INTEGRATED NATIONAL ENERGY AND CLIMATE PLAN OF ROMANIA

2021-2030 Update

First draft version

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List of abbreviations

ANRE – Romanian Energy Regulatory Authority
ANRM – National Agency for Mineral Resources
BAT – Best available technology
BR – Biennial Report on Climate Change
BRUA – Bulgaria, Romania, Hungary and Austria project
CCGT – Combined-Cycle Gas Turbine
CCS – Carbon Capture Storage
CDI – Challenge-Driven Innovation
CESEC – Central and South-Eastern European Connection Initiative
CHP – Combined Heat and Power
EC – European Commission
EF – Emission factor
EIS – European Innovation Scoreboard
EMAS – Eco-management and audit scheme
ENTSO–E – European Network Transmission System Operator for Electricity
ESCO – Energy Services Company
EU – European Union
EU ETS– European Union's Emissions Trading System
EUR – Euro
GEO – Government Emergency Ordinance
GHG – Greenhouse Gas Emissions
GTMP – General Transport Master Plan
HFC – Hydrofluorocarbon refrigerant
ICT – Information and communication technology
JTF – Just Transition Fund
LIFE – Financial instrument for the environment
LULCEF – Land use, Land-use Change and Forestry
MAC – Mobile air conditioning systems Directive
MRID – Romanian Ministry of Research, Innovation and Digitalization
NAPEE – National Action Plan for Energy Efficiency
NC – National Communication on Climate Change
NECP – National Energy and Climate Plan
NIR – National Inventory Report
NPP – Nuclear Power Plant
NRIS3 – National Research, Innovation and Smart Specialization Strategy
NUT 2 – Nomenclature of territorial units for statistics
OHL – Overhead line

PAEC – Circular Economy Action Plan
PCI – European Union's Projects of Common Interest
PNDR – National Rural Development Program
PNRR – National Recovery and Resilience Plan
PP – Power plant
PV – Photovoltaic
RCI – Regional Competitiveness Index
RES – Renewable Energy Sources
ROHU – Romania – Hungary project
RON – Romanian Leu
SDGs – Sustainable Development Goals
SITC – Standard International Trade Classification
SME – Small and medium-sized enterprises
TAP – Trans Adriatic Pipeline
TPP – Thermal Power Plant
TYNDP – Ten Year Network Development Plan
WAM – Scenario with additional measures
WEM – Scenario with existing measures

SECTION A: NATIONAL PLAN

1. OVERVIEW AND PROCESS FOR ESTABLISHING THE PLAN

1.1 Executive summary

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

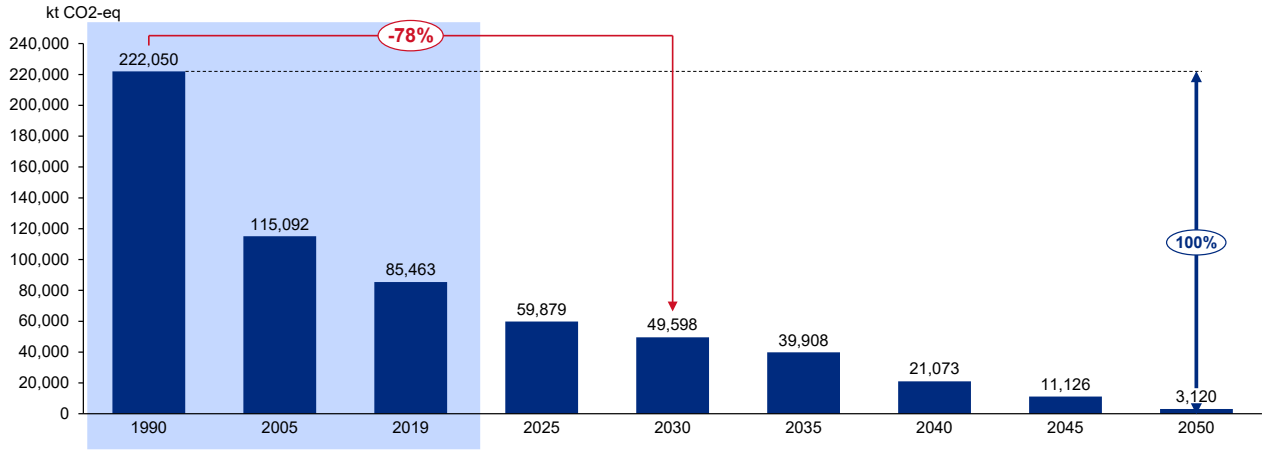
After the EU became a party to the Paris Agreement, it has assumed a prominent position in combatting climate change through its leadership across five key aspects: energy security, reducing carbon emissions, enhancing energy efficiency, strengthening the internal energy market, and promoting research, innovation, and competitiveness. Romania as a member of EU follow the policy adopted at the central level, but taking into account the country specification.

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

Dimension Decarbonisation

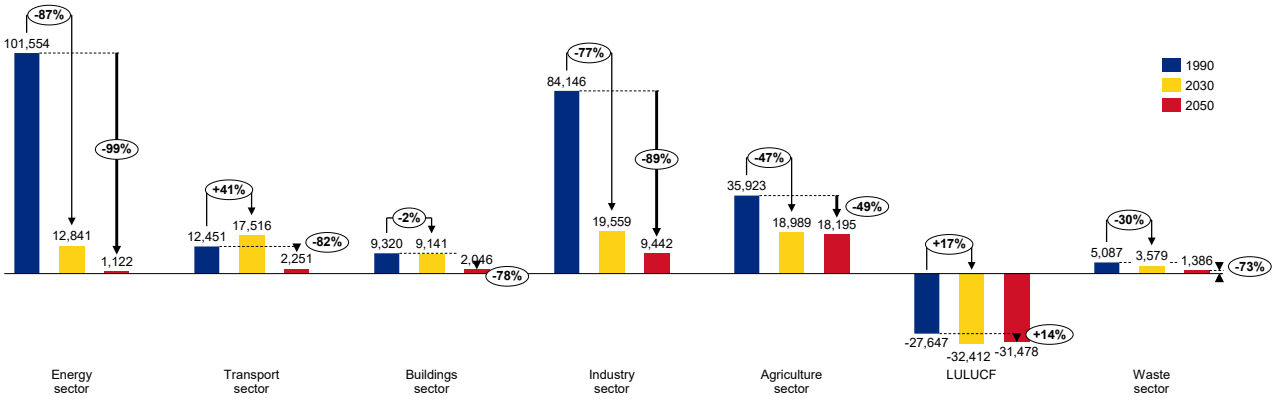
The GHG emission reduction target for Romania is set at 78% by 2030, compared to 1990 levels (Figure 2). Romania has made significant progress, achieving a reference point of 79% emission reduction by 2019, with a projection of 94% reduction by 2025. The long-term goal is to achieve a near-complete emission reduction of around 100% by 2050.

Figure 1. Indicative targets and trajectory for GHG emissions reduction



To meet these targets, Romania has established sector-specific goals for 2030 relative to 1990 levels (Figure 3):

Figure 2. Sectoral objectives for 2030 and 2050 relative to 1990 level

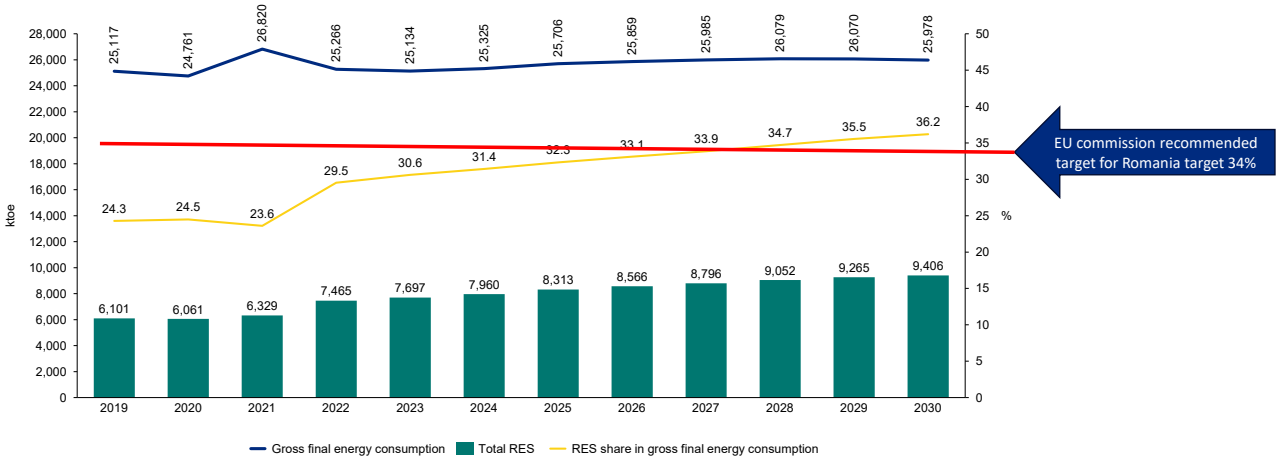


- Energy sector: Aiming for an 87% GHG emission reduction, primarily through decommissioning coal and lignite power plants and expanding renewable energy capacities.
- Transport sector: Seeking no more than a 41% increase in GHG emissions, primarily by promoting hybrid and electric vehicles.
- Buildings sector: Targeting a 2% reduction in GHG emissions through improved building performance and increased use of heat pumps and solar thermal collectors.
- Industry sector: Striving for a 77% GHG emission reduction, mainly achieved by replacing fossil fuels with electricity and renewables and enhancing technology efficiency.
- Agriculture: Pursuing a 47% GHG emission reduction through appropriate livestock diet and feed management.
- LULUCF: Aiming for a 17% increase in GHG removals, mainly through improved forest fire management.
- Waste: Targeting a 30% reduction in GHG emissions through proper waste reduction, reuse, and recycling.

Renewable Energy

Romania's objective is to reach at least 34% of renewable energy in gross final energy consumption by 2030. Projections indicate that by 2025, this percentage will reach 32%. Notably, increased wind and solar energy generation capacities, along with heat pumps for heating and cooling, will contribute significantly (Figure 3).

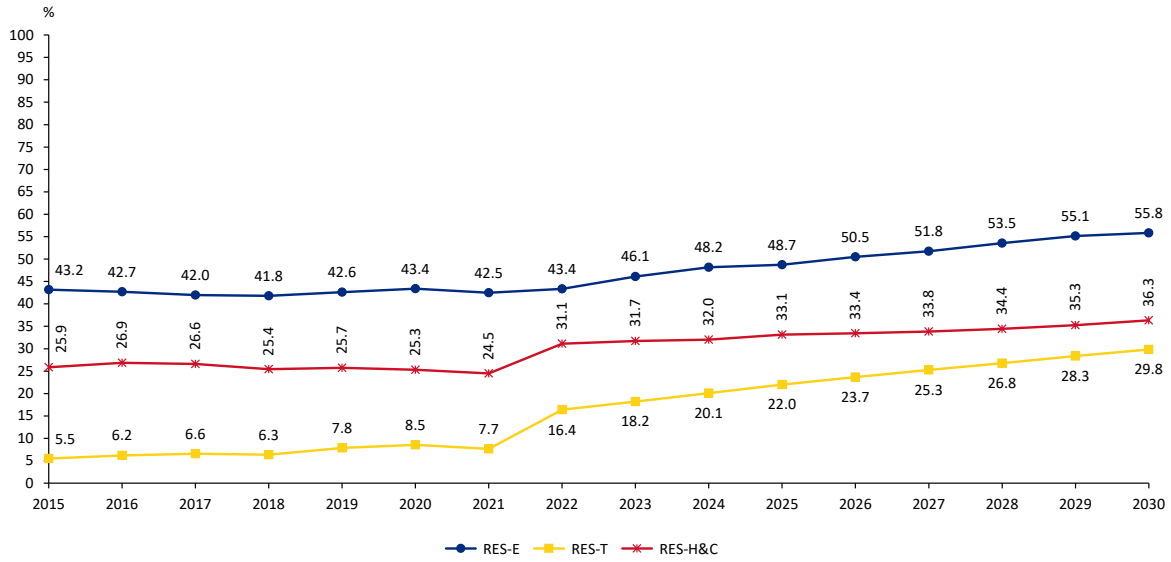
Figure 3. Share of energy from renewable sources in gross final consumption of energy, with an indicative trajectory



The estimated trajectories for the share of RES in the *transport sector* show that it will reach *29.8%* in 2030, which will be obtained mainly by increasing the use of electricity in this sector (Figure 12). The RES share in the *electricity sector* will also increase by 2030, reaching a point of *55.8%* in 2030, as a result of the construction of new RES (mainly wind and solar) capacities for electricity generation. On the other hand, due to the decreased use of biomass, especially in the rural areas, which will be replaced by cleaner technologies, the RES share in the *heating and cooling* sector will slightly increase throughout the whole analyzed period,

reaching *36.3%* in 2030. Although the biomass is considered as renewable source, it is envisioned that its consumption will be reduced since conservation of LULUCF absorptions is of great importance, as well as due to the adverse air quality consequences of biomass consumption. The biomass stove will be replaced mainly by clean heat pumps which are considered as renewable technology, too.

Figure 4. Estimated trajectories for the share of renewable energy in final energy consumption in the electricity, heating and cooling and transport sector



Dimension energy efficiency

The energy consumption projections for 2050 are based on the guiding principle of prioritizing energy efficiency ("taking utmost account of cost-efficient energy efficiency measures in shaping energy policy and making relevant investment decisions"[1]).

The anticipated energy consumption projections indicate a targeted reduction of 5% in primary energy consumption by 2030 compared to 2019 (as depicted in Figure 64), reaching an absolute value of 31,448 ktoe. Similarly, final energy consumption is expected to experience a slight decrease of 2% (as shown in Figure 22), achieving an absolute value of 23,140 ktoe in 2030. The long-term plan aims for a substantial reduction of 15% in primary energy consumption by 2050 relative to the 2019 level, accompanied by a more pronounced drop of 28% in final energy consumption.

Compared to the reference 2030 projections established by the Primes model, Romania's energy efficiency goal by 2030 is to achieve a remarkable 46% reduction in primary energy consumption and a corresponding 45% reduction in final energy consumption (Figure 64 and Figure 22). By 2050, Romania aims to lower its primary energy consumption by 52%, while the final energy consumption is projected to decrease further by 59% compared to the 2030 Primes model projections. These targets reflect a dedicated commitment to sustainability and a greener future.

[1] https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficiency-targets-directive-and-rules/energy-efficiency-first-principle_en#:~:text=The%20%E2%80%9Cenergy%20efficiency%20first%20principle,and%20making%20relevant%20investment%20decisions.

Figure 5. Estimated primary energy consumption trajectory

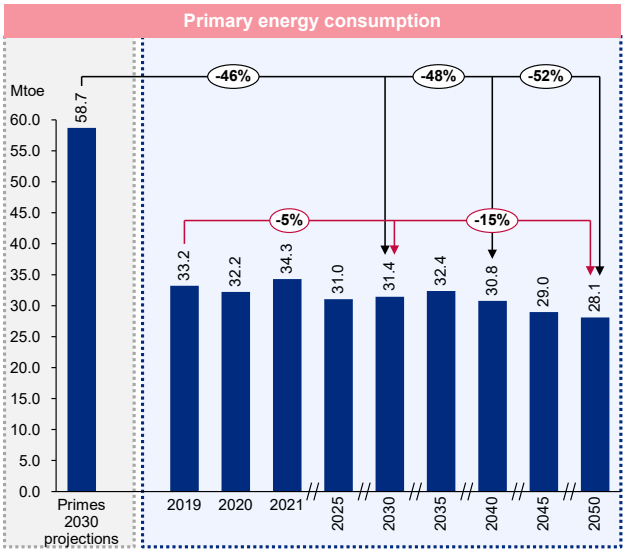
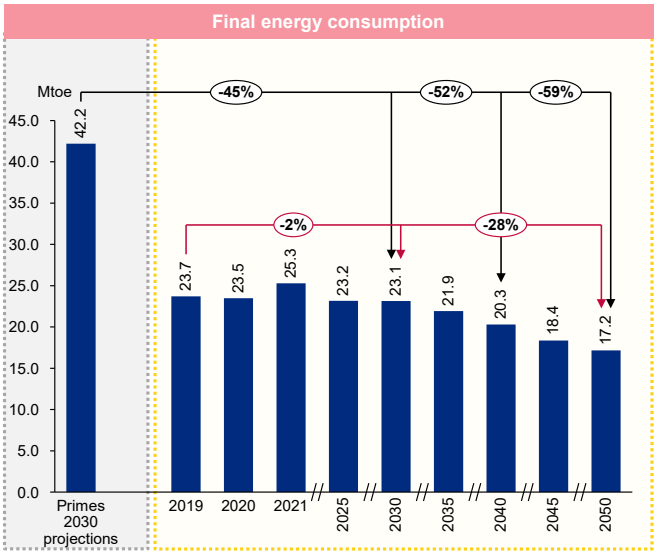


Figure 6. Estimated final energy consumption trajectory



Dimension energy security

Romania has conducted a comprehensive assessment to align its objectives with the goals of energy security. This assessment encompasses a wide range of initiatives, decisions, ongoing progress, and projections aimed at enhancing energy security. Key focus areas include increasing domestic energy supply and diversifying fuel imports.

Electricity Generation: Romania places a high priority on domestic energy supply. In the electricity generation sector, the aim is to diversify energy sources and reduce greenhouse gas emissions. The target for 2030 is to achieve an installed capacity of 30.4 GW, with approximately 76% originating from renewable sources (Figure 18). The plan also includes the construction of new nuclear and natural gas-powered facilities while maintaining electricity imports below 5%.

Natural Gas Supply: Romania is actively improving its natural gas transmission network, including interconnections, to diversify supplies and reduce dependence on Russia. This involves participation in various projects, such as BRUA, Eastring, ROHU – Second phase, and CESEC, to connect with future gas infrastructure projects.

Romania seeks to *reduce its import dependence* on crude oil, solid fossil fuels, and natural gas by 2030 through electrification, decommissioning coal power plants, and diversifying supply sources to achieve reduced respective import share targets, all while emphasizing the importance of diversification of the sources for import, especially for natural gas.

Romania is actively promoting *demand response consumption* to address energy demand fluctuations effectively. Additionally, the country is working on *energy storage* solutions, particularly power battery storage with a target of at least 240 MW or 480 MWh by 2025. The use of batteries and hydrogen technology is expected to enhance grid stability and support the integration of renewable energy sources.

Dimension internal energy market

Romania's comprehensive approach to its internal energy market under the Energy Union Strategy includes a focus on electricity interconnectivity, aiming to achieve the 2030 target of 15% interconnectivity through the expansion of cross-border capacity and increased installed capacity, alongside efforts to address price differentials. Key projects and modernization initiatives are outlined for both electricity and gas transmission infrastructure, with a strong emphasis on the completion of Projects of Common Interest. The country's plans extend to market integration, enabling non-discriminatory participation of renewable energy, demand response, and storage, while actively promoting self-generation and new technologies. Romania prioritizes flexibility in its energy system, with a focus on energy storage, particularly batteries, and aims to enhance the competitiveness of the retail energy sector, protect energy consumers, and address energy poverty. The

overarching objective is to create a more resilient, sustainable, and interconnected energy landscape in Romania.

Dimension Research, Inovation and Competitivnes

The National Strategy for Research, Innovation, and Smart Specialization 2022- 2027 articulates Romania's Vision 2030, built on four (interconnected) pillars (corresponding to the strategy's four general objectives), each with its own (indicators and) targets (Figure 14)[2]. If considering overall innovation performance (as mirrored in the EIS), Romania's goal is to become a moderate innovator (i.e., have an innovation performance between 70% and 100% of the EU average).

Table 1. Romania's National Strategy for Research, Innovation, and Smart Specialization 2022-2027 - main targets

Pillar / Indicator	Target
I. ***Romania develops, concentrates, and connects excellency to the scientific frontier and to societal challenges***	
• Number of doctorate graduates in relation to the number of graduates from higher education	10% increase
• Researchers per one thousand employed persons	0.12 annual growth (from 2.0 currently to 3.2 in 2030)
• Number of "leader" researchers (as defined in the 'EU framework for research careers') working in Romania in 2030	20% increase
• Number of WoS indexed articles in relation to the number of researchers • Research productivity (articles/researchers)	Proportional increase Increase from 0.85 to 1
• Quality of knowledge production ○ Articles in top 10% most cited articles ○ Articles in top 1% most cited articles ○ Number of triadic patents (as compared to 2021)	Increase from 7% to 10% (current EU average: 12%) Increase from 04% to 0.6% 50% increase
II. ***There is a large mobilization of enterprises towards innovation***	
• EIS performance	Achieving the status of Moderate Innovator
• Share of enterprises introducing new innovative products on the market	Increase from 2.9% to 6% (EU average in 2018: 13%)
• Share of innovative enterprises collaborating with research organizations	More than 7% (from 3.5% collaboration with universities and 1,5% collaboration with institutes in 2018)
• Number of public-private co-publications per one million inhabitants	Increase from 24.5 to 50 (current EU average: 95)
• Employment in innovative enterprises	Increase from 2.6% to 5% (EU average in 2018: 11.8%)
III. ***Innovation ecosystems associated with smart specializations support advancement in global value-added chains***	
• Growth rates of employment, value added, and exports in ecosystems associated with smart specialization areas and b**enefiting from major projects**	Twice as high - compared to the national average
IV. ***Internationalization and European and international cooperation***	
• Funding drawn from the Horizon Europe Program	Double - compared to funding drawn from Horizon 2020 (about 500 mill. euros between 2022 and 2027)
• Number of international scientific co-publications per one million inhabitants	Increase from 284 to 600 (current EU average: 1172)
• Public financing allocated to joint programs and European partnerships (including inter-regional investments in EU projects) – as percentage from the national public financing for R&D	Minimum 5%
• **Bilateral collaborations are complementary to these interventions and contribute to networking capacity building**	

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

The proposed policies and measures are designed to align with the established national targets and objectives, and will additionally contribute to achieving the EU goals. Table 11 provides an overview of how each policy or measure contributes to the various dimensions.

[2] Claudia, O. and Mihaela, H., 2022. Fostering Innovation in Romania. Insights from the Smart Specialization Strategies. *Studies in Business & Economics*, *17*(2).

Table 2. Interactions between the policies and measures

	Decarbo...	Efficienc...	Energy ...	Internal	R&I&C
PAM 1 Phasing out coal TPP	√	√	√	√	√
PAM 2 Introduction of green hydrogen into the energy system	√	√	√	√	√
PAM 3 Development of new CCGT capacities	√	√	√	√	√
PAM 4 Promotion of high-efficiency cogeneration capacities	√	√	√	√	√
PAM 5 Employing CCUS technologies	√			√	√
PAM 6 Implementation of the Kigali amendment in the Product uses as substitutes of ODS	√				√
PAM 7 Improvement of the industrial processes	√				
PAM 8 Setting an obligation for CO2 injecting and storing for the oil & gas industry	√				√
PAM 9 Reduction of emissions from enteric fermentation	√				
PAM 10 Increasing agricultural residues management	√				
PAM 11 Reduction of methane emission level from manure management and biogas production	√				√
PAM 12 Increasing the agrisolar production	√	√	√	√	√
PAM 13 Establishing integrated management of forest fires	√				
PAM 14 PV systems in agriculture	√				
PAM 15 Renewal of the agricultural machinery and equipment	√	√	√		
PAM 16 Establishment of agricultural associations	√				
PAM 17 Reduction of municipal waste per capita	√				
PAM 18 Increased recycling and biodegradable waste selection for composting	√				√
PAM 19 Improved incineration / co-incineration	√	√	√	√	√
PAM 20 Landfill gas flaring	√	√	√	√	√
PAM 21 Improved wastewater treatment	√				√
PAM 22 Increase of the domestic generation capacity from PV power plants	√	√	√	√	√
PAM 23 Increase of the domestic generation capacity from wind	√	√	√	√	√
PAM 24 Small hydro power plant	√	√	√	√	√
PAM 25 Rooftop PP	√	√	√	√	√
PAM 26 Installation of solar thermal collectors in the residential sector	√	√	√	√	√
PAM 27 Increase of the domestic generation capacity from Biomass and biogas CHP and PP	√	√	√	√	√
PAM 28 Development of market for more advance biofuels	√	√	√		√
PAM 29 Improve energy performance of public buildings at central level	√	√	√		√
PAM 30 Improve energy performance of public buildings at local level	√	√	√		√
PAM 31 Renovation of residential buildings	√	√	√		√
PAM 32 Renovation of commercial buildings	√	√	√		√

PAM 33 Rehabilitation of public lighting	√	√	√		
PAM 34 Development of energy services/market, ESCO	√	√	√		
PAM 35 Green procurement	√	√	√		
PAM 36 Energy audit and energy management	√	√	√		
PAM 37 Increased share of heat pumps	√	√	√		
PAM 38 Increased use of efficient technologies in the residential sector	√	√	√		
PAM 39 Replacement of conventional fuels with RES in manufacturing industries	√	√	√		
PAM 40 Increase technology efficiency in the industrial sector	√	√	√		
PAM 41 Increased share of alternative fueled cars	√	√	√		
PAM 42 Increased share of alternative fueled buses and trains	√	√	√		
PAM 43 Modernization of urban public transport	√	√	√		
PAM 44 Extension of the subway in Bucharest	√	√	√		
PAM 45 Increased share of alternative fueled trucks	√	√	√		
PAM 46 Modernization of railway, subway, naval and air transport	√	√	√		
PAM 47 Alternative mobility	√	√	√		
PAM 48 Support for the expansion and modernization of the electricity distribution network	√	√	√		
PAM 49 Increased use of nuclear energy	√	√	√		
PAM 50 Black Sea Corridor (TYNDP ID 138)	√		√	√	
PAM 51 Mid-Continental East corridor (TYNDP ID 144)	√		√	√	
PAM 52 HU-RO (TYNDP ID 259)	√		√	√	
PAM 53 North CSE Corridor (TYNDP ID 341)	√		√	√	
PAM 54 Georgia-Romania Black Sea interconnection cable project (TYNDP ID 1105)	√		√	√	
PAM 55 Increasing the interconnectivity between the eastern areas and the remaining of the interconnected power system.	√		√	√	
PAM 56 Integrating the output generated by powerplants in other areas (South, South-West, etc.)	√		√	√	
PAM 57 400kV OHL Suceava-Bălți	√		√	√	
PAM 58 Refurbishment and modernization of the existing substations	√		√	√	
PAM 59 Increasing the Natural Gas in Central-Eastern and South-Eastern Europe	√		√	√	
PAM 60 Daily withdrawal capacity increase in Bilciurești underground gas storage system (UGS)	√		√	√	
PAM 61 Electric energy storage capacities	√		√	√	
PAM 62 Development and use of fully-fledged national social assistance information system	√		√	√	
PAM 63 Ensuring implementation of just transition process	√		√	√	√

1.2 Overview of current policy situation

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

Romania's energy landscape stands at the intersection of tradition and transformation, reflecting both its historical reliance on conventional energy sources and its commitment to transitioning toward a sustainable, low-carbon future. As an active member of the European Union (EU), Romania aligns its energy system and policies with the overarching European energy framework, while also addressing its unique national energy challenges and opportunities.

Romania's Energy Mix: Romania's energy matrix is characterized by diversity, incorporating a mix of fossil fuels, renewables, and nuclear energy. Historically, Romania heavily depended on fossil fuels, particularly coal and natural gas, to meet its energy demands. The country's extensive coal reserves played a crucial role in ensuring energy security. Additionally, natural gas served as a vital energy source for both electricity generation and heating purposes, offering a cleaner alternative to coal.

In recent times, driven by EU directives and a growing emphasis on sustainability, Romania has embarked on a path to diversify its energy sources. Renewable energy has emerged as a key player in this transformation. The country has witnessed substantial growth in wind and solar energy production. Romania's geographical advantages, particularly the consistent and robust winds in regions like Dobrogea, have attracted investments and led to the development of significant wind energy projects. Likewise, abundant sunshine across the country has spurred the proliferation of solar photovoltaic installations on rooftops, solar farms, and commercial facilities.

Amid this transition, the Cernavodă Nuclear Power Plant has maintained its significance. Equipped with two operational reactors, both of Canadian design, the nuclear plant contributes substantially to Romania's electricity generation capacity. Nuclear energy is recognized for its low carbon emissions and reliability, further enhancing Romania's energy diversity.

This evolving energy mix underscores Romania's commitment to transitioning toward cleaner and more sustainable energy sources. This transition aligns not only with EU directives but also with global efforts to reduce greenhouse gas emissions and combat climate change. Romania's multifaceted energy portfolio reflects a pragmatic approach, striving to balance the nation's energy needs with environmental responsibility and the imperative of energy security.

EU Policy Context: Romania's energy ambitions are indivisibly linked with the EU's broader energy and climate policy objectives. The European Green Deal, a cornerstone of EU policy, commits the European Union to achieving carbon neutrality by 2050. This ambitious goal necessitates a profound transformation of the energy sector across member states.

Romania aligns itself with various EU directives and regulations encapsulated within the Clean Energy for All Europeans Package. These directives and regulations set the stage for the gradual transition to a cleaner, more sustainable energy system. Notable components of this package include the Renewable Energy Directive, which sets ambitious renewable energy targets for member states, and the Energy Efficiency Directive, emphasizing energy savings measures across sectors.

The Romanian National Energy and Climate Plan (NECP): In line with EU regulations, Romania has developed its National Energy and Climate Plan (NECP). This strategic document serves as a blueprint for aligning national energy and climate priorities with EU objectives, ensuring that Romania contributes to the EU's collective climate and energy goals while addressing its specific national challenges. Romania's NECP is structured along the following lines:

Renewable Energy Expansion: Romania is committed to a substantial increase in the share of renewable energy sources within its energy mix. This commitment extends to various renewable sources, including wind and solar power, biomass, and hydropower. Wind and solar energy projects are expected to proliferate, harnessing the nation's natural resources to generate clean electricity. The country's wind potential, especially in regions like Dobrogea, is a focal point for wind energy development. Biomass and hydropower are also part of the strategy, aiming to further diversify the renewable energy portfolio.

Fostering Energy Efficiency: The plan outlines a range of initiatives designed to enhance energy efficiency across sectors. These measures include the retrofitting of buildings for improved energy performance and the modernization of industrial processes to minimize energy consumption. The goal is to optimize energy use, reduce waste, and lower energy costs for businesses and households.

Emissions Reduction: Romania is committed to reducing greenhouse gas emissions across various sectors of its economy. This includes the industrial, transportation, and residential sectors. Efforts are focused on adopting cleaner technologies and practices, thereby mitigating the environmental impact of economic activities.

Just Transition: Recognizing the potential social and economic consequences of the energy transition, Romania's NECP emphasizes the importance of a "just transition." This entails supporting communities and workers affected by the shift to cleaner energy sources. Measures may include reskilling programs, job creation in renewable energy sectors, and social safety nets.

Infrastructure Development: Investment in energy infrastructure is a top priority in Romania's NECP. This encompasses enhancements to the energy grid, interconnection projects to improve regional and cross-border energy flows, and the development of electric vehicle charging networks. The aim is to ensure a robust and reliable energy system capable of accommodating the increased capacity of renewable energy sources and facilitating the transition to electric mobility.

These comprehensive strategies and initiatives underscore Romania's commitment to aligning with EU objectives for a sustainable and low-carbon energy future. Romania's NECP addresses not only the technical aspects of renewable energy integration and emissions reduction but also the social and economic dimensions, ensuring that the transition benefits both the environment and its citizens.

In conclusion, Romania's energy system and policy context are integral components of the broader European energy landscape. The Romanian NECP reflects the country's commitment to aligning with EU climate and energy goals while addressing its unique challenges and opportunities. Romania's journey toward a sustainable energy future not only supports its national interests but also contributes significantly to the EU's collective mission of combatting climate change and securing a clean, secure, and prosperous energy future for all Europeans.

In the table below the most relevant Romanian laws and government emergency ordinances in the energy and climate field are presented.

Table 3. Most relevant Romanian laws and government emergency ordinances for the energy and climate field

Title of the Law / Emergency Government Ordinance	Law / GEO Number and Date of Adoption	Regulatory scope
LAW on establishing social protection measures for the vulnerable energy consumers	No. 226/2021 from September 16, 2021 Amended 10 times with laws and GEOs	To protect vulnerable consumers from the increase in energy prices by granting subsidies for heating the homes, for energy consumption, for purchasing products and services for the improvement of the energy performance of buildings or for connection to the energy network. Under the Law, vulnerable consumers are defined as single people or families who, due to illness, age, insufficient income or isolation from energy sources, would benefit from social protection measures and additional services ensuring their minimum energy needs. The Law establishes further criteria for inclusion in the category of vulnerable energy consumers. An estimated 500,000 households will receive up to RON 500 (EUR 100) per month to pay bills during the cold season. **Financial measures** foreseen by this law consist of granting of aid intended to ensure the needs of minimal energy, more precisely: a) aid for heating the home; b) aid for energy consumption to cover part of the household's energy consumption throughout the year; c) aid for purchase, within a home, of energy-efficient equipment necessary for lighting, cooling, heating and providing hot water for consumption in the home, to replace household appliances with efficient ones, as well as for the

		use of means of communication that require energy consumption; d) aid for the purchase of products and services in order to increase the energy performance of buildings, or for connecting to energy sources. **Non-financial measures** foreseen by this law consist of access and connection facilities to energy sources available necessary to ensure minimum energy needs, including the prohibition of disconnection from energy sources for certain categories of vulnerable consumers, as well as transparent and accessible advice and information to the population regarding energy sources, costs and access procedures to them.
GOVERNMENT EMERGENCY ORDINANCE regarding the measures applicable to final customers in the electricity and natural gas market in the period April 1, 2022 - March 31, 2023, as well as for the modification and completion of some normative acts in the field of energy	No. 27/2022 from March 18, 2022 Approved with modifications with the Law no. 206/2022 Amended 11 times between 2022-2023 with laws and GEOs	Considering the situation determined by the price increase on the international electricity and natural gas markets, as well as the effects caused by these increases, it is necessary to institute temporary measures, so that the electricity and natural gas prices paid by customers final not to aggravate the level of energy poverty, but also taking into account the fact that during the state of alert economic operators faced problems determined by the existence of restrictions, the interruption of activity, the decrease in turnover, all these measures led to a blockage of these economic activities at the national level, which encumbers the possibility of bearing the additional costs determined by the price increase on the energy markets. Therefore, this Ordinance establishes: cap for the price of electricity for households and certain other categories, consumption ceiling (kWh/month) based on which benefits will apply and monetary compensation for the households' consumption of electricity and natural gas.
GOVERNMENT EMERGENCY ORDINANCE regarding some implementing measures of the Regulation (EU) 2022/1854 regarding an emergency intervention to address the problem of high energy prices	No. 186/2022 from December 28, 2022 Approved with modifications with the Law no. 119/2023 Amended twice in 2023	Considering the need to mitigate the direct economic effects of the increase in energy prices, taking into account the provisions of Council Regulation (EU) 2022/1854 regarding an emergency intervention to address the problem of high energy prices, which establish the obligation of member states to adopt and publish by December 31, 2022 , the measures to implement the temporary solidarity contribution on the surplus profits generated by Union companies and permanent establishments that carry out activities in the oil, natural gas, coal and refinery sectors.
LAW on Electricity and Natural Gas	No. 123/2012 from July 10, 2012 Amended 46 times with laws and GEOs	This law establishes the regulatory framework for activities within the electricity and thermal energy sector produced through cogeneration. The objectives of these activities include ensuring sustainable economic development, diversification of energy resources, fostering competitive electricity markets, providing non-discriminatory access to electricity networks, enhancing transparency in pricing, creating fuel safety reserves, facilitating interconnections with neighboring energy systems, improving market competitiveness, promoting renewable energy sources, and upholding environmental protection, security, and safety standards.
LAW on the establishing of the system for the promotion of energy production from renewable energy sources	No. 220/2008 from October 27, 2008 Amended 18 times with laws and GEOs	This law establishes a legal framework to expand renewable energy use by attracting investments in these resources that will enhance energy security, foster local and regional sustainable development and employment, reduce pollution, ensure possibilities for co-financing. The provisions of this law regulate the guarantees of origin, administrative procedures related to renewable

		energy projects, set grid connection rules, and establish sustainability criteria for biofuels and bioliquids. Additionally, the law introduces a system to promote electricity generated from renewable sources. This Law stimulated the development of the electricity production sector from renewable energy sources until 2016, but it cannot be invoked as legislation likely to lead to new investments in this sector
law on the integration of hydrogen from renewable and low-carbon sources in the industry and transport sectors (Hydrogen Law)	Law no. 237/2023 from June 2023	Hydrogen Law establishes obligations on fuel suppliers to provide fuels from renewable sources and sets minimum percentages of hydrogen from renewable sources in fuel used in Romania. The priority of the Hydrogen Law is to increase the country's energy production capacity and to strengthen Romania's energy security, thus achieving the targets set by Romania's National Recovery and Resilience Plan (PNRR) for regulating the hydrogen market in Romania. According to the Hydrogen Law, the fuel suppliers must ensure until 2030 that the energy value from the amount of non-biological renewable fuels supplied to the market in Romania and used in the transport sector during one year is at least equal to 5% of the energy content of all fuels supplied for consumption or market use in Romania. The Hydrogen Law is aligned with both the National Hydrogen Strategy and the European strategies for hydrogen development and REPowerEU.
GOVERNMENT EMERGENCY ORDINANCE on the decarbonization of the energy sector	No. 108/2022 from June 30, 2022 Amended 5 times with laws and GEOs	This emergency ordinance outlines a comprehensive framework for the gradual removal of electricity production from lignite and coal sources in the energy mix. It establishes timelines for shutting down and conserving energy facilities using these materials. The ordinance encompasses measures for the controlled reduction of coal and lignite-based electricity capacities, responsible decommissioning, closure and securing of related extraction sites, ecological restoration of closed plants and mining areas, and the facilitation of workforce transition and local economic support. Notably, the ordinance prohibits the commissioning of new electricity capacities based on lignite or coal, except for those with pre-existing licenses/permits issued prior to its enactment.
Law 334/2022 on phase out of coal TPP		Law 334/2022 sets a clear coal exit date, includes power plant closure benchmarks, introduces social protection measures, establishes governmental and advisory bodies to manage the implementation process and sets sanctions for non-compliance with the calendar.
GOVERNMENT EMERGENCY ORDINANCE on carbon capture storage	No. 64/2011 Approved with modifications with the Law no. 114/2013	Provides the institutional set-up and procedures for authorization, monitoring, and control of the granting exploration and storage permits for CO2 geological storage sites, which are issued by National Agency for Mineral Resources as competent authority both for CO2 geological storage and for hydrocarbon operations. The subject matter is further elaborated in the following bylaw: ▪ Procedure for granting the exploration permit for CO2 geological storage, issued in 2015 by ANRM ▪ Procedure for granting the CO2 geological storage permit issued through Decision 16/2017 of the ANRM President ▪ Guideline for preparing the documentation by operators/owners: Notification regarding the abandonment of offshore

		wells and disaffecting the facilities issued in December 2018 by the Regulatory Authority for Offshore Petroleum Operation in the Black Sea
LAW on Energy Efficiency	No 121/2014 from July 18, 2014 Amended 8 times with laws and GEOs	The purpose of this law is to create the legal framework for the development and application of the national policy in the field of energy efficiency in order to achieve the national objective of increasing energy efficiency. Policy measures in the field of energy efficiency are applied to the entire chain: primary resources, production, distribution, supply, transport and final consumption. The national indicative contribution regarding energy efficiency for the year 2030 shall be established in the integrated national plan in the field of energy and climate change 2021 - 2030. Ministry of Energy, i.e. the Energy Efficiency Department, an organizational structure within the ministry at the level of the central public authority, is mandated to develop and approve the primary and secondary policies and legislation in the field of energy efficiency.
Law Green Public Procurement	**No. 69/2016**	The law defines green public procurement as being "the process by which contracting authorities use environmental protection criteria to improve the quality of performances and optimize costs with short-, medium-, and long-term public procurement
Law on the energy performance of buildings	No. 372/2005	The law establishes minimum energy performance requirements for building renovation, minimum performance requirements for buildings with almost zero energy consumption.
GOVERNMENT EMERGENCY ORDINANCE on environment protection	No. 195/2005 from December 22, 2005 Approved with modifications with the Law no. 265/2006 Amended 29 times with laws and GEOs	This piece of legislation addresses the environmental protection, which is of major public interest, based on the principles and strategic elements that lead to sustainable development. The environment represents the set of conditions and natural elements of the Earth: air, water, soil, subsoil, characteristic aspects of the landscape, all atmospheric layers, all organic and inorganic matter, as well as living beings, natural systems in interaction, including the listed elements previously, including some material and spiritual values, quality of life and conditions that can influence human well-being and health. Environmental protection is the obligation and responsibility of central and local public administration authorities, as well as of all natural and legal persons. Central and local public administration authorities provide funds in their own budgets to fulfill the obligations resulting from the implementation of legislation in the field of environment and for environmental protection programs and collaborate with central and territorial public authorities for environmental protection in order to achieve them.
GOVERNMENT EMERGENCY ORDINANCE for supplementing the legal framework on the promotion of the use of energy from renewable sources and for amending and supplementing certain regulatory acts,	GEO 163/2022 from 6 December 2022	The Ordinance transposes the provisions of Art. 2-31, Art. 37 and Annex II, Annex III and Annexes V-IX of Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources and is primarily aimed at regulating the needs of both citizens and the private sector by aligning national policies with European policies and by accessing European funds for future investments in the renewable energy production sector.

