with multi-service offers at urban or local level. An example of this is the pilot projects launched by ARERA to encourage the participation of distributed resources in the dispatching services market;
- *Aid to support research and development projects for the conversion of production processes in the context of the circular economy*: measure (MIMIT management), implemented by means of the Ministerial Decree of 11 June 2020, aimed at facilitating the transition of economic activities towards a circular economy model, through the conversion of production of the industrial fabric. The measure incentivises development projects aimed at a more efficient and sustainable use of resources, giving tax advantages;
- *Guarantee Fund*: measure to increase credit opportunities, support businesses and professionals who have difficulties accessing bank credit because they do not have sufficient collateral;
- *Southern Cresci 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 JTF shall be endowed with the resources of the Development and Cohesion Fund;
- *Fund for the financing of innovative investment programmes and projects*: measure aimed at

boosting investment by central government and the development of the country through investment programmes and innovative projects in the following sectors: circular economy, decarbonisation, energy saving and environmental sustainability. In particular, the 2020 Budget Law provided for the establishment of a Fund of approximately EUR 22,5 million from 2020 to 2034;

- *Cohesion Funds*: a number of pilot projects on a metropolitan/regional scale aimed at achieving national priorities have been implemented under the Funds concerned, in line with the objectives of the EETS Plan.
- *Support for start-ups and venture capital active in the ecological transition (NRRP M2C2-I.5.4)*: measure (management of Cassa Depositi e Prestiti) aims to stimulate 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 – DM of 3 March 2022), managed by CDP Venture Capital SGR S.p.A. and endowed with EUR 250 million. The investment strategy of the GTF targets the areas of renewables, circular economy, mobility, energy efficiency, waste disposal, energy storage and related sectors;
- *Renewables and batteries (NRRP M2C2-5.1)*: measure to support industrial programmes capable of developing, consolidating and strengthening the national value chain, including with a view to preserving the security and continuity of supplies and supplies. Although it is a measure that mainly supports industry, it does not ignore research. R & D & I activities are among the rewarding criteria. A dedicated helpdesk for the submission of aid applications, 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 listed below:

- *Fund for interventions and measures for technological and industrial development*: measure (CSEA management) established by Legislative Decree No 28/2011 (EUR 100 million per year from electricity and gas tariff) and aimed at supporting measures and measures for technological and industrial development in the field of renewable sources and energy efficiency. The fund may also be activated, where necessary, 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 million over the three-year period 2018-2020) for the development of intangible capital, competitiveness and productivity, which may also be used to fund technological research in 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 undertakings and public contributions for demonstration projects show a steady trend of growth over time as shown in the table below.

Table 75 – Energy R & D expenditure (in EUR '000 current)

	Public sector (A)	Public undertakings (B)	Private companies (C)	Total Enterprise (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

Patents in low-carbon technologies have grown substantially since 2005 and have gained momentum since 2015. The share of such 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 in the share of patents relating to PV (which peaked by more than 11 % after 2010 by almost half), solar thermal (down to just over 1 %) and, to a lesser extent, electric cars (from 4 % to 3 %), and the sustained increase in the share of wind patents (reaching 6 % close to photovoltaic), electric storage technologies (which account for more than a quarter of environmental technologies) and electric vehicle charging systems, which throughout the five-year period increase their size to almost 5 %.

Moreover, the apparent and accelerated expansion of innovative activity in most KETs is reinforced more recently by the increase in patents for hydrogen technologies, which goes hand in hand with a substantial setback and subsequently contraction of fuel cell patents. It is also important to note that in the increasing 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 81 – Share of patents in low-carbon technologies in total environmental patents

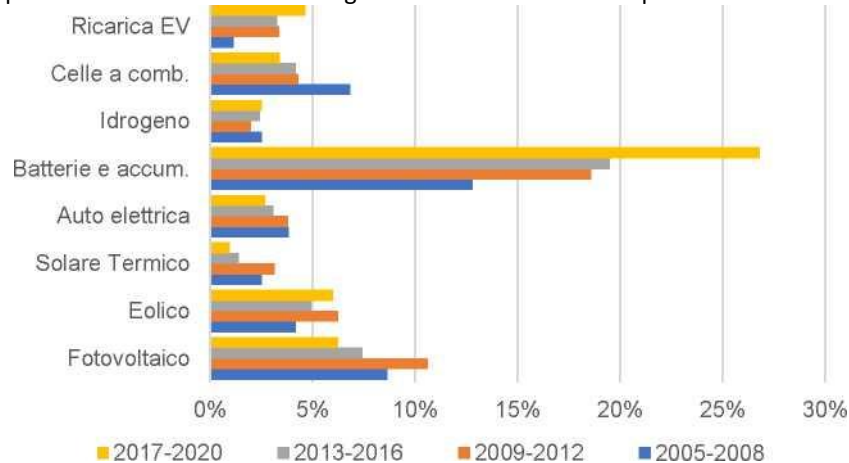
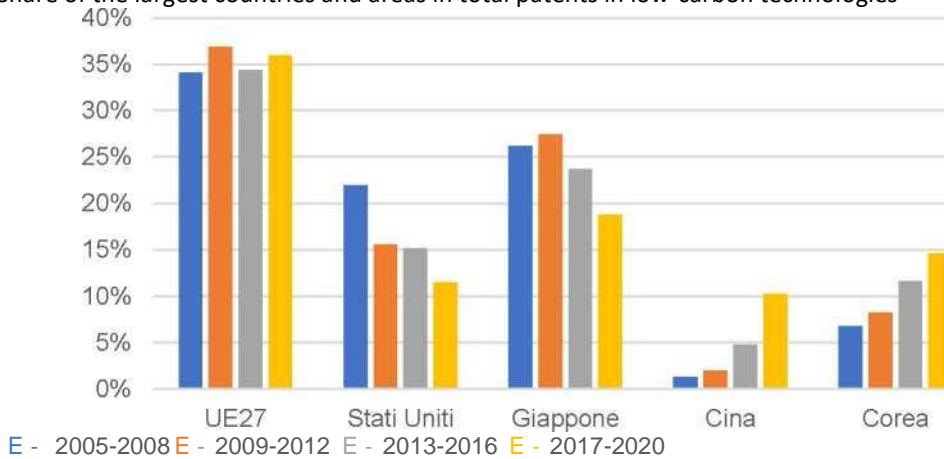


Figure 82 – Share of the largest countries and areas in total patents in low-carbon technologies



Source: ENEA processing on OECD data, REGPAT database August 2022

The momentum of innovation in low-carbon technology and the strong push from KETs at country level is reflected in a growing “protagonism” of Asian economies, with significant growth in China, particularly significant after 2017. In the period 2017-2020, China’s share of all low-carbon patents is over 10 %, which is more than twice as high as in the previous four-year period. Over the same period, the share of the Asian region as a whole (including Japan, Korea and China) increased by 4 %, reaching almost 45 %, despite the sharp decline in Japan, which nevertheless continues to hold almost a fifth of patents in all low-carbon technologies. China’s position is characterised by the acquisition of technological specialisation¹⁰⁵ in the technologies for electrical storage as a whole, those applied to mobility and electric vehicle charging systems (with specialisation indices of 1,5 and 1 respectively in the last two cases) – sectors in which Korea and Japan were already present (the latter leading across all electric mobility), but equally significant is

¹⁰⁵ 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 in world patents for the entire patenting activity. A country will therefore be specialised in a given technology class for index values above one.

further progress in PV, with a specialisation index of more than 1,5. On the other hand, China's position in fuel cells and hydrogen technologies is still very marginal, in contrast to Korea and Japan, which show strong and high specialisation in the former (1,6 and 2,5 respectively) and tend to gain ground in the latter, with significant specialisation in mobility applications (with specialisation index values of 1,3 and 2,3 respectively) and, in the case of Japan, there is an increasing technological advantage within the hydrogen sector, as can be seen from the growing specialisation in non-fossil production technologies from 2013 to 2016 (with a specialisation index rising from 1,2 to 1,8) and even earlier in storage technologies (with an index of 1,1 and 1,9).

On the other hand, the position of the United States appears to be constantly downgrading, as it has a share of patents on low carbon technologies in the period 2017-2020 just above that of China, and has also lost its specialisation in hydrogen technologies since 2013-2016.

Overall, the EU27 shows some signs of recovery over the past four years, deepening specialisation in wind power (specialisation index of up to 1,8) and strengthening the specialisation, most recently acquired, in the field of e-mobility, with a slight specialisation in enabling technologies geared to mobility (electric storage and hydrogen, specialisation index of 1,1 in both cases). Moreover, the figure for hydrogen technologies has been highly specialised in the sector since 2013-2016, and is also significant in the production of hydrogen from non-fossil sources and in storage technologies.

European progress in low-carbon technologies is also the result of innovative dynamics in which polarisation tends to increase around a small number of countries. In the case of wind power, the technological specialisation characterising the profile of Germany and Denmark is strengthened (specialisation index in 2017-2020 of 1,6 and 2,7 respectively). In the field of electric mobility there is a clear consolidation of Germany's specialisation, while specialisation in Italy is still at its inception (in 2017-2020 specialisation index just above the unit for electric vehicles, 1,3 in hybrid vehicles).

In the context of e-mobility, Germany and France are increasingly specialised in enabling technologies (electric storage technologies applied to mobility, electric vehicle charging systems, hydrogen technologies applied to mobility). Apart from mobility, specialisation in hydrogen technologies is growing considerably in Germany and France, both in the case of non-fossil production technologies and in storage technologies. In the case of PV, 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 field of e-mobility, Italy's position lags relatively behind the largest countries, but it also seems to predict the launch of a new phase of innovation activity, aimed at overcoming the only one hitherto represented by 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 rising from 0,5 to 0,8 in the first case and from 0,6 to 0,8 in the second case). This figure also 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.

Germany and France, on the other hand, point to a marked despecialisation in Italy in hydrogen technologies, particularly in the case of those applied to mobility. However, even in the case of technologies for the production of hydrogen from non-fossil sources, the specialisation index is steadily declining over the years, and in the most recent data it is well below the unit.

Table 76 – Technology specialisation index in low-carbon technologies, geo-economic picture

	2005	2009	2013	2017	2005	2009	2013	2017
	2008	2012	2016	2020	2008	2012	2016	2020
	Photovoltaic				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
	Technologies for electrical storage				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	2009	2013	2017	2005	2009	2013	2017
	2008	2012	2016	2020	2008	2012	2016	2020
	Wind turbines				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-UP**

Lombardy remains the most fertile ground for the creation of new innovative business activities (almost one in four energy start-ups is active on Lombardy soil). Energy start-ups are also more present in northern regions and Lazio, and it is interesting to note that, as can be seen throughout Italy, compared to other sectors, these are, on average, more active on the patent front. The size of the enterprise certainly remains the main problem: the vast majority of Italian start-ups bill less than EUR 500,000 – both in the energy sector (over 90 %) and in others – and few cases where the workforce employed exceeds ten people (around 5 %). In this respect, in addition to organisational constraints, the main difficulty lies in finding sources of funding.

The most obvious delay Italy is currently facing is the lack of a mature Venture Capital market. However, given the steady growth that this sector is experiencing, the impact of these companies on the national economy is beginning to become significant, with an added value of around EUR 3,3 billion, of which about 15 % comes from the energy sector. The employment impact remains marginal, accounting for around 60.000 jobs (more than half in northern Italy), of which only 8.000 are in the energy sector, but this number 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 price components (energy, network, taxes/levies)

- **ELECTRICITY**

In 2021, the total expenditure incurred by the Italian system on electricity consumption is estimated at around EUR 76 million, broken down as follows:

- 56.5 % for sales services (expenditure on energy supply on market¹⁰⁶, expenditure - marketing and retailing, expenditure on the supply of dispatching services);
- 9.8 % for network services (transmission, distribution and metering costs);
- 17.4 % for general system charges for proper functioning and viability - environmental of the country system (components of sos and r_{im});
- 16.3 % for taxes (excise duty, VAT).