GOVERNMENT EMERGENCY ORDINANCE on waste regime	No. 92/2021 from August 19, 2021 Approved with modifications with the Law no. 17/2023 Amended 5 times with laws and GEOs	In this piece of legislation, the Directive (EU) 2018/851 amending Directive 2008/98/EC on waste, is transposed. The objective is to regulate the efficient management of waste and promote prevention and reduction of waste generation, and if appropriate measures are not legally established it may lead to damage to the public interest, human health, as well as the interests and objectives the environmental policy regarding the conservation, protection and improvement of the quality of the environment. The specific objectives of this emergency ordinance is to ensure a high level of protection of the environment and the health of the population by establishing measures: ▪ prevention and reduction of waste generation and their efficient management; ▪ reduction of the adverse effects determined by the generation and management of waste; ▪ reducing the general effects determined by the use of resources and increasing the efficiency of their use, as essential elements for ensuring the transition to a circular economy and guaranteeing long-term competitiveness; and ▪ regarding the transport and traceability of waste.

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

Dimension 1: Decarbonization

Renewable Energy Development: Romania has promoted the development of renewable energy sources, such as wind, solar, and hydropower, to reduce carbon emissions. Feed-in tariffs, green certificates, and competitive auctions have incentivized renewable energy projects.

Carbon Pricing: Romania participates in the EU ETS, which puts a price on carbon emissions from large industrial installations, aligning with the EU's decarbonization efforts.

Dimension 2: Energy efficiency

Energy Efficiency Programs: Romania has introduced energy efficiency programs and initiatives aimed at reducing energy consumption in various sectors, including industry, transportation, and buildings. These efforts align with the EU's energy efficiency objectives.

Energy Performance of Buildings: Romania has implemented measures to improve the energy performance of buildings, including stricter energy efficiency standards for new constructions and renovations.

Dimension 3: Security of energy supply

Diversification of Energy Sources: Romania has been working to diversify its energy sources by increasing the share of renewable energy and enhancing energy efficiency. This diversification contributes to energy security by reducing dependence on a single energy source.

Natural Gas Infrastructure: Romania has invested in expanding its natural gas infrastructure, including pipelines and interconnections with neighboring countries. This enhances energy security by facilitating the supply of natural gas from multiple sources.

Dimension 4: Internal Energy Market

Market Liberalization: Romania has implemented measures to liberalize its energy market, allowing for greater competition and choice for consumers. This aligns with the EU's goal of creating a well-functioning internal energy market.

Integration with Regional Markets: Romania has integrated its electricity and gas markets with neighbouring countries, contributing to a more interconnected European energy market.

In addition to the most relevant Romanian laws and government emergency ordinances in the ANNEX I of the NECP the existing policy that are implemented are presented. These policies and measures are already reported in the Annex IX of the NECP progress report.

As one of the most important section for the realization of the NECP is now to deal with the energy poverty. Having this in mind, in this section attention is given to the energy poverty.

1. **ROMANIA - Present policy and planning documents and legal framework on energy poverty and vulnerable energy consumers**

Information on policy and planning documents

The 2021-2030 NECP is the most relevant policy and planning document still in force that deals with the subject matter. It notes that on the one hand, the progress of Romania in the combating of energy poverty and outlines, on the other hand, the need to recover the lagging behind the EU average. The national objective in this regard is thus to reduce the energy poverty rate and to ensure the protection of the vulnerable consumer in order to safeguard human rights, considering that the EU average rate for 2015 was achieved.

The trans-sectoral policies and measures in the 2021-2030 NECP foresee:

- Regulating and defining the vulnerable consumer and means for their financing, which prior to the adoption of the present NECP was already done through the Government Emergency Ordinance No. 1/2020 regarding certain fiscal-budgetary measures and amending and supplementing certain legislative acts, and ANRE's Order No. 235/2019 approving the Regulation for supply of electricity to final consumers;
- The Ministry of the Economy, Energy and the Business Environment to collaborate with the Ministry of Labour and Social Protection to prepare the national action plan for energy poverty cases, which would define the critical situations and the consumers who cannot be disconnected in such situations, and specifies the recovery of related costs by operators under a specific procedure approved under a Government decision on a proposal from ANRE;
- Providing for non-financial support for vulnerable low-income consumers by providing for the possibility of payment rescheduling (staggered payment of the electricity bill);
- Implementing the National Social Assistance Computer System;
- Granting aids for home heating for all the four heating systems: heat, natural gas, electricity and wood, coal and oil fuels, to vulnerable consumers;
- Subsidies for heat without differentiating consumers under vulnerability criteria, which are applied directly to the electricity price; and
- Granting aids to reduce energy poverty that consist of social benefits granted from the State budget through the budget of the Ministry of Labour and Social Protection and the family maintenance allowance, and aids to secure the minimum income guaranteed for families and single persons under poverty.

Information on the present primary and secondary legislation most relevant for the energy poverty and vulnerable energy consumers

Following the adoption of the present NECP, the following legal acts addressing directly or being relevant for the vulnerable energy consumers have been adopted and implemented:

1. **LAW on establishing social protection measures for the vulnerable energy consumers**
    - Adopted on: September 7, 2021
    - Entered into force on: November 1, 2021

- Main objective: To protect vulnerable consumers from the increase in energy prices by granting subsidies for heating the homes, for energy consumption, for purchasing products and services for the improvement of the energy performance of buildings or for connection to the energy network. Under the Law, vulnerable consumers are defined as single people or families who, due to illness, age, insufficient income or isolation from energy sources, would benefit from social protection measures and additional services ensuring their minimum energy needs. The Law establishes further criteria for inclusion in the category of vulnerable energy consumers. An estimated 500,000 households will receive up to RON 500 (EUR 100) per month to pay bills during the cold season. Key features of the system are:
    - The **financial measures** foreseen by this law consist of granting of aid intended to ensure the needs of minimal energy, more precisely: a) aid for heating the home; b) aid for energy consumption to cover part of the household's energy consumption throughout the year; c) aid for purchase, within a home, of energy-efficient equipment necessary for lighting, cooling, heating and providing hot water for consumption in the home, to replace household appliances with efficient ones, as well as for the use of means of communication that require energy consumption; d) aid for the purchase of products and services in order to increase the energy performance of buildings, or for connecting to energy sources.
    - A **maximum monthly average income for the beneficiaries of the assistance**: RON 1386 (EUR 277) per person within a family and RON 1445 (EUR 410) for a single person.
    - The establishment of the level of assistance by percentage compensation applied to a differentiated reference value depending on the heating system. Such compensation is between 10% and 100% depending on income. The grant will be settled directly in the invoice price.
    - **Non-financial measures** foreseen by this law consist of access and connection facilities to energy sources available necessary to ensure minimum energy needs, including the prohibition of disconnection from energy sources for certain categories of vulnerable consumers, as well as transparent and accessible advice and information to the population regarding energy sources, costs and access procedures to them.
    - The Law foresees the **minimum consumption limit** to be established by order joint of the President of the National Energy Regulatory Authority and the Minister of Labour and Social Protection.

2. **GOVERNMENT EMERGENCY ORDINANCE no. 27/2022 regarding the measures applicable to final customers in the electricity and natural gas market in the period April 1, 2022 - March 31, 2023, as well as for the modification and completion of some normative acts in the field of energy**

- Adopted on: March 18, 2022
- Approved with modifications with the Law no. 206/2022
- Amended: 11 times between 2022-2023
- Main objective / content: Considering the situation determined by the price increase on the international electricity and natural gas markets, as well as the effects caused by these increases, it is necessary to institute temporary measures, so that the electricity and natural gas prices paid by customers final not to aggravate the level of energy poverty, but also taking into account the fact that during the state of alert economic operators faced problems determined by the existence of restrictions, the interruption of activity, the decrease in turnover, all these measures led to a blockage of these economic activities at the national level, which encumbers the possibility of bearing the additional costs determined by the price increase on the energy markets. Therefore, this Ordinance establishes: cap for the price of electricity for households and certain other categories, consumption ceiling (kWh/month) based on which benefits will apply and monetary compensation for the households' consumption of electricity and natural gas.

3. **GOVERNMENT EMERGENCY ORDINANCE no. 186/2022 regarding some implementing measures of the Regulation (EU) 2022/1854 regarding an emergency intervention to address the problem of high energy prices**

   - Adopted on: December 28, 2022
   - Approved with modifications with the Law no. 119/2023
   - Amended: twice in 2023

Main objective / content: Considering the need to mitigate the direct economic effects of the increase in energy prices, taking into account the provisions of Council Regulation (EU) 2022/1854 regarding an emergency intervention to address the problem of high energy prices, which establish the obligation of member states to adopt and publish by December 31, 2022 , the measures to implement the temporary solidarity contribution on the surplus profits generated by Union companies and permanent establishments that carry out activities in the oil, natural gas, coal and refinery sectors.

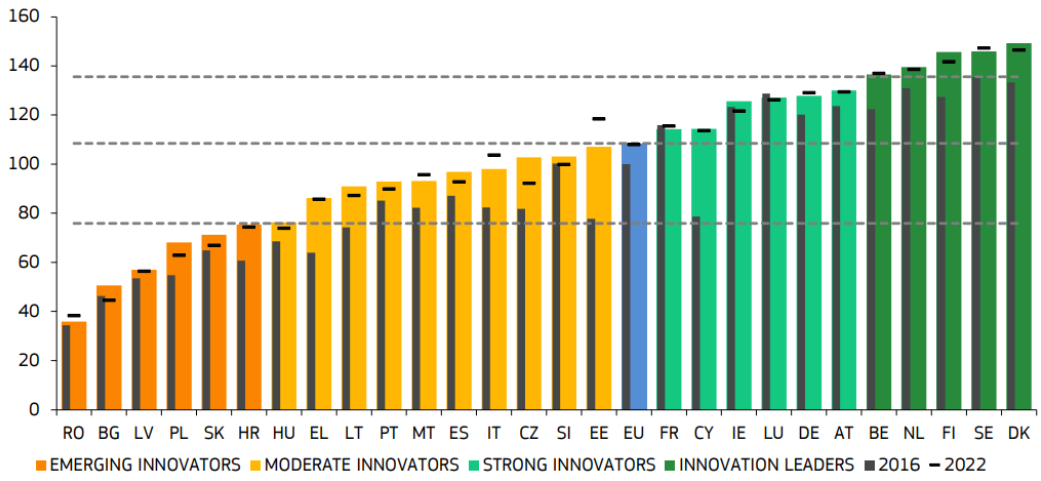
Dimension 5: research, innovation and competitiveness

Research and Innovation Funding: Romania has allocated funding for research and innovation in clean energy technologies, participating in EU research programs aimed at advancing energy innovation.

However, despite these efforts, recent data, such as the Summary Innovation Index from the European Innovation Scoreboard 2023 and the EU Regional Competitiveness Index 2.0 in 2022, presents a challenging picture for Romania.

Namely, the Summary Innovation Index places Romania the last among the EU countries (Figure 7)[3]. It is similar with the EU Regional competitiveness index 2.0 where all NUT 2 regions performance is on the bottom of the list, except for the Bucureşti-Ilfov region that is close to EU average[4].

Figure 7. Performance of EU Member States' innovation systems



In order to address low innovation potential of the country and to increase competitiveness of Romanian economy in 2022 the Government adopted the National Research, Innovation and Smart Specialization Strategy (NRIS3) developed by the Ministry of Research, Innovation and Digitization (MRID). This Ministry, among other activities also. have the role for:

- Development of policies related to the research, innovation and smart specialization in Romania,
- Coordination of the national funding programs associated with CDI

[3] European Commission, Directorate-General for Research and Innovation, Hollanders, H., European Innovation Scoreboard 2023, Publications Office of the European Union, 2023, https://data.europa.eu/doi/10.2777/119961

[4] https://ec.europa.eu/regional_policy/assets/regional-competitiveness/index.html#/

- Development of the legal framework associated with these processes
- Intermediate body for implementation of the Operational Program for Smart Growth, Digitization and Financial Instruments 2022-2027.

NRIS3 is strongly correlated with the National Strategy for Sustainable Development of Romania 2030, contributing directly to the target regarding "Strengthening scientific research, modernizing the technological capacities of the industrial sectors; encouraging innovations and significantly increasing the number of employees in research and development and increasing public and private spending on research and development'. Furthermore, through the Specific Objective - Connecting research and innovation activities with societal challenges - Strategic Research Agenda, NRIS3 supports the contribution of science and research to addressing the challenges of sustainable development, the content of this agenda representing a contextualization of these challenges for Romania.

Competitiveness in Renewable Energy: Romania has taken steps to enhance the competitiveness of its renewable energy sector, ensuring that it can compete effectively within the broader European energy landscape.

Action needed: To be checked and amended with the specific policies and measures.

III. Key issues of cross-border relevance

Several significant cross-border concerns must be considered as Romania strives to attain its energy and climate objectives, recognizing the necessity of collaborative efforts with neighboring countries within the broader EU context. These critical cross-border issues encompass:

Energy Market Integration: Ensuring the harmonization of energy markets and regulations with neighboring countries is crucial for promoting efficient cross-border energy trade and enhancing energy security. Romania should cooperate on market coupling, regulatory alignment, and infrastructure development to facilitate the free flow of electricity and natural gas across borders.

Interconnection Projects: Investing in cross-border energy infrastructure, such as electricity interconnectors and gas pipelines, is vital for increasing energy resilience and enabling the integration of renewable energy sources. Collaborative efforts with neighboring countries are needed to accelerate the development of these projects.

Renewable Energy Trade: Facilitating the trade of renewable energy, particularly excess electricity generated from wind, solar, and hydropower, can benefit both Romania and its neighbors. Bilateral agreements and regional initiatives can promote the exchange of clean energy, contributing to decarbonization efforts.

Energy Efficiency Cooperation: Collaborative efforts with neighboring countries in energy efficiency measures can help reduce energy consumption and greenhouse gas emissions. Sharing best practices, technologies, and policy frameworks can enhance regional sustainability.

Grid Resilience: Coordinating grid operations and planning with neighboring countries is essential for ensuring the reliable and resilient transmission of electricity. This becomes especially crucial as renewable energy capacity grows and cross-border electricity flows increase.

Emission Reduction Targets: Aligning emission reduction targets with neighboring countries and EU-wide objectives is essential for effective climate action. Consistency in emissions reduction efforts can prevent "carbon leakage" and maintain a level playing field for businesses.

Cross-Border Environmental Impact: Ensuring that energy projects and policies do not have adverse cross-border environmental impacts is critical. This includes evaluating the effects of infrastructure development and emissions on neighboring ecosystems and populations.

Cross-Border Data Sharing: Collaborating with neighboring countries on data sharing related to energy consumption, emissions, and renewable energy potential can improve the accuracy of assessments and the effectiveness of policy measures.

Security of Supply: Coordinating with neighboring countries on energy security measures, such as emergency response plans and crisis management, is essential to address potential supply disruptions collectively.

Just Transition in Border Regions: Ensuring a just transition for communities and workers in border regions affected by energy-related changes is crucial. Cross-border cooperation can help identify and implement strategies to support affected populations.

Incorporating these cross-border considerations into the Romanian NECP can enhance regional energy security, contribute to the EU's energy and climate objectives, and promote sustainable and collaborative approaches to addressing shared challenges.

IV. Administrative structure of implementing national energy and climate policies

The administrative framework responsible for executing national energy and climate policies is composed of ministries and various institutions, each assigned specific roles related to the implementation of existing strategies and plans, as well as those in development within the energy and climate change domains.

In the context of implementing the NECP, the principal stakeholders include:

- Ministry of Energy
- Ministry of Environment, Water and Forests
- Ministry of Economy, Entrepreneurship, and Tourism
- Ministry of Finance
- Ministry of Transport and Infrastructure
- Ministry of Agriculture and Rural Development
- Ministry of Development, Public Works and Administra tion
- Ministry of Investments and European Projects
- Ministry of Labour and Social Protection
- Ministry of Education
- Ministry of Research, Innovation and Digitalization
- The National Energy Regulatory Authority
- Key energy companies such as Transelectrica, Transgaz, and OPCOM

Additionally, there is a provision for involving other entities to be designated through legislative acts and ministerial orders. These entities are mandated to undertake specific responsibilities as part of the broader efforts to execute the NECP and contribute to its success.

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

I. Involvement of the national parliament

In the public consultation process for the previous NECP, the Chamber of Deputies of the Romanian Parliament provided recommendations with an aim to enhance Romania's energy and climate planning, including:

- Align electricity forecasts with official energy strategies.
- Match renewable energy targets with EU funding for grid enhancement.
- Identify European funding sources and develop investment plans for national transmission systems.
- Strengthen cybersecurity for digital innovations in energy systems.
- Implement congestion management in line with EU regulations.
- Regularly update the INECP with technology trends, costs, and funding sources.
- Incorporate ANRE orders and decisions while adhering to legislation.
- Develop energy storage capacities and backup systems.
- Ensure production-consumption balancing without compromising safety.
- Create action plans for INECP implementation, including coal region transition and energy efficiency.

In the first process of revision, the comments from different intitusion were received and addressed in the NECP. The following institutions provided comments:

1. Institute of national statistics
2. ANRE
3. Ministry of Environment, Water and Forests
4. Transelectrica
5. Ministry of Transport and Infrastructure
6. Ministry of Agriculture and Rural Development
7. Ministry of Labour and Social Protection
8. Ministry of Development, Public Works and Administra tion
9. Ministry of Investments and European Projects
10. Ministry of energy

II. Involvement of local and regional authorities

The Ministry of Energy ensures the involvement of local and regional authorities by including them in the NECP inter-institutional working group, participating in all stages of elaboration and review.

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

IV. Consultations of other Member States

To be finalized after completion of the overall process.

V. Iterative process with the Commission

To be finalized after:

- submission of the first draft,
- review of the Commission,
- consultation and revision (possible involvement of stakeholders)
- submission of the revised version

1.4 Regional cooperation in preparing the plan

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

1 Decarbonisation

- **Renewable Energy Integration**: Member States collaborate on the integration of renewable energy sources into the European grid. This involves setting collective targets for renewable energy capacity, sharing best practices, and planning cross-border renewable energy projects. Romania would need to coordinate its renewable energy deployment with neighboring countries to ensure a seamless flow of clean energy across borders.
- **Emissions Reduction Targets:** EU Member States work together to set and achieve emissions reduction targets. They align their efforts to ensure that the collective EU target for greenhouse gas reductions is met. Romania must coordinate its national emissions reduction strategies with those of other Member States to contribute effectively to the EU's climate goals.
- **Carbon Pricing and Trading:** The EU Emissions Trading System (EU ETS) is a cornerstone of decarbonization efforts. Member States coordinate their approaches to carbon pricing, emissions allowances, and the allocation of permits. Romania participates in this common market for carbon, which encourages emissions reductions across borders.
- **Just Transition:** Planning for a just transition in coal-dependent regions involves cooperation between Member States. Romania, like other countries, works with the EU to secure funding and support for affected communities and workers as it transitions away from coal and other high-emission industries.
- **Long-Term Climate Strategies:** EU Member States are required to develop long-term climate strategies. These strategies outline the path to achieving carbon neutrality by 2050. Romania's strategy aligns with those of other Member States and contributes to the EU's overall climate objectives.

2 Energy efficiency

- **Energy Efficiency:** Coordinated planning involves sharing experiences and strategies to improve energy efficiency across sectors. Member States cooperate to develop policies, programs, and initiatives aimed at reducing energy consumption and emissions. Romania collaborates on energy efficiency measures with a focus on cross-border opportunities.

3 Security of supply

- **Interconnection Projects:** The development of cross-border electricity and gas interconnectors is a crucial element of coordinated planning. These projects aim to improve energy security, facilitate the exchange of electricity and natural gas, and enhance the integration of renewable energy. Romania participates in regional initiatives to plan and implement such interconnection projects.

4 Internal energy market

- **Energy Market Integration:** Member States work towards a fully integrated European energy market. This includes coordinated planning for electricity and gas markets, regulatory alignment, and cross-border trade facilitation. Romania participates in regional electricity and gas markets and interconnections to strengthen energy market cooperation.

5 Research, innovation and competitiveness

- **Research and Innovation**: EU Member States jointly fund research and innovation projects related to decarbonization. Romania participates in Horizon Europe and other EU research programs to promote technological advancements and solutions that support decarbonization goals.

Coordinated planning on these elements is essential to ensure that Romania, along with other EU countries, meets its decarbonization targets, contributes to the EU's climate objectives, and fosters a collaborative approach to addressing the global challenge of climate change.

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

The quintessential importance of regional cooperation in the wake of the ongoing War in Ukraine, the threat of increased volatility in the Natural Gas and Electricity markets and the fast-paced transition to Net-Zero, is clearly discernible. In that spirit, within the process of drafting the Integrated National Energy and Climate Plan, the need for maintaining a consolidated and unified approach to setting the targets and policy proposals within each of the five pillars of the NECP has been addressed.

The topic of regional cooperation has been central within the preparatory (drafting) phase of the NECP, the relevant regional and international projects' aims and targets – which fall under the lines of this NECP have been considered. Policies and legislation with EU-wide impact have also had a strong position in drafting the National Climate and Energy targets.

As an active participant in multiple projects and/or initiatives intended to strengthen the EU's security of supply, RES deployment, the regional market integration and etc., Romania has been able to both contribute and also learn from its surrounding neighbours and EU partners. In that spirit, numerous specific policies, and measures throughout the NECP have been drafted – to reflect the aspiration and dedication of the Romanian government to maintain and contribute to the regional and EU-wide development. Subsequently, the existing regional cooperation in the relevant areas has been emphasized within the NECP and their foreseen impacts and purposes have been detailed.

In that context, within the domain of the **Energy Efficiency** dimension – the participation and work contribution to and of the Energy Saving Policies under Article 7 of the Energy Efficiency Directive (ENSMOV) project has been underlined.

In the domain of the **Energy Security** dimension – the expected benefits as well as the contribution of the Romanian side to the implementation of the BRUA and Eastring projects as well as the work conducted within the Central and South-Eastern Europe Connection Initiative (CESEC) are referenced, among other important regional cooperation examples.

With relevance to the **Energy Infrastructure** dimension – the presently listed projects within ENTSO-E's Ten-Year Network Development Plan 2022 (TYNDP 2022) as well as relevant Projects of Common Interest (PCI's) from the European Commission's Fifth List of PCI's, which impact the grid infrastructure development in Romania have been referenced. In addition to that, project specific measures and ambitions, stemming from these investment clusters have been included as Policies and Measures within the domain of this dimension.

Lastly, the totality of all aspirations set within this NECP unequivocally voice out support In the pursuit and the maintaining of long-lasting fruitful relationships with relevant stakeholders from the region and beyond. The sustenance of high-level regional cooperation between all concerned institutions within the Romanian system and the regional partners is crucial in fulfilling the set targets and general ambition of this NECP.

2. NATIONAL OBJECTIVES AND TARGETS

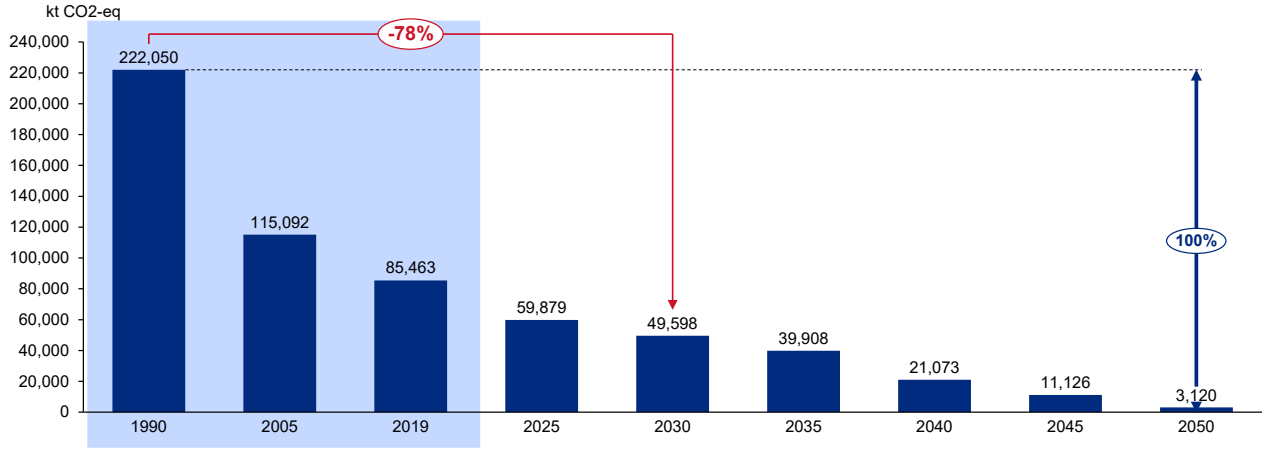
2.1 Dimension decarbonisation

2.1.1. GHG emissions and removals

I. The elements set out in point (a)(1) of Article 4

The economy wide GHG emission reduction target for Romania is 78% in 2030 compared to the reference of 1990 (Figure 8). The indicative trajectory shows that by 2019, Romania already has achieved a reference point of 79% of the total GHG reduction target and 94% will be achieved in 2025. In 2050, the goal is to reach around 100% emission reduction, compared to 1990 level.

Figure 8. Indicative targets and trajectory for GHG emissions reduction

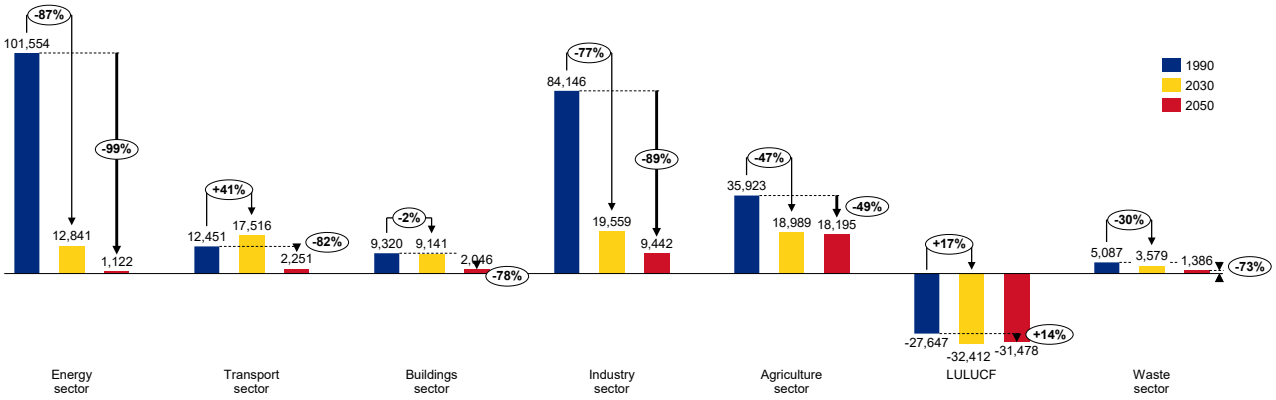


II. Where applicable, other national objectives and targets consistent with the Paris Agreement and the existing long-term strategies. Where applicable for the contribution to the overall Union commitment of reducing the GHG emissions, other objectives and targets, including sector targets and adaptation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

In order to achieve the target for GHG emissions reduction, sectoral ***objectives*** are set for *2030* relative to 1990 level (Figure 9):

- *Energy sector* – 87% GHG emission reduction (mainly through the gradual decommissioning of coal and lignite fired power plants and building RES capacities)
- *Transport sector* – no more than 41% GHG emission increase (mainly by increasing the share of hybrid, plug-in hybrid and electric vehicles)
- *Buildings sector* - 2% GHG emission reduction (mainly by improving the buildings performance and increasing the share of heat pumps and solar thermal collectors)
- *Industry sector* – 77% GHG emission reduction (mainly achieved by reduction of usage of fossil fuels, and their replacement with electricity and RES and improvement of the efficiency of the technologies)
- *Agriculture* – 47% GHG emission reduction (by appropriate Livestock diet and feed management)
- *LULUCF* – 17% GHG removals increase (mainly through appropriate forest fires management)
- *Waste* – 30% GHG emissions reduction (by proper reduction, reusage and recycling of the waste)

Figure 9. Sectoral objectives for 2030 and 2050 relative to 1990 level



2.1.2. Renewable energy

I. The elements set out in point (a)(2) of Article 4

The results from this NECP show that Romanian's objective for the proportion of renewable energy in gross final consumption of energy by 2030 could reach 36% (as depicted in Figure 10), which is above the EU commission target set for Romania (34%). According to the indicative trajectory, it is anticipated that by 2025, Romania could reach 32%. The highest contribution for reaching this objective, is attributed to the increased capacities for electricity generation from wind and solar energy, as well as the heat pumps for heating and cooling (Figure 11). The biomass will remain to have dominant role, but it share will decrease from 54% in 2022, to 39% in 2030.

Figure 10. Share of energy from renewable sources in gross final consumption of energy, with an indicative trajectory

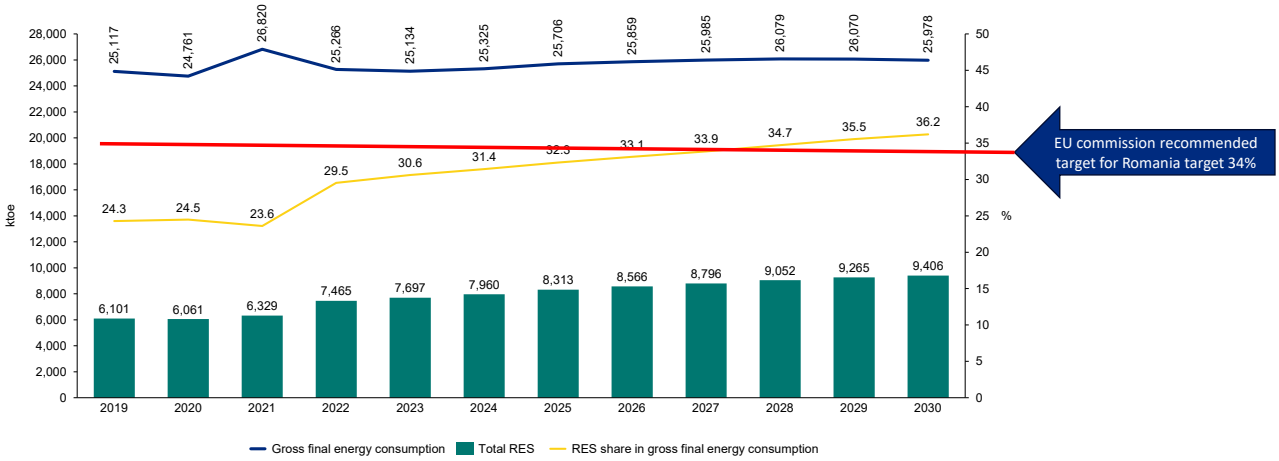
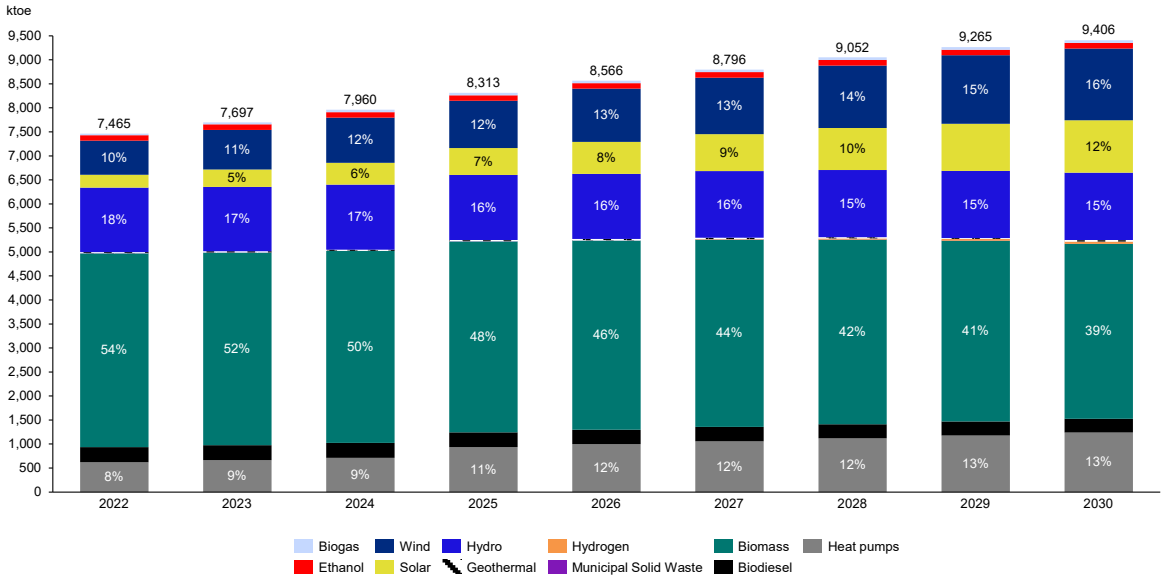


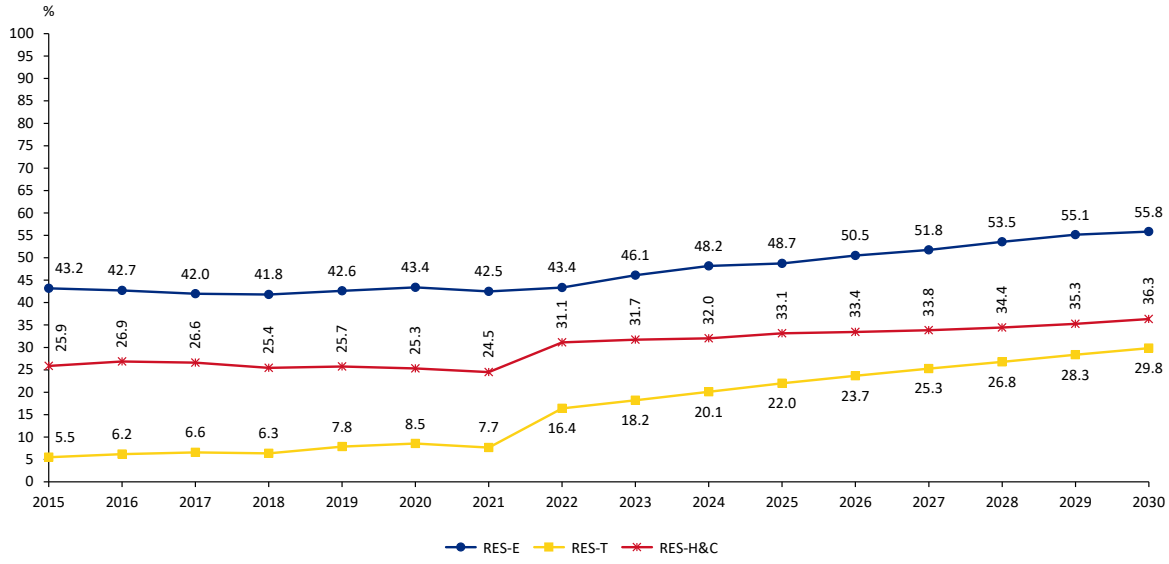
Figure 11. Consumption of RES and share of RES by fuel, with an indicative trajectory



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

The estimated trajectories for the share of RES in the *transport sector* show that it will reach *29.8%* in 2030, which will be obtained mainly by increasing the use of electricity in this sector (Figure 12). The RES share in the *electricity sector* will also increase by 2030, reaching a point of *55.8%* in 2030, as a result of the construction of new RES (mainly wind and solar) capacities for electricity generation. On the other hand, due to the decreased use of biomass, especially in the rural areas, which will be replaced by cleaner technologies, the RES share in the *heating and cooling* sector will slightly increase throughout the whole analyzed period, reaching *36.3%* in 2030. Although the biomass is considered as renewable source, it is envisioned that its consumption will be reduced since conservation of LULUCF absorptions is of great importance, as well as due to the adverse air quality consequences of biomass consumption. The biomass stove will be replaced mainly by clean heat pumps which are considered as renewable technology, too.

Figure 12. Estimated trajectories for the share of renewable energy in final energy consumption in the electricity, heating and cooling and transport sector



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

As previously stated, in order to reach the objective for the RES share in the electricity sector, the major component are the construction of new solar and wind capacities (Figure 13 and Figure 14). Therefore, it is assumed, that the share of electricity generated from hydro power plants in the gross final energy consumption will be reduced from around 64% in 2020, to 35% in 2030. On the other hand, wind will have the highest share of around 37%, followed by solar with around 24% share in the gross final energy consumption. This can be achieved by constructing a total of around *30.5 GW of solar power plants* (both land and rooftop) and *16 GW of wind power plants in 2050*.