It should be noted that the expenditure item relating to general costs, including almost EUR 3,9 billion of contributions from the State budget provided for in the Government's measures to contain the

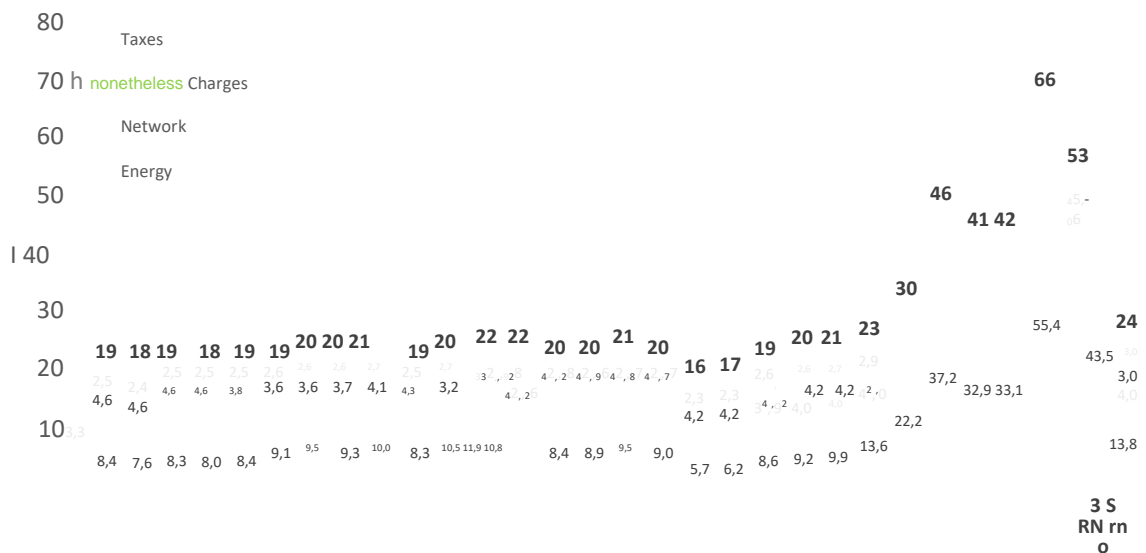
¹⁰⁶ the estimate of expenditure on energy purchases incurred by final customers in the open market is based on the assumption that off-exchange sales (approximately 24 % of the total) take as a reference the prices formed on the stock exchange.

81 % of final price increases are dedicated to support¹⁰⁷for energy from renewable sources and to CIP6 cogeneration (component A₃₅₀₅). Expenditure on network services is 28 % to be allocated to the transmission network and the remaining 72 % to the distribution network.

Dividing the total cost by the national level of consumption (298.5 TWh) gives an estimate of the unit cost of electricity for the consumer community. In particular, in 2021 this unit cost (before tax) is estimated at EUR 25,4 cents per kWh taken, about 58.5 % more than in 2020.

The quarterly time series of unit cost of electricity in the protected market for typical households (resident, power 3 kW, consumption 2 700 kWh) shows a significant break in absolute values and tariff components from the last quarter of 2021 until the first quarter of 2023. During this period, as a result of the unprecedented increase in the price of wholesale commodities, the final unit cost reached a tripling of its value. In terms of tariff components, the energy share has increased by more than 80 % of the final price, system charges have been cancelled by extraordinary regulatory measures to mitigate increases in bills, while taxes are increased due to the increase in VAT revenue. In Q2023, the unit cost of household electricity almost realigned with historical prices until 2021, with a final price of 24 cEUR/kWh (58 % energy, 17 % grid, 13 % levies, 12 % taxes).

Figure 83 Evolution of the price of electricity for the most protected household consumer and its tariff components (source: ARERA)



❖ NATURAL GAS

In 2021, the Italian system spent around EUR 51 billion on natural gas consumption (around EUR 76 billion), before excise and VAT taxes. The major part of the expenditure is accounted for by the raw material (gas) component¹⁰⁸, with a share of almost 62 %; the other items weighed around 14 % (transport and distribution service), 20 % (taxes) and 4 % (general charges).

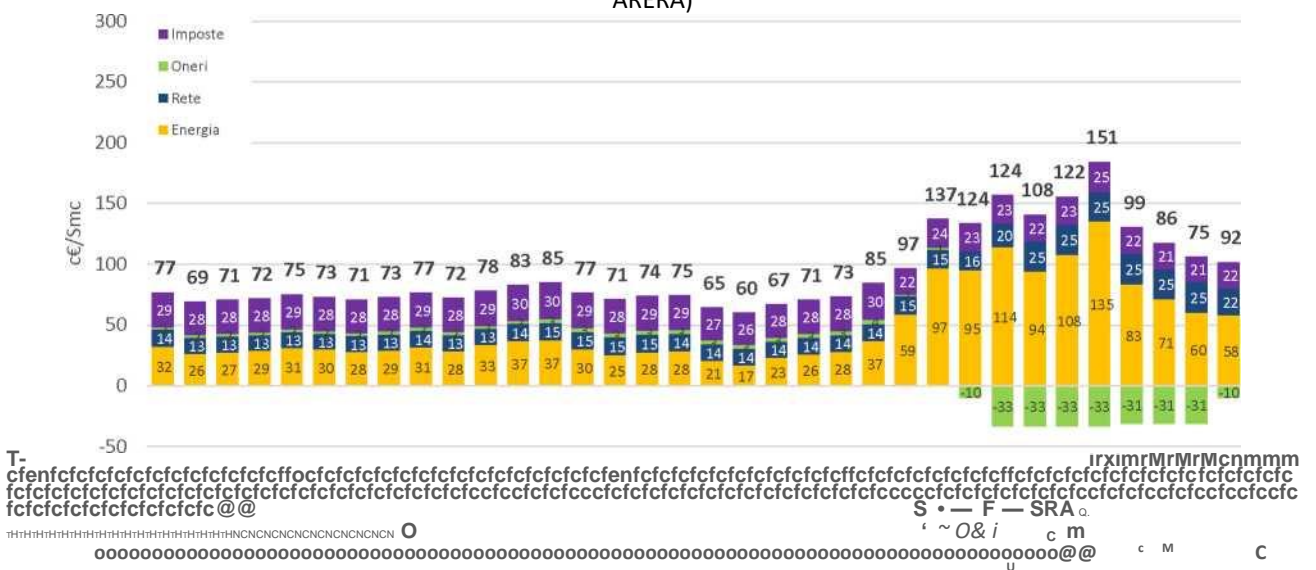
In terms of average unit cost, the withdrawal of gas from the national network amounts to around EUR 67,2/Smc before tax.

¹⁰⁷Provisions of Decree-Laws No 41 of 22 March 2021, No of 25 May 2021, No 73 of 27 September 2021 and No 130 referred to in Authority Decisions No 190/2020, No 124/2021, No 279/2021, No 278/2021 and No 396/2021. Those provisions cover the period from 1 April to 31 December 2021.

¹⁰⁸The cost of purchasing gas incurred by final customers is estimated using the average prices shown in the Authority's 2022 Annual Report: EUR 46,00/MWh for exchanges on stock exchanges and EUR 32,78/MWh for off-stock exchanges (average sales price charged by wholesalers to retailers).

The quarterly historical series of the unit cost of natural gas in the protected market for typical households (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 energy share increased 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 made negative and VAT rates reduced. 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 final PSV, which made it possible to quickly capture the drop in gas prices in the spot market over the winter months. In the third quarter of 2021, i.e. the last quarter before this period for several abnormal aspects, the gas price amounted to EUR 85/Smc or around EUR 9/kWh of which (44 % energy, 16 % network, 5 % charges, 36 % taxes).

Figure 84 Evolution of the price of natural gas for a protected domestic consumer and its tariff components (source: ARERA)



FUEL

Petroleum fuels accounted for 89 % of final energy consumption in the transport sector in 2021. In 2021, the Italian system spent a total of EUR 59109 billion on oil fuel consumption (32,9 Mtoe, including the share of blended biofuels), before excise and VAT taxes. Comparing the evolution of the price series

Methane [EUR/kg]

at the pump of the various fuels, petrol and diesel prices rose by 39 % and 47 % respectively from 2021 until the first half of 2022. These increases have been partly reduced through some extraordinary measures aimed at temporarily reducing taxes on petroleum products, which are 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 80/l. Motor methane is the fuel that has been most affected by the bad economic situation and has also tripled its historical value at the pump in the summer months of 2022. Electricity to power public charging vehicles, assuming costs for the energy share indexed to the PUN, has been increased in part by the cancellation of charges applied in 2022 (particularly relevant for this type of use).

In the first quarter of 2023, the national average price at the petrol pump was EUR 1,85/l (41 % industrial energy and grid price, 2 % biofuel obligation charges, 57 % tax), in line with that of automotive diesel of EUR 1,84/l (47 % industrial energy and grid price, 2 % biofuel obligation charges, 52 % taxes), while LPG is sold at an average of EUR 0,80/l (64 % industrial energy and grid price, 36 % taxes).

Figure 85 Price evolution at the Benzina pump, Gasolio auto, Metano, Public charging electricity (source: MASE calculations)

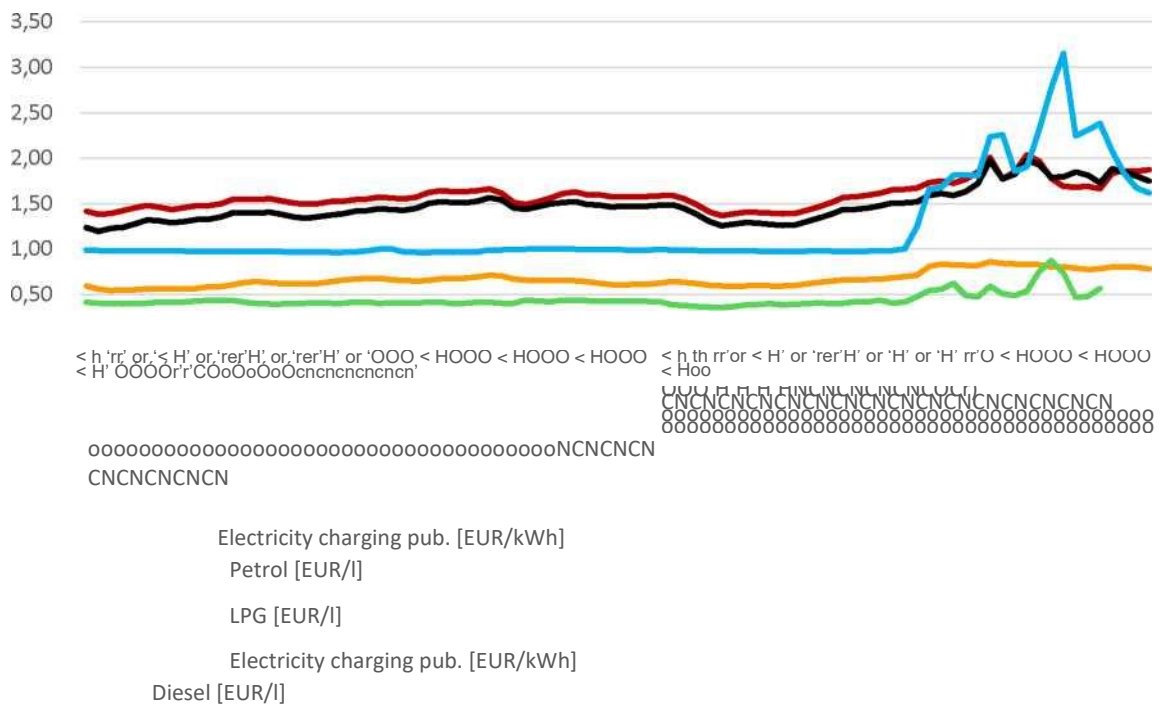


Figure 86 Evolution of the price (EUR/l) at the Benzine pump and its components (source: processing MASE)

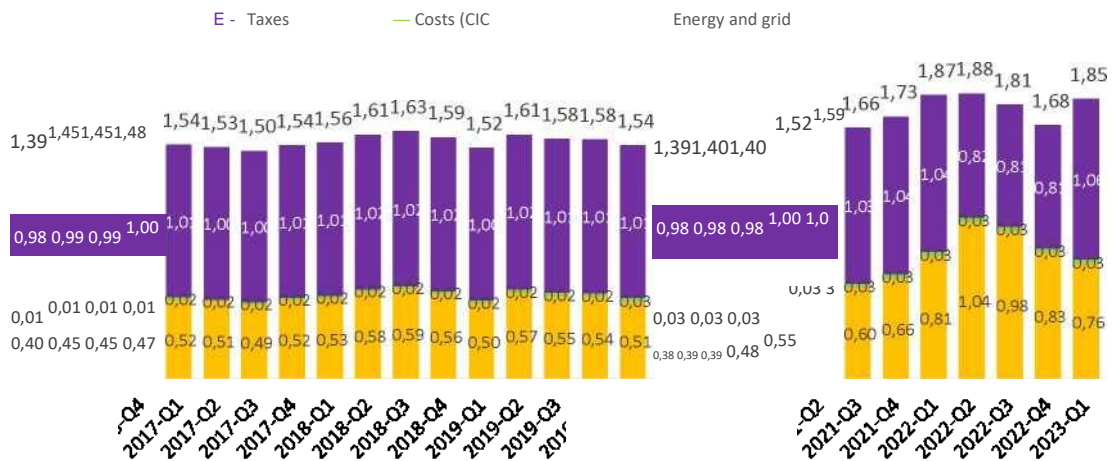
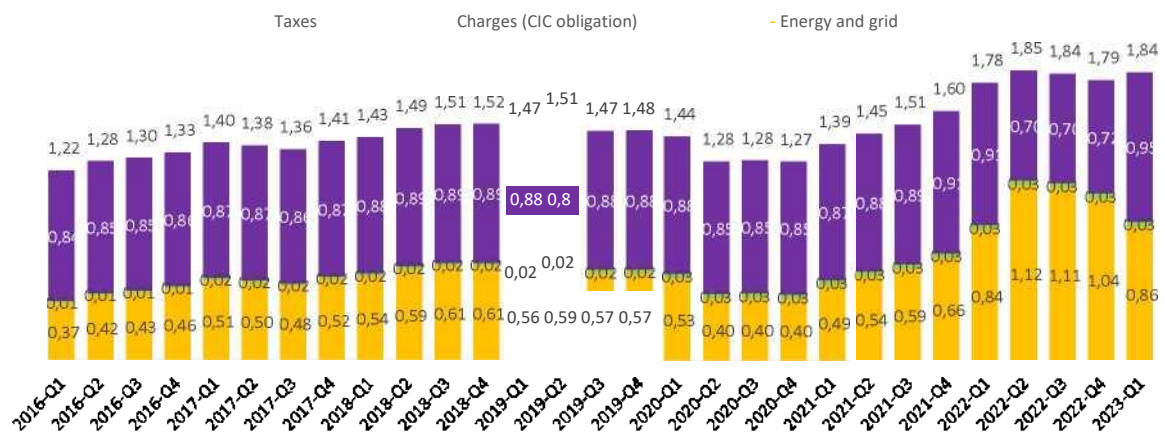


Figure 87 Evolution of the price (EUR/l) at the automotive gas pump and its components (source: processing MASE)



IV. Description of energy subsidies, including for fossil fuels

Parliament assigns to MASE the task of drawing up a Catalogue of environmentally harmful Sussids and Environmental Sussids Favorevoli (as provided for in Article 68 of Law No 221 of 28 December 2015, containing measures for the green economy and efficient use of resources). This inventory makes it possible to identify existing subsidies in Italy with a particular focus on their impact on the environment. As provided for in the legislation, the term ‘subsidy’ has been understood by the Parliament in the broadest definition, encompassing, among others, direct incentives, exemptions, rebates and rebates in taxes, benefits and implicit subsidies.