Figure 13. Estimated trajectory by RES technology in gross final energy consumption, electricity sector

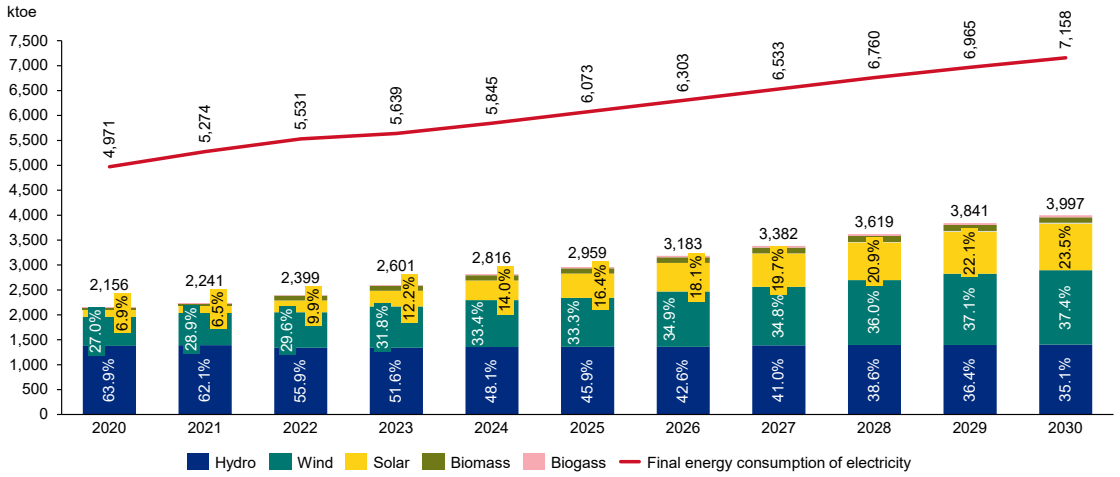
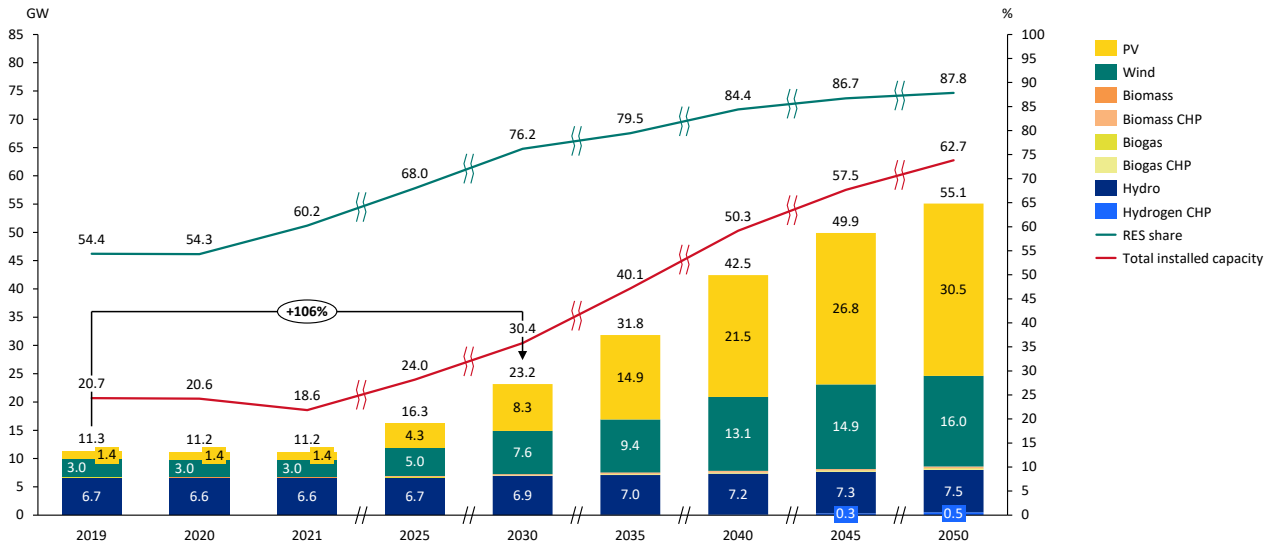


Figure 14. Trajectory of the installed capacity from RES for electricity production, by technology

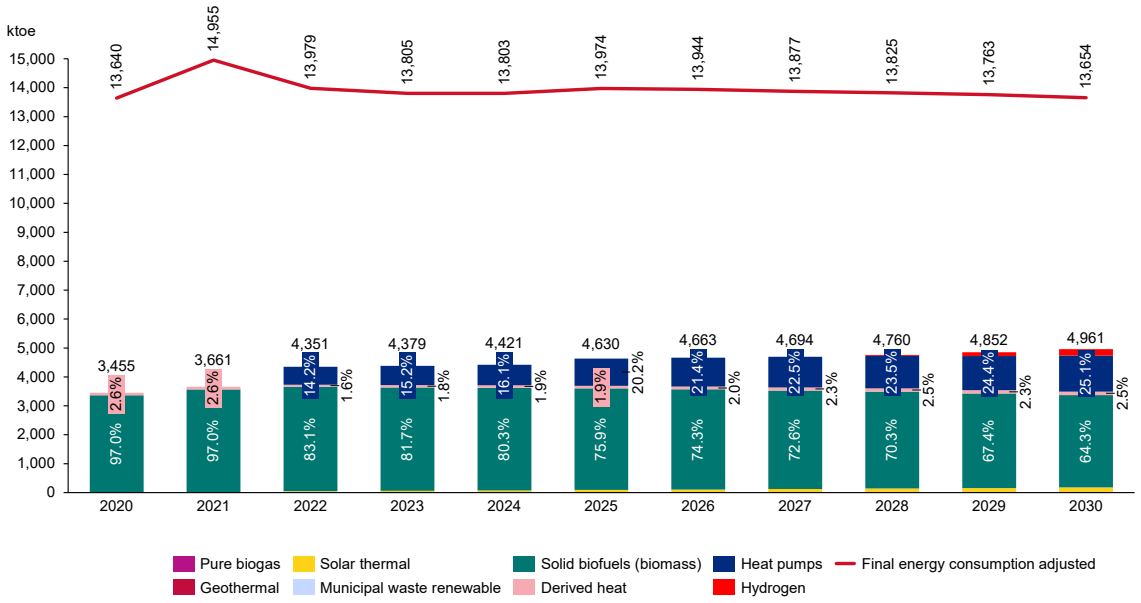


Note: after 2035 the natural gas power plants will run on hydrogen which lead to additional "RES" capacities. With this the total RES share in 2050 will be 95%. Remaining 5% are nuclear.

In order to reach the trajectory for the RES share in the heating and cooling sector for 2030 it is necessary to replace the biomass with clean technologies (Figure 15). As explained, While biomass is categorized as a renewable source, there is a plan to decrease its usage. This reduction is driven by the need to preserve Land Use, Land-Use Change, and Forestry (LULUCF) absorptions, and also to address the negative air quality effects associated with biomass consumption. The intention is to primarily replace biomass share in the gross

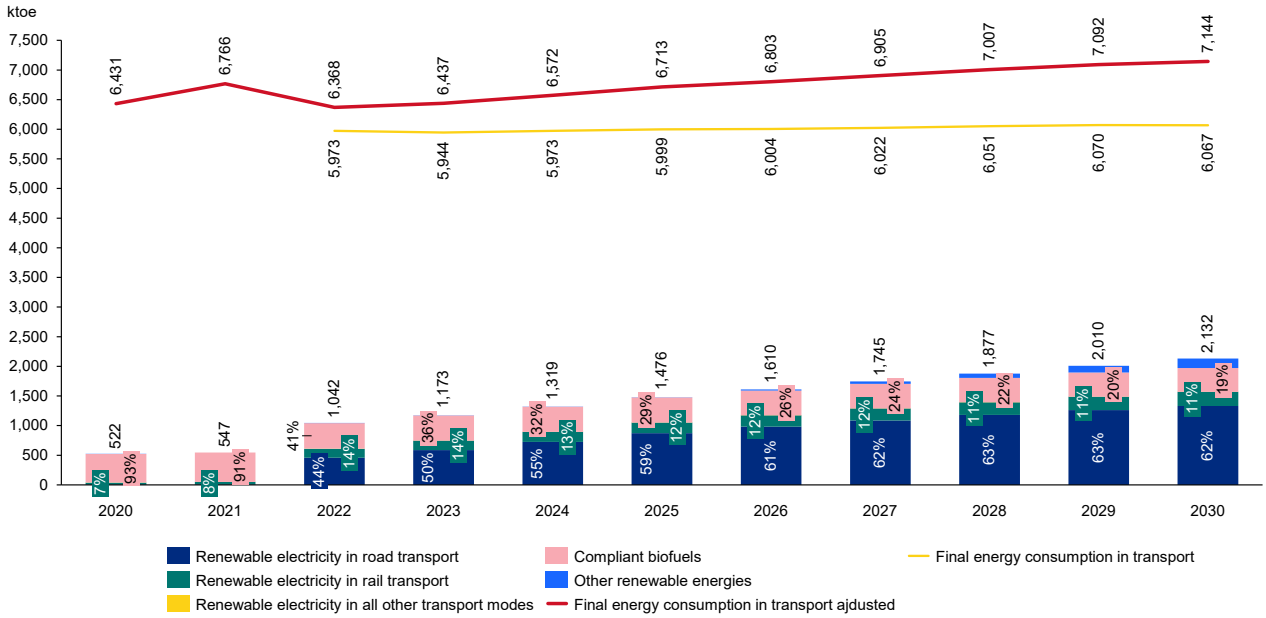
final energy consumption from 97% in 2020 to 64% in 2030. On the other hand, the share of heat pumps, which are also recognized as a renewable technology, will reach 25% in 2030.

Figure 15. Estimated trajectory by RES technology in gross final energy consumption, heating and cooling sector



The target for the RES share in the transport sector in 2030 will mainly be achieved by the electrification of this sector, so that the renewable electricity will have a share of more than 70% in 2030 (Figure 16). Additionally, the compliant biofuels will also have a significant role, with a share of 19% in 2030.

Figure 16. Estimated trajectory by RES technology in final energy consumption, transport sector



Note: According to the provisions of Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources, final energy consumption in transport presented in Figure 16 includes the electricity consumption in the transport sector, which is also included in Figure 13. depicting gross final energy in electricity. Adjusted consumption is calculated according to Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources and Share tool of EUROSTAT)

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.

The estimated trajectory on bioenergy demand shows that the biomass will remain the main fuel used (Figure 11). The consumption in 2030 of the biomass will remain at a similar level as in 2021, so its share will remain around 90% throughout the analyzed period. On the other hand, the projections for the sinks of the forestry sector are pretty conservative (Figure 12). It is assumed that the sinks will remain at a similar level as the recorded sinks in 2019-2020, according to the Romanian NIR from 2022. It should be noted that the sinks represented in Figure 12 for the period 2019-2021 are according to the Romanian NIR from 2023 in which a revision of the sinks was made for the whole period up to 2021. However, we remain of the opinion that the lower risk data should be taken, and that absorptions from this sector should not be less than 24,342 ktCO2-eq in 2030.

Figure 17. Estimated trajectory on bioenergy demand, disaggregated by fuels

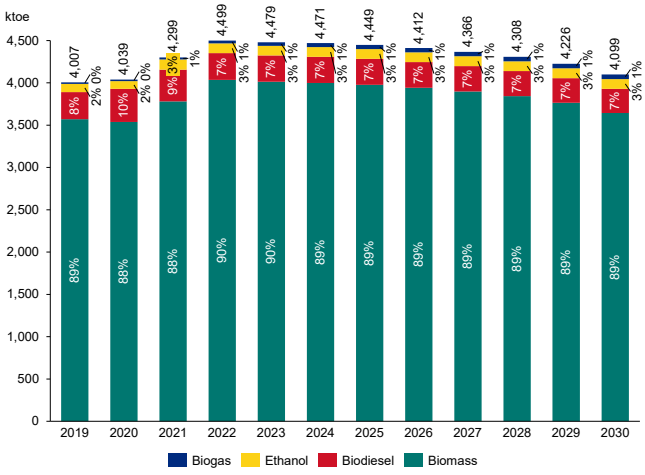
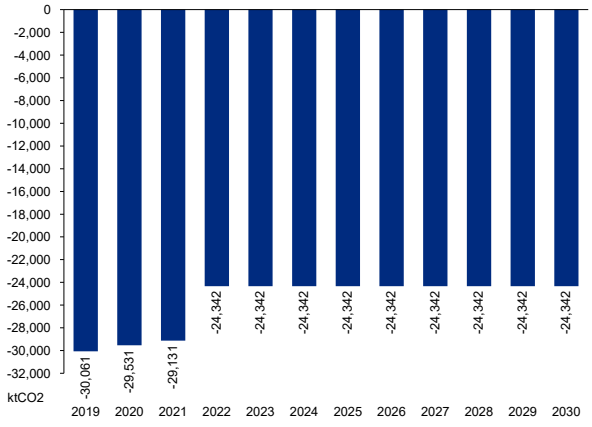
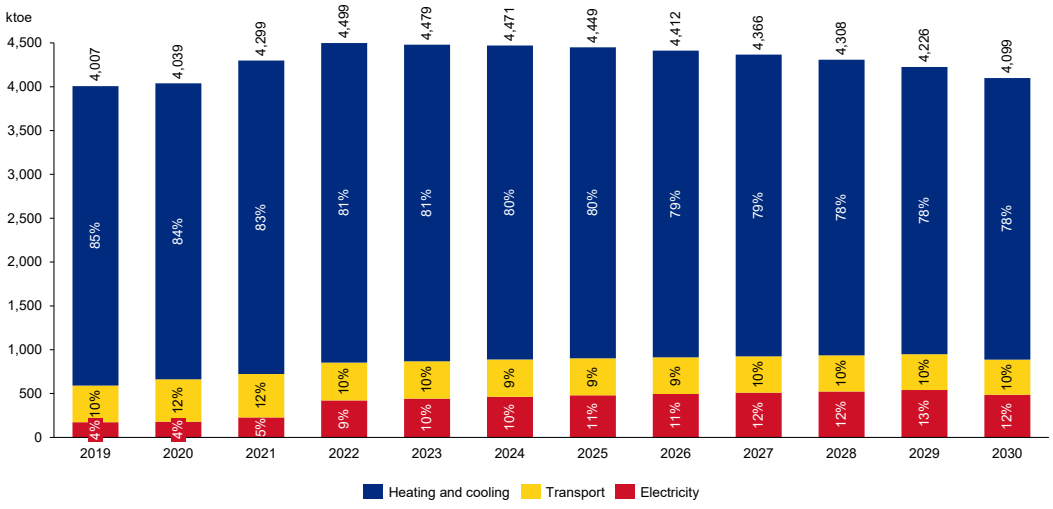


Figure 18. Estimated trajectory on sinks in forestry sector from LULUCF



When analysing by sectors, as expected, most of the bioenergy demand is used for heating and cooling due to the use of biomass (Figure 13). The objective is to reduce the share of this sector by 2030 to 78%, while increasing the share of the electricity sector due to the electricity generation from biomass and biogas.

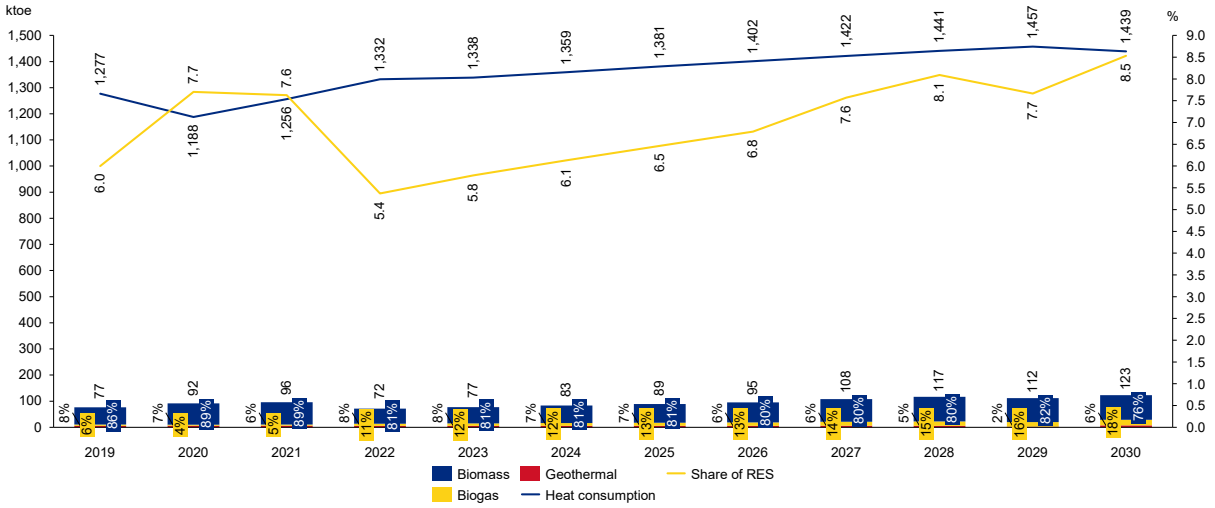
Figure 19. Estimated trajectory on bioenergy demand, disaggregated between heat and electricity



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

In Romania, district heating production from various sources showed distinct trends. Heat pump usage and solar thermal energy is projected to have significant growth, indicating a substantial contribution to district heating needs. In contrast, biomass-based district heating using solid biofuels remained relatively stable, with a gradual decrease. These trends reflect a shift towards more sustainable and renewable sources for district heating in Romania. The objective for the share of RES in the district heating is to reach 8.5% in 2030 (Figure 14).

Figure 20. Estimated trajectory on share of RES in district heating



2.2 Dimension energy efficiency

I. The elements set out in point (b) of Article 4

The energy consumption projections for 2050 are based on the guiding principle of prioritizing energy efficiency ("taking utmost account of cost-efficient energy efficiency measures in shaping energy policy and making relevant investment decisions"[1]).

The anticipated energy consumption projections indicate a targeted reduction of 5% in primary energy consumption by 2030 compared to 2019 (as depicted in Figure 64), reaching an absolute value of 31,448 ktoe. Similarly, final energy consumption is expected to experience a slight decrease of 2% (as shown in Figure 22), achieving an absolute value of 23,140 ktoe in 2030. The long-term plan aims for a substantial reduction of 15% in primary energy consumption by 2050 relative to the 2019 level, accompanied by a more pronounced drop of 28% in final energy consumption.

Compared to the reference 2030 projections established by the Primes model, Romania's energy efficiency goal by 2030 is to achieve a remarkable 46% reduction in primary energy consumption and a corresponding 45% reduction in final energy consumption (Figure 64 and Figure 22). By 2050, Romania aims to lower its primary energy consumption by 52%, while the final energy consumption is projected to decrease further by 59% compared to the 2030 Primes model projections. These targets reflect a dedicated commitment to sustainability and a greener future.

[1] https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficiency-targets-directive-and-rules/energy-efficiency-first-principle_en#:~:text=The%20%E2%80%9Cenergy%20efficiency%20first%20principle,and%20making%20relevant%20investment%20decisions.

Figure 21. Estimated primary energy consumption trajectory

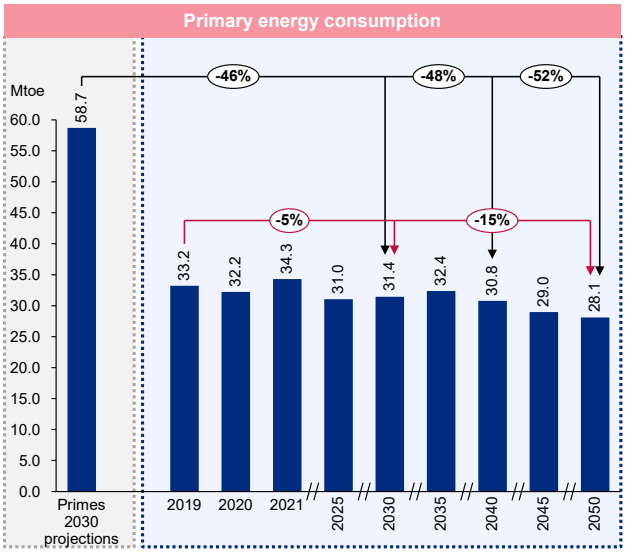
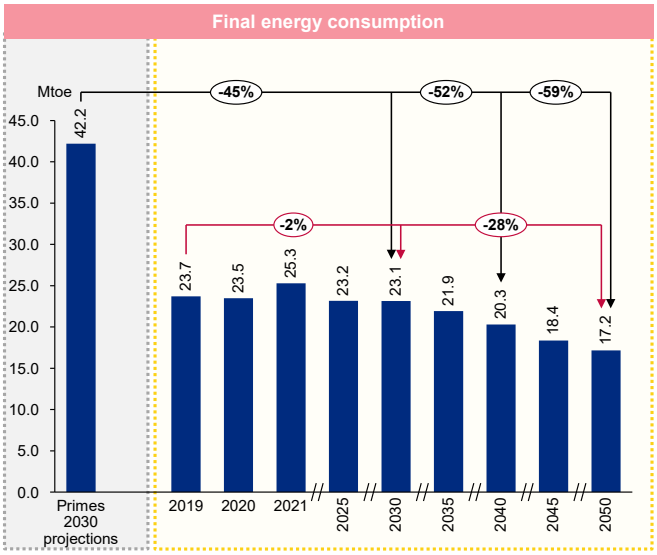


Figure 22. Estimated final energy consumption trajectory



II. The cumulative amount of end-use energy savings to be achieved over the period 2021-2030 under point (b) of Article 7(1) on the energy saving obligations pursuant to Directive 2012/27/EU

The projected annual energy saving over the period 2021 – 2030 are outlined in Table 4. By 2030, the cumulative energy savings are estimated to reach 10116.5 ktoe.

Table 4. Annual and cumulative end-use energy savings

Year	Annual energy savings (ktoe)										TOTAL
2021	**115**										**115.0**
2022	115	**115**									**230.0**
2023	115	115	**160.9**								**390.9**
2024	115	115	160.9	**183.9**							**574.8**
2025	115	115	160.9	183.9	**183.9**						**758.7**
2026	115	115	160.9	183.9	183.9	**183.9**					**942.6**
2027	115	115	160.9	183.9	183.9	183.9	**316.1**				**1258.6**
2028	115	115	160.9	183.9	183.9	183.9	316.1	**345.0**			**1603.7**
2029	115	115	160.9	183.9	183.9	183.9	316.1	345.0	**345.0**		**1948.6**
2030	115	115	160.9	183.9	183.9	183.9	316.1	345.0	345.0	**345.0**	**2293.6**
										TOTAL cumulative energy efficiency (ktoe)	**10116.5**

*Source: Ministry of energy*The indicative milestones for 2030, 2040 and 2050, the domestically established measurable progress indicators, an evidence-based estimate of expected energy savings and wider benefits, and their contributions to the Union's energy efficiency targets as included 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

Table 5 outlines the indicative milestones targeting the building sector. Following the recommended scenario in the National Long-term Renovation Strategy (LTRS) approved with the Governmental decision no. 1034/2022, the annual renovation rates are projected to increase gradually from 0.69% to 3.39% between 2021 and 2030, further ascending to 3.79% in the period 2031-2040 and eventually reaching 4.33% in the period 2041-2050. These progressive renovation rates are expected to yield a 9% reduction of final consumption in 2030 (0.83 Mtoe), and a cumulative 24% GHG emission reduction in 2021- 2030, and a 65% reduction of final consumption in 2050 (6.14Mtoe), and an 80% cumulative GHG emission reduction in 2021-2050.

Table 5. Indicative milestones to decarbonize the building stock by 2050

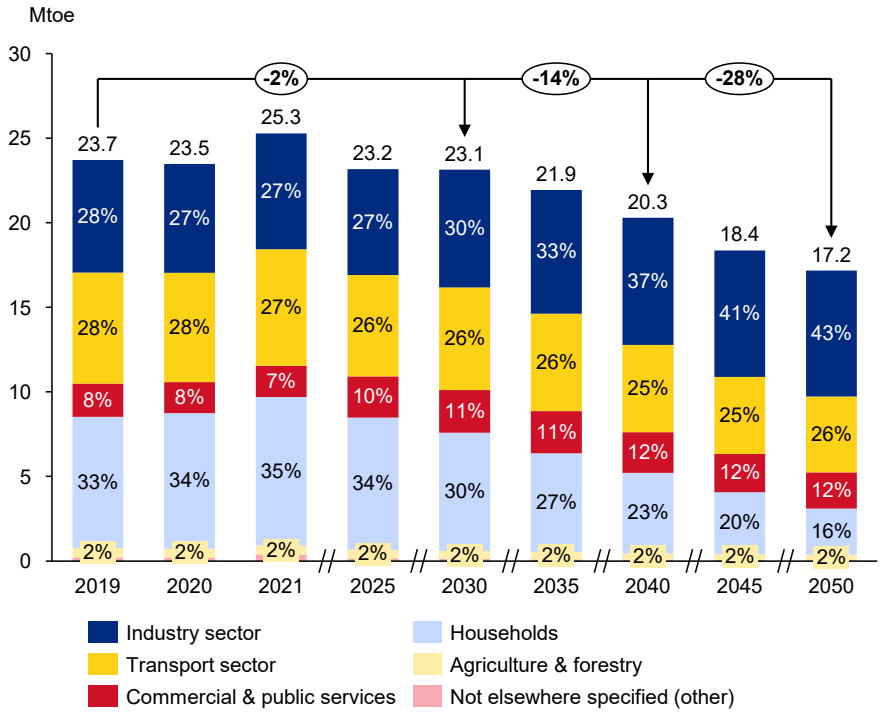
Milestones	2030	2040	2050
Savings	0.83 Mtoe (9%)	3.32 Mtoe	6.14 Mtoe (65%)
Total consumption	8.69 Mtoe	6.20 Mtoe	3.38 Mtoe
Annual renovation rate	gradual increase from 0.69% to 3.39%	3.79%	4.33% (77% of the total floor area of the building stock will be renovated or rebuilt)
Increase in NZEB buildings	1%	4%	23%
Decrease in worst performing buildings	19%	23%	26%
CO_2 reduction	24%	50%	80%
Total CO_2 emissions	7.50 Mton	4.93 Mton	1.99 Mton

Source: EU Commission Staff Working Document - Analysis of the national long-term renovation strategies (2022).[1], and National long-term renovation strategy[2]

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

The long-term projections of the final energy consumption by sector (depicted in Figure 23) illustrate that policies and initiatives aimed at improving building energy efficiency and promoting the use of more efficient technologies will significantly impact the household sector. This will lead to a decrease in its share of the final energy consumption from 33% in 2019 to 30% by 2030, further dropping to 16% by 2050. In contrast, the industrial sector's share is projected to rise, reaching 30% by 2030 and 43% by 2050. While the share of the transport sector's consumption in the overall final energy consumption undergoes a slight change, decreasing from 28% in 2019 to 26% by 2030 and 2050, the actual consumption in absolute terms is anticipated to decrease by around 8% by 2030 and nearly 32% by 2050.

Figure 23. Final energy consumption by sector



[1] https://energy.ec.europa.eu/system/files/2022-12/SWD-Analysis-of-2020-LTRS.PDF

[2] https://energy.ec.europa.eu/system/files/2021-04/ro_2020_ltrs_en_version_0.pdf

2.3 Dimension energy security

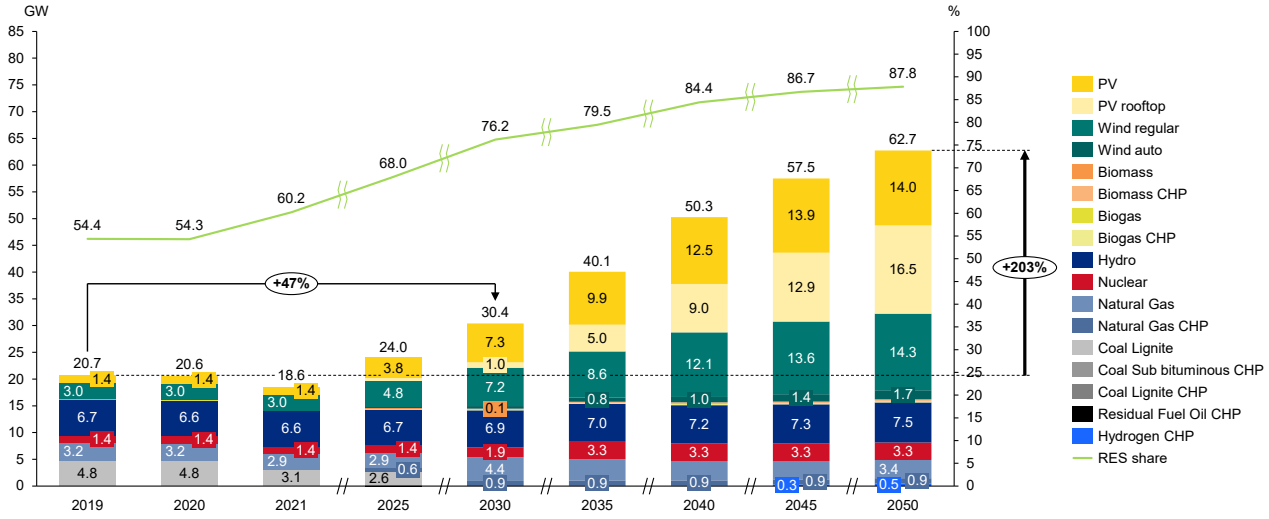
I. The elements set out in point (c) of Article 4

In order to set and synchronize the country's goals related to this aspect, a comprehensive assessment was conducted, encompassing diverse initiatives, decisions, ongoing progress, as well as the projections that promote the distinct aims of energy security. This mainly include the increase of the domestic energy supply, as well as the diversification of the import of different fuels.

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

Romania views energy supply from domestic sources as the most important objective for ensuring national energy security. Regarding electricity generation, the goal is to maintain diverse energy sources, while simultaneously lowering greenhouse gas emissions through the expansion of renewable energy sources (RES). As depicted in Figure 24, the target for 2030 is to achieve an installed capacity of 30.4 GW, marking a 47% increase from 2019. Of this projected capacity in 2030, roughly 76% will originate from renewable sources, ensuring the utilization of domestic resources for electricity generation.

Figure 24. Indicative objective for the installed capacity for electricity generation



Furthermore, by 2030 the objective of Romania is to construct new SMR on nuclear energy with installed capacity of 462 MW. Additionally, the goal is by 2030 to construct 2.6 GW natural-gas powered CCGT and 947 MW of natural-gas powered CHP.

The objective is to maintain electricity imports at their current level of below 5% in 2030.

Regarding the supply of natural gas, Romania's vision focuses primarily on advancing of the natural gas transmission network, including the interconnections, by being part of the BRUA project, the Eastring project, ROHU – Second phase project and Central and South-Eastern Europe Connection Initiative (CESEC). All of these projects will aid Romania’s efforts in diversifying natural gas supplies and reducing energy dependence on Russia, by providing connectivity with future gas infrastructure projects such as TAP, Central European gas hubs, and prospective gas transportation from Black Sea deposits.

III. Where applicable, national objectives with regard to reducing energy import dependency from third countries, for the purpose of increasing the resilience of regional and national energy systems

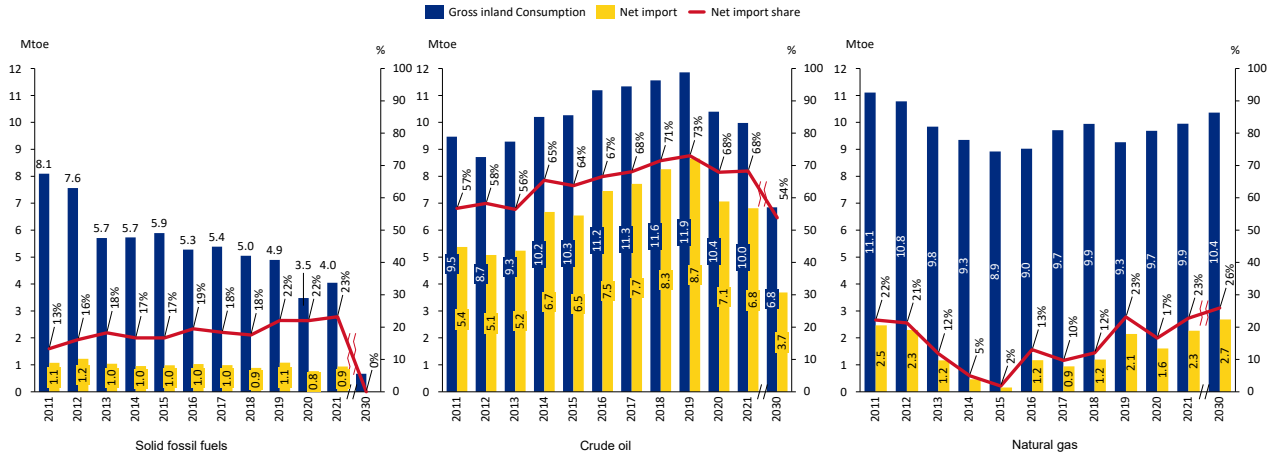
As stated in chapter 4.4 (Figure 66), among the highest energy import dependance of Romania is for crude oil, natural gas and solid fossil fuels. Therefore, Figure 25 shows the gross inland consumption, as well as the net import for these fuels.

The current (2021) import share of *crude oil* is 68%, and the *objective* is to reduce this import dependance of crude oil to *54% in 2030*. This objective can be achieved due to the reduced need for crude oil, mainly as a result of the electrification of the transport and the industry. The assumption for 2030 is that the domestic primary production of crude oil will be at a similar level as for 2021. Regarding the countries from which crude oil is imported, as shown in Figure 68, in 2021 73% of the import is from Kazakhstan and the Russian Federation, so therefore the goal is to diversify the countries from which the crude oil is imported.

The *goal* for the share of import of *solid fossil fuels for 2030* is to be *0%*. This is a result of the decommissioning of the coal power plants, so that there will be no need for import. The net import share in 2021 is 23%.

Due to the construction of new *natural gas* fired capacities, the net import share in *2030* is assumed to be *no more than 26%*. It should be mention that the assumption took into consuderation that the domestic primary production of natural gas in 2030 will be at a similar level as in 2021. Due to this significant import dependance in 2030, it is important to note that the goal of Romania is to *diversify the sources of supply*, having also in mind that in 2021 more than 75% of the imported quantity of natural gas was made from the Russian Federation.

Figure 25. Import dependency of crude oil, solid fossil fuels and natural gas (historical and projections for 2030)



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

Romania outlines goals aimed at encouraging demand response consumption to effectively address fluctuations in energy demand, as well as objectives related to energy storage. Romania was actively exploring the use of batteries for the storage of electricity, primarily in the context of renewable energy integration and grid stability. The objective is to have at least 240 MW or 480 MWh of power battery storage by 2025. The progress and utilization of the technical and economic potential of RES within the energy system hinge on the advancement of storage capabilities and the technology for incorporating hydrogen in the form of synthesis gas derived from RES, as well as its application in industrial processes.

2.4 Dimension internal energy market

2.4.1. Electricity interconnectivity

I. 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:

The primary objective of Romania is to increase the interconnectivity level in order to achieve the 2030 goal of 15%. In accordance with Art. 15 para. (2) and 16 para. (8) of Regulation (EU) 2019/943, the minimum

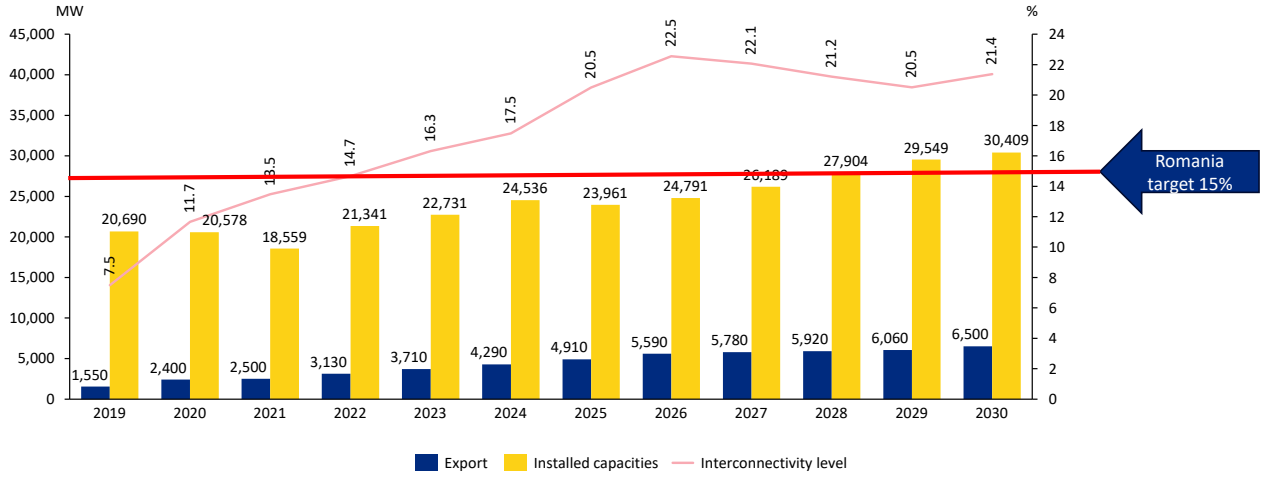
capacity available for cross-border trade to be ensured on the RO – HU border and RO-BG border, based on a linear trajectory, provided in the Planul de Dezvoltare a RET perioada 2022- 2031. In addition, in the annexes of this plan there is a table for the period up to 2030.

Maximum monthly NTC values [MW]	2021	2022	2023	2024	2025
HU->RO	800	980	1160	1340	1520
BG->RO	700	1110	1470	1830	2190

	2025	2030
RO export	**4910**	**6500**
RO - HU	1520	1700
RO - BG	2190	2600
RO - RS	1000	2000
RO - UA	200	200
RO import	**4910**	**6500**
HU - RO	1520	1700
BG - RO	2190	2600
RS - RO	1000	2000
UA - RO	200	200

The Cross-border capacity represents one of the factors used to compute the interconnectivity level. Another crucial factor is the installed capacity within Romania. Based on the conducted analyses, the anticipated electricity production capacity for 2030 is estimated to be approximately 30.4 GW. When the cross-border capacity is divided by the projected installed capacity, the interconnectivity level is obtained and it is of roughly 21%, surpassing the established target of 15% for 2030 (Figure 26). This implies that the expansion of installed capacity should run in parallel with the augmentation of cross-border capacity.

Figure 26. Interconnectivity level of Romania up to 2030



(1) Price differential in the wholesale market exceeding an indicative threshold of EUR 2/MWh between Member States, regions or bidding zones;

Based on the hourly day-ahead prices as reported by ENTSO – E the price differential was calculated for the period 2020-2021. It was found that in 2021 the price between Romania and Bulgaria and Hungary exceed 2 EUR/MWh, which is not the case in 2020.

Border	Unit	2020	2021
Romania - Hungary	EUR/MWh	0.79	2.96
Romania - Bulgaria	EUR/MWh	0.98	2.48

2.4.2. Energy transmission infrastructure

I. Key electricity and gas transmission infrastructure projects, and, where relevant, modernisation projects, that are necessary for the achievement of objectives and targets under the five dimensions of the Energy Union Strategy

To meet the 15% interconnection target set for 2030 as outlined in Communication No. 718/2017 regarding the consolidation of European energy networks, the primary means of achievement for Romania will be through the execution of Projects of Common Interest and the completion of other projects specified in the RET Development Plan.

Romania is an integral part of priority corridor number 3 within the "Electricity Interconnections in Central Eastern and South Eastern Europe ('NSI East Electricity')" initiative, which focuses on enhancing electricity interconnections and internal lines in both north-south and east-west directions. These efforts aim to facilitate the completion of the internal energy market and foster the integration of renewable energy production. This initiative has been acknowledged and supported within the fifth European list of Projects of Common Interest (PCI), ratified by Regulation (EU) No. 564/2022. Where applicable, main infrastructure projects envisaged other than Projects of Common Interest (PCIs). In the fourth and fifth PCI list the following projects are approved:

- Black Sea Corridor (TYNDP ID 138)
- Mid-Continental East corridor (TYNDP ID 144)
- Smart Grid CARMEN Project

Regarding the natural gas network the following projects are approved:

- Increasing the Natural Gas in Central-Eastern and South-Eastern Europe
- Daily withdrawal capacity increase in Bilciurești underground gas storage system (UGS)

More details about each measure are provided in the Chapter 3.4. The main objective of Romania, in order to active the interconnectivity level, and to diversified the supply of natural gas is to realized these projects.

II. Where applicable, main infrastructure projects envisaged other than Projects of Common Interest (PCIs)

To fulfill the obligation, every two years, Transelectrica prepares a comprehensive RET Development Plan that outlines the grid's growth and evolution over the next ten years. This plan is subject to approval by the regulatory authority ANRE. Transelectrica conducts prospective analyses of RET in both the short and long terms, covering the next 5 and 10 years, respectively. This biennial planning cycle aligns with it commitment to participate in the European association of TSOs, ENTSO-E, and contribute to the biennial European Ten Ten Years Network Development Plan (TYNDP). The latest network development plan of Translectrica covers the period 2022-2031.Under the new plan there are a lot of measures that are envisage related to:

- Refurbishment/modernization
- Safe supply
- Integration of production from new plants
- Increasing the interconnection capacity and integrating RES production

The implementation of the proposed measures will greatly improve the security of supply. More details about the measure are provided in the Chapter 3.4

2.4.3. Market integration

I. National objectives related to other aspects of the internal energy market such as increasing system flexibility, in particular related to the promotion of competitively determined electricity prices in line with relevant sectoral law, market integration and coupling, aimed at increasing the tradeable capacity of existing interconnectors, smart grids, aggregation, demand response, storage, distributed generation, mechanisms for dispatching, re-dispatching and curtailment, and real-time price signals, including a timeframe for when the objectives shall be met

Aiming at achieving the priority objective of integration in the internal market, Romania will continue the process of integration of the day-ahead and intra-day electricity markets under the pan-European Single Day-Ahead Coupling - SDAC and the Single Intra-Day Coupling - SIDC, having regard to the methodology of implicit allocation of the cross-border flow-based capacities applicable to the CORE region (implementation term: according to the roadmaps of the projects implementing the provisions of relevant EU regulations), to which it belongs, and without opting out the early implementation of the NTC-based single coupling of electricity markets.

At the regional level, one of Romania's key strategic initiatives was to secure its integration into the single day-ahead and intra-day market coupling systems, specifically SDAC and SIDC, during its period as a Member State. Romania successfully completed the day-ahead market coupling with Bulgaria. Nowever, Romania maintained its commitment to cooperation with the Energy Community contracting parties, especially concerning their accession to SDAC and SIDC. Still, the advancement of this collaboration remained contingent on the evolution of market mechanism determination within the Balkan region.

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

From 2020 onward, the day-ahead and intra-day markets are organised such as to ensure that all market participants can have access to the market individually or by aggregation. Final consumers may thus participate in organised electricity markets either directly or by aggregation if they have power above 500 kW approved in the connection certificate. If they have such approved power up to 500 kW inclusive, final consumers may participate in organised electricity markets excluding aggregation

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;

The electricity self-generation in Romania show notable rise in numbers, particularly in the years 2022 and 2023. The overall installed capacity of these prosumers is expected to surpass 1.1 GW by the end of 2023. This remarkable increase highlights the enthusiasm and commitment of individuals and businesses in Romania to take control of their energy consumption and reduce their carbon footprint.

The primary objective moving forward is to sustain this momentum by further encouraging the adoption of prosumer technologies and increasing the installed capacity of these decentralized energy producers. The ambitious aim is to reach a substantial milestone by 2030, with a target of 2.5 GW. This transition to a more distributed energy system empowers consumers to reduce their energy costs and generate clean, sustainable power.

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

In Romania's vision for the energy system by 2030 and after, energy storage in batteries plays a pivotal role in enhancing system flexibility. With the ability to offer primary, secondary, and tertiary regulation services, battery storage proves to be a reliable asset for system balance. The advantage lies in its adaptability to the

consumption curve, with the added benefit of not being subject to natural factors. This strategic investment serves the dual purpose of supporting the electricity network's flexibility and facilitating the integration of additional renewable energy capacity.

To achieve this enhanced flexibility, Romania's government, as outlined in the National Recovery and Resilience Plan, has set a specific target of installing 240 MW of battery storage capacity by 2025, with potential for storage of 480 MWh. Adequate funding has been allocated to support these objectives, underscoring the commitment to strengthening the nation's energy infrastructure and ensuring a more resilient and sustainable energy future. More details about this easures are provided in Chapter 3.4.3

Plants operating on natural gas play a vital role in enhancing the flexibility of the energy system. These technologies are characterized by their ability to swiftly respond to changes in electricity demand. Furthermore, natural gas-powered plants can act as a dependable backup to intermittent renewable energy sources, ensuring a consistent power supply even when renewable generation is low. The main objective of Romania is to commission new natural gas power plants that will increase the flexibility of the system and replace the electricity generated by coal. At the same time this new technology has a possibility to run on hydrogen after 2035.

V. Where applicable, national objectives to protect energy consumers and improve the competitiveness of the retail energy sector

Romania has implemented all the legislative provisions entitling final consumers to choose/change their supplier without additional costs with prior notice of 21 calendar days. At the same time, suppliers are prohibited from withdrawing from the supply contracts.

As regards the treatment of complaints, the regulatory authority has implemented a series of legislative acts (e.g. performance standard for supply of electricity and natural gas) regarding the management of relevant conflicts arising at the pre-contractual stage and during the implementation of contracts

2.4.4. Energy poverty

I. Where applicable, national objectives with regard to energy poverty, including a timeframe for when the objectives are to be met

The ability of people to secure energy for heating their home reflects the level of energy poverty in the country, but also reflects the development of energy market in the country. For this purpose, the indicator “Population unable to keep home adequately warm by poverty status” was used. According to this indicator, in 2022 15.2%[1] of the population in Romania is unable to keep their homes adequately warm (have difficulties paying their electricity bills, cannot heat their homes properly or do not have access to affordable sources of energy supply). At EU 28 level, the situation is better, 9.3% of the population are unable to keep their homes adequately warm. The implementation of the program for vulnerable consumers, as well as the implementation of energy efficiency measures, are expected to significantly improve this indicator.

2.5 Dimension research, innovation and competitiveness

I. National objectives and funding targets for public and, where available, private research and innovation relating to the Energy Union, including, where appropriate, a timeframe for when the objectives are to be met

The EU’s goal of the twin (green and digital) transition brings innovation (in its broadest sense) in the spotlight, while the EU Cohesion Policy (aiming to remedy the disparities between countries and regions) heavily relies

[1] https://ec.europa.eu/eurostat/en/web/products-eurostat-news/w/DDN-20230911-1

on the smart specialization strategy as main methodology for reinforcing national and regional innovation eco-systems.

The Energy Union is a set of policies and initiatives by the European Union (EU) to ensure secure, sustainable, competitive and affordable energy for its citizens. It is based on five mutually supportive dimensions: energy security, solidarity and trust; the internal energy market; energy efficiency; decarbonisation of the economy; and research, innovation and competitiveness.[1]

The EU has made significant progress in recent years in achieving the goals of the Energy Union. For example, the EU has reduced its greenhouse gas emissions by 22% since 1990, and the share of renewable energy in the EU's energy mix has increased to 22%[2]. However, there is still much work to be done. The transition to a low-carbon economy is expensive and will require significant investment. There is also a need to develop new technologies to replace fossil fuels, and to improve energy efficiency across the EU. The main goals of the Energy Union are to:

- Reduce greenhouse gas emissions by at least 40% by 2030, compared to 1990 levels.
- Increase energy efficiency by at least 32.5% by 2030.
- Increase the share of renewable energy to at least 32% of EU energy consumption by 2030.
- Guarantee at least 15% electricity inter-connection levels between neighbouring Member States.

Recently, Romania has made notable progress in aligning its energy sector with the goals set forth by the European Union's Energy Union initiative[3][4]

- Renewable Energy Expansion: Romania has been working towards increasing the share of renewable energy sources in its energy mix. This includes investments in wind, solar, hydroelectric, and biomass energy. The country has taken measures to encourage renewable energy production through various support mechanisms, such as feed-in tariffs and green certificates. These efforts contribute to the EU's target of achieving a higher percentage of renewables in the overall energy consumption.
- Energy Efficiency Improvements: Romania has been focusing on enhancing energy efficiency across various sectors. This involves implementing energy-efficient technologies, improving building standards, and promoting energy-saving practices in industries. By reducing energy consumption while maintaining or even improving productivity, Romania contributes to the broader EU objective of optimizing energy use.
- Decarbonization Efforts: To align with the Energy Union's commitment to reducing greenhouse gas emissions, Romania has been taking steps to transition to a low-carbon economy. This includes phasing out coal-fired power plants and investing in cleaner technologies. The country's efforts in this regard are essential for achieving the EU's overall climate targets.
- Interconnection and Infrastructure Development: Romania has been actively participating in the development of cross-border energy infrastructure, such as gas and electricity interconnections. These interconnections enhance energy security, improve market integration, and enable the efficient sharing of energy resources among EU member states. By collaborating on regional energy projects, Romania contributes to the Energy Union's goal of creating a unified energy market.
- Diversification of Energy Sources: Ensuring a diverse mix of energy sources is crucial for energy security. Romania has been exploring opportunities to diversify its energy sources, including importing natural gas from various routes and investing in domestic energy resources. This approach reduces dependency on a single energy supplier and aligns with the Energy Union's principle of diversification.
- Policy and Regulatory Reforms: Romania has been working on updating its energy policies and regulations to align with the EU's energy and climate goals. This involves setting ambitious targets, establishing frameworks for clean energy deployment, and promoting investor confidence in the energy sector. Such policy adjustments create a conducive environment for sustainable energy development.
- Research and Innovation*:* Romania has been promoting research and innovation in the energy sector. Research initiatives focusing on advanced energy technologies, smart grids, energy storage, and digitalization play a crucial role in advancing the Energy Union's goals and enhancing the overall

[1] https://www3.eurelectric.org/the-five-dimensions-of-the-energy-union/overview-and-key-findings/

[2] https://energycentral.com/c/ec/exclusive-interview-eu-vice-president-maros-%C5%A1ef%C4%8Dovi%C4%8D-energy-union-deepest

[3] staff_working_document_assessment_necp_romania_en_0.pdf (europa.eu)

[4] necp_factsheet_ro_final_0.pdf (europa.eu)

energy landscape. For example, Romania has set up a number of research and development centers in the energy sector, such as the National Institute for Research and Development in Electrochemistry and Electrometallurgy (INCETE). The government is also providing financial incentives for businesses to invest in renewable energy and energy efficiency projects.

Romania is also working to improve its energy infrastructure. This includes upgrading its electricity grid and building new interconnectors with neighboring countries. These investments will help Romania to better integrate into the European energy market and to import and export energy more easily.

The European Innovation Agenda states that ”Innovation is essential to drive Europe’s competitiveness and to ensure the health and well-being of its citizens. Innovation shapes markets, transforms economies, stimulates step changes in the quality of public services and is indispensable to achieve the overarching objectives of the twin green and digital transition.”[1] .

Each year, the European Innovation Scoreboard (EIS) assesses and compares the research and innovation performance of the EU Member States. By identifying the relative strengths and weaknesses of those systems EIS aids the EU countries in determining the intervention areas and initiatives needed to enhance their innovation performance.

According to latest data from the European Innovation Scoreboard 2023 released on 6th of July 2023 Romania is part of the group of “Emerging Innovators”, but on the bottom of the list from all EU countries (Figure 27)[2].

The performance of the Romanian Summary innovation index is at 33.1% of the EU average. In addition, the performance is increasing at a rate lower than that of the EU (8.5%- points) which mean that the country’s performance gap to the EU is becoming larger.

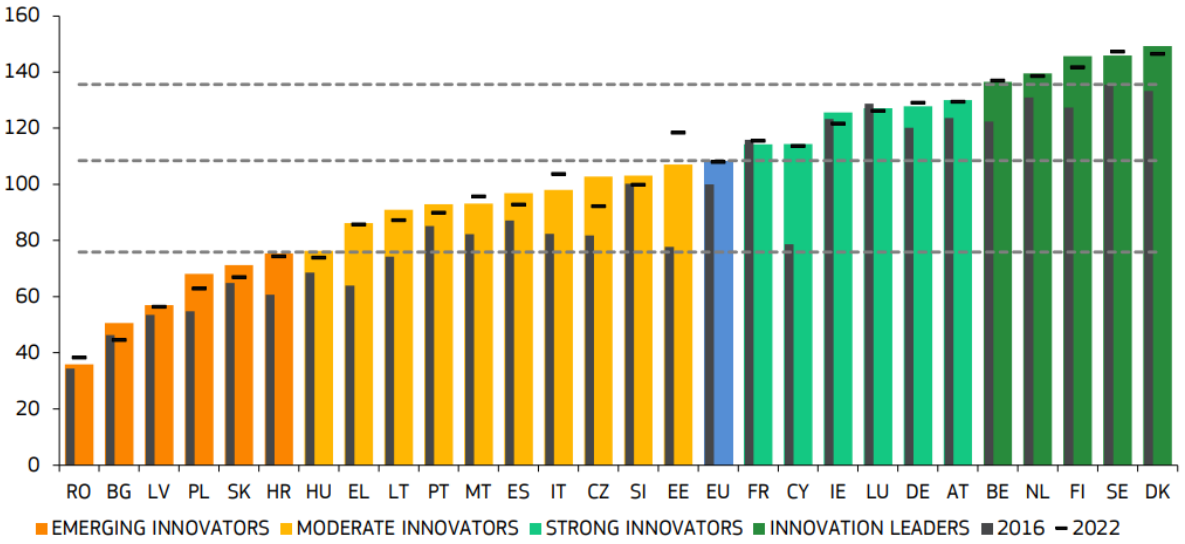
According to the EIS 2023 Romania country profile the biggest weaknesses of the country can be found in following sub-indicators:

- Population with tertiary education (number of persons in age 25-34 with some form of post-secondary education)
- Business process innovators (Number of Small and medium-sized enterprises (SMEs) who introduced at least one business process innovation either new to the enterprise or new to their market)
- Innovative SMEs collaborating with others (Number of Small and medium-sized enterprises (SMEs) with innovation cooperation activities including all enterprises that had any co-operation agreements on innovation activities with other enterprises or institutions in the three years of the survey period)
- Job-to-job mobility of HRST (Job-to-job mobility of Human Resources in Science & Technology. It is defined as the movement of individuals between one job and another from one year to the next. It does not include inflows into the labour market from a situation of unemployment or inactivity.)
- Employment in innovative enterprises (Number of employed persons in innovative enterprises (‘Enterprises that have either introduced an innovation or have any kind of innovation activity (including enterprises with abandoned/suspended or on-going innovation activities).

[1] European Commission. (2022). A New European Innovation Agenda. Communication from the commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Brussels. https://eur-lex.europa.eu/legalcontent/EN/TXT/?uri=CELEX:52022DC0332

[2] European Commission, Directorate-General for Research and Innovation, Hollanders, H., European Innovation Scoreboard 2023, Publications Office of the European Union, 2023, https://data.europa.eu/doi/10.2777/119961

Figure 27. Performance of EU Member States' innovation systems



However, there are few sub-indicators where performances are on the relatively well position compared to EU average:

- Broadband penetration (Number of enterprises with a maximum contracted download speed of the fastest fixed internet connection of at least 100 Mb/s)
- Medium and high-tech goods exports (Exports of medium and high technology products as a share of total product exports. Value of medium and high-tech exports, in national currency and current prices, including exports of the following SITC Rev.3 products: 266, 267, 512, 513, 525, 533, 54, 553, 554, 562, 57, 58, 591, 593, 597, 598, 629, 653, 671, 672, 679, 71, 72, 731, 733, 737, 74, 751, 752, 759, 76, 77, 78, 79, 812, 87, 88 and 891)
- Knowledge-intensive services exports (Exports of knowledge-intensive services is defined as the sum of credits in EBOPS 2011 (Extended Balance of Payments Services Classification) items: SC1 (Sea transport); SC2 (Air transport); SC3A (Space transport); SF (Insurance and pension services); SG (Financial services); SH (Charges for the use of intellectual property); SI (Telecommunications, computer, and information services); SJ (Other business services); SK1 (Audio-visual and related services))
- Trademark applications per billion GDP (Number of trademark applications applied for at EUIPO)
- Most cited publications (Scientific publications among the top-10% most cited publications worldwide as percentage of total scientific publications of the country)

In order to improve innovation potential of the country, Romanian government in 2022 adopted the National Strategy for Research, Innovation and Smart Specialization 2022-2027 (NRIS3) prepared by the Ministry for Research, Innovation and Digitalization (MRID)[1]. The strategy is based on 4 main pillars:

Pillar 1: Excellence in research and innovation. This pillar aims to strengthen the research and innovation capacities of Romania, by investing in human capital, research infrastructure, and knowledge transfer.

Pillar 2: Entrepreneurial ecosystem. This pillar aims to strengthen the entrepreneurial ecosystem in Romania, by supporting start-ups and SMEs, and by creating an environment that is conducive to innovation.

Pillar 3: Smart specialization. This pillar aims to identify and support the development of emerging technologies and sectors with high growth potential.

[1] Ministry for Research, Innovation and Digitalization (MCID). Romanian Government. (2022). National Strategy for Research, Innovation and Smart Specialization 2022-2027. https://www.research.gov.ro/uploads/comunicate/2022/strategia-nationala-de-cercetareinovare-i-specializare-inteligent-2022-2027.pdf

Pillar 4: International cooperation. This pillar aims to promote international cooperation in research and innovation, by facilitating partnerships between Romanian and international actors.

The strategy is expected to contribute to the economic development of Romania, by creating jobs, increasing productivity, and improving the quality of life. It is also expected to help Romania to address the challenges of the 21st century, such as climate change and the digital transformation.

Majority part of the national objectives and targets related to the dimensions: research, innovation and competitiveness are coming from the National Strategy for Research, Innovation and Smart Specialization 2022-2027 and are presented in the text bellow.

II. National objectives and funding targets for public and, where available, private research and innovation relating to the Energy Union, including, where appropriate, a timeframe for when the objectives are to be met

The National Strategy for Research, Innovation, and Smart Specialization 2022- 2027 articulates Romania's Vision 2030, built on four (interconnected) pillars (corresponding to the strategy's four general objectives), each with its own (indicators and) targets (Figure 14)[1]. If considering overall innovation performance (as mirrored in the EIS), Romania's goal is to become a moderate innovator (i.e., have an innovation performance between 70% and 100% of the EU average).

Table 6. Romania's National Strategy for Research, Innovation, and Smart Specialization 2022-2027 - main targets

Pillar / Indicator	Target
V. ***Romania develops, concentrates, and connects excellency to the scientific frontier and to societal challenges***	
• Number of doctorate graduates in relation to the number of graduates from higher education	10% increase
• Researchers per one thousand employed persons	0.12 annual growth (from 2.0 currently to 3.2 in 2030)
• Number of "leader" researchers (as defined in the 'EU framework for research careers') working in Romania in 2030	20% increase
• Number of WoS indexed articles in relation to the number of researchers • Research productivity (articles/researchers)	Proportional increase Increase from 0.85 to 1
• Quality of knowledge production ○ Articles in top 10% most cited articles ○ Articles in top 1% most cited articles ○ Number of triadic patents (as compared to 2021)	 Increase from 7% to 10% (current EU average: 12%) Increase from 04% to 0.6% 50% increase
VI. ***There is a large mobilization of enterprises towards innovation***	
• EIS performance	Achieving the status of Moderate Innovator
• Share of enterprises introducing new innovative products on the market	Increase from 2.9% to 6% (EU average in 2018: 13%)
• Share of innovative enterprises collaborating with research organizations	More than 7% (from 3.5% collaboration with universities and 1,5% collaboration with institutes in 2018)
• Number of public-private co-publications per one million inhabitants	Increase from 24.5 to 50 (current EU average: 95)
• Employment in innovative enterprises	Increase from 2.6% to 5% (EU average in 2018: 11.8%)
VII. ***Innovation ecosystems associated with smart specializations support advancement in global value-added chains***	
• Growth rates of employment, value added, and exports in ecosystems associated with smart specialization areas and b**enefiting from major projects**	Twice as high - compared to the national average
VIII. ***Internationalization and European and international cooperation***	
• Funding drawn from the Horizon Europe Program	Double - compared to funding drawn from Horizon 2020 (about 500 mill. euros between 2022 and 2027)
• Number of international scientific co-publications per one million inhabitants	Increase from 284 to 600 (current EU average: 1172)
• Public financing allocated to joint programs and European partnerships (including inter-regional investments in EU projects) – as percentage from the national public financing for R&D	Minimum 5%

[1] Claudia, O. and Mihaela, H., 2022. Fostering Innovation in Romania. Insights from the Smart Specialization Strategies. *Studies in Business & Economics*, *17*(2).

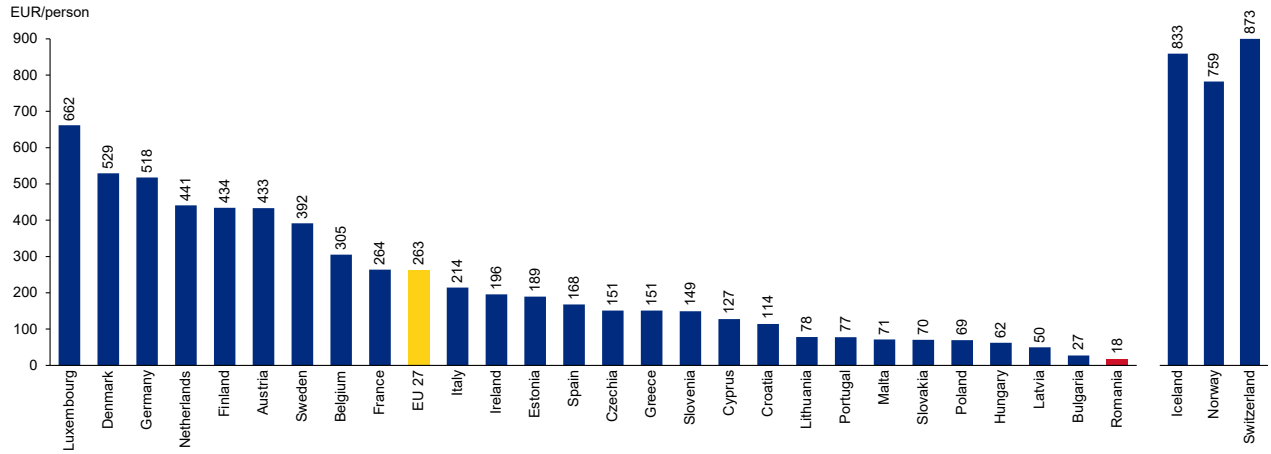
- **Bilateral collaborations are complementary to these interventions and contribute to networking capacity building**

Strengthening research activities depends significantly on attracting additional public and private investment in R&D activities.

Romania spends less, in per capita terms (EUR 17.6, Figure 28) but also as a % of GDP (0.12%), in research and development (R&D), according to Eurostat data. Romania ranks last in the European Union related to this indicator.

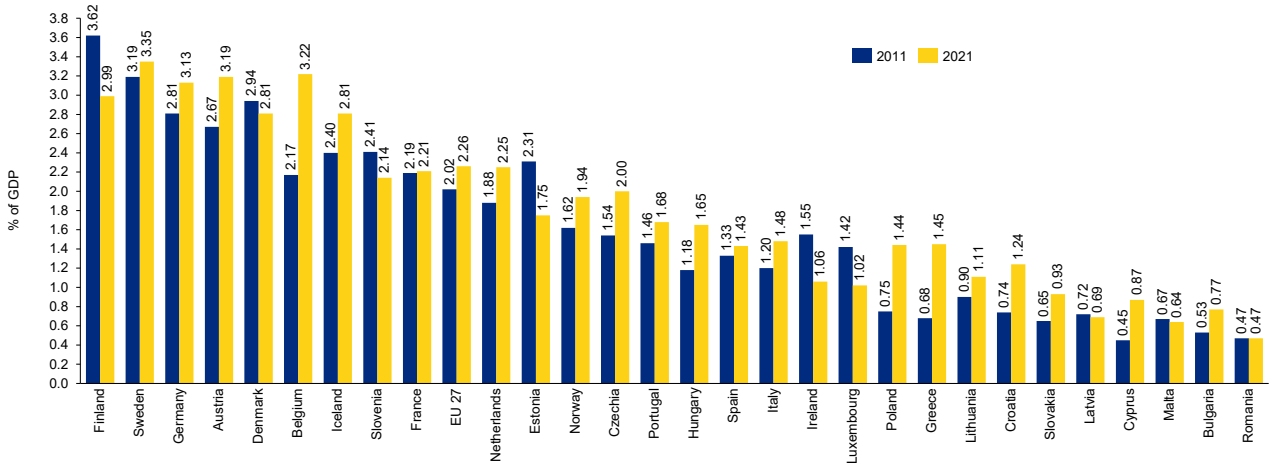
Related to gross domestic expenditure in R&D, Romania is also on the bottom of the list among EU countries (Figure 29, Figure 30).

Figure 28. Government budget allocation for R&D, 2022



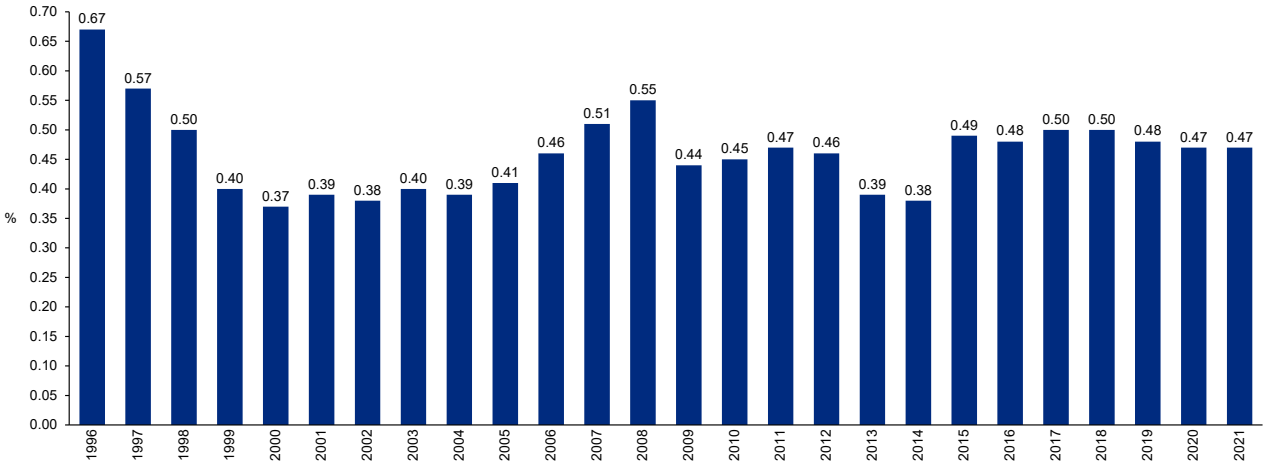
Source: EUROSTAT, data on government budget allocations for R&D (GBARD), Statistics | Eurostat (europa.eu) , team analyses

Figure 29. Gross domestic expenditure on R&D for 2011 and 2021



Source: EUROSTAT, GERD by sector of performance, Statistics | Eurostat (europa.eu), team analyses

Figure 30. Gross domestic expenditure on R&D for the period 1996 - 2020



Source: EUROSTAT, GERD by sector of performance, Statistics | Eurostat (europa.eu), team analyses

However, Romania within the NSRIS3 as a strategic option set very optimistic goal **to increase R&D public spending to reach 1% of GDP by 2027.**

The National Strategy for Research, Innovation, and Smart Specialization 2022- 2027 has been developed in line with European and national policies and strategies. The Strategy is strongly correlated with the National Strategy for Sustainable Development of Romania 2030. It is consistent with the national legislation in force for scientific research, technological development and innovation, it responds to the general priorities of the Government, the favourable condition "Good governance of the national or regional strategy of smart specialization" and the provisions of the Romania's National Recovery and Resilience Plan.

III. Where available, national 2050 objectives related to the promotion of clean energy technologies and, where appropriate, national objectives, including long-term targets (2050) for deployment of low-carbon technologies, including for decarbonising energy and carbon-intensive industrial sectors and, where applicable, for related carbon transport and storage infrastructure

Romania set very optimistic goal to increase R&D public spending to reach 1% of GDP by 2027. This includes investment in research, development and innovation, in human capital, and investment in the transfer of knowledge and technologies and the development of knowledge and innovation-based technologies through various programs.

In the recently adopted National Strategy for Research, Innovation, and Smart Specialization 2022- 2027, 2 (two) of the 7 (seven) identified thematic priority areas are directly linked to low-carbon targets, energy efficiency and adaptation to climate change:

3. Energy and mobility

3.1. Green mobility

It includes electric and hybrid vehicles, including hydrogen-based, for all types of transport, as well as: components of propulsion systems and their auxiliaries; storage systems and energy management for them; sharing and integrating these vehicles into smart cities; interoperability and intermodality solutions in transport.

3.2 Modern energy generation technologies with low or zero emissions

Energy conversion technologies and systems from renewable energy sources (hydraulic, wind, solar, biomass, geothermal), energy recovery of hydrogen, use of nuclear energy, low-emission energy recovery of coal and natural gas.

3.3. Digitalization in energy

Digital solutions for the monitoring and control of energy systems, integrated between the levels of the sector (production, transport, distribution, use) will facilitate the implementation of measures to

increase energy efficiency, increase the flexibility of the system, prioritize the consumption of clean energy and optimize the consumption of users. Digitization allows the implementation of Smart Grids-type functions at the level of electricity transport and distribution, but also at the level of users.

3.4. Energy storage

Energy storage is the main means by which the increase in the share of renewable energy sources is ensured. There are several major elements driving the development of technologies in the area of energy storage: efforts to decarbonize economic sectors, digitization and decentralization - where end consumers become active "actors" ("pro-sumers"). Storage systems can be chemical, with gravitational potential, with electric potential, at high temperature, with latent heat and kinetic type.

6. Environment and eco-technologies

6.1 Technologies for environmental management, monitoring and depollution

It includes technologies for monitoring the environment (including through sensor networks and satellite data), as well as those designed to improve the quality of air, water, soil and complex biological systems and to enable rapid and effective management of contamination situations.

6.2 Technologies for the circular economy

It includes technologies for waste management (such as those for optimized collection and selection, water filtration, biological reprocessing, waste-to-energy recovery, pyrolysis, etc.) and the set of solutions that contribute to reducing waste and increasing the degree of recycling in the value chains associated with electronic products, batteries, packaging, plastic materials, textile products, constructions, food, etc.

In order to achieve all above mentioned targets within the priority areas of smart specialization strategy, in addition to public research funding from the Romanian budget and private sector investment, European cohesion funds in 2021-2027, including those under the Recovery and Resilience Plan (RRP) and the Just Transition Fund (JTF), will play an important role in promoting research, development, innovation and competitiveness by 2030.

In addition, the Climate Change Fund should also play an important role in the future, which will be used, inter alia, to finance R&D and demonstration projects in the field of energy to explore the use of hydrogen and technologies for the production and use of electricity from RES, aimed at reducing emissions and adapting to climate change, including participation in the initiatives of the European Strategic Energy Technology Plan (SET-Plan) and the European Technology Platforms. Furthermore, the EU Innovation Fund, LIFE and Horizon Europe programs will also be available in the programming period up to 2027 to support innovation in low-carbon technologies, and funding to boost research and innovation in green technologies.

IV. Where applicable, national objectives with regard to competitiveness

Since 2010, the EU Regional Competitiveness Index (RCI) has been measuring the major factors of competitiveness for all the NUTS-2 level regions across the European Union[1]. The Index measures, with a rich set of indicators, the ability of a region to offer an attractive environment for firms and residents to live and work. Figure 31 and Figure 32represent the position of NUT 2 regions of Romania in correlation to other EU regions. It can be noticed that except the region of Bucureşti-Ilfov who is close to EU average, all other regions are fare bellow EU average.

[1] https://ec.europa.eu/regional_policy/assets/regional-competitiveness/index.html#/

Figure 31. EU Regional Competitiveness index 2.0. (2022 edition)

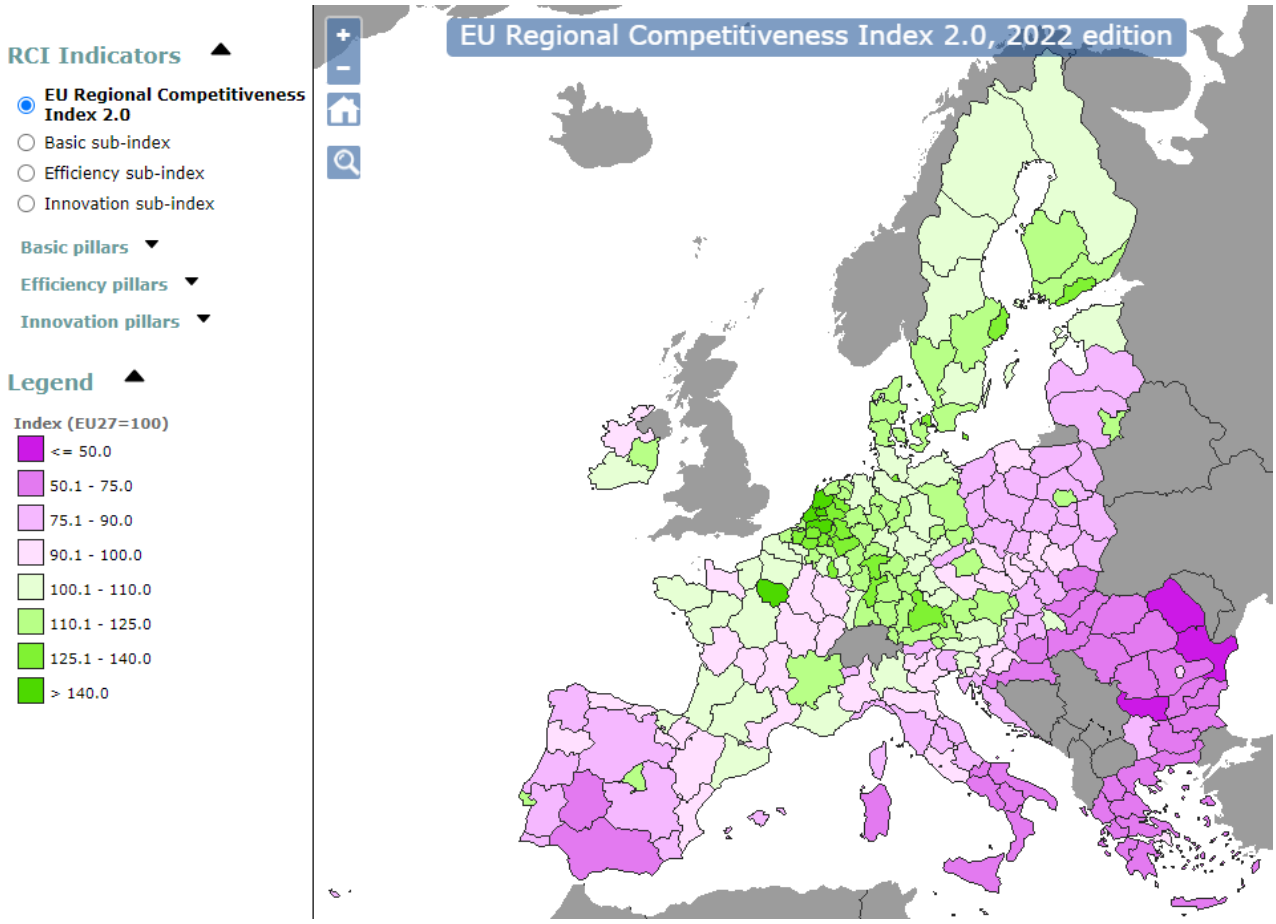
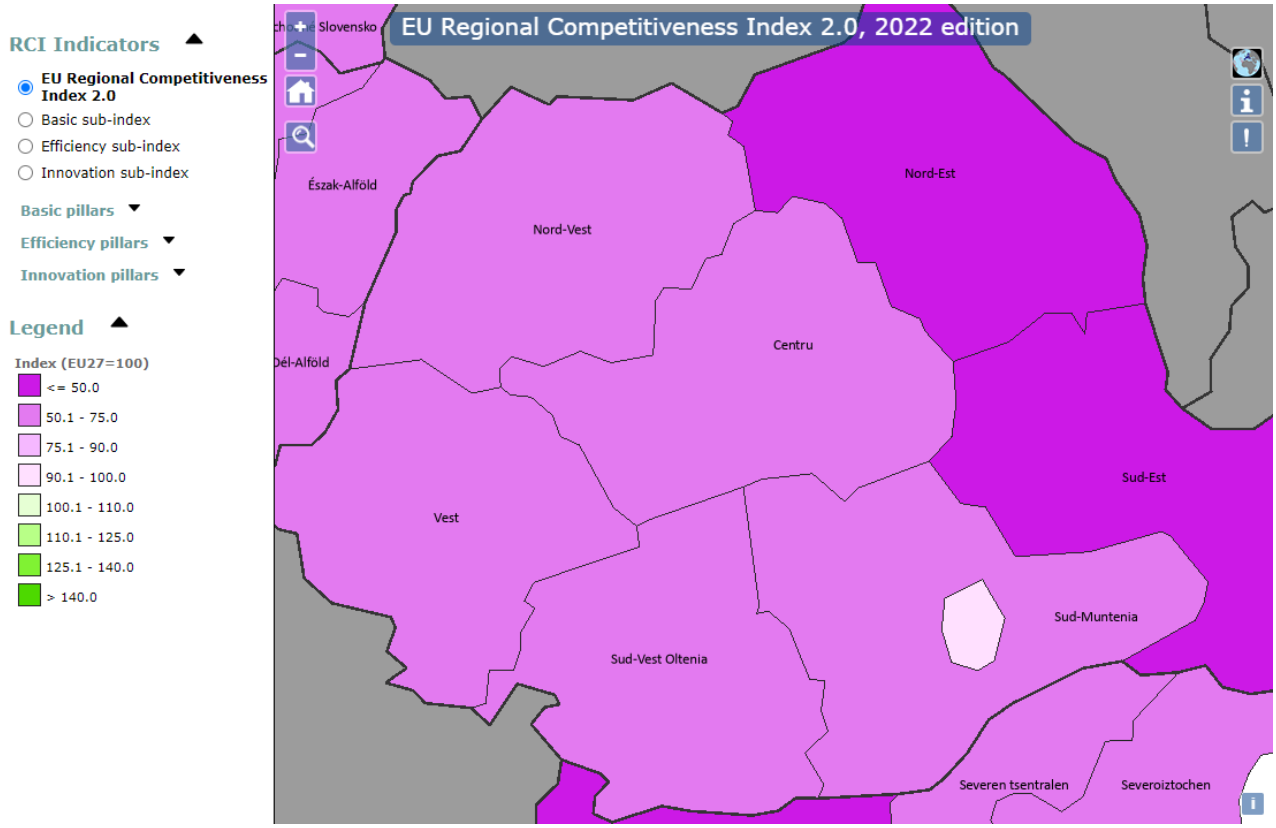


Figure 32. Romania's NUT 2 regions position on Regional Competitiveness Index 2.0 (2022 edition)



The National Strategy for Research, Innovation, and Smart Specialization 2022- 2027 directly address low level of competitiveness of Romania. Together with developed Regional Smart Specialization Strategies (developed by the respective Regional Development Agencies), these documents set the vision and path towards increasing competitiveness of the Romania's economy. Adopted objectives and goals should be able to drive economic competitiveness and social development, as well as the twin - green and digital – transition of the country.

The development processes of S3s was in line with the European Commission's guidelines and recommendations. Bottom-up approach, with substantial participation and involvement of stakeholders, was used in the entrepreneurial discovery process for identification of priority specialization areas and sub-areas. The smart specialization areas of national priority are focused on the areas that could drive other sectors of the economy and society and for which the national dimension of collaboration is crucial. Next table presents Romania's smart specialization areas that arise after S3 development process.

Table 7. Romania's S3 Smart Specialization Areas (Source: Romania's National and Regional Strategies for Smart Specialization)

Country level	Regional level
Bioeconomy (technologies for blue economy; improvement of seeds and breeds; technologies for eco-agriculture, agroecology, and forestry; agriculture 4.0; safe and sustainable food for healthy diet) **Digital economy and space technologies (microelectronic devices and systems for smart products; networks of the future, communications, and IoT; technologies for spatial economy; XR technologies; AI systems; cybersecurity; traceability technologies; robots and cognitive agents)** **Energy and mobility (green mobility; modern technologies for low/zero emission energy generation; digitalization of energy; energy storage)** **Advanced manufacturing (manufacturing technologies for aeronautics; digitalization and robotization of manufacturing; advanced manufacturing technologies)** **Advanced (functional) materials (optoelectronics; smart composite materials; recyclable materials and technologies for materials recycling; materials for electronic, electric, photonic, magnetic, and sensoristic applications; biocompatible materials; materials for energy)** **Environment and eco-technologies (technologies for environmental monitoring and management, and pollution control)** **Health – prevention, diagnosis, and advanced treatment (precision surgery; new generation nuclear technologies for diagnosis and treatment; longevity medicine; early diagnosis; technologies for the autonomous life; e-health; personalized and genomic medicine; technologies for wearables)**	**Nord-Vest:** Food; Cosmetics and food supplements; Health; New materials; Advanced production technologies; ICT **Centru:** Automotive and mechatronics industry; Aeronautical industry; Agri - food sector; Forestry, wood processing and furniture industry; Light industry; IT sector and creative industries; Health; Sustainable built environment; Tourism **Nord-Est:** Agri-food & wood industry; Energy; Environment; Textile; ICT; Health; Tourism **Sud-Est:** Engineering and shipping; Clothing industry; Agri-food and biotechnology; Aquaculture and fishing; Tourism; Information and communication technology **Bucuresti-Ilfov**: Information and communication technology (ICT); Cultural and creative industries; Intelligent systems and components (electronics, optoelectronics, mechatronics, microelectronics, etc.); Advanced materials; New foods and food safety; Health **Sud-Vest Oltenia:** Transport systems; Industrial and materials engineering; Agri-food; Health and wellness; ICT and digitalization; Creative industries **Vest:** Agriculture and food industry; Energy efficiency and sustainable buildings; Manufacturing and manufacturing industry; Cultural and creative industries; ICT and automotive; Health and quality of life

In order to update the smart specialization priorities, in 2025 and 2027 new cycles of entrepreneurial discovery process will be conducted. This process will be based on the evaluation of existing fields and subfields, doubled by the identification of new fields with specialization potential (starting from the Qualitative Periodic Reports on the dynamics of the CDI ecosystem).