The Grants Catalogue is a useful tool:

- To identify the area of intervention 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 revenue through forms of environmental taxation that affect pollution, natural resources, consumption and production harmful to the

environment);

- and, above all, to identify areas of reduction in “tax expenditures” in general.

Recently, 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, a number of State aid measures were authorised at national level in cooperation with the EU to compensate for the increase in gas and electricity prices. These are extraordinary rules the financial effects of which have not been included in the estimate of subsidies monitored by the Catalogue, precisely because of their transitional nature.

However, the instability of the energy market has accelerated decision-making processes across Europe, giving new impetus to various implementing instruments, including energy taxation.

The European Commission presented in 2021 the *Fit for 55* package and in 2022 the *REPowerEU* plan to reinforce the renewable energy targets already enshrined in the Green Deal.

In particular, in addition to the environmental taxation measures already approved as part of the *Fit for 55* package (reform of the ETS, *Carbon Border Adjustment Mechanism*), a revision of the Energy Taxation Directive (ETD) (Directive 2003/96/EC) has also been proposed, which, among other things, regulates the system of exemptions and tax relief applied by Member States (excise exemptions and tax reliefs are classified as subsidies in the Catalogue). According to the Commission, the current ETD is no longer able to align itself with the latest EU climate and energy targets, to the extent that it would appear to favour the use of fossil fuels and the malfunctioning of the internal market. The effectiveness of the current Directive is further limited by an outdated coverage of energy products, in particular biofuels, and 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 in the taxation of energy products used by Member States, is to eliminate obsolete exemptions and reduced rates compared to ordinary ones, which in fact encourage the use of fossil fuels.

Moreover, 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 to 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 COP in Glasgow in implementation of the Paris Agreement¹¹⁰, 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, in 2020 Italy’s energy subsidies exceed 1.6 % of GDP, 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 that took place with the establishment of the Cite (Article 4 of Decree-Law No 22 of 1 March 2021) and of the measures provided for in Article 18 of Decree-Law No 4 of 27 January 2022, the financial effect of five SADs, listed in the Energy category of the Environmental Subsidies Catalogue and classified as fossil subsidies, will come to an end as of 2022. These are:

¹¹⁰https://unfccc.int/sites/default/files/resource/cma2021_10_add1_adv.pdf.

- Reduction of excise duty on fuels used for 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 vessels handling exclusively within the port of transshipping (EN.SI.25).
- Funds for research, development and demonstration of hydrocarbons (oil and gas) (EN.SI.27).
- Funds for research, development and demonstration for coal (EN.SI.28).

The following tables include:

- the 6 subsidies eliminated or terminated;
- the 3 subsidies to be reformed at Community or global level;
- the 14 environmentally favourable energy subsidies resulting from the fifth edition of the Catalogue (2022), which incorporate two new subsidies, inserted between 2019 and 2020, which are the promotion of electricity produced from renewable energy sources and the stimulation of electricity generation plants powered by biogas.

The estimates of the annual financial effects of the grants cover the period 2018-2021.

Table 77 – List of subsidies/subsidies eliminated or terminated

N	Name	Reference standard	Financial effect (EUR million)			
			2018	2019	2020	2021
1	Funds for research and demonstration for hydrocarbons (oil and gas)	Article 23 (2) (a) Decree-Law of 22 June 2012 no 83 converted with amendments by Law No 7 August 2012 No 134. Deleted by Article 18 (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 26 October 1995 504). Deleted by Article 18 (1) of Decree-Law No 4 of 27 January 2022	22,9	25,8	22,4	19,0
3	Funds for research and demonstration for coal	Article 23 (2) (a) Decree-Law of 22 June 2012 no 83 converted, with amendments, by Law No 134 of 7 August 2012. Deleted by Article 18 (3) of Decree-Law No 27 January 2022 No 4	6,6	6,6	6,6	—
4	Reduction of excise duties on energy products for vessels that do only movements within the port of transshipping	Article 1 (367-2b) of Law No Deleted by Article 18 (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 used for the production of magnesium from Sea	Table A point 14 TUA (Legislative Decree No 26 October 1995 504). Deleted by Article 18 (1) of Decree-Law No 27 January 2022 No 4	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 motor fuel or fuel	Article 21-bis of Legislative Decree No 504 of 26 October 1995 (Programme lasting six years, starting on 1 January 2014 and ending on 31 December 2019)	0,3	0,2	—	—
Total environmentally harmful energy subsidies eliminated and terminated			106,6	109,5	105,9	21,3

Table 78 – List of environmentally harmful energy subsidies/subsidies to be reformed at the level European or international

N	Name	Reference standard	Financial effect (EUR million)			
			2018	2019	2020	2021
1	Issuance of ETS allowances allocated free of charge	Articles 20 to 23 of Legislative Decree No 30 of 13 March 2013	980,0	1.581,9	1.402,0	2.412,3
	Exemption from excise duty on energy used as fuel 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
3	Exemption from excise duty on energy used as fuel for maritime navigation	Table A point 3 TUA (Legislative Decree No 504 of 26 October 1995)	435,7	490,2	513,5	618,7
	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

Table 79 – List of subsidies in the energy sector with a favourable environmental impact (SAF)

N	Name	Reference standard	Financial effect (EUR million)			
			2018	2019	2020	2021
1	Energy account: system incentive dedicated to solar photovoltaic installations 2005 to 2012)	MINISTERIAL DECREE 28/07/2005 and Energy); Ministerial Decree No 19/02/2007 (II Energy Ministerial Decree No 06/08/2010 (III Energy Ministerial Decree No 05/05/2011 (IV Energy Account);	5.868,0	5.970,0	6.187,0	6.236,4
2	Energy Incentive electricity produced from renewable sources other than photovoltaic	Ministerial Decree of 23 June 2016	5.700,0	5.616,0	5.775,2	5.567,3
3	Deduction of 50 % or 65 % or 110 % for various energy retrofitting measures existing buildings of any cadastral category, including rural buildings, owned or held	Article 1 (175) of Law No 160/2019; Article 119 of Legislative Decree No 19 may 2020 No. 34 (Relaunch)	1.634,2	1.828,9	2.008,0	1.294,3
4	Deduction for the purchase of furniture and large household appliances of class A + (uncertain impact)	Article 16 (2) of Decree-Law No 63/2013; Article 7 (2-bis) 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	489,3
5	Exemption from excise duty for electricity produced with installations powered by renewable sources with an available power of more than consumed by companies of self-production at premises and other than dwellings	Article 1 (911) of Law No 208 of 28 December 2015. Article 52 (3) (b) TUA (Legislative Decree No 504 of 26 October 1995)	59,6	123,3	54,2	59,6
6	Tax credit on supplied district heating networks	Article 8 (10) (f) of Law No 448/1998	29,6	31,3	30,9	24,2

N	Name	Reference standard	Financial effect (EUR million)			
			2018	2019	2020	2021
	with biomass and geothermal energy					
7	Incentives for plants electricity production using biogas, with an electrical power of not more than 300 kW	Article 1 (954-957) of Law No 145 of 30 December 2018	—	25,0	25,0	25,0
8	Direct or indirect production of electricity by installations be obliged to report under the provisions governing the consumption tax on electricity. Exemption for vegetable oils not chemically modified.	Annex I to Legislative Decree No 504 of 26 October 1995	0,5	0,5	0,5	0,5
9	Tax credit for the purchase of vehicles fuelled with methane, LPG or electrically driven or for installation of equipment for supply of methane and LPG	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 147/2013)	0,2	0,1	0,0	0,1
10	Energy Incentive electricity produced from renewable energy sources	Ministerial Decree of 04 July 2019 (FER-E III)	—	—	1,6	d.q.
11	Special favourable arrangements OPs... the self-generation systems of electricity with ORC cycle	Article 12 of Law No 221 of 28 December 2015	d.q.	d.q.	d.q.	d.q.
12	Incentives on energy produced by installations fuelled by sustainable biomass, biogas and bioliquids	Article 1 (149-151) of Law No 208/2015	d.q.	d.q.	d.q.	d.q.
13	Promotion of energy efficiency measures and energy production from thermal RES (CHP and HE CHP)	Legislative Decree No 102/2014; Ministerial Decree of 5 September 2011; Decree Interministerial Ministerial Decree of 28 December 2012, Legislative Decree No	d.q.	d.q.	d.q.	d.q.
14	Encouragement of interventions support for technological and industrial development	Article 32 of Legislative Decree No 28/2011	d.q.	d.q.	d.q.	d.q.
	Total subsidies in the energy sector with a favourable environmental impact		13.575,8	13.947,2	14.502,0	13.696,6

d.q. to be quantified Source: MASE

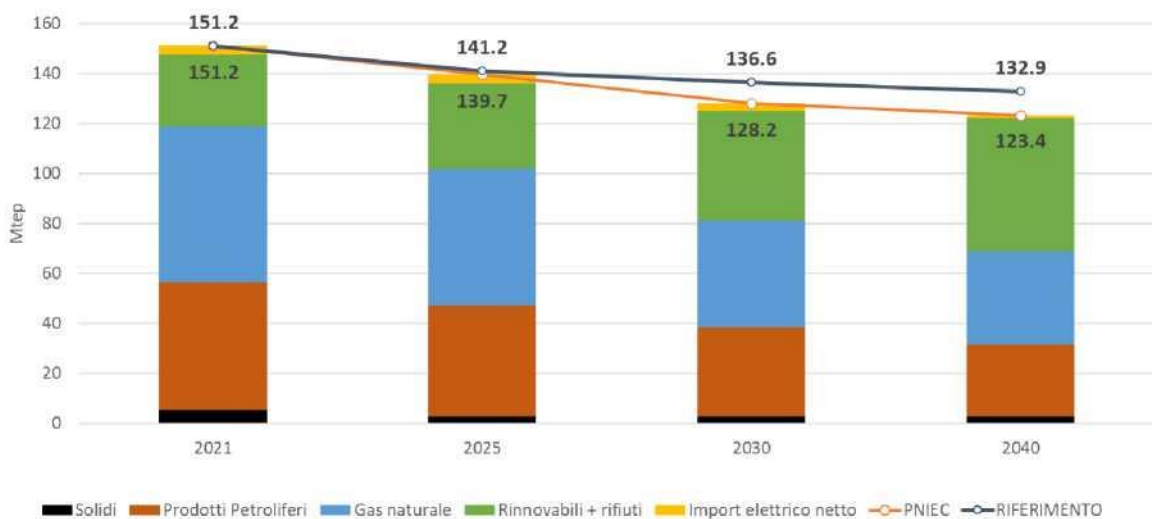
5 IMPACT ASSESSMENT OF PLANNED POLICIES AND MEASURES¹¹¹

5.1 impact of planned policies and measures referred to in section 3 on the energy system and greenhouse gas emissions and removals, including a comparison with projections with existing policies and measures (as set out in section 4).

1. 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 mentioned in 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 substitution of fossil sources by renewable sources. The graph and table below, which show the projections up to 2040 of the INECP scenario compared to the Reference Scenario, show the results of this process.

Figure 88 – Evolution of gross inland consumption (including non-energy uses) in the Reference and INECP scenarios
[Source: RSE]



¹¹¹Planned 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 relevant projections under point 5.1.i therefore include not only the policies and measures adopted and implemented (projections based on existing policies and measures), but also the planned policies and measures.