3. POLICIES AND MEASURES

3.1 Dimension decarbonisation

3.1.1. GHG emissions and removals

I. Policies and measures to achieve the target set under Regulation (EU) 2018/842 as referred in point 2.1.1 and policies and measures to comply with Regulation (EU) 2018/841, covering all key emitting sectors and sectors for the enhancement of removals, with an outlook to the long-term vision and goal to become a low emission economy and achieving a balance between emissions and removals in accordance with the Paris Agreement

PAM 1 Phasing out coal TPP

Main objective: Phasing out lignite coal and lignite-powered thermal power plant
Description: The LTS foresees phasing out of all lignite coal and lignite-powered thermal power plants, with an objective for decarbonization and promoting renewable energy. This measure considers that TPPs with a net installed capacity of 4920 MW, will be decommissioned by 2032.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	Energy supply	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Long Term Strategy of Romania • Recovery and resilience plan for Romania • OUG 108/2022 • Law 334/2022 on phase out of coal TPP • Just Transition Plan which includes Just Transition Territorial Plans
Methodology	Bottom-up modeling and Vo ovaa ver optimization using the LEAP-RO model. IPCC Methodology
Assumptions	It is envisaged that by 2032: • 1,425 MW (31.12.2025) • 1,140 MW (31.12.2026) will be decommissioned.
Status of implementation	Under implementation
- Steps taken	Closed capacities: • 1,695 MW on 31.12.2021 • 660 MW on 31.12.2022 Legislative changes: • the Government Emergency Ordinance no. 108/2022 on the decarbonization of the energy sector, • Law no. 334/29.11.2022 on the approval of Government Emergency Ordinance no. 108/30.06.2022 on the decarbonisation of the energy sector, • Government Emergency Ordinance no. 175/2022 amending the Law no. 334/29.11.2022, • Government Decision no. 1573/2022 on the approval of the postponement of the closure of certain lignite-fired energy capacities and related mining operations, • Government Decision no. 264/2023 on repealing Government Decision No 1.573/2022 approving the postponement of the closure of certain lignite-fired energy capacities and related mining operations, • Government Emergency Ordinance no. 14/2023 amending Government Emergency Ordinance no. 108/2022, • Government Emergency Ordinance no. 19/29.03.2023 amending Government Emergency Ordinance no. 108/2022. • The definitive withdrawal from operation of the Power Unit no. 3 - 330 MW from the Rovinari Thermal Power Plant, starting with 01.06.2023 and the mothballing of Power Unit no. 7 - 330 MW from the Turceni Thermal Power Plant in the period 01.06.2023 - 31.12.2025.
- Steps envisaged	• Continuation of the phase-out

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2021-2022	2025	2032

Progress	Additional phased-out capacity (MW)	2355	3780	4920
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			
Finance	Budget	M€		
	Source of finance	/		
Implementing entity		• Government of Romania • Ministry of Energy • Ministry of Environment, Water and Forests • Ministry of Economy, Entrepreneurship, and Tourism • Ministry of Investments and European Project • Private investors		
Monitoring entity				
Relation with other dimensions				

PAM 2 Introduction of green hydrogen into the energy system

Main objective: Decarbonisation of the energy system
Description: All natural gas-powered plants (CCGT, CHP) will be 100% ready for renewable gases (green hydrogen) by 2036

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	Energy supply	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Long Term Strategy of Romania • Recovery and resilience plan for Romania • Law on the integration of hydrogen from renewable and low-carbon sources in the industry and transport sectors (Hydrogen Law) 237/2023 • Emergency Ordinance nr. 53/2019 on the approval of the Multi-Annual Investment Financing Program for the modernization, rehabilitation, refurbishment and extension or establishment of centralized heat supply systems of localities and for amending and supplementing the Law on Community Public Utilities Services no. 51/2006 • Hydrogen strategy – in progress			
Methodology	Bottom-up modeling and least-cost optimization using the LEAP-RO model. IPCC Methodology			
Assumptions	100% green hydrogen CCGT and CHP by 2036			
Status of implementation	Planned			
- Steps taken	Preparation of Hydrogen Strategy and Action Plan for 2023-2030			
- Steps envisaged	• Replacement of technologies			
Indicators	Value in the last reporting year	Indicative trajectory	Target value	
	2020-2021	2025	2030	
Progress — Additional installed capacity (MW)		860	2615	
Emissions reduction (Gg CO_2-eq)				
Other — Primary energy savings (ktoe)				
Finance — Budget	M€			
Source of finance	Public private partnership			
Implementing entity	• Government of Romania • Ministry of Energy • Ministry of Environment, Water and Forests • Ministry of Economy, Entrepreneurship, and Tourism • Private investors			
Monitoring entity				
Relation with other dimensions				

*note: new CCGT on natural gas should be hydrogen ready

PAM 3 Development of new CCGT capacities

Main objective: Advancing the technologies used for energy production, thus lowering the GHG emissions
Description: The aim of the measure is development of new **CCGT to** be along with the objective of decarbonization of the energy sector by switching from the coal-based capacities to gas-fired and RES capacities

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	Energy supply	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Long Term Strategy of Romania • Recovery and resilience plan for Romania • GEO 108/2022 and • Just Transition Plan which includes Just Transition Territorial Plans
Methodology	Bottom-up modeling and least-cost optimization using the LEAP-RO model. IPCC Methodology
Assumptions	It is envisaged that by 2040 additional capacity of: • 430 MW (Iernut) starting from 01.01.2024 • at least 860 MW (Mintia) with a possibility to 1700 MW by 2026 • 1,325 MW (Isalnita & Turceni) starting from 01.07.2026. will be constructed.
Status of implementation	Planned
- Steps taken	•
- Steps envisaged	• Construction of power plants

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020-2021	2025	2030
Progress	Additional installed capacity (MW)		430	at least 2615
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			

Finance	Budget	65 M€ (Lernut); 425 M€ (Mintia)
	Source of finance	Private-public partnership (Modernization Fund)
Implementing entity		• Government of Romania • Ministry of Energy • Ministry of Environment, Water and Forests • Ministry of Economy, Entrepreneurship, and Tourism • Ministry of Investments and European Projects • Private investors
Monitoring entity		
Relation with other dimensions		

PAM 4 Promotion of high-efficiency cogeneration capacities

Main objective: Promotion of high-efficiency cogeneration capacities with installation of new CHPs.
Description: Cogeneration units will contribute to enhance energy supply security, particularly at the local level, thereby mitigating the risk of power and heat supply disruptions. Another potential benefit of cogeneration production lies in its reduced fuel demand compared to alternative technologies, which can positively impact the reduction of reliance on imports.
Efforts are underway to bolster high-efficiency cogeneration capabilities and integrate renewable energy sources into heat production for centralized heating systems.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	Energy supply	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Long Term Strategy of Romania • Recovery and resilience plan for Romania • Emergency Ordinance nr. 53/2019 on the approval of the Multi-Annual Investment Financing Program for the modernization, rehabilitation, refurbishment and extension or establishment of centralized heat supply systems of localities and for amending and supplementing the Law on Community Public Utilities Services no. 51/2006 • Law no. 325/2006 on the public heat energy supply service
Methodology	Bottom-up modeling and least-cost optimization using the LEAP-RO model. IPCC Methodology
Assumptions	It is envisaged that by 2040 additional capacity of: • 80 MW (Rompetrol Navodari) starting from 01.08.2023 • 52 MW (CTE Constanta) starting from 01.01.2025 • 295 MW (CTE Craiova CEO) starting from 01.01.2026 • 70 MW (others) starting from 01.07.2026. • 50 MW (CTE Grozavesti) starting from 01.01.2025 • 200 MW (CTE Sud Vitan) starting from 01.01.2026 • 200 MW (CTE Progresu) starting from 01.01.2027 will be constructed.
Status of implementation	Under implementation
- Steps taken	•
- Steps envisaged	• Construction of power plants

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020-2021	2025	2030
Progress	Additional installed capacity (MW)		192	1102
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			

Finance	Budget	M€
	Source of finance	Private-public partnership

Implementing entity	• Government of Romania • Ministry of energy • Ministry of Environment, Water and Forests • Ministry of Economy, Entrepreneurship, and Tourism • Private investors
Monitoring entity	
Relation with other dimensions	

PAM 5 Employing CCUS technologies

Main objective: Promotion of Carbon capture, storage and utilization for vast emission reduction
Description: By employing the CCUS technologies in the Mineral industry in which Cement production is included (as defined in 8 NC), at least 50% of the emissions will be captured by 2050.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical, regulatory	Industry	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Long Term Strategy of Romania • GEO no. 64 on the geological storage of carbon dioxide (Official Gazette of Romania no. 461 on 30 June 2011)
Methodology	Bottom-up modeling using the LEAP-RO model and IPCC Methodology
Assumptions	By 2050, 50% of the emissions captured in the Mineral industry
Status of implementation	Under implementation
- Steps taken	•
- Steps envisaged	•

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020 – 2021	2025	2030
Progress	Additional installed capacity (MW)			
Emissions reduction (Gg CO_2-eq)				2,583 kt (2050)
Other	Primary energy savings (ktoe)			

Finance	Budget	M€
	Source of finance	Private, donors through commercial EE loans, EE fund
Implementing entity		• National Agency for Mineral Resources • Ministry of Economy, Entrepreneurship, and Tourism • Ministry of Energy of Romania • Ministry of Environment, Water and Forests • ANRE • Private investors
Monitoring entity		
Relation with other dimensions		Decarbonisation

PAM 6 Implementation of the Kigali amendment in the Product uses as substitutes of ODS

Main objective: Implementation of the Kigali amendment of the Montreal protocol in the Product uses as substitutes of ozone depleting substances

Description: The implementation of the Kigali amendment to the Montreal protocol will reduce the emissions from the Product uses as substitutes of ozone depleting substances by approximately 7 times in 2050, compared to 2019.As a result of the Product uses as substitutes of ozone depleting substances, F-gases are included in this sector, which will be drastically reduced. As a result, in 2050, more than 96% of the GHG emissions in the Industry sector will be CO2 emissions.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Regulatory, technical	Industry	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Long Term Strategy of Romania • Recovery and resilience plan for Romania • Law no. 30/2020 (Official Gazette. no. 275/2 Apr. 2020) on adoption of Montreal Protocol Amendment on substances that deplete the ozone layer (Kigali Amendment, 2016)				
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC Methodology				
Assumptions					
Status of implementation	Under implementation				
- Steps taken	•				
- Steps envisaged	•				
Indicators	Value in the last reporting year	Indicative trajectory		Target value	
	2020 – 2021	2020	2025	2030	
Progress – Additional installed capacity (MW)					
Emissions reduction (Gg CO_2-eq)			not more than 1510	Not more than 1090	
Other – Primary energy savings (ktoe)					
Finance – Budget	M€				
Finance – Source of finance	Private investors				
Implementing entity	• Ministry of Economy, Entrepreneurship, and Tourism • Ministry of Energy of Romania • Ministry of Environment, Water and Forests • Private investors				
Monitoring entity					
Relation with other dimensions					

PAM 7 Improvement of the industrial processes

Main objective: Alignment of activity data and EF in industrial sector according to BR and NC in different industry categories
Description:

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical, regulatory	Industry	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Long Term Strategy of Romania • Recovery and resilience plan for Romania
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions	• In the cement production, the activity data in 2040 will be in accordance with NC 8 (approx. 8,600kt clinker production), while the process EF level (calculated on the basis of CaO and MgO content originating from carbonates) will be lowered from 0.52 to 0.49 tCO2/t clinker, according to NC 8. • The lime production will follow the production index growth trend (in accordance with the data CNSP) and the EF will be in accordance with the BR 4. • The glass production will follow the production index growth trend (in accordance with the data from CNSP) and the EF will be in accordance with BR 4. • The level of production and emission in the ceramics industry and in all the other industries employing non-metallic minerals will be in accordance with BR 4. • The annual growth rate of soda ash production will be 1.8%, in accordance with BR 4. • The EF in the steel production will lower from1.01 tCO2/t to 0.3 tCO2/t in 2030, as a result of employing electric arc furnace (EAF) and DRI-EAF technologies.
Status of implementation	Under implementation
- Steps taken	•
- Steps envisaged	•

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020 – 2021	2025	2030
Progress	Additional installed capacity (MW)			
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			

Finance – Budget	M€
Finance – Source of finance	Private, donors through commercial EE loans, EE fund
Implementing entity	• Ministry of Economy, Entrepreneurship, and Tourism • Ministry of Energy • Ministry of Environment, Water and Forests • Private investors
Monitoring entity	
Relation with other dimensions	Decarbonisation

PAM 8 Setting an obligation for CO_2 injecting and storing for the oil & gas industry

Main objective Established commitment for injecting and storing for the oil & gas industry
Description: According to Net Zero Industry Act (Proposal for a regulation of the European Parliament and of the Council on establishing a framework of measures for strengthening Europe's net-zero technology products manufacturing ecosystem (Net Zero Industry Act) - COM(2023) 161, 16.03.2023), 2030 commitments for CO_2 injecting and storing for the oil & gas industry are imposed.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical, regulatory	Industry	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Long Term Strategy of Romania • Recovery and resilience plan for Romania			
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC Methodology			
Assumptions				
Status of implementation	Under implementation			
- Steps taken	•			
- Steps envisaged	•			
Indicators	Value in the last reporting year	Indicative trajectory	Target value	
	2020 – 2021	2025	2030	
Progress — Additional installed capacity (MW)				
Emissions reduction (Gg CO_2-eq)				
Other — Primary energy savings (ktoe)				
Finance — Budget	M€			
Source of finance	Private investors			
Implementing entity	• Ministry of Economy, Entrepreneurship, and Tourism • Ministry of Energy • Ministry of Environment, Water and Forests • Private investors			
Monitoring entity				
Relation with other dimensions	Decarbonisation			

PAM 9 Reduction of emissions from enteric fermentation

Main objective: Decrease level of CH_4 emission from enteric fermentation
Description: Reduction of emissions from enteric fermentation by introducing a proper diet. Based on this assumption, the emission factor for enteric fermentation will be reduced by 10% in 2030 and by 30% in 2050 compared to 2050.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Education, Technical	AFLOU-Livestock	CH_4	National

Relevant planning documents, legal and regulatory acts	• Common Agricultural Policy of Romania • Long Term Strategy of Romania • Recovery and resilience plan for Romania		
Methodology	Bottom up modeling using LEAP-RO model, IPCC methodology		
Assumptions	• Increased number of highly productive dairy cows under intensive farming, • Introduced modified TMR and nutrition management. • Expected to be on organized in farms with more than 50 heads		
Status of implementation	Under implementation		
- Steps taken	•		
- Steps envisaged	• focus on enhancing animal nutrition and feeding practices to enhance the competitiveness of the animal breeding sector, improve product safety and quality, and reduce environmental impact		
Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020 – 2021	2025	2030
Progress: Additional installed capacity (MW)			
Emissions reduction (Gg CO_2-eq)			
Other: Primary energy savings (ktoe)			
Finance: Budget	M€		
Finance: Source of finance	Private sector, IPARD programme		
Implementing entity	National Sanitary Veterinary and Food Safety Authority		
Monitoring entity	Ministry of Agriculture and Rural Development		
Relation with other dimensions			

PAM 10 Increasing agricultural residues management

Main objective: Advanced utilization of residues in order to obtain circular bioeconomy without field burning residues, thus achieve zero emission.
Description: Reduction of climate damaging and yield decreasing crop fires by incentivizing farmers to save agricultural residues and potentially use crop stubble as an energy source or in livestock feeding instead. Improve agricultural residue management as an important C storage, initiating research projects and measuring technology to keep a side-specific balance given that crop residues also generate N2O.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Regulatory, Financial	AFOLU-Agriculture	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Common Agricultural Policy of Romania • Long Term Strategy of Romania • Recovery and resilience plan for Romania			
Methodology	Bottom up modeling using LEAP-RO model, IPCC methodology			
Assumptions	Starting from 2030, no agricultural residues will be burned on the field			
Status of implementation	Under implementation			
- Steps taken	•			
- Steps envisaged	•			
Indicators	Value in the last reporting year	Indicative trajectory		Target value
	2020 – 2021	2025		2030
Progress: Additional installed capacity (MW)				
Emissions reduction (Gg CO_2-eq)				
Other: Primary energy savings (ktoe)				
Finance: Budget	M€			
Source of finance	Private sector, IPARD programme			
Implementing entity	Ministry of Agriculture and Rural Development			
Monitoring entity	Ministry of Agriculture and Rural Development			
Relation with other dimensions				

PAM 11 Reduction of methane emission level from manure management and biogas production

Main objective: Reduction of CH_4 emission level from manure management and biogas production
Description: To reduce emissions from farming, it is necessary that the manure is stored and used properly on farmland. In order to make this happen, farmers need to be given advice to utilize and purchase the right technology. Giving financial support for technology that helps manage manure in a way that is suitable for the environment.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	AFOLU-Livestock	CH_4	National

Relevant planning documents, legal and regulatory acts		• Common Agricultural Policy of Romania • Long Term Strategy of Romania • Recovery and resilience plan for Romania
Methodology		Bottom up modeling using LEAP-RO model, IPCC methodology
Assumptions		By capturing and using the methane emission of manure for producing biogas, the manure management emission level will be reduced by 40% in 2050 compared to 2030 and 5% of the energy demand in agriculture will be fulfilled.
Status of implementation		Under implementation
	- Steps taken	•
	- Steps envisaged	•

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020 – 2021	2025	2030
Progress	Additional installed capacity (MW)			
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			

Finance	Budget	M€
	Source of finance	Private sector, IPARD programme
Implementing entity		National Sanitary Veterinary and Food Safety Authority
Monitoring entity		Ministry of Agriculture and Rural Development
Relation with other dimensions		

PAM 12 Increasing the agrisolar production

Main objective: Increase in the share of solar energy for agricultural purposes
Description: This measure brings together farming and producing clean energy. To achieve this goal, solar panels are installed above and in between farmland in a way that allows for both energy generation and profitable agriculture. This situation is a win for everyone involved. It helps the environment and makes sure there is enough of what we need. It also helps farmers by giving them more ways to grow financialy, and it helps make farms and rural areas stronger in the long run.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	AFOLU, Energy	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Common Agricultural Policy of Romania • Long Term Strategy of Romania • Recovery and resilience plan for Romania • LAW on the establishing of the system for the promotion of energy production from renewable energy sources
Methodology	Bottom up modeling using LEAP-RO model, IPCC methodology
Assumptions	In terms of energy use in Agriculture, the share of solar energy will be increased to 15% in 2050, while diesel consumption will be reduced to zero.
Status of implementation	Under implementation
- Steps taken	•
- Steps envisaged	•

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020 – 2021	2025	2030
Progress	Additional installed capacity (MW)			
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			

Finance	Budget	M€
	Source of finance	Private sector, IPARD programme
Implementing entity		Ministry of Agriculture and Rural Development Ministry of energy
Monitoring entity		Ministry of Agriculture and Rural Development Ministry of energy
Relation with other dimensions		

PAM 13 Establishing integrated management of forest fires

Main objective: Reducing the average annual burned area
Description: Forest fires are already detected as a very significant problem of forest loss and source of GHG emissions. This measure includes the protection of the forest area by preventing the forest fires and the damages resulting from forest fires.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	AFLOU-Forestry	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• The 2030 National Forest Strategy • Common Agricultural Policy of Romania • Long Term Strategy of Romania • Recovery and resilience plan for Romania
Methodology	Bottom up modeling using LEAP-RO model, IPCC methodology
Assumptions	The annual average forest burned area by 2050 will be equal to the average forest burned area during 2010-2019
Status of implementation	Under implementation
- Steps taken	•
- Steps envisaged	•

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020 – 2021	2025	2030
Progress	Additional installed capacity (MW)			
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			

Finance	Budget	M€
	Source of finance	Forest enterprises
Implementing entity		Ministry of Environment, Waters and Forests
Monitoring entity		Ministry of Environment, Waters and Forests
Relation with other dimensions		

PAM 14 PV systems in agriculture

Main objective: Increase the share of RES and reduce GHG emission coming from the agriculture sector.
Description: The installation of a photovoltaic system for irrigation, serving as a mitigation practice by replacing diesel with electric pumps and incorporating photovoltaic technology, is suitable for both existing and new on-farm irrigation systems. This measures also includes floating solar power projects on irrigation chanals as well as agrivoltaic.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Education, Technical financial ,	AFOLU-Land/Agriculture	CO_2	National

Relevant planning documents, legal and regulatory acts	• Common Agricultural Policy of Romania • Long Term Strategy of Romania • Recovery and resilience plan for Romania
Methodology	Bottom up modeling using LEAP-RO model, IPCC methodology
Assumptions	
Status of implementation	Under implementation
- Steps taken	• The National Agency for Land Improvement of Romania is set to apply for European funds for a floating solar park on a network of irrigation canals east of Bucharest (Gălățui-Călărași area). The government plans to complete the 20 MW project by the end of 2025. • InterNET Ltd, launched the first two agrivoltaics systems in Romania in June 2023 • Danish company Eurowind Energy is developing an agrivoltaic project in Romania, a 70 MW photovoltaic park that will combine solar energy with agriculture. To be complited by 2024
- Steps envisaged	• To promote the photovoltaic irrigation, agrivoltaic as mitigation measure

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020 – 2021	2025	2030
Progress	Additional installed capacity (MW)			
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			

Finance – Budget	M€
Finance – Source of finance	Private sector, IPARD programme
Implementing entity	Ministry of Agriculture and Rural Development
Monitoring entity	Ministry of Economy, Entrepreneurship, and Tourism
Relation with other dimensions	

PAM 15 Renewal of the agricultural machinery and equipment

Main objective: Modernisation of the agricultural machinery and equipment
Description: To implement various promotional and support schemes that will enable farmers to modernize the agricultural machinery

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical, financial	AFOLU-Agriculture	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts		• Common Agricultural Policy of Romania • Long Term Strategy of Romania • Recovery and resilience plan for Romania
Methodology		Bottom up modeling using LEAP-RO model, IPCC methodology
Assumptions		
Status of implementation		Under implementation
- Steps taken		•
- Steps envisaged		• Enlarge the number of new agricultural machines
Indicators		Value in the last reporting year: 2020 – 2021 / Indicative trajectory: 2025 / Target value: 2030
Progress	Additional installed capacity (MW)	
Emissions reduction (Gg CO_2-eq)		
Other	Primary energy savings (ktoe)	
Finance	Budget	M€
	Source of finance	Private sector, IPARD programme
Implementing entity		Ministry of Agriculture and Rural Development
Monitoring entity		Ministry of Agriculture and Rural Development
Relation with other dimensions		

PAM 16 Establishment of agricultural associations

Main objective: Reorganization of agricultural land in the form of agricultural associations
Description: Formation of new agricultural associations.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical, regulatory	AFOLU-Agriculture	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts		• National Strategy for Agriculture in Romania – Horizon 2035 • Romania's Agri-Food and Rural Development Strategy • Common Agricultural Policy of Romania • Long Term Strategy of Romania • Recovery and resilience plan for Romania • Agricultural Cooperatives Law no. 566 of 22 December 2004
Methodology		
Assumptions		
Status of implementation		Under implementation
	- Steps taken	•
	- Steps envisaged	•
Indicators		Value in the last reporting year: 2020 – 2021 / Indicative trajectory: 2025 / Target value: 2030
Progress	Additional installed capacity (MW)	
Emissions reduction (Gg CO_2-eq)		
Other	Primary energy savings (ktoe)	
Finance	Budget	M€
	Source of finance	Private sector, IPARD programme
Implementing entity		Ministry of Agriculture and Rural Development
Monitoring entity		Ministry of Agriculture and Rural Development
Relation with other dimensions		

PAM 17 Reduction of municipal waste per capita

Main objective: Minimization of waste generation
Description: To reduce the municipal waste generation in line with the Romanian Overview of national waste prevention programmes in Europe - Country Profile 2021 by EEA

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Education, regulatory, information	Waste	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• National Waste Management Plan • Long Term Strategy of Romania • Recovery and resilience plan for Romania • GEO no. 92/2021 on the waste regime repealed the Law no.211/2011 on the waste regime.
Methodology	Bottom up modeling using LEAP-RO model, IPCC methodology
Assumptions	By 2030, it is assumed that household waste per capita will be reduced by 10 % compared to 2017 (i.e. reduce MSW from the 228 kg per capita recorded in 2017 to 204 kg per capita by 2030).
Status of implementation	Under implementation
- Steps taken	•
- Steps envisaged	•

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020 – 2021	2025	2030
Progress	Additional installed capacity (MW)			
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			

Finance	Budget	M€
	Source of finance	End-users
Implementing entity		• Ministry of Environment, Water and Forests • Municipalities (Public municipal enterprises for waste management)
Monitoring entity		• Ministry of Environment, Water and Forests • State Environmental Inspectorate • Authorized Inspectors of Environment (Municipalities)
Relation with other dimensions		

PAM 18 Increased recycling and biodegradable waste selection for composting

Main objective: Recycle – converting the waste materials to raw materials and compost.
Description: Intensification of recycling as a transformation method of waste materials like paper, glass, metal, plastic, etc., into primary materials and converting organic food and garden waste into compost for use as fertilizers.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical, regulatory	Waste	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• National Waste Management Plan • Long Term Strategy of Romania • Recovery and resilience plan for Romania
Methodology	Bottom up modeling using LEAP-RO model, IPCC methodology
Assumptions	Recycling rates: • Wood – 25% in 2025, 30% in 2030 (as in Zero Waste Europe-Policy briefing document) and 50% in 2050 • Paper and textile – 80% in 2050 • Food and garden waste – 50% in 2030 and 60% in 2050. The reduced amount of food and garden waste will be used in the composting process. Additionally, the emissions factors for composting will be reduced to 3kt CH4/tonne and 0.24 kt N2O/tonne in 2050, which is in accordance to the GHG Emission Factors Review – ESA
Status of implementation	Under implementation
- Steps taken	•
- Steps envisaged	•

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020 – 2021	2025	2030
Progress	Additional installed capacity (MW)			
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			

Finance – Budget	M€
Finance – Source of finance	Local self-government through Public Utilities, Public Private Partnership, EU funds
Implementing entity	• Ministry of Environment, Water and Forests • Municipalities (Public municipal enterprises for waste management)
Monitoring entity	• Ministry of Environment, Water and Forests • State Environmental Inspectorate • Authorized Inspectors of Environment (Municipalities)
Relation with other dimensions	

PAM 19 Improved İncineration / co-incineration

Main objective: Improvement of incineration processes
Description: Improvement of the incineration process to address the expected increase waste incineration

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	Waste	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts		• National Waste Management Plan • Long Term Strategy of Romania • Recovery and resilience plan for Romania • GEO no. 92/2021 on the waste regime repealed the Law no.211/2011 on the waste regime.
Methodology		Bottom up modeling using LEAP-RO model, IPCC methodology
Assumptions		The volume of municipal waste incinerated / co-incinerated will increase to 500kt in 2030 and to 900kt in 2050 (similar as in 8NC), with the option of this waste being used for energy recovery in recovery facilities and/or in cement plants.
Status of implementation		Under implementation
- Steps taken		•
- Steps envisaged		•
Indicators		Value in the last reporting year: 2020 – 2021 / Indicative trajectory: 2025 / Target value: 2030
Progress	Additional installed capacity (MW)	
Emissions reduction (Gg CO_2-eq)		
Other	Primary energy savings (ktoe)	
Finance	Budget	M€
	Source of finance	Local self-government through Public Utilities, Public Private Partnership, EU funds
Implementing entity		• Ministry of Environment, Water and Forests • Municipalities (Public municipal enterprises for waste management)
Monitoring entity		• Ministry of Environment, Water and Forests • Authorized Inspectors of Environment (Municipalities) • State Environmental Inspectorate
Relation with other dimensions		

PAM 20 Landfill gas flaring

Main objective: Environmental protection and meeting the highest European standards
Description: Rehabilitation of the existing landfills and illegal ("wild") dumpsites with very high, high and medium risk in the waste management regions, as well as opening of regional landfills. The rehabilitation includes covering on the existing non-compliant landfills, supplemented by gas extraction and flaring.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	Waste	CO_2, CH_4	Regional

Relevant planning documents, legal and regulatory acts	• National Waste Management Plan • Long Term Strategy of Romania • Recovery and resilience plan for Romania
Methodology	Bottom up modeling using LEAP-RO model, IPCC methodology
Assumptions	60% of the emissions from the non-recycled waste plus the historical emissions will be used for flaring in 2050.
Status of implementation	Under implementation
- Steps taken	•
- Steps envisaged	•

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020 – 2021	2025	2030
Progress	Additional installed capacity (MW)			
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			

Finance	Budget	M€
	Source of finance	Local self-government through Public Utilities, Public Private Partnership, EU funds
Implementing entity		• Ministry of Environment, Water and Forests • Municipalities (Public municipal enterprises for waste management)
Monitoring entity		• Ministry of Environment, Water and Forests • State Environmental Inspectorate • Authorized Inspectors of Environment (Municipalities)
Relation with other dimensions		

PAM 21 Improved wastewater treatment					
Main objective: Improved collection and treatment of domestic wastewater **Description:** Enhanced wastewater collection in rural areas through increased sewage networks connection, and increased connections to wastewater treatment facilities across rural and urban areas.					
Timeframe		Type	Sector	Gases	Scope
2022 – 2050		Technical	Waste	CO_2, CH_4, N_2O	National
Relevant planning documents, legal and regulatory acts		• National Waste Management Plan • Long Term Strategy of Romania • Recovery and resilience plan for Romania • Water Law no. 107/1996 amended and supplemented by the Law no. 122/2020 from July 13, 2020.			
Methodology		Bottom up modeling using LEAP-RO model, IPCC methodology			
Assumptions		It is envisaged that: • 90% of the rural population will be connected to the sewage network by 2050. • By 2030, all urban areas will be connected to wastewater treatment plants. • 5% of the rural areas will be connected to wastewater treatment plants by 2025 and 70% by 2050. • The sludge resulting from the wastewater treatment will be used in agriculture or will be dried and used as energy source in the cement industry will be constructed.			
Status of implementation		Under implementation			
- Steps taken		•			
- Steps envisaged		•			
Indicators		Value in the last reporting year	Indicative trajectory	Target value	
		2020 – 2021	2025	2030	
Progress	Additional installed capacity (MW)				
Emissions reduction (Gg CO_2-eq)					
Other	Primary energy savings (ktoe)				
Finance	Budget	M€			
	Source of finance	Local self-government through Public Utilities, Public Private Partnership, EU funds			
Implementing entity		• Ministry of Environment, Water and Forests • Ministry of Investment and European Projects • Municipalities (Public enterprises for water supply and sewage services)			
Monitoring entity		Ministry of Environment, Water and Forests			
Relation with other dimensions					

II. Where relevant, regional cooperation in this area

In accordance with Article 5(4)-(7) of Regulation 2018/842/EU, Romania could transfer part of the annual emission allocation in the sectors outside the scope of ETS. Such transfers may be achieved under bidding procedures, by relying on market intermediaries acting as agents or under bilateral agreements

III. Without prejudice to the applicability of State aid rules, financing measures, including Union support and the use of Union funds, in this area at national level, where applicable

3.1.2. Renewable energy

I. Policies and measures to achieve the national contribution to the 2030 Union target for renewable energy and trajectories as referred to in point (a)(2) Article 4, and, where applicable or available, the elements referred to in point 2.1.2 of this Annex, including sector- and technology- specific measures

PAM 22 Increase of the domestic generation capacity from PV power plants

Main objective: Increase of the domestic generation capacity from PV power plants
Description: Construction of PV plants

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	Energy supply	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Long Term Strategy of Romania • Recovery and resilience plan for Romania • LAW on the establishing of the system for the promotion of energy production from renewable energy sources
Methodology	Bottom-up modeling and least-cost optimization using the LEAP-RO model. IPCC Methodology
Assumptions	It is envisaged that by 2050 additional capacity of: • 600MW each year from 2023 to 2025, • 700 MW each year from 2026 to 2030, • 525 MW each year from 2031 to 2050 will be constructed.
Status of implementation	Under implementation
- Steps taken	•
- Steps envisaged	• Construction of PV PP

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020-2021	2025	2030
Progress: Total installed capacity (MW)		2800	5800
Emissions reduction (Gg CO_2-eq)			
Other: Primary energy savings (ktoe)			

Finance: Budget	M€
Source of finance	Private, incentives through central government budget
Implementing entity	• Government of Romania • Ministry of Energy • ANRE • Ministry of Environment, Water and Forests • Ministry of Economy, Entrepreneurship, and Tourism • Private investors
Monitoring entity	
Relation with other dimensions	

PAM 23 Increase of the domestic generation capacity from wind

Main objective: Increase of the domestic generation capacity from wind
Description: Construction of wind power plants

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	Energy supply	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Long Term Strategy of Romania • Recovery and resilience plan for Romania • LAW on the establishing of the system for the promotion of energy production from renewable energy sources
Methodology	Bottom-up modeling and least-cost optimization using the LEAP-RO model. IPCC Methodology
Assumptions	It is envisaged that by 2050 additional capacity of: • 550MW each year from 2023 to 2025, • 600 MW each year from 2026 to 2030, • 675 MW each year from 2031 to 2040 • 750 MW each year from 2041 to 2050 will be constructed.
Status of implementation	Under implementation
- Steps taken	•
- Steps envisaged	• Construction of wind power plants

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020-2021	2025	2030
Progress: Total installed capacity (MW)		5030	7630
Emissions reduction (Gg CO_2-eq)			
Other: Primary energy savings (ktoe)			

Finance: Budget	M€
Source of finance	Private, incentives through central government budget
Implementing entity	• Government of Romania • Ministry of Energy • ANRE • Ministry of Environment, Water and Forests • Ministry of Economy, Entrepreneurship, and Tourism • Private investors
Monitoring entity	
Relation with other dimensions	

PAM 24 Small hydro power plant

Main objective: Increase of the domestic generation capacity from renewable energy sources
Description: Construction of new small hydro power plants taking into account environmental and social impacts

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	Energy supply	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts		• Long Term Strategy of Romania • Recovery and resilience plan for Romania • Law on the establishing of the system for the promotion of energy production from renewable energy sources • Water Law no. 107/1996 amended and supplemented by the Law no. 122/2020 from July 13, 2020.
Methodology		Bottom-up modeling and least-cost optimization using the LEAP-RO model. IPCC Methodology
Assumptions		It is envisaged that by 2050 additional capacity of: • 65 MW (AHE Bumbesti Livezeni) starting from 01.01.2024 • 12 MW (AHE Pascani Sirt) starting from 01.01.2025 • 55 MW (AHE Cornetu – Avrig (Caineni and Lotrioara)) starting from 01.01.2027 • 55 MW (AHE Surduc Siriu) starting from 01.01.2027 • 38 MW (AHE Siret Cosmesti - Movileni) starting from 01.01.2027 • 35 MW (AHE Rastolita) starting from 01.01.2028 • 15 MW (AHE Cerna Belareca) starting from 01.01.2028 – • 29 MW (AHE Izbiceni Dunare, Islaz) starting from 01.01.2030 will be constructed.
Status of implementation		Under implementation
	- Steps taken	•
	- Steps envisaged	• Construction of SHPPs

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020-2021	2025	2030
Progress	Additional installed capacity (MW)		77	304
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			

Finance	Budget	M€
	Source of finance	Public private partnership
Implementing entity		• Government of Romania • Ministry of Energy • Ministry of Environment, Water and Forests • Ministry of Economy, Entrepreneurship, and Tourism • Private investors
Monitoring entity		
Relation with other dimensions		

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

The statistical transfer mechanism provides for the excess RES produced in an EU Member State to be transferred to other Member States. This mechanism enables more flexibility, in view of achieving the shares established at Member State level, by providing them with an instrument to develop the RES potential in a mutually advantageous manner. In this way, countries with high RES potential may support other Member States in achieving their individual targets. This method of cooperation among Member States was introduced with the adoption of Directive 2009/28/EC on the promotion of the use of energy from renewable sources and the continuation of this mechanism is provided in the “Clean Energy Package” as a legislative package.

In this context, the instruments provided by this cooperation mechanism (statistical transfer or co-financing of RES production projects by two or more Member States) may constitute an opportunity to increase the installed RES capacity in Romania provided that the respective static transfer is not achieved to the detriment of the achievement of the national RES targets and with a negative impact on the operation of the NES under conditions of safety.

III. Specific measures on financial support, where applicable, including Union support and the use of Union funds, for the promotion of the production and use of energy from renewable sources in electricity, heating and cooling, and transport

The implementation of a substantial portion of these measures will rely on the utilization of the Recovery and Resilience Fund allocated for Romania. It plays a key role in supporting the ambitious programs and projects.

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 under Article 6(4) of the RED II is essential for Romania to ensure that the support mechanisms and subsidies for renewable electricity align with the EU's state aid rules and contribute to the country's renewable energy targets. According to the National Recovery and Resilience Plan, Romania is seeking to encourage growth in renewable electricity production through a competitive financing scheme (contract of difference mechanizam). This initiative is designed to enhance the bankability of renewable projects and promote a diversified energy market, making it an attractive prospect for various market actors.

The proposed competitive stimulation program aims to minimize costs and promote energy production from renewable sources through an open, competitive framework, primarily targeting small and medium-sized enterprises (SMEs) while remaining accessible to larger investors. With these mechanisms aligned with financing guidelines, with this scheme around 950 MW from photovoltaic and wind are envisage to be installed. This capacity is expected to generate approximately 1700 GWh per year, constituting roughly 3% of the nation's annual energy consumption, which stands at approximately 55 TWh.

At the same time as it is shown in PAM 25, through Green house photovoltaic program, PV rooftops are supported.

V. Specific measures to introduce one or more contact points, streamline administrative procedures, provide information and training, and facilitate the uptake of power purchase agreements Summary of the policies and measures under the enabling framework Member States have to put in place 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.

PAM 25 Rooftop PP

Main objective: Increase of the domestic generation capacity from renewable energy sources
Description: Construction of rooftop power plants, on private as well as public buildings, either prosumers or systems from which the overall produced electricity will be used for own purposes or will be stored. One of the possibilities for increasing the installed capacity of solar roof-top systems is through renewable energy communities

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical, regulatory	Household, commercial and industry sector	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Long Term Strategy of Romania • National Long Term Renovation Strategy • Recovery and resilience plan for Romania • LAW on the establishing of the system for the promotion of energy production from renewable energy sources • Law for energy performance of buildings 372/2005 • Law on Energy Efficiency
Methodology	Bottom-up modeling and least-cost optimization using the LEAP-RO model. IPCC Methodology

Assumptions	New PV auto & rooftop PP: • 100MW each year from 2023 to 2029 • 800MW each year from 2030 to 2050 (solar strategy EU) will be constructed.			
Status of implementation	Under implementation			
- Steps taken	• Green house photovoltaic program - Order no. 1063 of April 26, 2023 for the approval of the Financing Guide for the Program on the installation of photovoltaic panel systems for electricity production, in order to cover the consumption needs and deliver the surplus to the national grid - published on 03.05.2023. Support for installation of PV on the roof up to 4000 EUR. In 2023, 500 mill. EUR are allocated under the program.			
- Steps envisaged	• Construction of rooftop PP			
Indicators	Value in the last reporting year	Indicative trajectory	Target value	
	2020-2021	2025	2030	
Progress: Additional installed capacity (MW)		At least 1500	At least 2500	
Emissions reduction (Gg CO_2-eq)				
Other: Primary energy savings (ktoe)				
Finance: Budget	M€			
Source of finance	Private, donors, subsidies from national and local budget, EE fund			
Implementing entity	• Government of Romania • Environment Fund Administration • Ministry of Energy • Ministry of Environment, Water and Forests • Ministry of Economy, Entrepreneurship, and Tourism • Private investors			
Monitoring entity				
Relation with other dimensions				

PAM 26 Installation of solar thermal collectors in the residential sector

Main objective: Reduction of the energy costs and improvement of the efficiency
Description: Hot water electric heaters are one of the biggest energy consumers with a major impact on bills. On the other hand, the reduced investment cost for purchasing and installation of solar thermal collectors is of great importance because it can drop consumer bills for hot water. Also, these systems serve for energy savings and can satisfy at least 50% at annual level, depending on the hot water needs. Furthermore, solar thermal collectors can be used in combination with electricity and district heating systems.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	Households and commercial sector	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Law on Energy efficiency • National Long Term Renovation Strategy • Long Term Strategy of Romania • Recovery and resilience plan for Romania • LAW on the establishing of the system for the promotion of energy production from renewable energy sources • Law for energy performance of buildings 372/2005 • Law on Energy Efficiency
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions	The share of solar thermal collectors: • Urban - 2030, 28% and 2050, 54% • Rural – 2030, 16% and 2050, 33%
Status of implementation	Under implementation
- Steps taken	•
- Steps envisaged	•

	Indicators		Value in the last reporting year	Indicative trajectory	Target value
			2020 – 2021	2025	2030
	Progress	Additional installed capacity (MW)			
	Emissions reduction (Gg CO_2-eq)				
	Other	Primary energy savings (ktoe)			
	Finance	Budget	M€		
		Source of finance	Private, EE fund, incentives from the central government budget, donors		
	Implementing entity		• Ministry of Energy • End-users		
	Monitoring entity				
	Relation with other dimensions				

VI. Assessment of the necessity to build new infrastructure for district heating and cooling produced from renewable sources

PAM 27 Increase of the domestic generation capacity from Biomass and biogas CHP and PP

Main objective: Increase of the domestic generation capacity from Biomass and biogas CHP and PP
Description: Construction of new biomass and biogas CHP and PP. Beside increasing the RES share with this CHPs, they should also contribute in increasing the flexibility of the electricity system and ensuring the security of supply. It is envisioned that waste biomass will be used, taking into account the sustainability of the biomass at national level.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	Energy supply	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Long Term Strategy of Romania • Recovery and resilience plan for Romania • LAW on the establishing of the system for the promotion of energy production from renewable energy sources • Law on Energy Efficiency • Emergency Ordinance nr. 53/2019 on the approval of the Multi-Annual Investment Financing Program for the modernization, rehabilitation, refurbishment and extension or establishment of centralized heat supply systems of localities and for amending and supplementing the Law on Community Public Utilities Services no. 51/2006 • Law no. 325/2006 on the public heat energy supply service
Methodology	Bottom-up modeling and least-cost optimization using the LEAP-RO model. IPCC Methodology
Assumptions	It is envisaged that by 2050 additional capacity of: • New biomass CHP – 10 MW each year by 2050 • New biogas CHP – 5 MW each year by 2050 • New biogas PP – 5 MW each year by 2050 will be constructed.
Status of implementation	Under implementation
- Steps taken	• Supporting investments for the modernization/rehabilitation of the smart district heating network, under Key Programme 5: "High efficiency cogeneration and modernization of district heating networks
- Steps envisaged	• Construction of biomass and biogas power plants

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020-2021	2025	2030
Progress	Totall installed capacity (MW)			330
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			

Finance	Budget	M€
	Source of finance	Private, incentives through central government budget
Implementing entity		• Government of Romania • Ministry of Energy • Ministry of Environment, Water and Forests • Ministry of Economy, Entrepreneurship, and Tourism • Private investors
Monitoring entity		
Relation with other dimensions		

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*

PAM 28 Development of market for more advance biofuels				
Main objective: Increase the domestic production of advance biofuels **Description:** RES share in the transport sector will be achieved only if advance biofuels are used . Having in mind the obligation under RED II directive of using advance biofuels and the sustainability criteria that should be fulfilled, Romanian authorities should collaborate with the companies in order to increase the domestic production.				
Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	Energy supply	CO_2, CH_4, N_2O	National
Relevant planning documents, legal and regulatory acts	• Long Term Strategy of Romania • LAW on the establishing of the system for the promotion of energy production from renewable energy sources			
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC Methodology			
Assumptions	At least 3.5% advance biofuels by 2030			
Status of implementation	Under implementation			
- Steps taken	•			
- Steps envisaged	•			
Indicators	Value in the last reporting year	Indicative trajectory	Target value	
	2020-2021	2025	2030	
Progress: Totall installed capacity (MW)			330	
Emissions reduction (Gg CO_2-eq)				
Other: Primary energy savings (ktoe)				
Finance: Budget	M€			
Source of finance	Private, incentives through central government budget			
Implementing entity	• Ministry of Transport and Infrastructure • Ministry of Energy • Ministry of Environment, Water and Forests • Ministry of Economy, Entrepreneurship, and Tourism • Private investors			
Monitoring entity				
Relation with other dimensions				

— *other biomass uses by other sectors (agriculture and forest-based sectors); as well as measures for the sustainability of biomass production and use*

Measures PAM 13 contribute to the sustainability of biomass production.