Table 80 – Primary and final energy consumption (for each sector), projections 2020-2040 in the scenario INECP (Mtoe) [Source: RSE]

PNIEC scenario	2021	2025	2030	2040
Gross inland consumption¹	151.2	139.7	128.2	123.4
Solids ²	5.5	2.6	2.7	2.6
Petroleum products	51.0	44.8	35.9	28.9
Natural gas ³	62.4	54.4	42.7	37.2
Renewables + waste	28.5	34.1	44.1	53.6
Electricity	3.7	3.7	2.9	1.1
Primary energy consumption⁴	145.3	132.6	121.5	116.7
Final energy consumption⁵	113.3	109.0	100.3	95.7
detailed by sector	113.3	109.0	100.3	95.7
Industry	26.4	24.6	24.3	24.2
Residential	31.9	28.3	26.5	24.7
Tertiary	15.0	16.2	14.5	14.6
Transport	36.8	37.4	32.6	30.0
Agriculture	3.3	2.5	2.4	2.4
details by source	113.3	109.0	100.3	95.7
Solid	1.8	1.4	1.3	1.3
Petroleum products	39.9	36.8	28.7	21.3
Natural gas	34.4	29.3	24.0	21.1
Electricity	25.1	25.0	26.8	31.2
Heat	3.1	3.8	3.4	3.3
Renewables	8.9	12.6	16.1	17.5
Final non-energy consumption	5.9	7.1	6.7	6.8

¹ Indicator 'Gross inland consumption (Europe 2020-2030)' that includes international aviation and excludes ambient heat and international shipping.

² Including non-renewable waste and iron and steel gas.

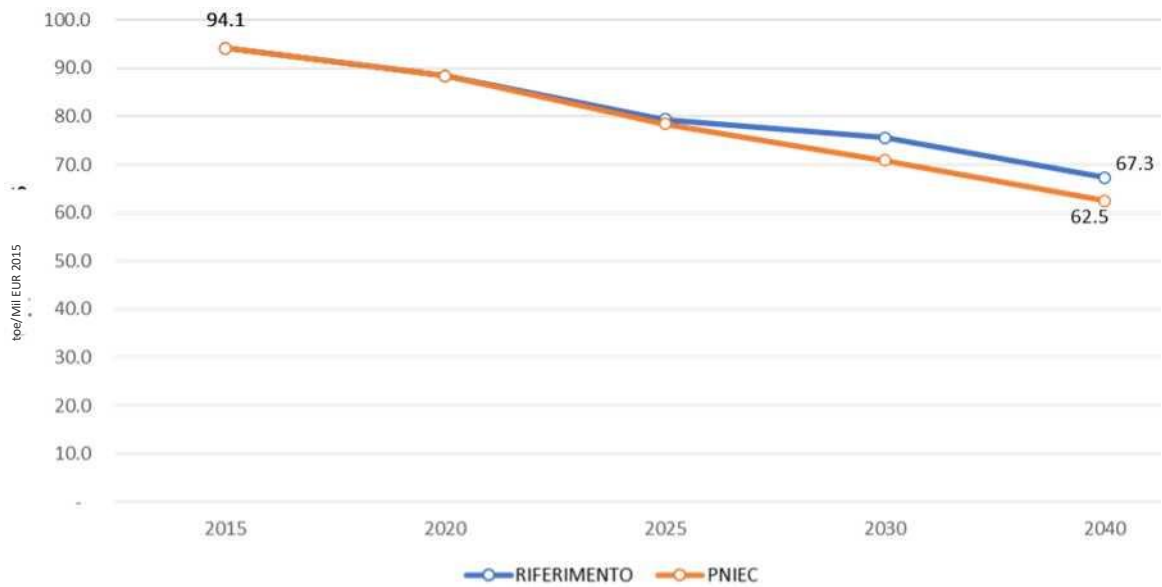
³ Does not include international bunkering.⁴ Primary consumption does not include non-energy uses included in gross inland consumption.

⁵ Indicator 'Final energy consumption (Europe 2020-2030)'.

It should be pointed out that the fall in gross domestic consumption is due exclusively to the above-mentioned dynamics of efficiency and decarbonisation of the energy system. Indeed, GDP developments are expected to increase from 2021 onwards, albeit at moderate rates in the medium to long term.

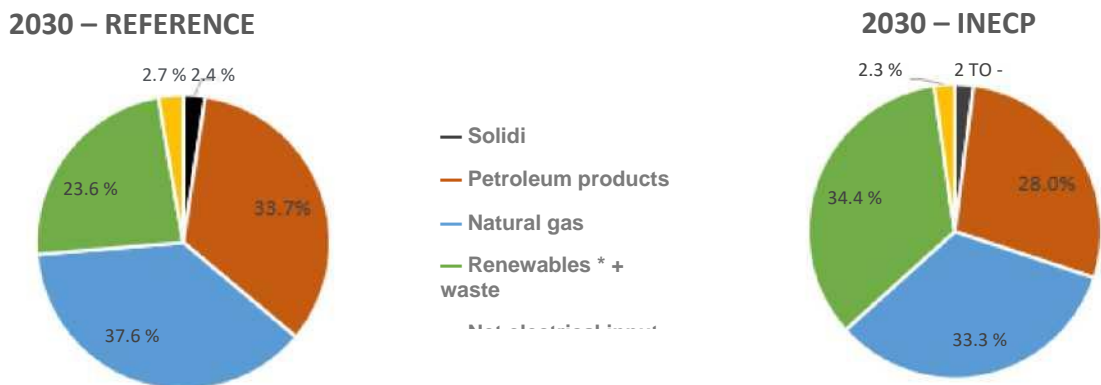
The effect of technological efficiency processes, resulting from the implementation of policies, is illustrated by the trend in the energy intensity parameter of economic activities, which is steadily declining in the short, medium and long term.

Figure 89 – Evolution of energy intensity by 2040



Both the reference and the INECP scenarios show energy efficiency gains that more than offset the relative sectoral consumption. In the INECP scenario, the additional policies and measures contribute to achieving higher efficiencies: energy intensity is reduced by 1.7 % on average per year in the period 2020-2040 (1.4 % in the Reference scenario).

Figure 90 – Mix of primary needs as at 2030



* Including biogas for biomethane production

There is an increasing contribution from renewable sources to the detriment of fossil fuels, with a share of the primary energy mix rising from 19 % in 2021 to 34 % in 2030 in the INECP scenario.

Petroleum products after 2030 continue to be used in long-distance passenger and freight transport, but their use is below 2040 (around 23 % of the primary mix, compared to 32 % in the Reference Scenario). Their decline is most significant in the last few years of the

projection of the scenario when oil in transport is significantly replaced by biofuels, hydrogen and electrically powered vehicles, both for passenger and freight transport.

Both the reference and the INECP scenarios show a reduction in the contribution of natural gas to the primary energy mix as early as 2030; however, renewables substitution and efficiency processes are more pushed in the INECP scenario. Therefore, the use of fossil natural gas decreases from 41 % in 2021, to 33 % in 2030, to 30 % in 2040 (in the Reference scenario, these percentages amount to 38 % in 2030 and 35 % in 2040 respectively).

As regards energy security, there is a gradual increase in terms of national energy production, with particular reference to renewable sources. This, together with the fall in consumption, translates into a sharp reduction in energy dependency (rather than in the reference scenario).

Table 81 – Domestic energy resources, projections 2025-2040 – PNIEC scenario (ktoe)

	2025	2030	2040
National production	45.202	56.473	64.795
Solid	—	—	—
Petroleum products	4.272	4.128	3.856
Natural gas	3.889	3.202	2.381
Renewables *	37.042	49.143	58.558

* Includes transport biofuels, biomethane and the share of non-renewable waste.

Table 82 – Net imports, projections 2025-2040 — PNIEC scenario (ktoe)

	2025	2030	2040
Net imports	99.853	78.992	67.252
Solid	1.239	1.183	1.133
Crude oil and petroleum products	42.520	33.672	26.492
Natural gas	50.569	39.580	35.151
Electricity	3.712	2.906	1.151
Renewables *	1.814	1.651	3.326

* Includes biofuels for transport.

Table 83 – Energy Deployment, projections 2025-2040 – PNIEC scenario

	2025	2030	2040
Energy dependence	68.8 %	58.3 %	50.9 %

One of the main levers through which the objectives of decarbonising the energy system are to be achieved is the electrification of final consumption accompanied by an increasing penetration of renewables in the power generation sector.

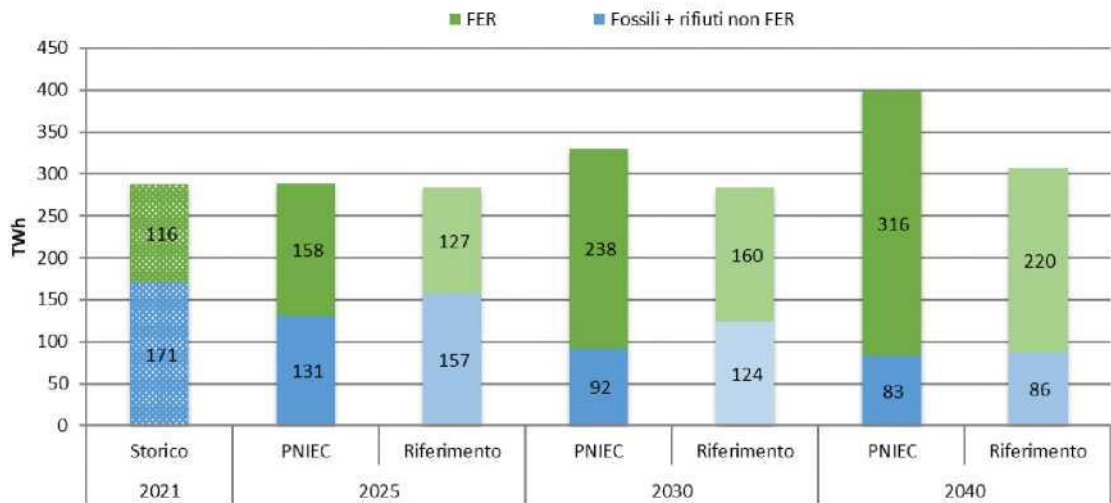
In the PNIEC scenario, there is therefore an increase in electricity generation that allows for electrification of end-use sectors: net production amounted to 326 TWh in 2030 and 398 TWh in 2040 (corresponding to an increase of 16 % and 42 % respectively compared to historical data in 2021). At the same time, the contribution of renewables in the generation sector increases from 40 % in 2021 to 72 % in 2030 and 80 % in 2040; this increase is mainly due to non-programmable renewable sources (photovoltaic and wind), the deployment of which is triggered by ever lower investment costs.

Net electricity imports appear to contribute less significantly in the Policy scenario than in the Reference scenario. In the PNIEC scenario, import by 2030 is reduced to 34 TWh (compared to 43 TWh

in the Reference Scenario) as a result of the increase in non-programmable renewable sources.

Electricity overgeneration resulting from the increase of non-programmable renewable sources can be limited through (i) adequate development of electricity infrastructure, (ii) the development of electricity storage systems and (iii) its use to produce other types of zero-emission energy carriers (e.g. hydrogen, e-fuels) that contribute to the decarbonisation of less electrified sectors (e.g. industry). However, it should be borne in mind that it is not necessarily an efficient solution to completely zero overgeneration. It would not be economically rational, nor beneficial, to integrate all non-programmable renewable production, with the possible consequences of oversizing network infrastructure, storage systems and electrolyzers, or of sub-optimal use of these.

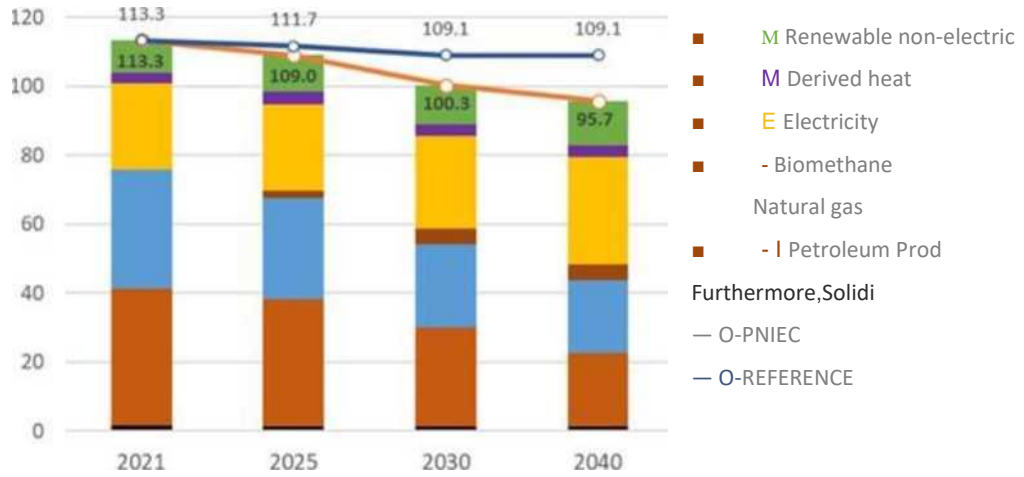
Figure 91 – Evolution of gross electricity generation by 2040 (including electricity for electrolyzers and excluding pumped electricity production) [Source: RSE]



The measures and policies considered in the INECP scenario make it possible to reduce final energy consumption by around 9 Mtoe by 2030, by a total of 100 Mtoe.