VIII. Where applicable, regional cooperation in this area:

Within the domain of regional cooperation, Romania has been the beneficiary of **the Renewable Energy, Energy Efficiency, Energy Security Program** in Romania. Sponsored by the EEA Financial Mechanism and the Norwegian financial mechanism. The program's main objectives are to contribute to the Program area(s)' Renewable Energy, Energy Efficiency, Energy Security and to the objective Less carbon intensive energy and increased security of supply. And shall contribute to the Program area(s) Renewable Energy, Energy Efficiency, Energy Security and to the objective Less carbon intensive energy and increased security of supply[1].

[1] https://eeagrants.org/news/programme-agreement-signed-energy-programme-romania

3.1.3. Other elements of the dimension

I. Where applicable, national policies and measures affecting the EU ETS and assessment of the complementarity and impacts on the EU ETS

Measures under Chapter 3.1.1, 3.1.2, as well as measures related to energy efficiency and fuel switch in the industry sector affecting the EU ETS.

II. Policies and measures to achieve other national targets, where applicable

Not applicable.

III. Policies and measures to achieve low emission mobility (including electrification of transport)

Please see the measures that are related with the electrification of the transport sector and are part from Energy efficiency dimension.

IV. Where applicable, national policies, timelines and measures planned to phase out energy subsidies, in particular for fossil fuels

Please see the chapter 4.6.IV

3.2 Dimension energy efficiency

I. Energy efficiency obligation schemes and alternative policy measures under Articles 7a and 7b and Article 20(6) of Directive 2012/27/EU and to be prepared in accordance with Annex III to this Regulation

Romania decided to have alternative policy and measures in order to fulfil its obligation under Article 7. Measure that contribute to achieving this goal are PAM 4 PAM 22PAM 23PAM 25PAM 27PAM 29PAM 30PAM 31PAM 32PAM 36PAM 37PAM 40PAM 41PAM 47PAM 61,

II. Long-term renovation strategy to support the renovation of the national stock of residential and non-residential buildings, both public and private, including policies, measures and actions to stimulate cost-effective deep renovation and policies and actions to target the worst performing segments of the national building stock, in accordance with Article 2a of Directive 2010/31/EU

PAM 29 Improve energy performance of public buildings at central level

Main objective: Retrofitting of existing public buildings to meet the objectives of the EE Directive and the Energy Efficiency Law
Description: This measure focuses on the renovation of existing public buildings under the central government's jurisdiction, encompassing activities such as the replacement of windows, insulation etc. As a part of this initiative, it will facilitate the issuance of energy performance certificates for these buildings. This certificate serves as a prerequisite for authorizing the implementation of the renovation projects, ensuring compliance with energy efficiency standards before renovation can commence.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical, regulatory	Central government buildings	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• National Long Term Renovation Strategy • Law on energy efficiency • Long Term Strategy of Romania • Recovery and resilience plan for Romania		
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC Methodology		
Assumptions	Annual renovation rate of 3% of the existing central government buildings (National long term renovation strategy)		
Status of implementation	Under implementation		
- Steps taken	•		
- Steps envisaged	•		
Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020 – 2021	2025	2030
Progress: Additional installed capacity (MW)			
Emissions reduction (Gg CO_2-eq)			
Other: Primary energy savings (ktoe)			
Finance: Budget	M€		
Finance: Source of finance	Central government budget, donors		
Implementing entity	• Ministry of Economy, Entrepreneurship, and Tourism • Ministry of Development, Public Works and Administration • Ministry of Finance • Local self-government • Municipal public enterprises • Donors and financial institutions		
Monitoring entity			
Relation with other dimensions			

PAM 30 Improve energy performance of public buildings at local level

Main objective: Retrofitting of existing public buildings to meet the objectives of the EE Directive and the Energy Efficiency Law
Description: This measure specifically addresses the renovation of existing public buildings within the jurisdiction of the local self-government, encompassing activities such as the replacement of windows, insulation etc. As a key component of this initiative, it will streamline the process for issuing energy performance certificates for these buildings. These certificates serves as a mandatory requirement before the renovation projects is finished, ensuring that the buildings meet established energy efficiency standards. This promotes more sustainable and energy-efficient infrastructure and streamlines the authorization process.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical, regulatory	Local self-government buildings	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• National Long Term Renovation Strategy • Law on energy efficiency • Long Term Strategy of Romania • Recovery and resilience plan for Romania			
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC Methodology			
Assumptions	Annual renovation rate of 3% of the existing local self-government buildings			
Status of implementation	Under implementation			
- Steps taken	•			
- Steps envisaged	•			
Indicators	Value in the last reporting year	Indicative trajectory		Target value
	2020 – 2021	2025		2030
Progress: Additional installed capacity (MW)				
Emissions reduction (Gg CO_2-eq)				
Other: Primary energy savings (ktoe)				
Finance: Budget	M€			
Finance: Source of finance	Local self-government budget, donors			
Implementing entity	• Ministry of Economy, Entrepreneurship, and Tourism • Ministry of Development, Public Works and Administration • Ministry of Finance • Local self-government • Municipal public enterprises • Donors and financial institutions			
Monitoring entity				
Relation with other dimensions				

PAM 31 Renovation of residential buildings

Main objective: To meet the requirements under the Energy Efficiency Law
Description: This measure relates to the renovation of residential buildings, which may involve activities such as the replacement of windows, insulation etc. These renovation efforts can be initiated by the building owners themselves and/or supported by commercial banks and funds. As a significant aspect of this initiative, it aims to facilitate the issuance of energy performance certificates for these buildings. This certificate is mandatory requirement before renovation projects is finished, ensuring compliance with established energy efficiency standards.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical, regulatory	Households	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts		• National Long Term Renovation Strategy • Law on energy efficiency • Long Term Strategy of Romania • Recovery and resilience plan for Romania
Methodology		Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions		The renovation rate, as outlined in National Long Term Strategy scenario 2, aligns with the parameters defined in the WAM scenario of the NECP. This rate serves as a key benchmark for the scale of building renovation projects, reflecting a strategic approach to achieving energy efficiency and sustainability goals in the residential sector.
Status of implementation		Under implementation
	- Steps taken	•
	- Steps envisaged	•
Indicators		Value in the last reporting year / Indicative trajectory / Target value
		2020 – 2021 / 2025 / 2030
Progress	Additional installed capacity (MW)	
	Emissions reduction (Gg CO_2-eq)	
Other	Primary energy savings (ktoe)	
Finance	Budget	M€
	Source of finance	Private, donors through commercial EE loans, EE fund
Implementing entity		• Ministry of Energy • Ministry of Development, Public Works and Administration • Donors and financial institutions • Households
Monitoring entity		
Relation with other dimensions		

PAM 32 Renovation of commercial buildings

Main objective: Retrofitting of existing commercial buildings to meet the objectives of the EE Directive and the Energy Efficiency Law
Description: This measure relates to the renovation of existing commercial buildings, which may involve activities such as the replacement of windows, insulation etc. These renovation efforts can be initiated by the building owners themselves and/or supported by commercial banks and funds. As a significant aspect of this initiative, it aims to facilitate the issuance of energy performance certificates for these buildings. This certificate is mandatory requirement before renovation projects is finished, ensuring compliance with established energy efficiency standards.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical, regulatory	Commercial sector	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts		• National Long Term Renovation Strategy • Law on energy efficiency • Long Term Strategy of Romania • Recovery and resilience plan for Romania
Methodology		Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions		The renovation rate, as outlined in National Long Term Strategy scenario 2, aligns with the parameters defined in the WAM scenario of the NECP. This rate serves as a key benchmark for the scale of building renovation projects, reflecting a strategic approach to achieving energy efficiency and sustainability goals in the residential sector.
Status of implementation		Under implementation
	- Steps taken	•
	- Steps envisaged	•
Indicators		Value in the last reporting year / Indicative trajectory / Target value
		2020 – 2021 / 2025 / 2030
Progress	Additional installed capacity (MW)	
	Emissions reduction (Gg CO_2-eq)	
Other	Primary energy savings (ktoe)	
Finance	Budget	M€
	Source of finance	Private, donors through commercial EE loans, EE fund
Implementing entity		• Ministry of Energy • Ministry of Economy, Entrepreneurship, and Tourism • Ministry of Investments and European Projects • Ministry of Finance • Commercial building owners
Monitoring entity		
Relation with other dimensions		

III. Description of policy and measures to promote energy services in the public sector and measures to remove regulatory and non-regulatory barriers that impede the uptake of energy performance contracting and other energy efficiency service models

PAM 33 Rehabilitation of public lighting

Main objective: Reduce the costs and increase the quality of street lighting
Description: The cost of street lighting, including electricity and maintenance, can have a huge impact on the budget of the municipalities. In addition, having in mind that a lot of manufactories work on daily bases on the improvement of the light bulbs, new opportunities are being opened for the municipalities. The inefficient light bulbs should be replaced, purchasing new ones that comply with the criteria of belonging to the highest EE class possible (CFL and LED lamps).

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	Local self-government	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts		• Law on energy efficiency • Long Term Strategy of Romania • Recovery and resilience plan for Romania
Methodology		Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions		Improvement rate of 100% of street lighting by 2040.
Status of implementation		Under implementation
	- Steps taken	• Street lighting at some location replaced • Promotional activities for the implementation of public-private partnership (PPP) taken
	- Steps envisaged	• Continuing the promotional activities for the implementation of public-private partnership

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020 – 2021	2025	2030
Progress	Additional installed capacity (MW)			
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			

Finance	Budget	M€
	Source of finance	Central and local government budget, ESCO
Implementing entity		• Government of Romania • Ministry of Energy • Ministry of Development, Public Works and Administration • Ministry of Environment, Water and Forests • Local self-government
Monitoring entity		
Relation with other dimensions		

PAM 34 Development of energy services/market, ESCO

Main objective:
Description: The Energy Service Companies (ESCO) is one of the mechanisms through which the implementation of energy efficiency projects in Romania can be increased.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical, regulatory	Energy	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Law on energy efficiency • Long Term Strategy of Romania • Recovery and resilience plan for Romania • Law on Energy Efficiency			
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC Methodology			
Assumptions				
Status of implementation	Under implementation			
- Steps taken	•			
- Steps envisaged	•			
Indicators	Value in the last reporting year	Indicative trajectory		Target value
	2020 – 2021	2025		2030
Progress — Additional installed capacity (MW)				
Emissions reduction (Gg CO_2-eq)				
Other — Primary energy savings (ktoe)				
Finance — Budget	M€			
Source of finance	Private investors			
Implementing entity	• Ministry of Energy • Ministry of Environment, Water and Forests • Ministry of Economy, Entrepreneurship, and Tourism			
Monitoring entity				
Relation with other dimensions	Decarbonization, Energy security			

IV. Other planned policies, measures and programmes to achieve the indicative national energy efficiency contributions for 2030 as well as other objectives referred to in point 2.2 (for example measures to promote the exemplary role of public buildings and energy-efficient public procurement, measures to promote energy audits and energy management systems, consumer information and training measures, and other measures to promote energy efficiency)

PAM 35 Green procurement

Main objective: Application of energy efficiency criteria ("greening") in public procurement procedures
Description: Not all new technologies have the highest energy efficiency standard, so the best one should be found. The public sector has a big problem with the selection of the most efficient technology because the price is the criteria that participates with highest share in the final decision. Green public procurement can help the public sector to save money in the long term. This is because environmentally friendly products and services can be more energy-efficient and cost-effective over their lifecycle. In addition, green public procurement can help reduce waste disposal costs and avoid the cost of environmental damage. The public sector has a responsibility to lead by example and promote sustainable practices. Green public procurement can help demonstrate the commitment of public sector organizations to sustainability and can inspire other organizations to follow suit.
Article 9 of the EE Law stipulates that Central and local administration authorities, as well as all other public authorities or entities that apply the Law on Public Procurements and/or the KEEF, shall purchase only products, services, and buildings with high energy-efficiency performance. When tendering service contracts with significant energy content, authorities and bodies referred to above shall assess the possibility of concluding long- term energy performance contracts that provide long-term energy savings. The above-mentioned principle shall also apply to private legal persons in the event of contracting procurements of works, supplies or services financed and or subsidized at least fifty percent (50%) by public funds or through KEEF financial support.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Regulatory, technical	Public bodies	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts		• Law on energy efficiency • Long Term Strategy of Romania • Recovery and resilience plan for Romania • Law no. 69/2016 on Green Public Procurement • Green Procurement Action Plan
Methodology		Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions		Increased rate of advanced energy efficiency technology due to public procurement by 7%
Status of implementation		Under implementation
	- Steps taken	•
	- Steps envisaged	•
Indicators		Value in the last reporting year: 2020 – 2021 / Indicative trajectory: 2025 / Target value: 2030
Progress	Additional installed capacity (MW)	
	Emissions reduction (Gg CO_2-eq)	
Other	Primary energy savings (ktoe)	
Finance	Budget	M€
	Source of finance	Central and local government budget
Implementing entity		• Ministry of Economy, Entrepreneurship, and Tourism • National agency of Public Procurement • Local self-government
Monitoring entity		
Relation with other dimensions		Decarbonization, Energy security, Research, innovation and competitiveness

PAM 36 Energy audit and energy management

Main objective: Reduce the consumption in the industry sector
Description: Romania has been actively promoting energy audit and energy management practices as part of its efforts to improve energy efficiency, reduce energy consumption, and meet energy efficiency targets. Large companies are required to conduct regular energy audits. These audits aim to identify energy-saving opportunities, improve energy efficiency, and reduce energy consumption. Energy audits may be conducted by internal teams or external energy consultants. As part of the energy management system ISO 50001 standard can be implemented. ISO 50001 provides a framework for organizations to establish, implement, maintain, and improve an energy management system to continually improve energy performance.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Regulatory, technical	Buildings and Industry	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Law on energy efficiency • Long Term Strategy of Romania • Recovery and resilience plan for Romania			
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC Methodology			
Assumptions				
Status of implementation	Under implementation			
- Steps taken	•			
- Steps envisaged	•			
Indicators	Value in the last reporting year	Indicative trajectory		Target value
	2020 – 2021		2025	2030
Progress: Additional installed capacity (MW)				
Emissions reduction (Gg CO_2-eq)				
Other: Primary energy savings (ktoe)				
Finance: Budget	M€			
Finance: Source of finance	Private investors			
Implementing entity	• Ministry of Economy, Entrepreneurship, and Tourism • Ministry of Energy			
Monitoring entity				
Relation with other dimensions	Decarbonization, Energy security, Research, innovation and competitiveness			

PAM 37 Increased share of heat pumps

Main objective: More efficient use of electricity
Description: Replacement of energy production sources based on biomass, coal, lignite, oil, needed for heating / cooling processes with heat pumps, until reaching a 25% share of heat pumps in the useful energy demand for heating / cooling in 2050.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Regulatory, policy	Households and commercial sector	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Law on Energy efficiency • Long Term Strategy of Romania • Recovery and resilience plan for Romania
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions	It is assumed that inefficient heating devices will be gradually replaced with heat pumps. The share of heat pumps in useful heat demand in 2050 is 25%.
Status of implementation	Under implementation
- Steps taken	•
- Steps envisaged	•

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020 – 2021	2025	2030
Progress	Additional installed capacity (MW)			
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			

Finance	Budget	M€
	Source of finance	Private, EE fund, incentives from the central and local government budget, donors
Implementing entity		• Ministry of Energy • Ministry of Development, Public Works and Administration • End-users
Monitoring entity		
Relation with other dimensions		

PAM 38 Increased use of efficient technologies in the residential sector

Main objective: Improved energy savings in residential sector by utilization of efficient technologies
Description: The adoption of more advanced technologies can play a pivotal role in achieving energy efficiency goals. This adoption not only leads to energy savings but also serves to mitigate outdoor and indoor air pollution, boost the utilization of renewable energy sources, and enhance overall living comfort. To successfully meet energy efficiency targets, it is essential to prioritize the promotion and adoption of efficient technologies on the demand side.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Regulatory, policy	Households and commercial sector	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Law on Energy efficiency • Long Term Strategy of Romania • Recovery and resilience plan for Romania				
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC Methodology				
Assumptions					
Status of implementation	Under implementation				
- Steps taken	•				
- Steps envisaged	•				
Indicators		Value in the last reporting year	Indicative trajectory		Target value
		2020 – 2021	2020	2025	2030
Progress	Additional installed capacity (MW)				
Emissions reduction (Gg CO_2-eq)					
Other	Primary energy savings (ktoe)				
Finance	Budget	M€			
	Source of finance	Private, EE fund, incentives from the central and local government budget, donors			
Implementing entity	• Ministry of Energy • Ministry of Development, Public Works and Administration • End-users				
Monitoring entity					
Relation with other dimensions					

PAM 39 Replacement of conventional fuels with RES in manufacturing industries

Main objective:
Description: Replacement of fossil fuels (such as coal and oil), reduction of the use natural gas and their replacement by electricity, hydrogen, energy-reach waste, RES (including biomass), and heat (including heat produced by autoproducers and waste heat from thermal processes), in compliance with the rules regarding environmental protection

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical, regulatory	Industry	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Long Term Strategy of Romania • Recovery and resilience plan for Romania
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions	
Status of implementation	Under implementation
- Steps taken	•
- Steps envisaged	• Replacement of inefficient technologies

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020 – 2021	2025	2030
Progress	Additional installed capacity (MW)			
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			

Finance	Budget	M€
	Source of finance	Private investors
Implementing entity		• Ministry of Economy, Entrepreneurship, and Tourism • Ministry of Energy • Ministry of Environment, Water and Forests • Private investors
Monitoring entity		
Relation with other dimensions		Decarbonisation

PAM 40 Increase technology efficiency in the industrial sector

Main objective:
Description: The efficiency of the technologies will be increased according to the state-of-the-art of the Primes model and to the best available technologies from each industrial sector

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	Industry	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts		• Long Term Strategy of Romania • Recovery and resilience plan for Romania
Methodology		Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions		
Status of implementation		Under implementation
- Steps taken		•
- Steps envisaged		•
Indicators		Value in the last reporting year: 2020 – 2021 / Indicative trajectory: 2025 / Target value: 2030
Progress	Additional installed capacity (MW)	
Emissions reduction (Gg CO_2-eq)		
Other	Primary energy savings (ktoe)	
Finance	Budget	M€
	Source of finance	Private investors
Implementing entity		• Ministry of Economy, Entrepreneurship, and Tourism • Ministry of Energy • Ministry of Environment, Water and Forests • Private investors
Monitoring entity		
Relation with other dimensions		Decarbonisation

PAM 41 Increased share of alternative fueled cars

Main objective: Increased share of alternative fueled cars
Description: There is significant need of promoting and use of alternative fuelled cars to reduce GHG emissions in order to obtain more sustainable transport and to achieve the goals set in the European Green Deal, Green Agenda, and Paris Agreement. Moreover, as a result of an additional e-charging stations' deployment, it is estimated that in by 2050 65% of the passenger cars in Romania will be electric and 20% Hydrogen, while the remaining 13% will be divided between PHEV and 2% Gasoline cars.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical, information	Transport	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Long Term Strategy of Romania • Recovery and resilience plan for Romania			
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC Methodology			
Assumptions	It is envisaged that by 2050 the share by fuel in cars will be: • Gasoline – 2% • Hybrid – 0% • Plug-in hybrid – 13% • Electric – 65% • Diesel – 0% • Hydrogen – 20% • LPG – 0%			
Status of implementation	Under implementation			
- Steps taken	•			
- Steps envisaged	• Change of car fleet			
Indicators	Value in the last reporting year	Indicative trajectory		Target value
	2020-2021	2025		2030
Progress: Share of alternative cars (Electric and hydrogen)				
Emissions reduction (Gg CO_2-eq)				
Other: Primary energy savings (ktoe)				
Finance: Budget	M€			
Source of finance	Private investors			
Implementing entity	• Government of Romania • Ministry of Energy • Ministry of Environment, Water and Forests • Private investors			
Monitoring entity				
Relation with other dimensions	Decarbonization, Energy security, Research, innovation and competitiveness			

PAM 42 Increased share of alternative fueled buses and trains

Main objective: Increased share of alternative fuelled buses
Description: There is significant need of promoting and use of alternative fuelled buses and trains to reduce GHG emissions in order to obtain more sustainable transport and to achieve the goals set in the European Green Deal, Green Agenda, and Paris Agreement.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical, information	Transport	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Long Term Strategy of Romania • National Integrated Urban Development Strategy for Resilient, Green, Inclusive and Competitive Cities 2022-2035 (Romania's Urban Policy) • Recovery and resilience plan for Romania
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions	It is envisaged that by 2050 the share by fuel in buses will be: • Hybrid – 0% • Electric – 75% • Diesel – 0% • Hydrogen – 25% • Rest (gasoline, LPG, CNG) – 0% It is envisaged that by 2030 the number of alternative trains will be:electric • Electric - 988 • Hydrogen - 12
Status of implementation	Under implementation
- Steps taken	•
- Steps envisaged	• Change of bus fleet

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020 – 2021	2025	2030
Progress	Share of alternative busses (Electric and hydrogen) Number of alternative trains			
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			

Finance	Budget	M€
	Source of finance	Private investors
Implementing entity		• Government of Romania • Ministry of Energy • Ministry of Environment, Water and Forests • Private investors
Monitoring entity		
Relation with other dimensions		Decarbonization, Energy security, Research, innovation and competitiveness

PAM 43 Modernization of urban public transport

Main objective: Modernization of urban public transport
Description: Urban transport as a major source of emissions, mainly caused by the significant increase in the number of registered vehicles, opens a potential for modernization of public transport with new vehicle fleet.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	Transport	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts		• Long Term Strategy of Romania • Recovery and resilience plan for Romania • National Integrated Urban Development Strategy for Resilient, Green, Inclusive and Competitive Cities 2022-2035 (Romania's Urban Policy) • Law no.155/2023 on sustainable urban mobility • Law no. 104/2011 on ambient air quality
Methodology		Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions		
Status of implementation		Under implementation
- Steps taken		•
- Steps envisaged		•
Indicators		Value in the last reporting year: 2020 – 2021 / Indicative trajectory: 2025 / Target value: 2030
Progress	Additional installed capacity (MW)	
Emissions reduction (Gg CO_2-eq)		
Other	Primary energy savings (ktoe)	
Finance	Budget	M€
	Source of finance	Private, incentives through central government budget
Implementing entity		• Government of Romania • Ministry of Development, Public Works and Administration • National network of energy managers • Local public authorities • Ministry of Energy • Ministry of Environment, Water and Forests • Ministry of Economy, Entrepreneurship, and Tourism • Private investors
Monitoring entity		
Relation with other dimensions		

PAM 44 Extension of the subway in Bucharest

Main objective: Improve the public transport.
Description: Development of the underground transport network in the municipalities of Bucharest and Cluj-Napoca

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	Transport	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts		• Long Term Strategy of Romania • Recovery and resilience plan for Romania • Investment Plan for the development of the national transport infrastructure over the period 2020 - 2030
Methodology		Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions		12.7 km new metro lines in 2026
Status of implementation		Under implementation
- Steps taken		•
- Steps envisaged		• Building network for subway extension
Indicators		Value in the last reporting year: 2020 – 2021 / Indicative trajectory: 2025 / Target value: 2030
Progress	Additional installed capacity (MW)	
Emissions reduction (Gg CO_2-eq)		
Other	Primary energy savings (ktoe)	
Finance	Budget	356.9 M€
	Source of finance	EE fund, incentives from the central and local government budget, donors
Implementing entity		• Government of Romania • Ministry of Transport and Infrastructure • Ministry of Energy • Private investors
Monitoring entity		
Relation with other dimensions		

PAM 45 Increased share of alternative fueled trucks

Main objective: Increased share of alternative fuelled trucks
Description: There is significant need of promoting and use of alternative fuelled trucks to reduce GHG emissions in order to obtain more sustainable transport and to achieve the goals set in the European Green Deal, Green Agenda, and Paris Agreement. It is estimated that in by 2050 62% of the HGV & LCV in Romania will be electric, 35% Hydrogen and 3& Hybrid.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical, information	Transport	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts		• Long Term Strategy of Romania • Recovery and resilience plan for Romania
Methodology		Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions		It is envisaged that by 2050 the share by fuel in HGV & LCV will be: • Diesel – 0% • Gasoline – 0% • Hybrid – 3% • Electric – 62% • Hydrogen – 35%
Status of implementation		Under implementation
- Steps taken		•
- Steps envisaged		•
Indicators		Value in the last reporting year: 2020 – 2021 / Indicative trajectory: 2025 / Target value: 2030
Progress	Share of alternative trucks (Electric and hydrogen)	
Emissions reduction (Gg CO_2-eq)		
Other	Primary energy savings (ktoe)	
Finance	Budget	M€
	Source of finance	Private investors
Implementing entity		• Government of Romania • Ministry of Energy • Ministry of Environment, Water and Forests • Ministry of Economy, Entrepreneurship, and Tourism • Private investors
Monitoring entity		
Relation with other dimensions		

PAM 46 Modernization of railway, subway, naval and air transport

Main objective: Modernization of railway, naval and air transport
Description: Construction of new/upgraded operational railway infrastructure. Introduction of new electric trains in railway transport, new fleets in naval transport and new aircrafts.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	Transport	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts		• Investment Plan for the development of the national transport infrastructure over the period 2020 - 2030 • Romania's General Transport Master Plan and Rail System • Long Term Strategy of Romania • Recovery and resilience plan for Romania
Methodology		Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions		2851 km of railway in 2026
Status of implementation		Under implementation
	- Steps taken	•
	- Steps envisaged	•

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020 – 2021	2025	2030
Progress	Additional installed capacity (MW)			
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			

Finance	Budget	21.9 M€ (railway), 7.8 M€ (subway), 4.3 M€ (naval), 2.9 M€ (air) in the period 2020-2030
	Source of finance	EE fund, incentives from the central and local government budget, donors
Implementing entity		• Government of Romania • Ministry of Transport and Infrastructure • Ministry of Energy • Ministry of Environment, Water and Forests • Ministry of Economy, Entrepreneurship, and Tourism • Private investors
Monitoring entity		
Relation with other dimensions		

PAM 47 Alternative mobility					
Main objective: Reduction of the local air pollution **Description:** This measure encompasses a range of initiatives, such as organizing campaigns, offering subsidies, and establishing systems to encourage the use of new or rented bicycles, electric scooters, car sharing, ride-sharing and mobility as a service. It also aims to promote walking as a viable means of transportation within the city. Additionally, this measure involves the introduction of parking policies designed to curtail the reliance on cars in urban areas. Particularly in smaller towns, where many residents often use cars for short trips, these strategies are expected to foster a shift toward greater utilization of bicycles, electric scooters, and walking. This shift can help alleviate traffic congestion, reduce emissions, and enhance the overall sustainability and livability of these communities.					
Timeframe		Type	Sector	Gases	Scope
2022 – 2050		Regulatory, technical, information	Transport	CO_2, CH_4, N_2O	National
Relevant planning documents, legal and regulatory acts		• Long Term Strategy of Romania • Recovery and resilience plan for Romania • National Integrated Urban Development Strategy for Resilient, Green, Inclusive and Competitive Cities 2022-2035 (Romania's Urban Policy) • Law no.155/2023 on sustainable urban mobility • Law no. 104/2011 on ambient air quality			
Methodology		Bottom-up modeling using the LEAP-RO model. IPCC Methodology			
Assumptions					
Status of implementation		Under implementation			
- Steps taken		•			
- Steps envisaged		• Continue the implementation of the campaigns and subsidies for buying new bicycles and renting bicycles • Continue the construction of new bicycles tracks			
Indicators		Value in the last reporting year	Indicative trajectory		Target value
		2020 – 2021	2025		2030
Progress	Length of cycle paths (km)				
Emissions reduction (Gg CO_2-eq)					
Other	Primary energy savings (ktoe)				
Finance	Budget	M€			
	Source of finance	Private, EE fund, incentives from the central and local government budget, donors			
Implementing entity		• Government of Romania • Ministry of Development, Public Works and Administration • Ministry of Energy • Ministry of Environment, Water and Forests • Ministry of Economy, Entrepreneurship, and Tourism • Private investors			
Monitoring entity					
Relation with other dimensions					

V. Where applicable, a description of policies and measures to promote the role of local renewable energy communities in contributing to the implementation of policies and measures in points i, ii, iii and iv

Please refer to Section 3.1.2

VI. Description of measures to develop measures to utilise energy efficiency potentials of gas and electricity infrastructure

PAM 48 Support for the expansion and modernization of the electricity distribution network

Main objective: The objective of the investment is to extend and modernize electricity distribution networks in order to reduce losses in the network and ensure the safety and continuity of distribution services.
Description: The reduction of electricity losses is important for Romania as it directly impacts energy efficiency and cost-effectiveness, benefiting both consumers and utilities. By minimizing losses, Romania can enhance the sustainability of its energy sector, lower electricity bills, and ensure a more reliable and resilient power grid to meet the country's increasing energy needs and integrate more power plants on renewable energy sources.

Timeframe	Type	Sector	Gases	Scope
2022 – 2031	Technical	Energy	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Emergency Ordinance 60/2022 • Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a system for trading greenhouse gas emission quotas within the Union and amending Directive 96/61/EC			
Methodology	- Bottom-up modeling using the LEAP-RO model. IPCC Methodology			
Assumptions	Energy saving of about 131 GWh			
Status of implementation				
- Steps taken	• Grid Development Plan;			
- Steps envisaged	•			
Indicators:	Value in the last reporting year	Indicative trajectory	Target value	
	2020-2021	/	2030	
Progress — Energy savings (GWh)	/		131	
Emissions reduction (Gg CO_2-eq)	/			
Other — Primary energy savings (ktoe)	/			
Finance — Budget (M€)	1103 mill. EUR (modernization fund)			
Source of finance	State funds, European funds, [Other] international funding and private investors			
Implementing entity	• Government of Romania • Electricity distribution companies • ANRE; • Ministry of energy;			
Monitoring entity	ANRE			
Relation with other dimensions	Decarbonization, Energy security,			

VII. Regional cooperation in this area, where applicable

Romania's regulatory energy agency ANRE has been part as a beneficiary, of the Enhancing the Implementation and Monitoring and Verification practices of **Energy Saving Policies under Article 7 of the Energy Efficiency Directive (ENSMOV) project** for the period 2019 - 2023.The ENSMOV project seeks to provide support to Member States and stakeholders for the implementation of energy efficiency policies. It is intended to help member states monitor, revise, improve and implement the energy efficiency policies by developing the existing resources (projects), with focus on the practical and strategic aspects arising from Article 7 of the Energy Efficiency Directive (EED0). This project has been funded by the European Commission under the Horizon 2020 Program. ANRE has participated in the project alongside beneficiaries from Austria, Belgium, Bulgaria, Croatia, France, Germany, Greece, Hungary, Italy, Lithuania, Netherlands, Poland, and the UK[2].

[2] Project's webpage: https://ensmov.eu/about-ensmov/

VIII. Financing measures, including Union support and the use of Union funds, in this area at the national level

The tables contain information on the budget and funding sources, if available, for each of the proposed policies and measures

3.3 Dimension energy security

I. Policies and measures related to the elements set out in point 2.3

PAM 49 Increased use of nuclear energy

Main objective: Increased use of nuclear energy by construction of additional capacities (CANDU and SMR) and repowering the existing CANDU
Description: In total, 2.8 MW & 462 MW (3.262MW) of nuclear energy will be fully available in 2032-2036 and 2038-2050.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	Energy supply	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts		• Long Term Strategy of Romania • Recovery and resilience plan for Romania
Methodology		Bottom-up modeling and least-cost optimization using the LEAP-RO model. IPCC Methodology
Assumptions		It is envisaged that by 2050 additional capacity of: • U3 (CANDU) – 700 MW in Q4 2030 • U4 (CANDU) – 700 MW in Q4 2031 • SMR - 462 MW in Q4 2029 will be constructed. Furthermore, it is envisaged that: • U1 during 2027-2029 • U2 during 2036-2038 will be repowered.
Status of implementation		Under implementation
- Steps taken		Operating units • U1 (CANDU) – 700 MW • U2 (CANDU) – 700 MW
- Steps envisaged		• Construction of nuclear plants

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020-2021	2025	2030
Progress	Additional installed capacity (MW)	1400	1400	2562
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			

Finance	Budget	M€
	Source of finance	Public private partnership
Implementing entity		• Government of Romania • Ministry of Energy • Ministry of Environment, Water and Forests • Ministry of Economy, Entrepreneurship, and Tourism • Private investors
Monitoring entity		
Relation with other dimensions		

II. Regional cooperation in this area

Since 2017 Romania has been part of **the BRUA project**, alongside Austria, Bulgaria, and Hungary. One of the main goals of the projects has been the development of the national gas transmission system on Romanian territory, along the corridor Bulgaria-Romania-Hungary-Austria (referred to as BRUA Phase 1 and 2)[3] additionally, the projects focus on Romanian territory has been the enhancement of the bi-directional gas transmission along the corridor Bulgaria-Romania-Hungary-Austria (this is referred to as Phase 3 of the BRUA project) and the development of the Southern Gas transmission corridor – which is intended to enable taking of Natural Gas from the Black Sea (Black Sea – Podisor).

Romania is also part of **the Eastring project**, which was started in 2018, and is joined by Hungary, Bulgaria, and Slovakia – as the project proposer. The project's main aim is to secure Natural gas supply to the entirety of the Balkan countries demand and to provide supply routes for western gas providers/shippers, to supply the region and Türkiye from established European centers (ex. Gaspool and Baumgarten). Additionally, another aim of the project is to establish a new pipeline corridor and offer a cost-effective transmission route between Western EU hubs and the Balkans/Türkiye, for future (to-come) Natural gas imports to Europe, from established and/or alternative sources from the Middle East, the Black Sea, Caspian sea and etc.[4]

In 2020 Romania joined Austria, Hungary, Slovakia, Ukraine and Slovenia in signing the **ROHU – Second phase project.** The main objective within this project is to increase the gas transmission capacity at the Romania-Hungary border, allowing natural gas flows from the Black Sea to the whole of Central-Eastern Europe. The targeted capacity is 4.4 bcm/yr.[5]

Romania has also taken part in the high – level dialogue established within **the Central and South-Eastern Europe Connection Initiative (CESEC)** which are aimed at increasing furthermore the regional cooperation between the member states and fulfilling European strategic objectives. Moreover, Romania partakes in planning future natural gas infrastructure projects within the framework of **the "Vertical Corridor" initiative**, alongside Bulgaria, Hungary and Greece[6].

III. Where applicable, financing measures in this area at national level, including Union support and the use of Union funds

The tables contain information on the budget and funding sources, if available, for each of the proposed policies and measures

[3] https://projects.3seas.eu/projects/brua-development-on-the-territory-of-romania-of-the-national-gas-transmission-system-along-the-corridor-bulgaria-romania-hungary-austria-(brua-phase-1-and-2)-and-enhancement-of-the-bidirectional-gas-transmission-corridor-bulgaria-romania-hungary-austria-(brua-phase-3)-and-the-development-on-the-territory-of-romania-of-the-southern-gas-transmission-corridor-for-taking-over-gas-from-the-black-sea-shore-(black-sea-podisor)

[4] https://projects.3seas.eu/projects/eastring

[5] https://projects.3seas.eu/projects/rohu-second-phase

[6] https://www.mae.ro/en/node/2160

3.4 Dimension internal energy market

3.4.1. Electricity infrastructure

I. Policies and measures to achieve the targeted level of interconnectivity as set out in point (d) of Article 4

PAM 50 Black Sea Corridor (TYNDP ID 138)

Main objective: Improve the interconnectivity between Romania and Bulgaria;
Description: This is a project aimed at improving the transmission grid interconnectivity between Romania and Bulgaria, thus furthering the European Union's strategic priorities for the trans-European energy infrastructure. The project will help with the transfer of generation from the Western coast of the Black Sea to supply the demand and in storage centres in Central and South-Eastern Europe. The foreseen investments under this project are the construction of three 400 kV OHL.

Timeframe	Type	Sector	Gases	Scope
2022 – 2024	Technical	Energy	/	Transnational

Relevant planning documents, legal and regulatory acts	• Romanian electricity transmission grid (RET) development plan, 2022 – 2031; • Fourth European Projects of Common Interest (EU – PCI) list; • ENTSO – E Ten Year Network Development Plan (TYNDP), 2022
Methodology	-
Assumptions	The cross-border transfer capacity of electricity between Romania and Bulgaria is expected to be increased by 600 MW in each direction (Romania → Bulgaria || Bulgaria → Romania).
Status of implementation	Four separate investments clustered within project (**Invest. ID:** 275, **Invest. ID** 273, **Invest. ID** 715 and **Invest. ID** 800). All Under implementation
- Steps taken	• With regards to Invest. ID 275: Under construction; • With regards to Invest. ID 273: Under construction; • With regards to Invest. ID 715: Under construction; • With regards to Invest. ID 800: Completed;
- Steps envisaged	• With regards to Invest. ID 275: To be commissioned in 2024; • With regards to Invest. ID 273: To be commissioned in 2024; • With regards to Invest. ID 715: To be commissioned in 2024; • With regards to Invest. ID 800: /;

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020-2021	/	2024
Progress	/		
Emissions reduction (Gg CO_2-eq)	/		
Other: Primary energy savings (ktoe)	/		

Finance – Budget (M€)	• With regards to Invest. ID 275:
	  ○ CAPEX – 76.04, OPEX – 0.41/per year;
	• With regards to Invest. ID 273:
	  ○ CAPEX – 50.32, OPEX – 0.25/per year;
	• With regards to Invest. ID 715:
	  ○ CAPEX – 15.02, OPEX – 0.15/per year;
	• With regards to Invest. ID 800:
	  ○ CAPEX – 63, OPEX – 0.8/per year;
	• Total project costs:
	  ○ CAPEX – 204.38, OPEX – 1.61;

Source of finance	State funds, European funds, [Other] international funding and private investors
Implementing entity	• Government of Romania • Transelectrica; • Romanian Energy Regulatory Authority (ANRE); • Ministry of energy; • Private investors and developers;
Monitoring entity	ENTSO - E
Relation with other dimensions	Decarbonization, Energy security,

PAM 51 Mid-Continental East corridor (TYNDP ID 144)

Main objective: Improve the interconnectivity between Romania and Serbia;
Description: The main aim is increasing the transmission capacity along the East-West corridor in the South-Eastern and Central Europe, to contribute to the market integration in the region and enhancing the integration of large renewable sources in the Banat region, located in the close proximity of the Serbia-Romania and Hungary-Romania borders.

Timeframe	Type	Sector	Gases	Scope
2022 – 2029	Technical	Energy	/	Transnational

Relevant planning documents, legal and regulatory acts	• Romanian electricity transmission grid (RET) development plan, 2022 – 2031; • Fourth European Projects of Common Interest (EU – PCI) list; • ENTSO – E Ten Year Network Development Plan (TYNDP), 2022
Methodology	-
Assumptions	The cross-border transfer capacity of electricity between Romania and Serbia and between Romania and Hungary is expected to be increased by 617 MW in the direction Hungary-Romania, 335 MW in the direction Romania-Hungary, 844 MW in the direction Romania → Serbia and 600 MW in the direction Serbia → Romania.
Status of implementation	Six separate investments clustered within project (**Invest. ID:** 238, **Invest. ID** 269, **Invest. ID** 270, **Invest. ID** 701, **Invest. ID** 705 and **Invest. ID** 1827, ID according to ENTSO-E).
- Steps taken	• With regards to Invest. ID 238: Completed; • With regards to Invest. ID 269: Under construction; • With regards to Invest. ID 270: In permitting; • With regards to Invest. ID 701: Under construction; • With regards to Invest. ID 705: Under construction; • With regards to Invest. ID 1827: In permitting;
- Steps envisaged	• With regards to Invest. ID 238: To be commissioned in 2025; • With regards to Invest. ID 269: To be commissioned in 2024; • With regards to Invest. ID 270: To be commissioned in 2026; • With regards to Invest. ID 701: To be commissioned in 2025; • With regards to Invest. ID 705: To be commissioned in 2026; • With regards to Invest. ID 1827: To be commissioned in 2029;

Indicators	Value in the last reporting year	Indicative trajectory	Target value
Progress	2020-2021	/	2029
Emissions reduction (Gg CO_2-eq)	/		
Other – Primary energy savings (ktoe)	/		

Finance – Budget (M€)	• With regards to Invest. ID 238: ○ CAPEX – 47, OPEX – 0.23/per year; • With regards to Invest. ID 269: ○ CAPEX – 28.05, OPEX – 0.14/per year; • With regards to Invest. ID 270: ○ CAPEX – 46.93, OPEX – 0.23/per year; • With regards to Invest. ID 701: ○ CAPEX – 23.26, OPEX – 0.23/per year; • With regards to Invest. ID 705: ○ CAPEX – 18.02, OPEX – 0.18; • With regards to invest. ID 1827: ○ CAPEX – 50.39, OPEX – 0.38; • Total project costs: ○ CAPEX – 213.65, OPEX – 1.39;
Source of finance	State funds, European funds, [Other] international funding and private investors
Implementing entity	• Government of Romania • Transelectrica; • Romanian Energy Regulatory Authority (ANRE); • Ministry of energy; • Private investors and developers;
Monitoring entity	ENTSO - E
Relation with other dimensions	Decarbonization, Energy security,

PAM 52 HU-RO (TYNDP ID 259)

Main objective: Improve the interconnectivity between Romania and Hungary;
Description: This is a project aimed at improving the transmission grid interconnectivity between Romania and Hungary, thus furthering the European Union's strategic priorities for the trans-European energy infrastructure.

Timeframe	Type	Sector	Gases	Scope
2022 – 2029	Technical	Energy	/	Transnational

Relevant planning documents, legal and regulatory acts	• Romanian electricity transmission grid (RET) development plan, 2022 – 2031; • ENTSO – E Ten Year Network Development Plan (TYNDP), 2022
Methodology	-
Assumptions	The cross-border transfer capacity of electricity between Romania and Hungary is expected to be increased by 1117 MW in the direction Romania → Hungary and 685 MW in the direction Hungary → Romania.
Status of implementation	Six separate investments clustered within project (**Invest. ID:** 1205, **Invest. ID** 1832, **Invest. ID** 1833, **Invest. ID** 1834, **Invest. ID** 1835 and **Invest. ID** 1836, ID according to ENTSO-E).
- Steps taken	• With regards to Invest. ID 1205: Planned, but not yet permitting; • With regards to Invest. ID 1832: Planned, but not yet permitting; • With regards to Invest. ID 1833: Planned, but not yet permitting; • With regards to Invest. ID 1834: Planned, but not yet permitting; • With regards to Invest. ID 1835: Planned, but not yet permitting; • With regards to Invest. ID 1836: Planned, but not yet permitting;
- Steps envisaged	• With regards to Invest. ID 1205: To be commissioned in Q_4 2030; • With regards to Invest. ID 1832: To be commissioned in Q_4 2027; • With regards to Invest. ID 1833: To be commissioned in Q_4 2028; • With regards to Invest. ID 1834: To be commissioned in Q_4 2028; • With regards to Invest. ID 1835: To be commissioned in Q_4 2028; • With regards to Invest. ID 1836: To be commissioned in Q_4 2028;

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020-2021	/	2029
Progress	/		
Emissions reduction (Gg CO_2-eq)	/		
Other: Primary energy savings (ktoe)	/		

Finance – Budget (M€)	• With regards to Invest. ID 1205: ○ CAPEX – 110, OPEX – 1.1/per year; • With regards to Invest. ID 1832: ○ CAPEX – 5.18, OPEX – 0.052/per year; • With regards to Invest. ID 1833: ○ CAPEX – 1.38, OPEX – 0.014/per year; • With regards to Invest. ID 1834: ○ CAPEX – 2.91, OPEX – 0.029/per year; • With regards to Invest. ID 1835: ○ CAPEX – 1.53, OPEX – 0.015/per year; • With regards to Invest. ID 1836: ○ CAPEX – 3.37, OPEX – 0.034/per year; • Total project costs: ○ CAPEX – 124.37, OPEX – 1.244;
Source of finance	State funds, European funds, [Other] international funding and private investors
Implementing entity	• Government of Romania • Transelectrica; • Romanian Energy Regulatory Authority (ANRE); • Ministry of energy; • Private investors and developers;
Monitoring entity	ENTSO - E
Relation with other dimensions	Decarbonization, Energy security,

PAM 53 North CSE Corridor (TYNDP ID 341)

Main objective: Improve the interconnectivity between Romania and Serbia;
Description: The project is aimed at enhancing the market integration in the region, thus allowing the lower difference in marginal energy costs. Additionally, the project is intended to allow the connection of larger RES capacities and impact the security of supply in the region by increasing the available balancing capacity available for cross-balancing.

Timeframe	Type	Sector	Gases	Scope
2022 – 2029	Technical	Energy	/	Transnational

Relevant planning documents, legal and regulatory acts	• Romanian electricity transmission grid (RET) development plan, 2022 – 2031; • ENTSO – E Ten Year Network Development Plan (TYNDP), 2022
Methodology	-
Assumptions	The cross-border transfer capacity of electricity between Romania and Serbia is expected to be increased by 680 MW in the direction Romania → Serbia and 720 MW in the direction Serbia → Romania.
Status of implementation	Six separate investments clustered within project (**Invest. ID:** 1536, **Invest. ID** 1537 and **Invest. ID** 1538, ID according to ENTSO-E).
- Steps taken	• With regards to Invest. ID 1536: Planned, but not yet permitting; • With regards to Invest. ID 1537: Planned, but not yet permitting; • With regards to Invest. ID 1538: Planned, but not yet permitting;
- Steps envisaged	• With regards to Invest. ID 1536: To be commissioned in Q_3 2029; • With regards to Invest. ID 1537: To be commissioned in Q_3 2028; • With regards to Invest. ID 1538: To be commissioned in Q_3 2028;

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020-2021	/	2029
Progress	/		
Emissions reduction (Gg CO_2-eq)	/		
Other: Primary energy savings (ktoe)	/		

Finance: Budget (M€)	• With regards to Invest. ID 1536:
	  ○ CAPEX – 4, OPEX – 0.04/per year;
	• With regards to Invest. ID 1537:
	  ○ CAPEX – 45, OPEX – 0.45/per year;
	• With regards to Invest. ID 1538:
	  ○ CAPEX – 35, OPEX – 0.35/per year;
	• Total project costs:
	  ○ CAPEX – 84, OPEX – 0.84;

Source of finance	State funds, European funds, [Other] international funding and private investors
Implementing entity	• Government of Romania • Transelectrica; • Romanian Energy Regulatory Authority (ANRE); • Ministry of energy; • Private investors and developers;
Monitoring entity	ENTSO - E
Relation with other dimensions	Decarbonization, Energy security,

PAM 54 Georgia-Romania Black Sea interconnection cable project (TYNDP ID 1105)

Main objective: Improve the interconnectivity between Romania and Georgia;
Description: The aim is to assist Energy Security of EU and Caucasus region, support the development of RES projects and increase the transit opportunities between the two regions.

Timeframe	Type	Sector	Gases	Scope
2022 – 2029	Technical	Energy	/	Transnational

Relevant planning documents, legal and regulatory acts		• Romanian electricity transmission grid (RET) development plan, 2022 – 2031; • ENTSO – E Ten Year Network Development Plan (TYNDP), 2022
Methodology		-
Assumptions		The cross-border transfer capacity of electricity between Romania and Serbia and between Romania and Hungary is expected to be increased by 1000 MW in the direction Romania → Georgia and 1000 MW in the direction Georgia → Romania.
Status of implementation		One investment within this project (**Invest. ID:** 1782, ID according to ENTSO-E).
	- Steps taken	• With regards to Invest. ID 1782: Under consideration;
	- Steps envisaged	• With regards to Invest. ID 1782: To be commissioned in Q_4 2029;
Indicators		Value in the last reporting year: 2020-2021 / Indicative trajectory: / / Target value: 2029
Progress		/
Emissions reduction (Gg CO_2-eq)		/
Other	Primary energy savings (ktoe)	/
Finance	Budget (M€)	• With regards to Invest. ID 1205: ○ CAPEX – 2118.85, OPEX – 9.42/per year; • Total project costs: ○ CAPEX – 2118.85, OPEX – 9.42/per year;
	Source of finance	State funds, European funds, [Other] international funding and private investors
Implementing entity		• Government of Romania • Transelectrica; • Romanian Energy Regulatory Authority (ANRE); • Ministry of energy; • Private investors and developers;
Monitoring entity		ENTSO - E
Relation with other dimensions		Decarbonization, Energy security,

PAM 55 Increasing the interconnectivity between the eastern areas and the remaining of the interconnected power system.

Main objective: Increase the interconnectivity between Dobrogea, Moldova and the remaining of the power system and integrate the power generated from RES and other sources in the eastern region.
Description: The aim of this measure is to support the build-out and refurbishment of grid transmission equipment in the east regions (Dobrogea and Moldova especially) in order to increase the capacity of interconnection between the East regions and the rest of the Country.

Timeframe	Type	Sector	Gases	Scope
2022 – 2031	Technical	Energy	/	National

Relevant planning documents, legal and regulatory acts		• Romanian electricity transmission grid (RET) development plan, 2022 – 2031;
Methodology		-
Assumptions		The overall state of the electricity transmission system will be improved, operational and maintenance security of multiple regions around the Country will be improved and the grid will be further developed and modernized. The eastern region (especially Dobrogea and Moldova) will be better connected to the rest of the interconnected power system in the Country. Greater RES buildout will be enabled and supported in the Eastern region.
Status of implementation		
- Steps taken		• Included in the Grid Development Plan 2022 - 2031
- Steps envisaged		• The foreseen individual projects within the Grid Development Plan 2022 – 2031, which are aimed at the modernization and/or building of new substations and lines need to be implemented within the foreseen period – as stated in the Grid Development Plan 2022 – 2031;
Indicators:		Value in the last reporting year: 2020-2021 / Indicative trajectory: / / Target value: 2031
Progress		/
Emissions reduction (Gg CO_2-eq)		/
Other	Primary energy savings (ktoe)	/
Finance	Budget (M€)	
	Source of finance	State funds, European funds, [Other] international funding and private investors
Implementing entity		• Government of Romania • Transelectrica; • Romanian Energy Regulatory Authority (ANRE); • Ministry of energy; • Private investors and developers;
Monitoring entity		ANRE
Relation with other dimensions		Decarbonization, Energy security,

PAM 56 Integrating the output generated by powerplants in other areas (South, South-West, etc.)

Main objective: Increase the interconnectivity between other areas of the country and integrate the power generated from RES and other sources .
Description:

Timeframe	Type	Sector	Gases	Scope
2022 – 2031	Technical	Energy	/	National

Relevant planning documents, legal and regulatory acts		• Romanian electricity transmission grid (RET) development plan, 2022 – 2031;
Methodology		-
Assumptions		Other region (South, South-West) will be better connected to the rest of the interconnected power system in the Country. Greater RES buildout will be enabled and supported in these regions
Status of implementation		
	- Steps taken	• Included in the Grid Development Plan 2022 – 2031; • The foreseen individual projects within the Grid Development Plan 2022 – 2031, which are aimed at the modernization and/or building of new substations and lines need to be implemented within the foreseen period – as stated in the Grid Development Plan 2022 – 2031;.
	- Steps envisaged	

Indicators:	Value in the last reporting year	Indicative trajectory	Target value
	2020-2021	/	2031
Progress	/		
Emissions reduction (Gg CO_2-eq)	/		
Other – Primary energy savings (ktoe)	/		

Finance	Budget (M€)	
	Source of finance	State funds, European funds, [Other] international funding and private investors
Implementing entity		• Government of Romania • Transelectrica; • Romanian Energy Regulatory Authority (ANRE); • Ministry of energy; • Private investors and developers;
Monitoring entity		ANRE
Relation with other dimensions		Decarbonization, Energy security,

PAM 57 400kV OHL Suceava-Bălți				
Main objective: Increase the interconnectivity between Romania and Republic of Moldova . **Description:** This is a new 400kV OHL aimed at improving the transmission grid interconnectivity between Romania and Republic of Moldova,				
Timeframe	Type	Sector	Gases	Scope
2022 – 2031	Technical	Energy	/	National
Relevant planning documents, legal and regulatory acts	• Romanian electricity transmission grid (RET) development plan, 2022 – 2031;			
Methodology	-			
Assumptions	The cross-border transfer capacity of electricity between Romania and Republic of Moldova is expected to be increased by 350 MW in the direction Romania → Moldova and 350 MW in the direction Moldova → Romania.			
Status of implementation				
- Steps taken	• Included in the Grid Development Plan 2022 – 2031;			
- Steps envisaged	•			
Indicators:	Value in the last reporting year	Indicative trajectory	Target value	
	2020-2021	/	2030	
Progress	/			
Emissions reduction (Gg CO_2-eq)	/			
Other: Primary energy savings (ktoe)	/			
Finance: Budget (M€)				
Finance: Source of finance	State funds, European funds, [Other] international funding and private investors			
Implementing entity	• Government of the Republic of Romania • Transelectrica; • Romanian Energy Regulatory Authority (ANRE); • Ministry of energy; • Private investors and developers;			
Monitoring entity	NRA(ANRE)			
Relation with other dimensions	Decarbonization, Energy security,			

II. Regional cooperation in this area

Romania cooperates with Republic of Moldova to build a new 400kV interconnection line between Suceava and Bălți. The aim of this project is to further strengthen the interconnectivity between Romania and Republic of Moldova.

Romania is part of **the Black Sea corridor project (TYNDP ID: 138)**, the aim of this project is to further strengthen the interconnectivity between Romania and Bulgaria, with the construction of several (three) 400 kV high voltage transmission system lines (Overhead lines (OHL)).[7]

Romania is also part of **the Mid-Continental East Corridor interconnectivity project (TYNDP ID: 144)**, which aims at strengthening the interconnectivity between Romania and Serbia and Hungary by building two new 400 kV OHL's and the upgrade/completion of several 220 kV OHL's and substations.[8] Romania's interconnectivity with Serbia, is also supported under **the North CSE Corridor project (TYNDP ID: 341)**. The aim of this project is to enhance the market integration in the region, allowing the lower difference in marginal energy costs, allow the connection of huge capacities of renewable sources that have applied for connection in the observed area and increase the security of supply in the region by increasing the available balancing

[7] https://tyndp2022-project-platform.azurewebsites.net/projectsheets/transmission/138

[8] https://tyndp2022-project-platform.azurewebsites.net/projectsheets/transmission/144

capacity across the mentioned border. The investments under this project will also advance further the development of the East – to – West corridor. [9]

In addition to the forementioned initiatives and projects, Romania is also part of **the HU – RO project** **(TYNDP ID: 259)**.The aim of this project is to strengthen the interconnectivity between Hungary and Romania, through the investment in a new 120 km single circuit 400 kV OHL between Romania and Hungary. As part of this project, several additional internal investments in grid development on the Romanian side are planned.[10]

Lastly, Romania has been part of **the Georgia-Romania Black Sea interconnection cable project** **(TYNDP ID: 1105)**, which is intended to connect the Georgian power system to the Synchronous grid of continental Europe as well as impact the energy security in both the Caucasus region and in Continental Europe, stimulate the RES buildout and increase trade and transit opportunities between the regions in mind. [11]

III. Where applicable, financing measures in this area at national level, including Union support and the use of Union funds

The tables contain information on the budget and funding sources, if available, for each of the proposed policies and measures

[9] https://tyndp2022-project-platform.azurewebsites.net/projectsheets/transmission/341

[10] https://tyndp2022-project-platform.azurewebsites.net/projectsheets/transmission/259

[11] https://tyndp2022-project-platform.azurewebsites.net/projectsheets/transmission/1105

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 (PCI) or and other key infrastructure projects

PAM 58 Refurbishment and modernization of the existing substations

Main objective: Improve the domestic electricity transmission grid infrastructure.
Description: The aim of this measure is the refurbishment and/or building new substations where needed, because of which the overall state of the electricity transmission grid will be modernized and more capable of sustaining a rapid development of RES projects' build-out in the Country.

Timeframe	Type	Sector	Gases	Scope
2022 – 2031	Technical	Energy	/	Transnational

Relevant planning documents, legal and regulatory acts	• Romanian electricity transmission grid (RET) development plan, 2022 – 2031; • ENTSO – E Ten Year Network Development Plan (TYNDP), 2022
Methodology	-
Assumptions	The overall state of the electricity transmission system will be improved, operational and maintenance security of multiple regions around the Country will be improved and the grid will be further developed and modernized.
Status of implementation	
- Steps taken	• Included in the Grid Development Plan 2022 - 2031
- Steps envisaged	• The foreseen individual projects within the Grid Development Plan 2022 – 2031, which are aimed at the modernization and/or building of new substations need to be implemented within the foreseen period – as stated in the Grid Development Plan 2022 – 2031;

Indicators:	Value in the last reporting year	Indicative trajectory	Target value
	2020-2021	/	2031
Progress	/		
Emissions reduction (Gg CO_2-eq)	/		
Other – Primary energy savings (ktoe)	/		

Finance – Budget (M€)	
Source of finance	State funds, European funds, [Other] international funding and private investors
Implementing entity	• Government of Romania • Transelectrica; • Romanian Energy Regulatory Authority (ANRE); • Ministry of energy; • Private investors and developers;
Monitoring entity	ANRE
Relation with other dimensions	Decarbonization, Energy security,

PAM 59 Increasing the Natural Gas in Central-Eastern and South-Eastern Europe

Main objective: Three main objectives have been set: (i) The increase and improvement of the operational independence by building its own compression unit and connecting the gas storage to a high-pressure gas transport network. (ii) Enhancing the regional and national security of supply and (iii) increasing flexibility of the storage – particularly by increasing withdrawal capacity during peak demand periods., by approximately 75% (up to 3.5 mcm) in the first stage and an additional 43% (up to 5 mcm) in a second stage.
Description: The revamping and expansion of an existing gas storage facility of 300 million cubic meters (mcm), in Targu Mures, that is located in Central Romania, to a facility with storage capacity of 400 mcm in the first stage and expected total of 600 mcm storage capacity in the second stage.

Timeframe	Type	Sector	Gases	Scope
2022 – 2031	Technical	Energy	/	National

Relevant planning documents, legal and regulatory acts		• European Union List of projects of common interest of 2021 (fifth list) → Project belongs to Cluster 6.20 (Project ID in PCI: 6.20.4);
Methodology		-
Assumptions		• First stage → Increase the existing storage capacity by 100 mcm, to a total of 400 mcm; • Second stage → Increase the existing storage capacity by an additional 200 mcm, to a total of 600 mcm;
Status of implementation		
- Steps taken		• Investment requests have been submitted thus far, for this PCI;
- Steps envisaged		• Revamping of the equipment in the [Natural] Gas storage facility in Targu Mares; • Taking steps and beginning work to increase Gas storage capacity at projected levels, within the corresponding phases;
Indicators:	Storage flexibility (%); Storage capacity (mcm);	Value in the last reporting year: 2020-2021 / Indicative trajectory: / / Target value: 12/2026
Progress		/
Emissions reduction (Gg CO_2-eq)		/
Other	Primary energy savings (ktoe)	/
Finance	Budget (M€)	
	Source of finance	State funds, European funds, [Other] international funding and private investors
Implementing entity		• Government of Romania • Transelectrica; • Romanian Energy Regulatory Authority (ANRE); • Ministry of energy; • Private investors and developers;
Monitoring entity		European Union. ACER and ENTSO - G
Relation with other dimensions		Decarbonization, Energy security,

PAM 60 Daily withdrawal capacity increase in Bilciurești underground gas storage system (UGS)				
Main objective: Modernizing the infrastructure of the [Underground] Natural Gas storage system in Bilciurești and increasing the daily withdrawal capacity. **Description:** Development of new infrastructure facilities that will be able to take on and support the additional flow. Four new [storage] wells are expected to drill within the framework of this investment. Additionally, 39 of the existing wells are expected to be modernized. The expansion units are expected to be optimized and modernized, and a new pipeline is expected between Bilciurești UGS and Bautimanu Compressor Unit. investments are planned for the modernization of the M3 cooling system and the digitalization of natural gas storage process at Bilciurești UGS.				
Timeframe	Type	Sector	Gases	Scope
2022 – 2031	Technical	Energy	/	National

Relevant planning documents, legal and regulatory acts	• European Union List of projects of common interest of 2021 (fifth list) → Project belongs to Cluster 6.20 (Project ID in PCI: 6.20.7);
Methodology	-
Assumptions	• The project aims to increase the daily delivery capacity of Natural Gas in Bilciurești UGS from 14 million Scm/day to 20 million m3/day - and an increase in storage capacity of 108 million Scm/cycle
Status of implementation	
- Steps taken	• Investment requests have been submitted thus far, for this PCI;
- Steps envisaged	• Systematization of intake/discharge (exhaust) manifolds, injection/withdrawal of gas; • Modernization of 3 TEG dehydration units; • Modernization of metering panel at Bautimanu; • Drilling and equipping 4 new well. • Modernization of the gas; • Revamping of the equipment in the [Natural] Gas storage facility in Targu Mares;

Indicators:	Value in the last reporting year	Indicative trajectory	Target value
Storage flexibility (%); Storage capacity (mcm);	2020-2021	/	12/2026
Progress			
Emissions reduction (Gg CO_2-eq)	/		
Other: Primary energy savings (ktoe)	/		

Finance – Budget (M€)	
Source of finance	State funds, European funds, [Other] international funding and private investors
Implementing entity	• Government of Romania Transelectrica; • Romanian Energy Regulatory Authority (ANRE); • Ministry of energy; • Private investors and developers;
Monitoring entity	European Union. ACER and ENTSO - G
Relation with other dimensions	Decarbonization, Energy security,

II. Regional cooperation in this area

Romania actively engages in regional cooperation with neighboring countries in the field of natural gas infrastructure PCI project. By collaborating with neighboring nations and promoting PCI projects, Romania seeks to diversify its energy sources.

III. Where applicable, financing measures in this area at national level, including Union support and the use of Union funds

The tables contain information on the budget and funding sources, if available, for each of the proposed policies and measures

3.4.3. Market integration

I. Policies and measures related to the elements set out in point 2.4.3

Please see the 2.4.3

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.

PAM 61 Electric energy storage capacities

Main objective: Increase the flexibility of the electricity system.
Description: Energy storage in batteries offers essential system-balancing services, including primary, secondary, and tertiary regulation, thanks to its flexibility in production and consumption alignment with demand, and its independence from natural factors.

Timeframe	Type	Sector	Gases	Scope
2022 – 2031	Technical	Energy	/	National

Relevant planning documents, legal and regulatory acts		• Recovery and resilience plan for Romania
Methodology		
Assumptions		• Achieving a minimum total electricity storage capacity of 240 MW (equivalent to 480 MWh) by December 31, 2025, will be carried out through a project selection process with criteria designed to align with the technical guidelines for (2021 / C58 / 01)
Status of implementation		
	- Steps taken	• Government of Romania has launched a public call
	- Steps envisaged	• Constuction of the storage capacities

Indicators:	Value in the last reporting year	Indicative trajectory	Target value
	2020-2021	2025	
Progress	Storage capacities (MW)	240 MW	
Emissions reduction (Gg CO_2-eq)	/		
Other	Primary energy savings (ktoe)	/	

Finance	Budget (M€)	
	Source of finance	103.48 mill. EUR, (79.6 mill., EUR from the National Recovery and Resilience Plan, rest from the budget)
Implementing entity		• Government of Romania Transelectrica; • Romanian Energy Regulatory Authority (ANRE); • Ministry of energy; • Private investors and developers;
Monitoring entity		European Union.
Relation with other dimensions		Decarbonization, Energy security,

III. Where applicable, measures to ensure the non-discriminatory participation of renewable energy, demand response and storage, including via aggregation, in all energy markets

Please see the Chapter 2.4.3 and PAM 60

IV. Policies and measures to protect consumers, especially vulnerable and, where applicable, energy poor consumers, and to improve the competitiveness and contestability of the retail energy market

Please see the Chapter 3.4.4

V. Description of measures to enable and develop demand response, including those addressing tariffs to support dynamic pricing

In Romania, the introduction of smart meters and dynamic price electricity contracts represents a significant leap forward in the modernization of the country's energy infrastructure. Smart meters, equipped with advanced technology, allow for real-time monitoring and management of electricity consumption in homes and businesses. These devices provide consumers with precise information about their energy usage, enabling them to make more informed decisions and optimize their electricity consumption patterns. This not only empowers consumers to take greater control over their energy costs but also supports more efficient use of electricity. ANRE is following the implementation of the plan for replacement of old with smart meters.

Dynamic price electricity contracts, often associated with smart meters, introduce a flexible pricing structure that varies throughout the day. These contracts encourage consumers to shift their energy-intensive activities to periods when electricity demand is lower, typically during off-peak hours. By doing so, consumers can benefit from lower electricity prices, reducing their energy bills and contributing to the overall stability of the electrical grid. This dynamic pricing model aligns consumption with supply, making it more economically and environmentally sustainable. As Romania continues to invest in these technologies, it is expected that smart meters and dynamic price electricity contracts will play a pivotal role in promoting energy efficiency, reducing carbon emissions, and enhancing the resilience of the country's energy infrastructure.

VI. Regional cooperation in this area

Romania was part of **the Interim Coupling Project (ICP - DE-AT-PL-4M MC)** along with Germany, Austria, Poland, Romania, Czechia, Hungary, and Slovakia. The aim of the project was to further develop the regional integration of the day-ahead organized electricity markets, with the introduction of Net Transmission Capacity (NTC-based) implicit capacity allocation, on six borders (PL-DE, PL-CZ, PL-SK, CZ-DE, CZ-AT, HU-AT). With this the Multi-Regional Coupling project was coupled with the 4M MC Countries (Hungary, Czech Republic, Romania and Slovakia) – thus their (4M MC) Countries' day-ahead markets were integrated in the Pan-European day-ahead power market. The project was successfully completed in 2021[12,13].

Following the success of the Interim Coupling Project, Romania later became part of **the Core Flow-Based Market Coupling Project**. The project's main goal was to the development and implementation of a flow-based day-ahead market coupling across the whole Core capacity calculation region (Core CCR)[14]. The project was concluded in June 2022, with the successful go-live on the 8th of June[15].

Between 2019 – 2021, Romania was part of an **NTC-based project of day-ahead market coupling** between Romania and Bulgaria. The project was purposed to achieve the development and implementation of a flow-based day-ahead market coupling throughout the Core region (Austria, Belgium, Croatia, the Czech Republic, France, Germany, Hungary, Luxembourg, the Netherlands, Poland, Romania, Slovakia and Slovenia) under the single day-ahead market coupling (SDAC) project. The BG - RO border was included in the SDAC coupling on 27th of October 2021 – thus, the southeast European region was fully integrated (looped in) in the Single day - ahead coupling[16,17].

[12] https://arhiva.anre.ro/en/press/press/press-release-request-to-initiate-the-interim-project-for-a-ntc-based-market-coupling

[13] The 2021 - 2030 Integrated National Energy and Climate Plan

[14] chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.jao.eu/sites/default/files/2022-06/Core%20FB%20MC%20Successful%20Go-live.pdf

[15] https://www.jao.eu/core-fb-mc

[16] https://www.epexspot.com/en/news/closing-loop-inclusion-bulgarian-romanian-border-single-day-ahead-coupling-sdac

[17] The 2021 - 2030 Integrated National Energy and Climate Plan

Romania participated in **the SIDC project**. The aim of the project was the integration of the borders pertaining to the integration of the bidding zones in Bulgaria, Croatia, the Czech Republic, Hungary, Poland, Romania, and Slovenia in the already coupled area (consisting of: Belgium, Denmark, Germany, Estonia, Finland, France, Latvia, Lithuania, Norway, The Netherlands, Austria, Portugal, Sweden, and Spain)[18]. Romania's OPCOM is part of **the operational contractual framework for cooperation of TSO's and DEMO's pertaining to the creation, development, and operation of the Single Intra-Day Coupling (SIDC) project**. OPCOM participates directly in the SIDC creation and operation activities, including in the performance of joint activities, participation in the development process (ex. the development of the coupling infrastructure, XBID), implementation[19].

Romania's TSO – Transelectrica participates in **the Platform for the International Coordination of Automated Frequency Restoration and Stable System Operation (PICASSO)**, which is aimed at establishing a European platform for the exchange of balancing energy from automatic frequency restoration reserves (aFRR), in line with Article 21 of EC Regulation (EU) 2017/2195 of 23rd November 2017, which establishes a guideline on electricity balancing (EB GL). The go-live of the aFRR platform i.e., Transelectrica is expected to connect to the aFRR platform in the first quarter (Q_1) of 2024[20,21].

Transelectrica is a member of **the Manual Activated Reserves Initiative (MARI) project**. The project is aimed at creating, developing, and maintaining a European mFRR platform. The go-live of the mFRR platform in Romania is expected in the second quarter (Q_2) of 2024[22,23].

Transelectrica started operational participation in **the International Grid Control Cooperation (IGCC) project**. The aim of the IGCC is to avoid counter-acting activations of aFRR balancing energy through the process known as imbalance netting[24,25].

[18] https://www.energy-community.org/dam/jcr:31b14753-d1dc-4dc8-84f2-37bea7f4342a/ECRB112019_ACER.pdf

[19] The 2021 - 2030 Integrated National Energy and Climate Plan

[20] https://www.entsoe.eu/network_codes/eb/picasso/

[21] https://www.entsoe.eu/documents/nc/Implementation/picasso/PICASSO_7th_Accession_roadmap_ext.pdf

[22] https://www.entsoe.eu/network_codes/eb/mari/

[23] https://www.entsoe.eu/documents/nc/NC%20EB/2023/MARI_Accession_roadmap_April_2023.pdf

[24] https://www.entsoe.eu/network_codes/eb/imbalance-netting/

[25] https://www.entsoe.eu/documents/nc/NC%20EB/2022/20220106_Press_release_Transelectrica_go-live_v1.0.pdf

3.4.4. Energy poverty

I. Where applicable, policies and measures to achieve the objectives set out in point 2.4.4

PAM 62 Development and use of fully-fledged national social assistance information system

Main objective: Fair and efficient granting of energy subsidies
Description: The information system will be primarily used by the local public administration authorities in the process of granting legally prescribed benefits to the eligible categories, among which are the vulnerable energy consumers. The system will ensure the automated processing of data on the applicants and verification of the eligibility criteria for the categories of vulnerable consumers. Eventually, the subsidy will be granted only to vulnerable consumers who have been identified as such by the responsible authorities, thus overcoming the current problem with the insufficient capacities among the local public administration, as well as significantly reduce, if not completely reduce the corruption.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	Households	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Special bylaw on administering and use of the information system			
Methodology				
Assumptions				
Status of implementation				
- Steps taken	•			
- Steps envisaged	•			
Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020 – 2021	2025	2030
Progress – Additional installed capacity (MW)				
Emissions reduction (Gg CO_2-eq)				
Other – Primary energy savings (ktoe)				
Finance – Budget	€			
Finance – Source of finance	Central government budget			
Implementing entity	• Ministry of Labor and Social Protection			
Monitoring entity				
Relation with other dimensions				

PAM 63 Ensuring implementation of just transition process

Main objective: Reducing the adverse socio-economic impacts as result of closing the coal energy industry
Description: Implementation of this measure will target the mono-industrial regions as Valea Jiului is, but also other regions dependent on the coal industry or on other energy intensive sectors. The phase out process will certainly have negative impacts such as increased number of unemployed persons and increased poverty among the citizens in these areas. Therefore, measures should be defined and implemented to ensure just transition process.

Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Legal	Households	CO_2, CH_4, N_2O	Local

Relevant planning documents, legal and regulatory acts	• Special law on just transition process to be drafted, adopted and implemented, which will contain concrete measures to minimize the adverse effects in certain regions
Methodology	
Assumptions	
Status of implementation	
- Steps taken	•
- Steps envisaged	•

	Indicators		Value in the last reporting year	Indicative trajectory	Target value
			2020 – 2021	2025	2030
	Progress	Additional installed capacity (MW)			
	Emissions reduction (Gg CO_2-eq)				
	Other	Primary energy savings (ktoe)			
	Finance	Budget	€		
		Source of finance	Central government budget		
	Implementing entity		• Ministry of Energy • Ministry of Economy Entrepreneurship and Tourism • Ministry of Labor and Social Protection		
	Monitoring entity				
	Relation with other dimensions				

3.5 Dimension research, innovation and competitiveness

I. Policies and measures related to the elements set out in point 2.5

Romania has made significant progress in research and innovation in recent years. In 2021, the country's gross expenditure on research and development (GERD) was 1.1% of GDP, up from 0.9% in 2016 (it is still lower than the EU average of 2.2% of GDP). The number of researchers per 1,000 inhabitants also increased, from 1.3 in 2016 to 1.5 in 2021.

These investments in research and innovation are paying off. Romania has seen a significant increase in its number of patent applications in recent years. In 2021, the country filed 2,300 patent applications, up from 1,700 in 2016.[26]

Romania's improved research and innovation performance is helping to boost its competitiveness. In the 2022 Global Competitiveness Index, Romania ranked 48th out of 140 countries, up from 53rd in 2016.[27]

The Romanian government is committed to further investing in research and innovation. The National Strategy for Research, Development and Innovation 2021-2030 sets a target of increasing GERD to 2% of GDP by 2030. From this estimation, public investment in research and development from 0,17% of GDP in 2018 should be increased to 1 % of GDP in 2030. In addition, increasing private investment in research, development and innovation is a priority; Romania aims to reach the level of 1% of GDP by 2027 for R&D expenses of the business environment.
The government is also taking steps to improve the commercialization of research results. According to the Mr. Adrian Curaj, head of Romania's Executive Agency for Financing Higher Education, Research, Development and Innovation (UEFISCDI), "the proposed changes will help set Romania on a path to tripling its participation in Horizon Europe, compared to its performance in the predecessor programme Horizon 2020. The ongoing reforms should allow researchers in Romania to get at least €1 billion out of the EU's research flagship scheme by 2027" . Projects applied from the domestic R&D and higher education institutions related to the smart energy systems should be one of the priorities areas within the Horizon programme with aim for accelerating the Romania's journey towards a modern, digital energy ecosystem.

The government's investments in research and innovation are essential for Romania's future economic growth. By investing in research and innovation, Romania can become a more competitive economy and create new jobs.

Despite having some challenges such as still low levels of investment in research and development, brain drain, weak innovation system, Romania has made significant progress in research and innovation in recent years. With continued investment and reforms, the country can become a more competitive economy and create new jobs.

Smart specialization is supported at the national level especially through the POCIDIF program (Smart Growth, Digitalisation and Financial Instruments Programme), and at the regional level through the regional operational programs (POR). SNCISI (National Strategy for Research, Innovation and Smart Specialization) and RIS3 (Regional Innovation Strategies 3) represent the strategic milestones for the development and implementation of these programs.

Both at the regional and national level, innovation actors will be encouraged to access funds from other national (PNCDI IV, PNRR, POEO 2022-2027, POTJ) and international programs (Horizon Europe Program, Interregional and Cross-border Cooperation Programs, Erasmus+, Invest EU, Innovation Fund - Ministry of Energy, etc.) with aim to pave the way to a more efficient and effective energy sector.

Several public institutions are involved in the governance of research and innovation (R&I) area in Romania[28]:

- R&I policy formulation, implementation, monitoring and assessment is under the responsibility of the **Ministry of Research, Innovation and Digitisation** (MCID). The Ministry is advised by a number of

[26] Romania's Patent Landscape: Grants, Applications & Trends (ttconsultants.com)
[27] Romania Competitiveness Index - 2023 Data - 2024 Forecast - 2007-2022 Historical (tradingeconomics.com)
[28] https://ec.europa.eu/research-and-innovation/sites/default/files/rio/report/PSF_background_report_final_23Nov_2021.pdf

consultative bodies, involving representatives from the science, technology and industrial communities.

- Scientific research at the university level is under the responsibility of the **Ministry of Education**.
- **The Executive Agency for Higher Education and R&D&I Funding (UEFISCDI)**, the **Romanian Space Agency (ROSA)** and the **Institute of Atomic Physics (IFA)** coordinate (administratively) some specific programmes and sub-programmes of the National R&D&I Plan.
- **Other ministries** play a role in the Romanian R&I system. The **Ministry of Economy** is responsible for designing and implementing entrepreneurship policies. The **Ministry of Agriculture and Rural Development**, the **Ministry of Health**, the **Ministry of Energy**, and the **Ministry of Defence** manage their own R&D Plans. The **Ministry of Investment and European Projects** is in charge of the management of the European Structural and Investment Funds (ESIF).
- At the regional level, the **Regional Development Agencies (RDAs)** are the executive bodies that implement R&I policy, but have a limited role in policy design and elaboration.

Key national documents relating to the dimension of "Research, Innovation and Competitiveness", which are considered in the preparation of the Romania's NECP 2021-2030, are:

- **National Strategy for Research, Innovation and Smart Specialization 2022-2027** (NRIS3) prepared by the Ministry for Research, Innovation and Digitalization (MRID)[29].

The Government of Romania is committed in creating suitable conditions to foster investment in Research, Development and Innovation, which is the key for the advance in science, for finding solutions to societal challenges, for the development and use of technologies with an impact on the quality of life, increasing productivity and competitiveness, creating sustainable jobs. Significant focus of the research activities on climate, energy, and mobility should lead towards decarbonization, security of energy supply, energy efficiency, integration of renewable energies, and other related energy and climate issues.