Figure 92 – Evolution of final consumption by source at 2040 [Source: RSE]

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With regard to emissions, the historical evolution of national emissions and the expected evolution of the scenario with the additional policies identified so far are set out below.

Table 84 – National GHG emissions and European targets (Mt CO₂eq) – scenario with additional policies
[Source: ISPRA]

	1990	2005	2021	2025	2030	2040
Total emissions	523	594	418	374	312	252
ETS emissions *		248	132	121 116	94 87	nonethel ess,
ESR emissions		344	284	251 256	216 223	nonethel ess,
ESR targets * *			273	241	194	nonethel
Difference to ESR targets			10,9	+ 10,3 + 15,3	+ 22,0 + 29,1	nonethel ess,

* Considering the scope of the Directive before the adoption of Directive (EU) 2023/959. National aviation emissions are not included.

** indicative targets, targets will be specified by specific rules to be adopted at European level. The estimate was based on the criteria laid down in Regulation (EU) 2023/857 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030.

With reference to the table, it is important to point out that there are still elements of uncertainty with regard to the sectoral evolution of emissions, so that, while the value of total emissions remains unchanged, the distribution between ESR and ETS may vary, particularly as the distribution of renewables across sectors varies.

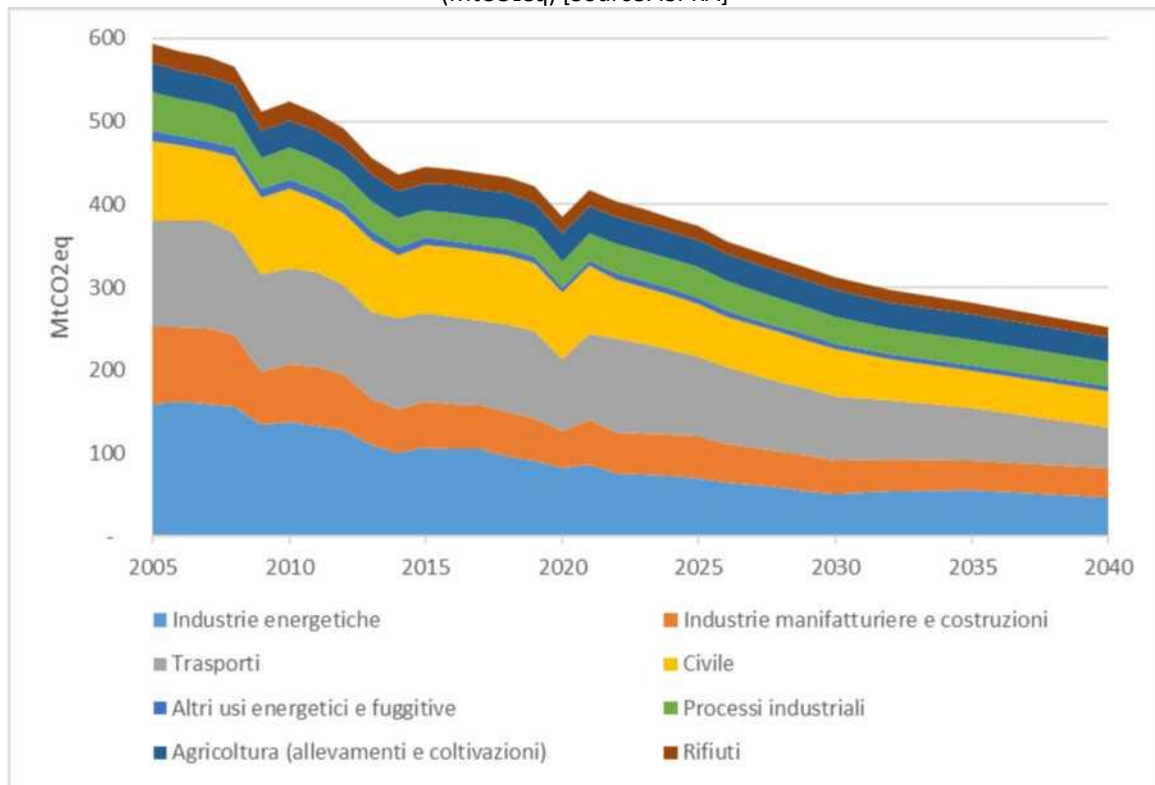
The table below shows the emissions broken down at sectoral level under the highest reduction scenario of ESR emissions in the table above.

Table 85 – Historical GHG emissions up to 2015 and according to the INECP scenario broken down by sector (MtCO₂eq) [Source: ISPRA]

GHG emissions, Mt CO ₂ eq.	2005	2015	2020	2021	2025	2030	2035	2040
From ENERGY USE, of which:	488	360	300	333	288	232	206	181
Energy industries	160	106	82	87	70	51	55	46
Manufacturing industries and construction	92	56	46	54	50	41	37	36
Transport	128	107	87	103	97	77	62	49
Civil	96	82	79	83	64	56	46	44
Other energy and fugitive uses	12	9	7	6	8	7	6	6
By OTHER FONTI, of which:	106	86	85	85	86	80	75	71
Industrial processes	47	33	31	32	37	33	30	29
Agriculture (livestock and crops)	35	32	33	33	32	32	31	30
Waste	24	20	20	20	17	16	14	12
Total (excluding LULUCF)	594	446	385	418	374	312	281	252
LULUCF	- 36	- 44	- 33	- 27	- 34	- 35	- 30	- 37

* With regard to navigation, the figure refers to domestic ships and movements in ports, international ships are not included

Figure 93 – Historic GHG emissions up to 2021 and under the scenario of 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 sharp reduction in emissions in the energy industries (-41 %), mainly due to the reduction of emissions from the electricity sector. Emissions in this sector are directly linked to fossil fuel power generation. The significant growth of renewable electricity generation 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 demand for private transport;
- in the residential sector, a 32 % reduction in emissions due to the significant renovation rate of buildings, continued efficiency and progressive electrification of the sector mainly due to the massive penetration of heat pumps;
- a smaller contraction (-14 %) in emissions from industry, considering energy uses, industrial processes and F-gases as a whole; there have been very substantial reductions for this sector in the historical years (-39 % from 2005 to 2021), partly due to the economic crisis and partly due to the structural change in activity and the increase in the efficiency of production processes, the effects of which are also evident in the reduction of emissions in the projection years, despite the assumption of a major recovery in production. The conversion of the Taranto steel production hub, and to a lesser extent the use of CCS and the increase in the use of renewable gases, are also contributing to this sector;

non-energy emissions substantially unchanged compared to the baseline; with regard to agriculture in particular, a number of measures are still in the process of being defined, so emissions have been conservatively reported at the same level as in the baseline.

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 possible, health, environment, 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, as referred to in section 3, at least until the last year of the period covered by the plan, including a comparison with projections with existing policies and measures

The INECP 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 summarises the economic structure of a country over a given period, briefly and immediately highlighting the interdependencies between the various sectors that make up the economy. The matrices, properly transformed through specific procedures, 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 National Statistical Institute (ISTAT) on an annual basis. The latest tables, available at the time of writing, refer to the year 2019 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 cannot, in some cases, be fully associated with the measures assessed in the scenarios in this plan (current and policy policies). This is the case, for example, for plants producing energy from renewable sources. In order to overcome the problem, the costs of carrying out the works (and the costs of operation and maintenance – O & M – in the case of installations for the production of electricity and heat) were broken down into the 63 economic sectors covered by the matrices. For example, expenditure on investment in new photovoltaic installations has been broken down and allocated partly to the electrical equipment manufacturing sector (inverters, cables, etc.), partly to the manufacture of metal products (supporting structures) and so on, allocating to each cost item a variable weight depending on the specific impact on the total expenditure. In doing so, they were able to simulate the impact on the national economic system of the demand for new measures, linked to renewable sources or energy efficiency, included in the scenarios of the Plan.

Another focus is on the proportion 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 that take account of the share of imports in the various sectors, however, it cannot be ruled out that, in particular sectors of economic activity (for example, those which reconstruct the photovoltaic sector in combination), this share, although already considered, may be underestimated. Data collected by ISTAT in the context of the PRODCOM International¹¹² Trade Survey were used to address this problem.

The results obtained by applying the input/output model relate to the economic benefits, in terms of added value and employment, temporary and permanent, direct and indirect. Permanent spillovers refer to employment related to the use and maintenance of goods throughout their lifetime, while temporary spillovers relate to employment.

The PRODCOM survey¹¹² provides information on around 4000 industrial products (sales, imports and exports), providing a complete picture of industrial production using statistical methods harmonised at Community level. Through the PRODCOM survey it is possible to obtain data on the market for certain components of the spending vectors (e.g.: photovoltaic cells), which cannot be found on supply and use tables because they are not sufficiently disaggregated.

limited in time to the design, development, installation and construction phase of the asset. The employment benefits are distinguished directly, relating to employment directly attributable to the sector being analysed, and indirect, relating to the sectors supplying the activity analysed both downstream and upstream. The estimated employment is not to be understood in terms of persons physically employed in the various sectors, but in terms of AWU (Labour Unit), which indicate the amount of work done per year by a full-time employee. 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 impact (i.e. without taking into account any negative effects in sectors that could be regarded as competing) of the investments in the measures provided for in the INECP scenario. These spillovers have been subtracted from those obtained for investments in the same measures, but in accordance with current policies; in this way, the impact of the increased investments triggered in the INECP scenario, amounting to around EUR 27 million per year in the period 2023-2030, can be appreciated.

In short:

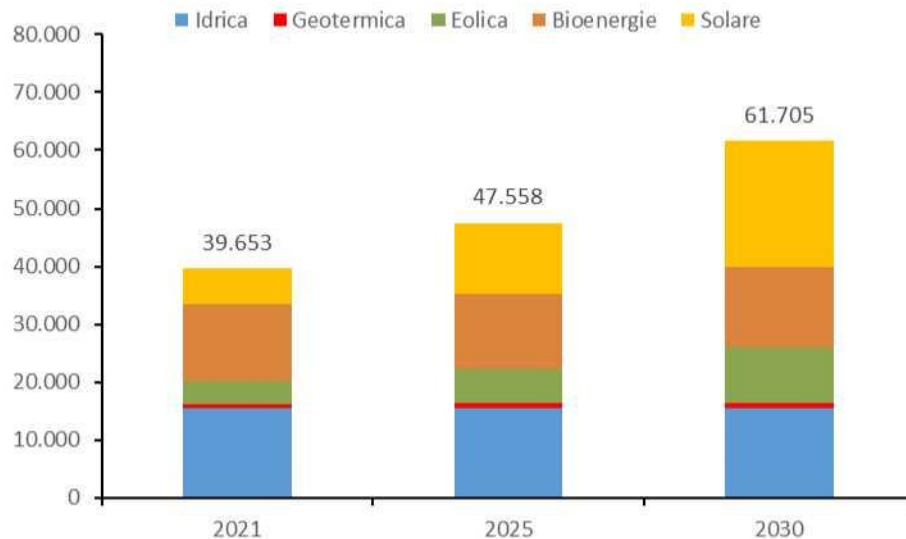
- the average annual additional contribution to the creation of Value Added over the period 2023-2030 is estimated at more than EUR 13 billion compared to what would be the case under current policies;
- the average annual temporary employment (direct and indirect AWU) is estimated at around 191 in addition to those calculated for the current policy scenario in the period 2023-2030.

Table 86 – Summary of the main results obtained from the application of the input model – output [Source: RSE, GSE]

SECTOR		Δ annual investment EUR mldEUR (2023-2030)	Δ VA average annual MldEUR (2023-2030)	Δ annual average temporary ULA (2023-2030)
Residential	Building upgrading	6,9	4,7	86.000
	Heat pumps (heating and cooling)	1,9	1,1	15.000
	Heating and domestic hot water	0,1	0,1	1.000
District heating	Distribution	0,0	0,0	0
Tertiary	Building upgrading	1,5	1,0	18.000
Industry	Industrial processes, engines and others	0,3	0,2	2.000
Transport	Cars, motorcycles, vans, buses, lorries	10,6	3,3	32.000
Electrical sector	Bioenergy	– 0,1	– 0,1	– 1.000
	Photovoltaic	2,5	1,1	15.000
	Onshore wind	1,2	0,7	9.000
	Offshore wind	0,2	0,1	2.000
	Fossil fuels	– 0,2	– 0,1	– 1.000
Electrical system	National transmission network development	0,9	0,6	6.000
	Upgrading of distribution networks	0,9	0,6	6.000
Storage systems	Electrochemical pumping and storage facilities	0,2	0,1	1.000
Total		27,2	13,6	191.000

The following histogram shows the evolution by source of permanent employment (direct and indirect AWU) resulting from the installation of new FER-E plants between 2021 and 2030 under the PNIEC scenario. Estimates show that, in terms of AWU, employment grew from more than 39 in 2021 to more than 61 in 2030, with a positive balance of more than 22 AWU (+ 56 %).

Figure 94 – Developments by source of permanent employment as a result of the evolution of the FER-E fleet according to the INECP scenario [Source: GSE]



Considering also the evolution of the fossil-powered plant fleet, the overall employment balance in the electricity generation sector, in terms of AWU, is positive at around 18. In the fossil sector, there was a decrease in employment between 2030 and 2021 of around 3.600 AWU, in particular due to the phase-out of coal.

Table 87 – Permanent employment by source in 2021 and 2030 following the evolution of the electricity generation fleet according to the INECP scenario [Source: GSE]

Technology,	Permanent AWU 2021	Permanent AWU 2030	Δ Permanent ULA 2030-2021
ERF	39.653	61.705	22.052
Hydropower	15.545	15.545	— 0
Wind turbines	3.880	9.671	5.791
Solar energy	6.169	21.821	15.652
Geothermal	630	771	141
Bioenergy	13.429	13.897	468
Fossil fuels	17.271	13.625	— 3.646
Coal	3.135	—	— 3.135
Natural gas	13.666	13.238	— 428
Petroleum products	470	387	— 83
Total	56.924	75.330	18.406

❖ SOCIAL IMPACTS AND JUST TRANSITION ASPECTS

territories facing serious socio-economic challenges resulting from the transition towards climate neutrality.

The Fund aims to ensure that the achievement of the ambitious climate targets under the *European Green Deal*, which aims to make the EU climate neutral by 2050, is fair and leaves no one behind.

The JTF shall support regions and territories through grants in sectors that are considered most sensitive and exposed to the consequences of the transition to climate neutrality, including 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 establishment 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 challenges for the transition in the short and long term of a given territory, with a time horizon of 2030 and with particular attention to 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 can 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 regeneration, retraining of workers.

In Annex D to the¹¹³ Country Report published as part 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. Investments from the JTF for Italy are therefore concentrated in these two areas of Italy through the implementation of a national JTF programme whose Managing Authority is the responsibility of 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 MASE. In 2021, in order to draw up the territorial plans, the European Commission launched a close dialogue with stakeholders, led by the Department for Cohesion Policies and the Agency for Territorial Cohesion, with the aim of identifying the intervention logic and highlighting any coherent projects already present in the territories. Negotiations with the European Commission took place in 2022 and, following the submission of a first proposal sent on 20 June, concluded by Decision C (2022) 9764 of 16 December 2022 approving the National Programme and the two Territorial Plans¹¹⁴.

The Territorial Plans, designed with strong coherence and synergy with regional programmes financed by the ERDF and ESF + and other territorial programmes (e.g. Sulcis Plan, CIS Taranto), contain a description of the transition process at national level, an assessment of the challenges to be addressed and its social, economic and environmental effects and a description of the types of intervention to be financed.

Specifically, the challenges identified focus on three main areas:

¹¹³ <https://www.agenziacoazione.gov.it/wp-content/uploads/2022/06/Allegato-D-2020-1.pdf>

¹¹⁴ <https://www.agenziacoazione.gov.it/wp-content/uploads/2022/12/sfc2021-PRG-2021IT16JTPO01-1.1.pdf>

Energy and environment, for which the Plan provides for a significant increase in RES production in the identified areas, in order to mitigate the effects of the transition, combat energy poverty, contribute to the economic diversification of the areas and create new jobs. In addition, support will be given to a preparatory action to recover situations of environmental damage that exist

widely, with targeted measures to rehabilitate the area.

Economic diversification, for which the Plan provides, in the areas identified, which will be affected by a contraction in industrial activities, for the transition to 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 SMEs in the area

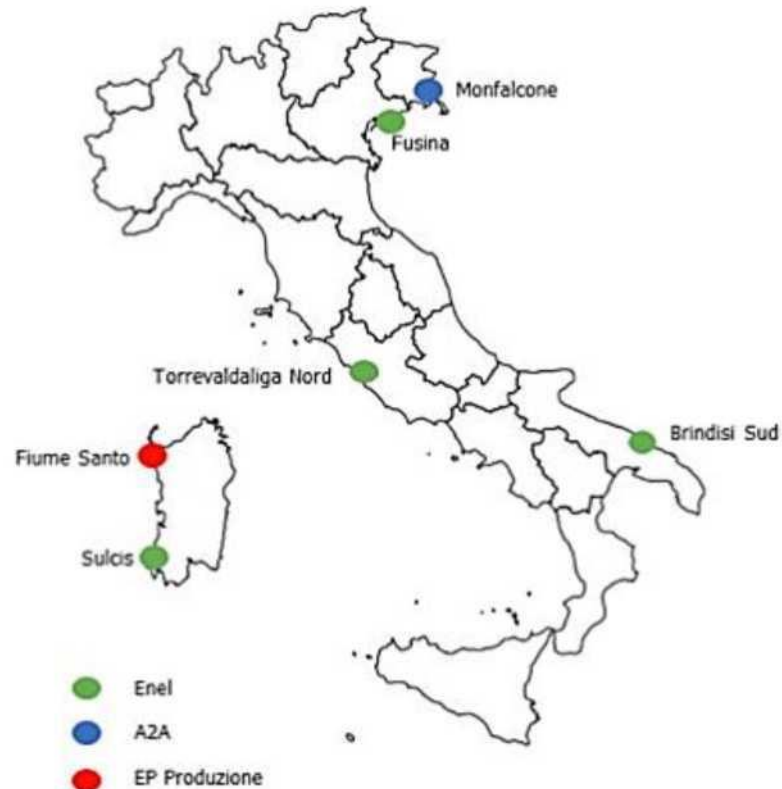
- Social and employment effects, for which the development of new economic sectors and activities will lead to an increase in demand for staff with green skills. The JTF NP will tap this potential demand for employment to develop job opportunities for those who have lost it and for those who are at risk of losing it as a result of the transition. In order to meet the objective set out above, these training and retraining measures will be based on the results of a profiling of the skills and characteristics of the individuals described, which will form the basis for the formulation of teaching and learning pathways.

At European level, the JTF makes EUR 17,5 million available. With national co-financing, an amount of EUR 1,211 million is allocated to Italy: the Programme allocates EUR 367,2 million to Iglesias Sulcis and EUR 795,6 million to Taranto, while EUR 48,4 million have been reserved for technical assistance in accordance with Regulation (EC) No 2021/1060. Resources allocated to territories are divided between challenges, with 30 % dedicated to energy and the environment, 38 % to economic diversification, and 32 % to measures to mitigate the social and employment effects caused by the transition.

- **PHASE OUT OF COAL**

Currently, six coal-fired thermal power plants are in operation in Italy, generally located in areas with a strong industrial focus:

- Fiumesanto Central (SS): 2 units with a total gross electrical power of 640 MW.
- Power station Monfalcone (GO): 2 units with an electrical power of 165 and 171 respectively MW.
- Power station Torrevaldaliga North (RM): 3 units each with a gross electrical output of 660 MW.
- Power station Brindisi South: 3 units each with a gross electrical power of 660 MW.
- Central Sulcis (CA): 2 units with a gross electrical power of 280 MW and 210, respectively MW.
- Fusina Central (VE): 2 units each with a gross electrical power of 330 MW.



The phase out of coal will be accompanied, with a view to ensuring a fair energy transition, by measures to protect workers in order to develop and retrain employment, combat poverty and inequalities and safeguard the regions to which they belong.

To provide effective responses 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 laid down that the share of the proceeds from the auctions for the allocation of EU-ETS allowances, up to a maximum of EUR 20 million per year, from 2020 to 2024 was to be allocated to the 'Fund for the conversion of jobs in areas where coal-fired power plants are located' to be set up at the Ministry of Economic Development (now the Ministry of Enterprise and Made in Italy).

From an institutional point of view, the assessment of the infrastructure changes that may be necessary for the actual implementation of the phase out of coal from electricity production will be based on a comparison in dedicated sectoral tables promoted by MASE (for electric market areas and specific to Sardinia) with operators, local self-government, Terna and the social partners. The purpose of the tables is to assess the technical and regulatory conditions, the necessary infrastructure and the means of safeguarding employment. In addition, with a view to a just energy transition, with the coordination of the Energy Services Manager and in cooperation with the above-mentioned tables, specific monitoring of the socio-economic effects, in particular on employment and income distribution, of the measures of the INECP will be developed, with a particular focus on the industrial and carbon-intensive regions particularly affected by decarbonisation policies.

Finally, an interesting project integrating private and public policies and dialogue between employers and social partners was implemented by Enel S.p.A. (former sole national manager of electricity generation, processing, transmission and distribution activities). This is the 'Futur – E' project, which

provides for 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 involves:

- the retraining and relocation of surplus workers through agreements and negotiations, based on a comparison between the company, the workers and their representatives and the integration of company and public policies;
- the conversion and regeneration of brownfield sites with a focus on safeguarding supply chains.

- **THE EUROPEAN SOCIAL CLIMATE FUND**

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 envisaged to earmark 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, a new financial mechanism, the so-called 'Social Climate Fund' (SCF), was established by Regulation (EU) No 2023/955 of 10 May 2023 for the period 2025-2032, the aim 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 they can support their decarbonisation.

More specifically, the main objective of the Fund is to support households, micro-enterprises and transport users of the most vulnerable by providing – albeit temporarily – direct income support to reduce energy poverty, while financing national measures and investments aimed at reducing in the medium and long term reliance on fossil fuels through increased energy efficiency of buildings, decarbonisation of heating and cooling of buildings, including the integration of energy from renewable sources, and granting improved access to zero- and low-emission mobility and transport.

Italy intends to make use of the Fund proposed by the Commission. More details on the policies that will be activated using the financial resources made available through the Fund will be provided in Italy's Social Climate Plan, which is necessary to have access to the Fund's aid, the official presentation of which is foreseen, in accordance with the European Regulation, by the end of June 2025.

- **POSSIBLE SOCIAL IMPACTS ON EMPLOYMENT, EDUCATION AND SKILLS INCLUDING JUST TRANSITION ASPECTS**

The National Institute for the Analysis of Public Policies (INAPP), mandated by the Ministry of Labour and Social Policy, has set up an information system on professions, employment and professional needs, linking the economic and productive system and the education/vocational training system. This information system is designed to ensure a double level of time reading of the data: short-term recruitment forecasts and needs

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professional contingent; medium-term employment forecasts and anticipation of job needs over five years. In this context, INAPP analysed the future needs for ¹¹⁵in the electricity, gas, water and steam supply sector (ATECO 35), in the light of current institutional and regulatory guidelines, with particular reference to the INECP. The purpose of the analysis, using an expert panel set up for this purpose¹¹⁶, is to:

- identify the professionals most involved and transformed from now to 5 years;
- identify new skills and innovative skills;
- update and implement the INAPP Professions database;

- make suggestions on curriculum elements that should be innovated/inserted to adapt the professional unit to change.

In order to carry out this analysis, the following steps were necessary:

- statistical definition of the sector and mapping of products/services and production processes characterising the current scenario and analysis of the main economic and employment dynamics;
- identification of trends and drivers that will mark the near future and their combination with key drivers of change;
- identification, in relation to these changes, of changes in professional roles and tasks;
- recognition, in relation to changes in roles 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 covered by the study is contained in Section D 'Supply of electricity, gas, steam and air conditioning' of the ATECO 2007 classification and is entirely 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 this is an *intensive capital* sector, with a turnover of approximately EUR 160 million with a workforce of around 83 thousand. Companies with more than 250 employees account for 64 % of the workforce, compared with 23 % for Italian firms as a whole.

The drivers of change that could have a significant impact in terms of demand for skills and occupations were also identified:

- climate change and extreme weather;
- energy transition: decarbonisation, renewables and energy efficiency;
- transition from a multi to a predominantly single-vector supply system based on electricity;
- continuous research and new digital technologies;
- liberalisation and increasing competition not only on energy produced but also on a range of services of a secondary nature and on quality understood as traceability, eco-sustainability in respect of the territory and CSR;
- increasing importance of marketing and development of online sales activities;

- ¹⁵ this is a study to anticipate professional needs using scenario methodologies as part of the National Operational Plan on Active Employment Policy Systems (NOP SPAO) ESF programming 2013-2020.

- ¹⁶ the Panel of Experts was invited to attend: MiSE, GSE, trade unions, businesses and trade associations in the sector.

- redistribution of energy production and increasing importance of the territory as a forum for discussion with local authorities and populations;
- global population growth and subsequent consumption growth.

On the basis of the factors listed above, the most significant changes in the professions typical of the sector have been assumed and the skills that may be associated with them have been identified, namely:

- be able to develop approaches geared towards self-diagnosis, self-correction and continuous improvement;
- be able to take decisions in relation to supervised tasks and in support of their work autonomy;
- be able to promote and participate effectively in activities based on interaction between different nodes in the liability chain and vertical and horizontal collaboration;
- be able to manage processes for changing corporate organisational structures with a view to increasing the value of human capital;
- be able to accommodate customer requirements for the development of products and services;
- be able to oversee the distribution strategy of buying and selling products, and

- services;
- be able to effectively communicate relevant information on processes, products, services and solutions;
 - be able to identify and supervise the logistical processes, internal and external to the company, which allow 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 their own context by acquiring relevant information sets in good time;
 - be able to promote risk analysis within business processes;
 - be able to continuously transfer innovative know-how 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

The competences listed above have been cross-checked with the professional units (PO) considered to be most involved in the energy transition scenario. Below is the list of selected professional units.

Table 88: 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 managers of large companies active in mineral extraction, manufacturing, electricity, gas and water production and distribution, and waste management
1.3.1.2.0	Entrepreneurs and managers of small businesses active 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 the procurement of 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	Electricity distribution network technicians
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 electricity generation and storage equipment

The study also points out that the energy transition will lead to the increasing involvement of professionals in the field of statisticians, mathematics and meteorologists. These are so-called data scientists that contribute to the creation of new jobs within the energy sector, where the enabling technologies of Industry 4.0 (Internet of Things, Artificial Intelligence, Big Data, Robotics, etc.) find more demanding forms of development and applications than other sectors. This requires the presence of professionals who are 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 may, in the future, have a specific competence within the selected professional units, according to the following criteria:

- high level of importance (red colour), in order to deal with changes in professional tasks and objectives required by the profession, the entity cannot fail to possess these skills in depth;
- medium importance (green colour), in order to deal with changes in the tasks linked to the PO and in the objectives required by the profession, the entity needs to possess immediately the basic elements of those skills, the acquisition and full command of which may be deferred over time but must be acquired;
- level of sufficient importance (yellow colour), in order to deal with changes in the tasks linked to the PO and in the objectives required by the profession, the individual needs to possess the basic elements characterising professional competence, in particular in order to improve understanding and interaction within and outside the workplace;

low level of importance (white colour) was considered that this type of competence, for that particular profession, is not sufficiently relevant.

Table 89: Cross-match between the identified skills and the selected professional units

Competenze 2° livello	Molto importante	Importante	Poco importante	Ininfluyente	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	Red	Red	Red	Red	Red
Be able to take decisions in relation to supervised tasks and in support of their work autonomy	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Be able to promote and participate effectively in activities based on interaction between different nodes of the liability chain and vertical and horizontal collaboration	Green	Red	Red	Red	Red	Red	Red	Red	Red	Green	Green	Green	Green	Red	Red	Red	Red	Red
Be able to manage processes for changing corporate organisational structures with a view to increasing the value of human capital	Yellow	Red	Red	Red	Red	Red	Red	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
Be able to accommodate customer requirements for product and service development	Green	Red	Yellow	Red	Red	Red	Red	Red	Red	Green	Green	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow
Be able to oversee the strategy of buying and selling products and services	Green	Red	Yellow	Yellow	Red	Red	Red	Red	Red	Red	Red	Red	Red	Yellow	Yellow	Yellow	Yellow	Yellow
Be able to effectively communicate relevant information on processes, products, services and solutions	Red	Red	Red	Red	Red	Red	Red	Red	Red	Yellow	Yellow	Yellow	Yellow	Green	Yellow	Yellow	Yellow	Yellow
Be able to take decisions in relation to their own context by obtaining relevant information sets in good time	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Be able to identify and supervise the logistical processes, internal and external to the company, which allow the product/service to be distributed from the place of production to the final customer;	White	Yellow	Green	Red	Red	Red	Red	Green	Green	Red	Red	Red	Red	Red	Yellow	Yellow	Yellow	Yellow
Be able to interact positively within intercultural and multidisciplinary contexts	Red	Yellow	Red	Red	Red	Red	Red	Red	Red	Green	Green	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	Red	Red	Red	Red	Red
Be able to continuously transfer new knowledge sets	White	Yellow	Green	Green	Green	Green	Green	Green	Green	Yellow	Yellow	Yellow	Yellow	Green	Green	Green	Green	Green

within production, organisation and research processes		Yellow	Green	Green	Green	Green	Yellow	Yellow	Yellow	Yellow	Green	Green	Green
Be able to interpret and apply general and specific regulations in relation to the local, national (and international) business/organisational system of reference		Yellow	Red	Red	Red	Green	Yellow	Yellow	Yellow	Yellow	Green	Yellow	Yellow
Be able to select the most appropriate technologies in the management and development of business production processes		Red	Red	Red	Yellow	Yellow	Yellow	Green	Yellow	Yellow	Green	Green	Green
Be able to use information systems and web-based communication tools in the day-to-day management of business processes	Yellow	Green	Red	Red	Green	Green	Red	Red	Yellow	Red	Green	Yellow	Green

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 developed. The identification of future needs for clusters of skills shows that the greatest demand, as could be expected, concerns technological and digital skills, as well as those of a cross-cutting nature. This is followed by those relating to marketing, specialisations and, finally, management, plant operation and maintenance.

The current VET provision does not yet appear to adequately include these new sets of skills in education and training programmes. Indeed, the survey of VET providers highlighted the weakness of supply in relation to the most relevant professionals for the future by drawing the distance between the offer already available and that needed for the balanced development of the sector.

5.3 overview of investment needs

i. Existing investment flows and forward investment assumptions with regards to the planned policies and measures

Achieving the new ambitious decarbonisation targets resulting from the European framework represents a very ambitious challenge for Italy and its economy, with not only 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 shape the economic development of EU countries and will require substantial investment in energy infrastructure, the efficiency of the building stock (both public and private) and the transport sector, to support their modernisation and sustainability.

From an initial development, 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, in the period 2023-2030, around EUR 217 billion of additional investment will be needed in comparison with the current policy scenario (an increase of 36 % over the period considered). Such investments would target high-tech and innovative solutions, which would have to affect both the transformation and the supply side of energy and its end-use.

Table 90 – Investments in technologies, processes and infrastructure necessary for the evolution of the energy system¹¹⁷ [Source: RSE]

Sector	Evolution to current policies	Investment for INECP	
	Cumulative costs (2023-2030) [mldEUR]	Cumulative costs (2023-2030) [mldEUR]	Delta [mldEUR]
Residential	62,2	134,2	72,0
Tertiary	37,5	49,6	12,1
Industry	10,0	12,6	2,6
District heating (distribution only)	0,05	0,08	0,04
Transport (vehicles only)	440,2	524,9	84,8
Electricity sector (generating installations)	39,8	69,4	29,6
Electricity system (grids)	18,0	37,2	14,5
Storage systems (batteries, pumping) (1)	4,8	6,3	1,5
Total	617,1	830,3	217,2

(1) This excludes accumulations coupled to small PV installations, as such investments are already at cost of the PV installations.

Significant additional investments for the development of renewable sources are: in the photovoltaic sector alone, it is estimated that around EUR 20 billion of additional investment is needed in the period 2023-2030 to achieve the objectives of the INECP scenario compared to what is foreseen in the current policy scenario. For accumulated investments in the transmission network under current policies, ongoing

¹¹⁷ investments are accounted for in the energy scenarios carried out using the TIMES model by RSE.

preliminary, reference was made to the latest approval of ARERA in 2021118, i.e. the SOP 2020 of TERNA was taken, removing the investments of the projects excluded from approval and repropotional over the period 2023-2030.

Table 91 – Investments in RES electricity generation technologies necessary for the evolution of the energy system
[Source: RSE]

Sources	Evolution to current policies	Investment for INECP	
	Cumulative costs (2023-2030) [mldEUR]	Cumulative costs (2023-2030) [mldEUR]	Delta [mldEUR]
Bioenergy and hydropower	4	2	– 1
Geothermal energy	2	2	0
Photovoltaic	16	36	20
Concentrated solar power	2	2	0
Onshore wind	11	21	10
Offshore wind	1	3	2
Fossil fuels	4	3	– 1
Total	40	69	30

With regard to the electricity system, on the other hand, it is planned to ensure that it is authorised to develop non-programmable renewable sources provided for in the INECP scenario, with investments in 2023-2030 amounting to more than EUR 32 million (+ EUR 15 million compared to the current policy scenario): approximately EUR 12 million for operations on the distribution networks and at least EUR 21 million for the development of the national transmission network. Finally, investments of more than EUR 6 million are planned to build new storage systems (pumping and batteries).

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)

❖ SUSTAINABLE FINANCE: ITALY'S EXPERIENCE FOR THE INECP

THE EU'S REGULATORY AND REGULATORY FRAMEWORK

Following the signing of the Paris Climate Agreement and the UN 2030 Agenda for Sustainable Development, the EU has embarked on a path to integrate sustainability into economic policies, with the aim of moving towards a circular, low-carbon and energy-efficient economic development model in line with the various environmental issues (Green Deal).

118ARERA, Opinion of 22 December 2020 574/2020/i/eel, "Assessment of the Schedules of the 2019 and 2020 ten-year national transmission network development plans"

The process of regulatory and regulatory development of sustainable finance and the economic political dimension of the European Union therefore become interconnected and part of a single process in which the Action Plan Financing Sustainable Growth, published by the European Commission in 2018, is its starting point.

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.

The table below summarises the European regulatory framework, considering the actions and objectives for which the standards were designed.

Table 92 – 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 issued			
Environmental taxonomy	Develop a common identification system for sustainable activities	Status: in force from 1 January 2022	Four Delegated Acts: 1 Ad Climate change Mitigation and AD Climate Change Adaptation – effective 1-01-22. 2 Ad 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 – under discussion.
Benchmarks	Developing climate benchmarks and related information	Status: in force from 30 April 2020	Ad (EU) 2020/1818 – in force since 23 December 2020. 2th AD under preparation by ESAS authorities (EBA, Eiopa, Esma)
Directive (EU) 2022/2464 (CSRD)	Harmonise sustainability reporting.	Status: in force since 5 January 2023.	2 ad under preparation by EFRAG (the first by 30 June 2023, the second by 30 June 2024)
Implementing Regulation (EU) 2022/	Amends the implementing technical standards on disclosure of ESG risks.	Status: in force from 19 January 2023	NA
Directive (EU) 2022/2381	Improve gender balance among directors of listed companies.	Status: in force from 27 December 2022	NA
Sustainable Finance Disclosure Regulation (SFDR) (EU) 2019/2088	It 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 issued			
Proposal for a Green Bond Standard Regulation (COM/2021/391)	Introduction of a voluntary standard certifying the alignment of projects to be funded with the Taxonomy.	Status: delivered on 6 July 2021; 28 February 2023, the Council and the European Parliament reached a provisional agreement.	NA
Proposal for a Corporate	Introduces obligations of two due diligence for some	Status: proposed on 23 February	NA

Sustainability Due Diligence Directive (CSDD) – COM (2022) 71 –	categories of companies compared to actual or potential adverse impacts on human rights and the environment.	2022; past to Parliament and the Council of the EU – final adoption and deadlines for entry into force are awaited.
Proposed structure of the Social Taxonomy	It establishes a classification system that identifies activities that contribute substantially to their achievement and directs private investment towards socially relevant activities.	Status: submitted by Platform on Finance Sustainable on 28 February 2022. NA
Retail investment Ecolabel	It establishes a certification scheme for investment financial products in line with the environmental and climate objectives of the European Union.	Status: During the NA Design

NONETHELESS, QITALIAN REFERENCE UADRO

In the light of the European legislative 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 the provisions on financial intermediation, within the meaning of 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 by 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 Text of Banking and Credit Laws.

— 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 1 September 1993, as amended by Law No 232 of 11 December 2016 on the regulation of ethical and sustainable finance banking operators.

NONETHELESS, LA FINANZA S OSTENIBILE IN THE NATIONAL FRAMEWORK

The most common green and sustainable finance instruments in the market include green bonds, i.e. debt issued by companies, banks, states, other public entities and supranational bodies (e.g. World Bank) to raise resources exclusively for financing or refinancing environmental projects.

The ecological transition requires a green transformation of energy and transport infrastructure and strong investments in building stock and industry to support their modernisation and sustainability. In this context, the public financial sector plays a key role.

In the context of the INECP and the energy transition policies, with regard to sustainable public finance instruments, the Ministry of Economic Development (Mefil) of 3 March 2021 launched the first issue of Green BTP, in line with the position taken in the 2020 Budget Law (No 160 of 27 December 2019) and announced in the 2021 Guidelines on Public Debt Management, for an amount of EUR 8,5 billion. Green BTP are medium to long-term bonds and have the same characteristics as the other Political Treasury bills. The first Green BTP, issued, expires on 30 April 2045.

For the issuance of Green Government Bonds, the Mef has adopted the Green Bond Framework, which sets out the environmental strategy and the four essential mechanisms that will accompany the issuance of green bonds: the criteria for the selection of expenditure in the State budget deemed eligible for emissions of green TP, the use of the revenue from the various emissions, the monitoring of those expenses and the environmental impact of those costs.

The contents of the Framework were drawn up within the framework of the Inter-Ministerial Committee on Green Government Bonds, which was set up specifically pursuant to the Budget Law for 2020 and of which MASE is a member. The Framework will be regularly updated in the light of 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 in the process of being published.

With the proceeds of Green Government Bonds, Italy finances state expenditure intended to contribute to the achievement of the environmental objectives outlined by the European Sustainable Business Taxonomy and will help Italy to support the Sustainable Development Goals of the UN 2030 Agenda.

In order to be considered eligible in line with the reference framework, expenditure must fall within one of the following: Sectors:

- Renewable electricity sources and thermal;
- Energy efficiency;
- Transport;
- Pollution prevention and control and circular economy;
- Protection of the environment and biological diversity;
- Research.

This expenditure is included in the State budget for a period from the third year preceding the year of issue to the year following the year of issue.

On 20 October 2021, the Mef reopened, by trade union, the Green TP for an amount of EUR 5 billion and, in line with the previous issue, the net proceeds were allocated to the financing of State green expenditures in accordance with the Framework.

In May 2022, the Mef published the 2022 Environmental and Impact Report (2022 BTP *Green Allocation and Impact Report*) of the net revenues collected from BTP Green emissions in 2021, which shows the allocation of emission revenues in line with the criteria laid down in the Framework and, where available, the positive environmental impact of measures covered by green expenditure. The document provides a detailed analysis of the programmes and projects according to their financial nature (tax advantages, capital expenditure and current expenditure), their time distribution over the four-year period 2018-2021 and their relative weight in 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

Of the total green expenditure reported as eligible, over 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 can be attributed to capital investments (railway infrastructure, electrification of railway sections, construction of new high-speed/high capacity sections – AV/AC, support grants for rail mobility – people and goods). The energy efficiency category, consisting of a number of facilitation measures;

granted for expenditure on energy retrofitting of buildings, a share of 12.2 % of the total expenditure reported (i.e. EUR 1,63 billion) was allocated. Finally, the incentive measures for the production of energy from renewable sources account for 2.2 % (or EUR 296 million) of the total green expenditure reported in the four-year period 2018-2021.

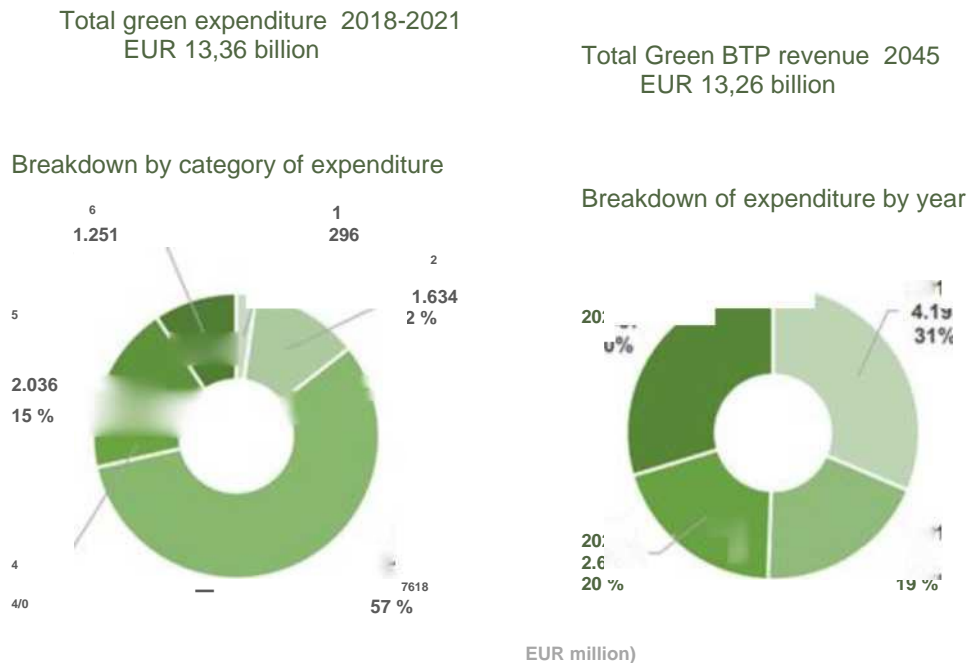
Below is a table summarising the green expenditure covered by the emission and a figure summarising the impact of the expenditure, as reported in the 2022 report referred to above.

Table 93 – Green expenditure – First issue BTP 2045 of 3 March 2021 (EUR million)

Category	Reference year				Tot four-year period
	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 96 – Allocation and impact of BTP 2045 of 3 March 2021



Source: MEF – 2022 BTP Green Allocation and Impact Report

A FEW NATIONAL EXAMPLES OF SUSTAINABLE FINANCE INSTRUMENTS

The issuance of ESG bonds by public institutions is a relatively new phenomenon that has experienced a rapid growth rate since 2007. Green bonds are now the most representative of an ecosystem of financial instruments including *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 a reference institutional investor, issues *green*, *social* and *sustainability bonds*. CDP has also published a Framework, aligned with the ICMA principles, on which the issuance rules are based. In particular, CDP defined four *Eligible Categories*:

- infrastructure and city development;
- financing for SMEs and large enterprises;
- *social housing*;
- clean energy and environmental sustainability.

The following table shows some examples of *green*, *social* and *sustainability bonds* identified by the CDP Framework.











Table 94 – Examples of green, social and sustainability bonds within the CDP framework

Type of product	Eligibility category	Subcategory	Eligibility criterion	Example of project
Green bonds	D	Sustainable management of natural resources	<ul style="list-style-type: none"> • Improving waste management • Extension of the useful life of the asset • Reduction of raw material consumption and generation of waste • 	<ul style="list-style-type: none"> • Recycling or composting facilities to intercept waste otherwise going to landfill • Extension of the useful life of a product or its intensity of use
Social bonds	C	Access to the home	<ul style="list-style-type: none"> • Increasing access to social housing services – facilitated for people in a state of social and economic marginality 	<ul style="list-style-type: none"> • Construction, retrofitting or refilling of buildings for social housing
Sustainability Bonds	A + D	Sustainable and accessible urban infrastructure	<ul style="list-style-type: none"> • Development of quality, sustainable and universal infrastructure contributing to the improvement of living conditions in urban agglomerations and under-served areas 	<ul style="list-style-type: none"> • Development of cycling and/or pedestrian cycle (i.e. soft mobility) or other zero-emission modes of transport • Digitalisation and virtualisation of services projects

Source: MASE reprocessing on CDP data

Cassa Depositi e Prestiti arrived at its sixth issuance of *social bonds* in 2021. The following table summarises the *social security and sustainability bonds* issued by CDP since 2017.

Table 95 – Social and sustainability bonds issued by CDP from 2017 to 2021

Year of emission	Typology	Intended use	Measurement Coupon		Deadline	SDG
			nominal	gross annual		
2017	Social bonds	Support for SMEs with less than 250 employees and based 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	
2018	Sustainability Bonds	Support for the development and modernisation of Italian water infrastructure	EUR 500 million	2.125 %	5 years	
2019	Social bonds	Funding for energy and seismic construction and upgrading of public school and university buildings, as well as for urban regeneration projects, in areas prone to degradation, social exclusion and insecurity.	EUR 750 million	2.125 %	7 years	
2020	COVID-19 Social response bond (dual tranche)	Special support for businesses affected by the economic effects of the pandemic	EUR 500 million	1.50 % (3 years) 2 % (7 years)	3 years (tranche 1) 7 years (trunk 2)	
2020	Social housing bonds	Support for social and subsidised housing projects for the most vulnerable population groups, who do not have the requirements for subsidised construction or the economic capacity to meet the conditions of the housing market	EUR 750 million	1.00 %	10 years	
2020	Social bonds	Supporting Italian companies investing in research and innovation, as well as those affected by the pandemic	EUR 750 million	1.00 %	8 years	  
2021	Social bonds	Support Italian SMEs and Mid Cap mainly located in southern Italy	EUR 500 million	0.75 %	8 years	 

Source: MASE reprocessing on CDP data

Green bonds can be ‘corporate’ if issued by the private sector, ‘municipal’ if issued by local governments and ‘city’ if issued by cities.

In 2017, Borsa Italiana launched the sustainable segment of the bond market, a cross-sector segment, the creation of which gives institutional and retail investors the opportunity to identify the instruments whose proceeds are intended to finance sustainable growth.

To date, Borsa Italiana has identified 225 sustainable finance instruments with a value of over EUR 300 billion. There are 49 issuers, divided between corporate, supranational, governmental and banking issuers. The use of *green* and/or *social issues* is of interest not only to large listed issuers, but also to SMEs, in 9 they issued certified ‘mini’ green bonds, for a total of more than EUR 124 million.

In total, 115 *green* instruments, 70 *sustainable*, 22 *social*, 12 *sustainability linked*, 5 *transition* and 1 *climate action bonds* were listed.

NONETHELESS, **LAND SACE GUARANTEES**

Lastly, in the context of sustainable finance instruments, SACE guarantees are referred to. 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 aimed at facilitating the transition to a clean and circular economy.

The instrument, signed by means of a memorandum of understanding between the Ministry of Economic Affairs and Finance and SACE, consists of the possibility of requesting the issuing of bank guarantees by SACE in order to facilitate the financing of sustainable projects, i.e. meeting the sustainability objectives of the European Taxonomy and the targets 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 aimed, inter alia, at the decarbonisation of the economy, the circular economy and the adaptation and mitigation of risks on the ground arising from climate change.

The guarantees ensure easier access to medium/long-term financing, or to the increase of credit lines available in the banking system. It is an instrument that facilitates access to private credit through public guarantees, an example of effective cooperation between public economic policies and the private action of the banking and credit system.

5.4 impact of planned policies and measures referred to in section 3 on other Member States and on regional cooperation at least until the last year of the period covered by the plan, including a comparison with 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 both technological collaboration and exchanges of best practices that will lead to the creation of important new synergies in the different fields of collaboration with other Member States. In addition, topics identified as potential for regional collaboration may indeed lead to joint projects.

As regards the electricity sector, the Terna National Transmission Network Development Plan for 2023 on cross-border interconnections provides for the following actions:

- increasing interconnection capacity on the Northern border (France, Switzerland, Austria and Slovenia), including through solutions to optimise the use of existing infrastructure;
- interconnection between the electricity systems of Corsica, Sardinia and the Italian Peninsula, mainly for reasons of security and integration of production from renewable sources;
- the development of strategically relevant interconnection capacity with North Africa, 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 safe operation of the network and increase the efficiency of markets and services.

The expected impacts of such cross-border interconnection development interventions are:

- greater integration of the European market, enabling greater efficiency and enhancing competition through the use of the resources available at lower cost in the various countries;
- a diversified supply of the production mix through better use of immediate aid mechanisms between transmission system operators;
- better secure management of electricity systems through a more economical and diversified supply of reserve and balancing services from abroad.

As far as the gas sector is concerned, the current regional and global context has imposed a radical change in European gas flows, which has stimulated inter-national cooperation and has exposed 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 enable Italy to diversify its sources of supply and potentially make new resources available also for the benefit of other European countries. To this end, steps are being taken to:

- to increase transport capacity from the points of entry to southern Italy through the construction of the 'Adriatica route';
- to create the conditions for the upgrading of the Southern Corridor through TAP by encouraging an increase in capacity from the Azerbaijan supply route, including the construction of the Matagiola Massafra methane pipeline;
- to optimise the use of LNG import capacity in existing terminals and to develop new regasification capacity, which will continue to play a strategic role in encouraging Italy's participation in the Mediterranean and global LNG market in competition with northern European terminals.

The initiatives described above will lead the Italian system to become 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 mentioned in the previous paragraph should lead to a fall in prices on the national electricity market by reducing the price gap that has historically penalised Italy as a result of greater market integration. The price gap is expected to gradually narrow as European countries gradually converge their generation sources towards systems that are all largely based on non-programmable renewable sources.

In addition to the coupling of day-ahead and intraday markets, which has long been fully operational, the deployment of all European balancing platforms provided for in Regulation (EU) 2017/2195 will also 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 be an improvement in the environmental quality of transport and, consequently, of air.

In the gas sector, the new possibilities to supply gas at competitive prices and the resulting increase in liquidity will influence price formation at PSV and will make the Italian hub more attractive for export, including through the construction of infrastructure that will allow for the enhancement of total export capacity to Austria and the 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 requirements for modulation, which will have to take account of the quantities of gas that will be exported from the Italian system during the winter season at a time when the signal of the gas price differential between PSV and neighbouring markets allows it, also plays a key role in ensuring supply at critical times of winter. With this in mind, the development of new storage capacity at the Alfonsine field, in addition to initiatives to renew and upgrade the existing storage system, is strategic. In addition, it is necessary to take into account the increase in increasing shares of renewable gas production and feed-in into the Italian system, as well as the possibility of accessing green gases potentially produced by North African countries that can be made available to the European market via the Italian transmission network.

iii. Where appropriate, impact on regional cooperation

Italy is involved in the regional cooperation groups chaired by the European Commission, which ensure 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 trade associations and international work groups should be highlighted.

Meanwhile, efforts will be maintained to expand 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 situations of

extreme emergency and to address the lack of storage capacity of neighbouring systems, as provided for in Regulation (EU) 2017/1938, as amended and subsequently.

¹⁰⁹ *the estimate of the system cost of petroleum fuels to be taken as an indication is made by applying to final consumption of petroleum products in the transport sector the national average prices at the pump of petroleum products.*