- **Romania's Sustainable Development Strategy 2030**[30]

The strategy looks at the recent history of Sustainable Development as a concept from an international, European, and national perspective. Gives a short introduction for each of the 17 Sustainable Development Goals, the aim of each specific goal for Romania, and the current situation regarding implementing Romania's previous Sustainable Development Strategy adopted by the Government in November 2008. Finally, the strategy describes the decision to be taken to establish the operational framework for implementing and monitoring this Strategy's goals and targets. The aim is to ensure consistent government action and increase the active participation of all relevant stakeholders including citizen initiatives, thus uniting Sustainable Development's three pillars to transform our society into a more sustainable one.

- **National Plan for the Implementation of the National Strategy for Research, Development and Innovation 2021-2030 (PNIRDI 2021-2030)**[31]

This plan outlines the specific actions that will be taken to implement the NRSDI 2021-2030. It includes measures to increase funding for research and innovation, to improve the skills and training of researchers, and to promote the commercialization of research results.

- **Smart Growth, Digitalisation and Financial Instruments Programme (POCIDIF)**[32]

POCIDIF is one of the Operational Programmes (OP) of Romania for the 2021-2027 programming period. It is financed by the European Regional Development Fund (ERDF) and has a budget of EUR 2.143 billion. This

[29] Ministry for Research, Innovation and Digitalization (MCID). Romanian Government. (2022). National Strategy for Research, Innovation and Smart Specialization 2022-2027. https://www.research.gov.ro/uploads/comunicate/2022/strategia-na-ional-de-cercetareinovare-i-specializare-inteligent-2022-2027.pdf

[30] http://dezvoltaredurabila.gov.ro/web/wp-content/uploads/2019/03/Romanias-Sustainable-Development-Strategy-2030.pdf

[31] chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://energy.ec.europa.eu/system/files/2020-06/ro_final_necp_main_en_0.pdf

[32] https://mfe.gov.ro/wp-content/uploads/2023/01/9cf5726fa7062a9b0ca4fc8443ff0bf9.pdf

program aims to support Romania's transition to a smart, green and inclusive economy. It will do this by investing in:

- Research and innovation
- Digitalization
- SMEs and entrepreneurship
- Human capital
- Social inclusion and poverty reduction
- Environmental protection

The POCIDIF is expected to contribute to the achievement of Romania's national strategic objectives, such as the Sustainable Development Goals and the National Recovery and Resilience Plan. It is also expected to create jobs and boost economic growth. Some of the key priorities of the POCIDIF are:

- Research and innovation: The POCIDIF will support research and innovation projects in a wide range of areas, including new technologies, digitalization, and environmental protection.
- Digitalization: The POCIDIF will support the digitalization of businesses, public administration, and education.
- SMEs and entrepreneurship: The POCIDIF will support the development of SMEs and entrepreneurship, including the creation of start-ups.
- Human capital: The POCIDIF will support the upskilling and reskilling of workers, in order to meet the needs of the labor market.
- Social inclusion and poverty reduction: The POCIDIF will support the social inclusion and poverty reduction, including the development of social services and the promotion of active inclusion.
- Environmental protection: The POCIDIF will support the protection of the environment, including the development of green infrastructure and the improvement of energy efficiency.

- **Sustainable Development Program 2021-2027** (approved by EU)[33]

Romania's Sustainable Development Program 2021-2027 (NECP) is a strategic document that sets out the country's priorities for sustainable development in the next seven years. The NECP is aligned with the Sustainable Development Goals (SDGs), which are a set of 17 goals adopted by the United Nations in 2015. The NECP has four main objectives:

- Sustainable economic development: The NECP aims to promote economic growth that is sustainable and inclusive. This will be done by investing in infrastructure, education, and research and development.
- Environmental protection: The NECP aims to protect the environment and mitigate climate change. This will be done by reducing greenhouse gas emissions, improving energy efficiency, and promoting sustainable agriculture.
- Social inclusion: The NECP aims to reduce poverty and social exclusion. This will be done by investing in education, healthcare, and social protection.
- Good governance: The NECP aims to improve governance and public administration. This will be done by strengthening institutions and promoting transparency and accountability.

In addition, this program can and should influence the educational sector with strengthening the education for sustainable development with main focus on development of climate changes literacy among youth (now children – tomorrow main consumers). “A country’s competitiveness starts not on the factory floor or in the engineering lab. It starts in the classroom.”34 Effective energy sector can significantly increase Romanian competitiveness, therefore focus on building awareness and literacy among youth about the importance of efficient use of energy resources should be one of the priorities of the Government of Romania.

- **Just Transition Programme** (approved by EU)[35]

Romania's Just Transition Programme is a €2.14 billion plan that will help the country to transition to a climate-neutral economy. The JTP will focus on six regions that are most affected by the transition: Dolj, Galaţi, Gorj,

[33] https://mfe.gov.ro/wp-content/uploads/2022/11/ccd9ae994ca747e93c52ec9c97fc4c39.pdf

[34] Lee Iacocca (American automobile executive Ford Motor Company and Chrysler Corporation)

[35] https://mfe.gov.ro/wp-content/uploads/2022/12/21e46881d6b62fc6f6941423d889a14e.pdf

Hunedoara, Mureş, and Prahova. These regions are all heavily reliant on coal mining or other carbon-intensive industries. The JTP is expected to create around 100,000 jobs and to reduce greenhouse gas emissions by 10 million tonnes per year. It is also expected to contribute to the achievement of Romania's national strategic objectives, such as the Sustainable Development Goals and the National Recovery and Resilience Plan. The JTP is a key part of Romania's commitment to achieving climate neutrality by 2050. It is a necessary investment to ensure that the transition is fair and just for everyone.

Here are some of the key components of Romania's JTP:

- Renewable energy: The JTP will support the development of renewable energy projects, such as solar and wind farms. This will help to reduce Romania's reliance on fossil fuels and to create new jobs in the clean energy sector.
- Energy efficiency: The JTP will support the improvement of energy efficiency in buildings, industry, and transport. This will help to reduce Romania's energy consumption and to save money.
- Green jobs: The JTP will support the creation of green jobs in the renewable energy sector, energy efficiency sector, and other sectors that are helping to reduce greenhouse gas emissions.
- Upskilling and reskilling: The JTP will support the upskilling and reskilling of workers who are affected by the transition. This will help them to find new jobs in the clean energy sector or other sectors.
- Social programs: The JTP will support social programs to support those who are affected by the transition. This could include programs to provide income support, job training, and healthcare.

- **National Plan for the Implementation of the National Strategy for Research, Development and Innovation 2021-2030** (PNIRDI 2021-2030) [36]

This plan outlines the specific actions that will be taken to implement the NRSDI 2021-2030. It includes measures to increase funding for research and innovation, to improve the skills and training of researchers, and to promote the commercialization of research results.

- **National Action Plan for the Implementation of the Paris Agreement** (NAP)[37]

This plan sets out the actions that Romania will take to implement the Paris Agreement on climate change. It includes measures to reduce greenhouse gas emissions, to increase the use of renewable energy, and to improve energy efficiency.

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

Romania is collaborating with other member states in a number of ways to enhance innovation, research, and competitiveness. These collaborations include participating in the EU's research and innovation program Horizon Europe, receiving funding from the European Structural and Investment Funds (ESIF), signing bilateral agreements with other countries, and being a member of international organizations such as the European Commission, the European Space Agency, and the Organisation for Economic Co-operation and Development. Romania is also collaborating through initiatives such as the European Innovation Council (EIC), the European Institute of Innovation and Technology (EIT), and the European Research Council (ERC). These collaborations are helping Romania to improve its research and innovation performance and create a more competitive economy.

Some specific examples of how these collaborations are working:

- Romania received around €1.2 billion in funding from Horizon Europe in 2021. This funding is being used to support a number of research and innovation projects in areas such as renewable energy, digitalization, and healthcare.
- Romania has received ESIF funding to support a number of projects in the areas of research, innovation, and competitiveness. These projects have helped to create jobs, improve skills, and boost economic growth.

[36] chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://energy.ec.europa.eu/system/files/2020-06/ro_final_necp_main_en_0.pdf

[37] NAP-progress-publication-2020.pdf (unfccc.int)

- Romania has signed bilateral agreements with other countries on research and innovation. These agreements have helped to facilitate the exchange of knowledge and expertise, and they have helped to promote Romania's participation in international research and innovation projects.
- Romania is a member of a number of international organizations that promote research and innovation. These organizations provide Romania with access to resources and expertise, and they help to promote Romania's participation in international research and innovation projects.

Furthermore, the following European institutes and councils promote innovation and research culture in Romania.

- The European Innovation Council (EIC): The EIC is a public-private partnership that supports innovative businesses. Romania is a partner in the EIC, and it has received funding from the EIC to support a number of innovative businesses.
- The European Institute of Innovation and Technology (EIT): The EIT is a network of knowledge and innovation hubs that supports the development of new technologies and businesses. Romania is a partner in the EIT, and it is home to a number of EIT Knowledge and Innovation Centers.
- The European Research Council (ERC): The ERC is a funding agency that supports excellent research across all fields of science. Romania is a partner in the ERC, and it has received funding from the ERC to support a number of research projects.

III. Where applicable, financing measures in this area at national level, including Union support and the use of Union funds

Research, development, and innovation (R&D&I) are essential for the economic growth and competitiveness of any country. Romania is committed to investing in R&D&I, and there are a number of financing measures and available financing instruments available to support R&D&I activities in Romania. These measures include EU funding programs, such as Horizon Europe, the European Structural and Investment Funds (ESIF), and the European Innovation Council (EIC), as well as national funding programs, such as the National Research and Development Program, the National Innovation Program, and the Start-Up Romania Program. These programs provide funding for research and innovation projects in all areas of science and technology, with a focus on areas that are important to Romania's economic development, such as climate change, energy, and the environment, health, food, and bioeconomy, digitalization, industry, and space, security and defense, and inclusive and sustainable growth.

Some of the financing measures in this area at national level are listed below:

- Horizon Europe: Horizon Europe is the EU's research and innovation program for the period 2021-2027. It is the largest research and innovation program in the world, with a budget of €95.5 billion. Horizon Europe supports research and innovation projects in all areas of science and technology, with a focus on the following:
    - Climate change, energy, and the environment;
    - Health, food, and bioeconomy;
    - Digitalization, industry, and space;
    - Security and defense; and
    - Inclusive and sustainable growth.
- European Structural and Investment Funds (ESIF): The ESIF are a set of funds that are used to support investment in research, innovation, and competitiveness in the EU. Romania is a recipient of ESIF funding, and it has used this funding to support a number of projects in these areas.
- Erasmus+ programme 2021-2027 priorities:
    - Environment and fight against climate change topics
        - developing knowledge strategies and methods in the green sector
        - green curriculum development
        - drawing up sustainable development plans for organisations
        - promoting environmentally responsible consumption habits
        - the potential of culture in promoting sustainable development
        - rural development, e.g., sustainable agriculture, resource management, soil protection etc.
- European Innovation Council (EIC): The EIC is a public-private partnership that supports innovative businesses. The EIC provides grants, loans, and equity investments to businesses that are developing new technologies or products.

- European Institute of Innovation and Technology (EIT): The EIT is a network of knowledge and innovation hubs that supports the development of new technologies and businesses. The EIT has a number of hubs in Romania, and it provides support to businesses, researchers, and students.
- European Research Council (ERC): The ERC is a funding agency that supports excellent research across all fields of science. The ERC provides grants to researchers who are conducting cutting-edge research.

In addition to these EU funding programs, there are also a number of national funding programs in Romania that support research, development, and innovation. These programs are typically funded by the Romanian government, but they may also receive funding from other sources, such as businesses, foundations, and individuals.:

- The National Research and Development Program: This program is funded by the Romanian government and it supports research and development projects in all areas of science and technology.
- The National Innovation Program: This program is funded by the Romanian government and it supports innovation projects in the business sector.
- The Start-Up Romania Program: This program is funded by the Romanian government and it provides support to start-up businesses that are developing innovative products and services.
- The Entrepreneurship and Competitiveness Program: This program is funded by the Romanian government and it provides support to businesses that are looking to improve their competitiveness.
- The Research and Development Tax Credit: This program provides tax breaks to businesses that invest in research and development.

At the end, it is up to Romanian universities, research and science institutes and other innovation actors to attract as much as possible project applications and funds (EU and other donors driven programs – e.g. Green Climate Fund) towards green transition.

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SECTION B: ANALYTICAL BASIS

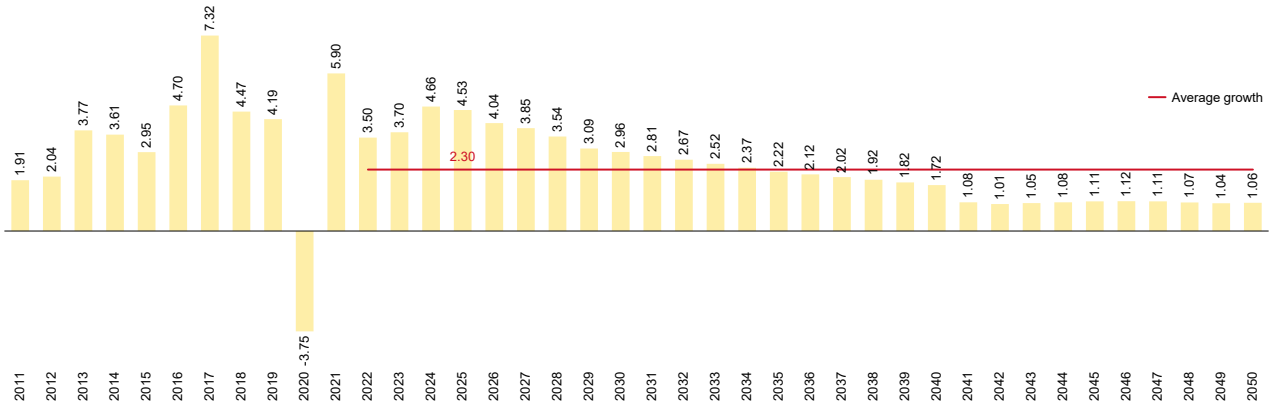
4. CURRENT SITUATION AND PROJECTIONS WITH EXISTING POLICIES AND MEASURES

4.1 Projected evolution of main exogenous factors influencing energy system and GHG emission developments

I. Macroeconomic forecasts (GDP and population growth)

One of the main assumptions used for energy demand and GHG emission projections used in all scenarios is the GDP growth. For the projections of the GDP, the data from the National Commission for Strategy and Prognosis of Romania are used. The average GDP growth in the period 2022-2050 is assumed to be 2.3%, with the dynamic presented in Figure 33.

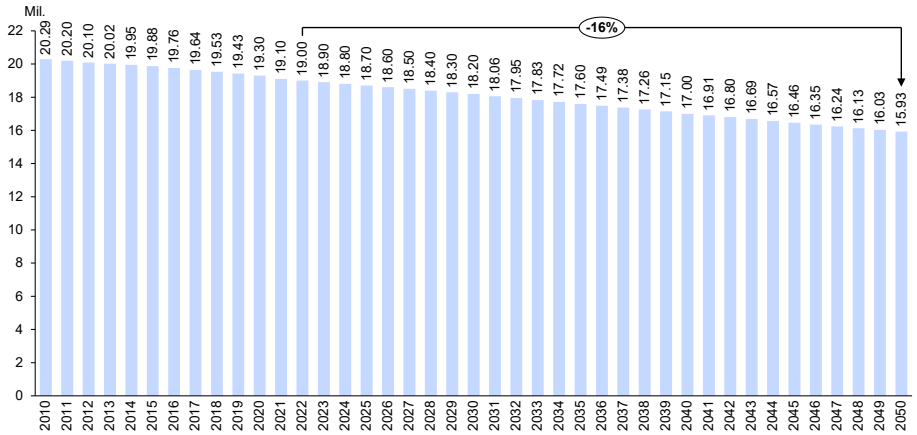
Figure 33. GDP growth (%) - historical and projected values up to 2050



Source: The National Commission for Strategy and Prognosis

The population is the other major assumption and Figure 34 shows the population evolution, which was employed in the scenarios, based on the data provided by the National Commission for Strategy and Prognosis of Romania. The population is expected to decline by 16% in 2050 compared to 2022 (Figure 35).

Figure 34. Population in Romania – historical and projected values



Source: The National Commission for Strategy and Prognosis

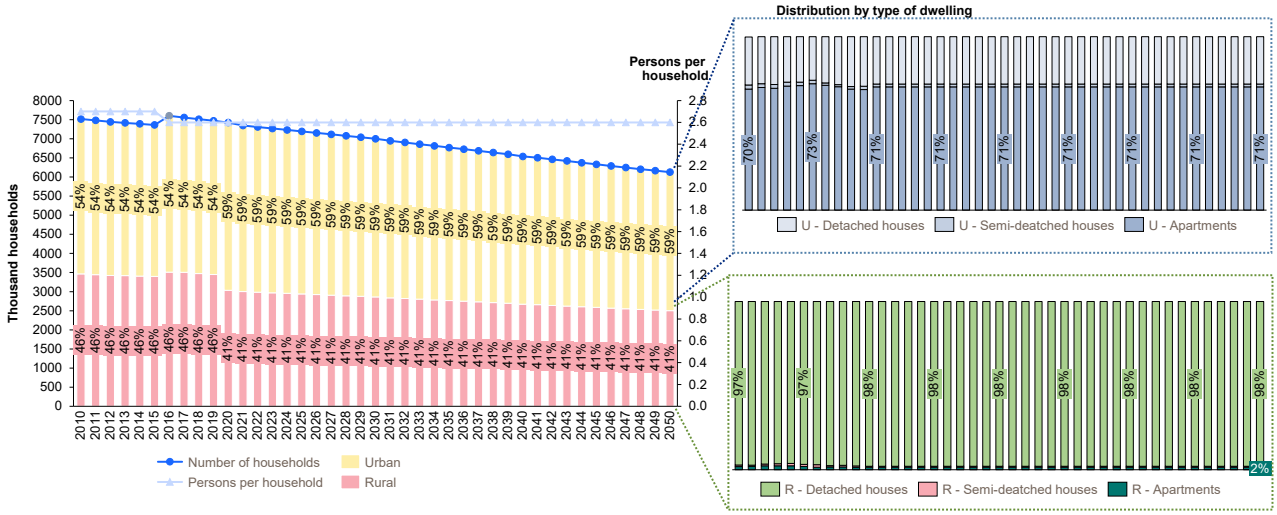
II. Sectoral changes expected to impact the energy system and GHG emissions

In this section the specific parameters and assumptions for sectoral changes that impact the energy system and GHG emissions are explained.

Residential and Services sector

For the household sector, there are many more factors that are crucial for accurate energy consumption projections in addition to the population and GDP. One of the factors is the average number of people living in each home, which is in the range 2.7 in 2010 to 2.6 in 2050 (Figure 35). The number of households is also determined based on the population and the average number of people living in each one, declining to around 6127 thousand households in 2050 (mainly due to population decrease). According to Figure 35, the households are divided into urban and rural, and for each of them there are three groups: detached, semi-detached houses and apartments.

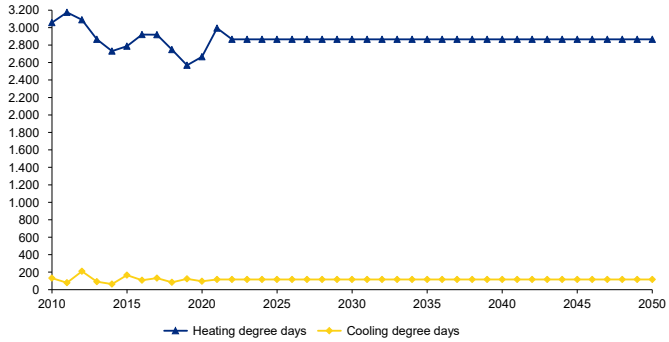
Figure 35. Number of households, person per households and split of households by type



Source: Eurostat – Average number of persons per household, INS – The structure of households by the dwelling's tenure status
Note: Number of households is calculated using the data on usually resident population from INS and average number of persons per household form Eurostat

The number of heating and cooling degree days is a key factor in the estimation of the useful energy demand in both the residential and commercial sectors. The model is calibrated using the heating and cooling degree days for the years 2010 to 2020, while the average number of degree days in that period is utilized for the years after 2020 (Figure 36).

Figure 36. Heating and cooling degree days

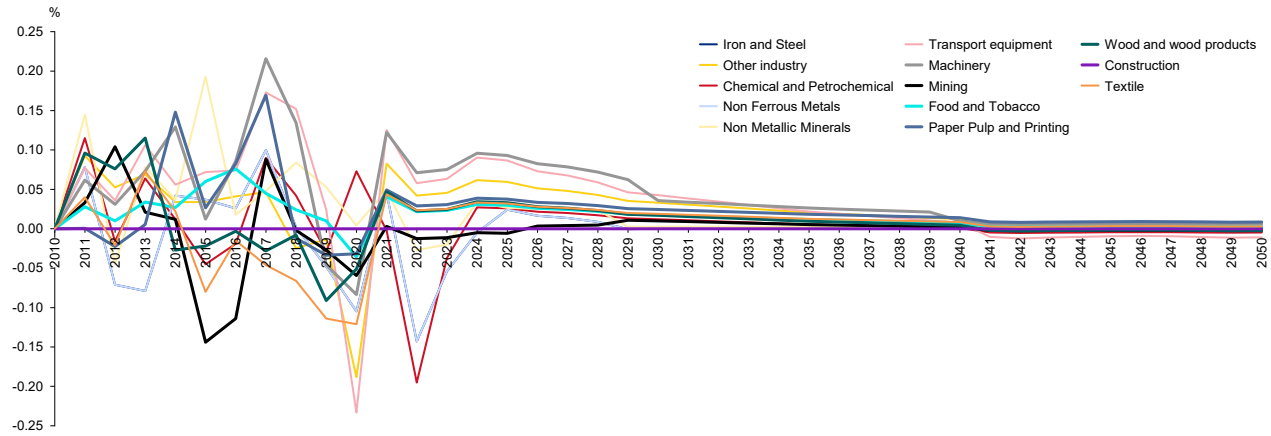


Source: EUROSTAT (2010-2020), LEAP Romania (2021-2050)

Industry and Industrial Processes and Product Use

For the Industry sector, the most important parameter is the production index growth per industry type (Figure 37). The data for the production index growth is determined by calculating the correlation of the GDP with the corresponding production index growth of the specific industry. All the data are also in accordance with the data obtained from the National Commission for Strategy and Prognosis of Romania.

Figure 37. Industry production index growth



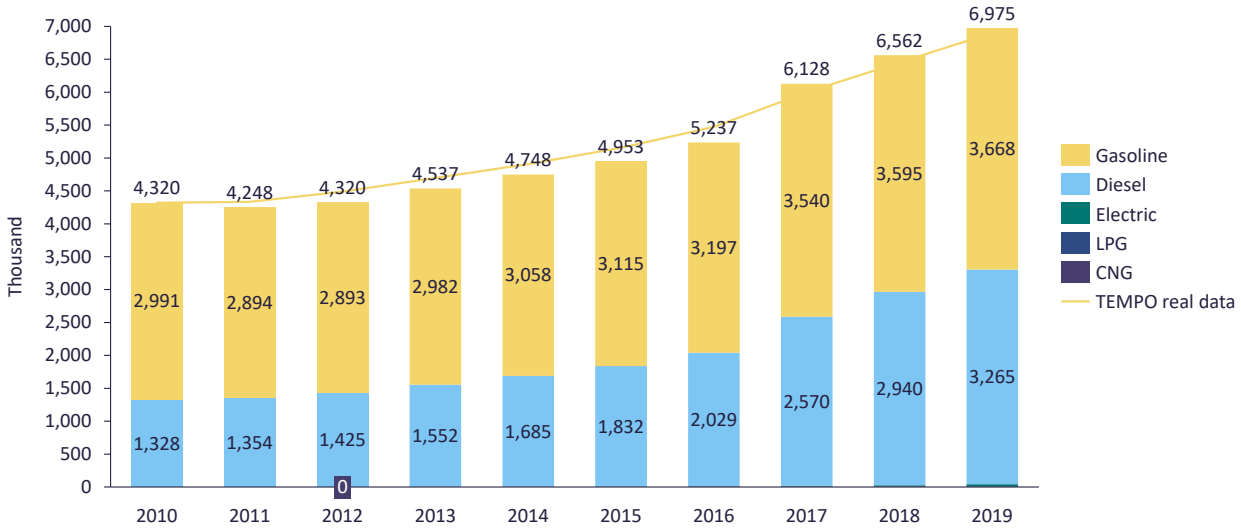
Source: The National Commission for Strategy and Prognosis, project team analyses

On one hand, the production index growth is used in order to project the useful energy demand in each industry type. On the other hand, the same values are used for the projection of the activity data in the Industrial processes and product use sector. Additionally, for the Product uses as substitutes of ozone depleting substances, the implementation of the Kigali amendment of the Montreal protocol is assumed.

Transport

For the road transport sector, the main parameters through which the energy demand can be determined are the passenger per km and the tonnes of freight per km. These parameters calculated based on the number of vehicles, number of kilometres per vehicle [km per vehicle] and number of passengers or goods per vehicle. The fuel economy of the vehicles taken into consideration is also factored when determining the energy demand for road transport sector. The evolution of the number of registered cars during 2010-2019 is presented in Figure 38.

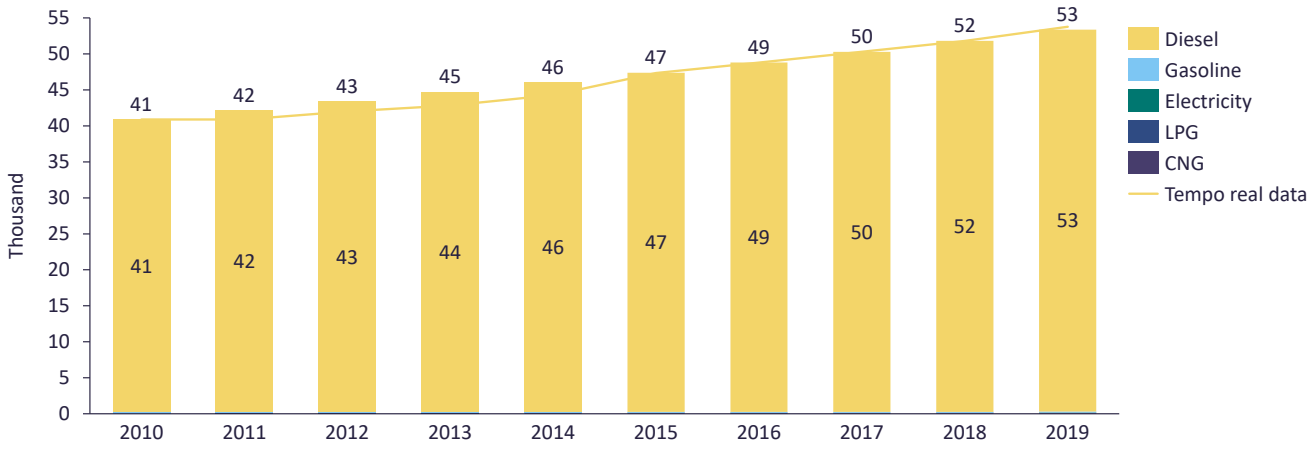
Figure 38. Number of passenger cars projected from the model and real data from TEMPO



Source: LEAP-RO model, National Institute of Statistics, team analysis

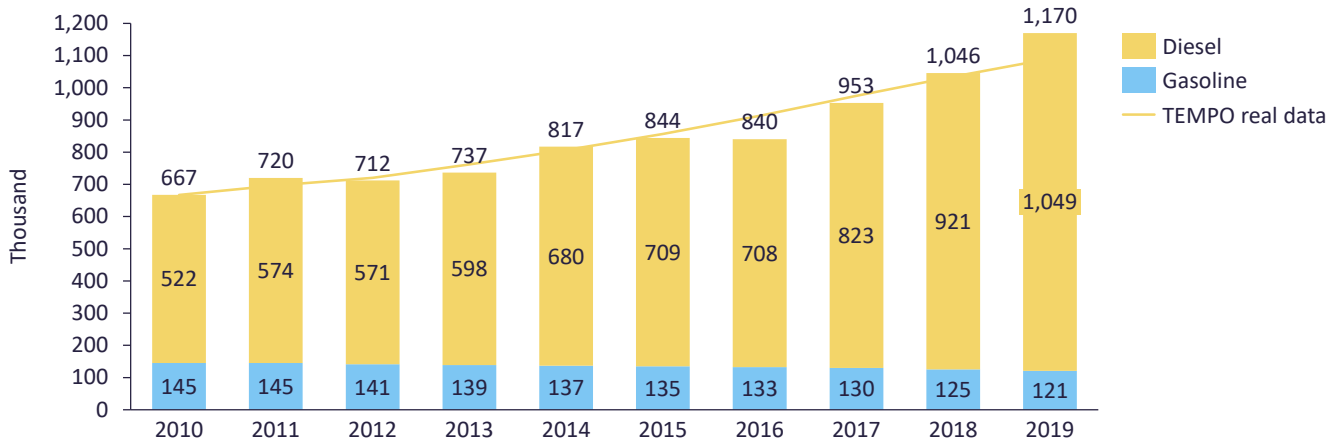
Additionally, for the road transport, the number of busses and the number of heavy goods vehicles are also used in the model. Figure 39 and Figure 40 show the modelling output per fuel type and the real data from the National statistics Institute. The number of both types of vehicles is increasing, but the increase in the number of HGV is more dramatic, which are almost doubled in the analysed period.

Figure 39. Number of passenger road transport vehicles projected from the model and real data from TEMPO



Source: LEAP-RO model, National Institute of Statistics, team analysis

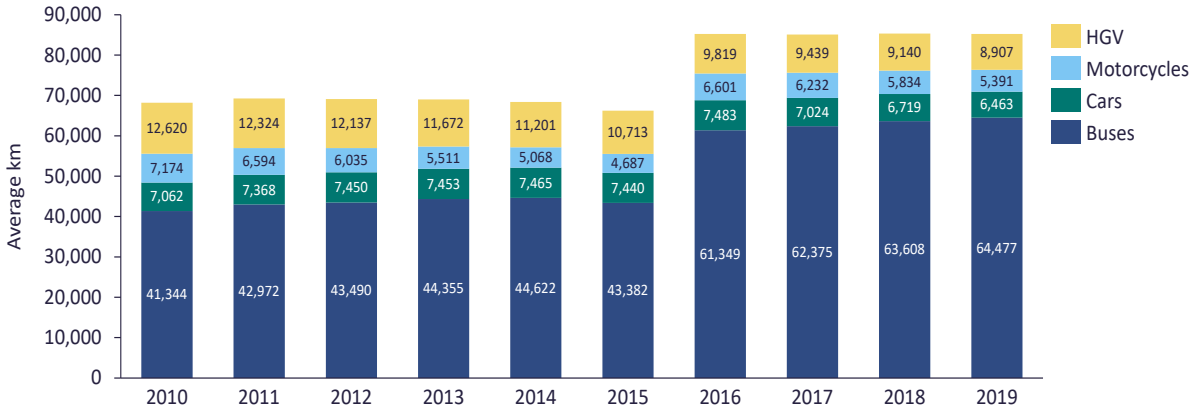
Figure 40. Number of Heavy Goods Vehicles (HGV) projected from the model and real data from TEMPO



Source: LEAP-RO model, National Institute of Statistics, team analysis

The second parameter which is very important for calculating the passenger kilometres is the average km per vehicle. For this purpose, data from EUROSTAT/TEMPO were used, as presented in Figure 40. Here it can be noticed that the average passenger kilometres of the busses are very high (and higher when compared to all other types of vehicles), which may lead to the need for further research this data. Data for the period 2010-2015 used in the graph come from estimates based on censuses road traffic performed once every five years.

Figure 41. Average km per vehicle type



Source: EUROSTAT (Motor vehicle movements on national and foreign territory), National Institute of Statistics, team analysis

Note: After carrying out the census, the data are recalculated, thus updating the data obtained by estimation with the data obtained from the road traffic census for the base year (2015) and recalculating the data for previous years.

Table 8 presents the average number of passengers for the busses, motorcycles, cars and the average tonnes of goods per HDV. The data for the busses and HDV are derived from the National statistics Institute's data for passenger/tonne kilometres and total number of kilometres. For cars and motorcycles the data from the JRS TIMES EU model - data for Romania are used. The fuel consumption of each type of vehicle is derived from the calibration of the model.

Table 8. Occupancy and fuel consumption by vehicle type

Vehicle	Fuel	Occupancy/goods Passenger/t	Fuel consumption l/100 km
Passenger road transport vehicles	CNG/Biogas		
	Diesel	9.36	33
	Gasoline	9.36	34
	LPG	9.36	37
Motorcycles	Gasoline	1.10	4
Cars	CNG	1.98	8.4
	Diesel	1.98	6.9
	Gasoline	1.98	7.6
	LPG	1.98	8.4
HDTs	Diesel	3.10	33
	Gasoline	3.10	25

Agriculture and LULUCF

The major drivers of GHG emissions in the Agriculture is the livestock population. The assumption, presented in Table 9 are based on the 2010-2021 historical data for Livestock in the BR 4 and on the sectoral investment plans.

Table 9. Livestock population projections

Buffalo	Female	- 0.5%
	Other types of buffalo	- 0.5%
Goats	Dairy goats	+ 1.1%
	Other types of goats	+ 0.4%
Horses	Horses	- 1.1%
Mules and Asses	Mules and Donkeys	+ 0.2%
Poultry	Adult for eggs	+ 0.7%
	For meat	+ 0.7%
Rabbit	Rabbit	+ 0.5%
Cattle	Slaughter calves younger than 1 year	+ 1.1%
	Breeding cattle younger than 1 year	+ 0.65%
	Breeding cattle between 1 and 2 years	- 0.04%
	Slaughter cattle between 1 and 2 years	+ 2.63%
	Breeding bulls older than 2 years	+ 1.1%
	Heifers for breeding older than 2 years	- 0.4%
	Slaughter male and female cattle older than 2 years	+ 0.13%
	For work	+ 0.27%
	Dairy cow	+ 1.1%
Pigs	Under 20 kg	+ 1.85%
	Between 20 and 50 kg	+ 1.85%
	Fattening	+ 1.85%
	Boars	+ 0.5%
	Breeding sows	+ 1.6%
Sheep	Dairy sheep	+ 1.2%
	Rams for breeding	+ 1.2%
	Other types of sheep	+ 1.2%

Source: Based on the 2010-2021 historical data for Livestock in the BR 4 and on the sectoral investment plans

Additionally, the following assumptions are assumed in the scenarios for the Agriculture and the LULUCF sectors:

- Introduction of a proper diet of the Livestock, that will lead to reduced GHG emissions
- No longer burning of agricultural residues in the fields starting in 2030 in the WAM scenario, and 2050 in the WEM scenario
- Reduction of the emission factor of FSN_N in synthetic fertilizer will be reduced by 20% in 2050 in the WAM scenario, and by 10% in 2050 in the WEM scenarios
- In order to reduce the emissions from the manure management, CH_4 recovery is envisioned. The amount of CH_4 emissions that will be recovered will be used as biogas fulfilling of 5% of the energy demand in Agriculture by 2050 in the WAM scenario. At the same time, methane capture will lead to manure management emission reduction: 40% in 2050 compared to 2020 in the WAM scenario and 20% in the WEM scenario.

- In terms of energy use in the Agriculture, the share of solar energy will increase in both scenarios to 15% in 2050, while diesel consumption will reduce to zero.
- Regarding LULUCF, it is assumed that the annual average forest burned area by 2050 will be equal to the average forest burned area during 2010-2019 in both scenarios.

Waste

Regarding the Waste sector the same key drivers as for the Energy sector, i.e. GDP and population are used. For achieving the LTS goals for the waste sector, the following policies and measures, based on the EU Waste Framework Directive of the Waste, will be implemented:

- Residual waste - 10% of the municipal waste will be landfilled by 2035
- Reduce – minimize the amount of waste produced. By 2030, it is assumed that household waste per capita will be reduced by 10% compared to 2017 (i.e. reduce Municipal Solid Waste (MSW) from the 228 kg per capita recorded in 2017 to 204 kg per capita by 2030). This assumption is consistent with the Romanian Overview of national waste prevention programmes in Europe - Country Profile 2021 by EEA[1]
- Reuse – reuse, repair and repurpose the products in order to avoid disposal. 2020 EU circular economy action plan aims to halve the quantity of municipal waste not recycled or prepared for reuse by 2030, while all EU Member States must recycle or prepare for reuse at least 60% of their municipal waste by 2030.
- Recycle – converting the waste materials to raw materials (such as paper, glass, metal, plastic etc.) and compost, which is a way of recycling organic food and garden waste, which are then used as fertilizers. In this regard, the following minimum requirements for material recovery are envisioned:
    - Wood – 25% in 2025, 30% in 2030 (as in Zero Waste Europe-Policy briefing document[2]) and 50% in 2050
    - Paper and textile – 80% in 2050 (this is in agreement with the Zero Waste Europe-Policy briefing document and the EU Strategy for Sustainable and Circular Textiles)
    - Food and garden waste – 50% in 2030 and 60% in 2050. Food and garden waste will be used in the composting process. Additionally, the emissions factors for composting will be reduced to 3kt CH_4/tonne and 0.24 kt N_2O/tonne in 2050, which is in accordance to the GHG Emission Factors Review – ESA[3].
- Recover energy – converting the non-recycled waste into usable energy. Although the amount of waste going to landfills will be significantly reduced, there will still be a significant amount of emissions produced by the accumulated waste. Therefore, it is important to further reduce these emissions by using two techniques:
    - Energy production – it is assumed that, in 2030, 30% of the emissions from the non-recycled waste plus the historical emissions will be used for electricity production, this share increasing to 60% in 2050, in the WAM scenario. For the WEM scenario, these percentages are 20% in 2030 and 40% in 2050.
    - Flaring – a share of the non-recycled waste plus the historical emissions, excluding the waste used for energy production, will be flared. These shares will be 40% in 2030 and 60% in 2050 in the WAM scenario. For the WEM scenario, the shares will be 35% in 2030 and 50% in 2050.

[1] https://www.eea.europa.eu/themes/waste/waste-prevention/countries/romania-waste-prevention-country-profile-2021/view and https://www.eea.europa.eu/themes/waste/waste-prevention/countries

[2] https://zerowasteeurope.eu/wp-content/uploads/2020/07/zero_waste_europe_policy-briefing_achieving-the-eu%E2%80%99s-waste-targets.pdf

[3] https://www.esauk.org/application/files/9616/4268/9204/Appendix_2_ESA_EF_Review_Final.pdf

- Incineration / co-incineration – The annual volume of incinerated / co-incinerated waste will increase to 500kt in 2030 and to 900kt in 2050 in both scenarios. Optionally, this waste may be used for energy recovery in recovery facilities and/or in cement factories.

For the Wastewater treatment, it is assumed that:

- 55% of the rural population will be connected to sewage systems by 2050 according to the WEM scenario, and 90% according to the WAM scenario.
- All sewage systems in urban areas will be connected to wastewater treatment plants by 2030. 5% of rural areas connected to sewage systems will be connected to wastewater treatment plants by 2030 and 70% by 2050.
-

III. Global energy trends, international fossil fuel prices, EU ETS carbon price

One of the key references for price comparisons and forecasts is the annual World Energy Outlook produced by the IEA. According to this report and considering a net-zero emissions scenario by 2050, it is projected that the prices of natural gas, crude oil, and coal in the EU will see a significant decrease compared to their 2021 levels (Figure 42). However, concurrently, the price of CO2 emissions is expected to rise to approximately 250 EUR/t (Figure 43).

Figure 42 Fossil fuel prices by scenario

			Net Zero Emissions by 2050		Announced Pledges		Stated Policies	
Real terms (USD 2021)	**2010**	**2021**	**2030**	**2050**	**2030**	**2050**	**2030**	**2050**
IEA crude oil (USD/barrel)	96	69	35	24	64	60	82	95
Natural gas (USD/MBtu)								
United States	5.3	3.9	1.9	1.8	3.7	2.6	4.0	4.7
European Union	9.0	9.5	4.6	3.8	7.9	6.3	8.5	9.2
China	8.0	10.1	6.1	5.1	8.8	7.4	9.8	10.2
Japan	13.3	10.2	6.0	5.1	9.1	7.4	10.9	10.6
Steam coal (USD/tonne)								
United States	63	44	22	17	42	24	46	44
European Union	113	120	52	42	62	53	60	64
Japan	132	153	59	46	74	59	91	72
Coastal China	142	164	58	48	73	62	89	74

Source : World Energy Outlook 2022

Figure 43 CO2 prices for electricity, industry and energy production in selected regions by scenario

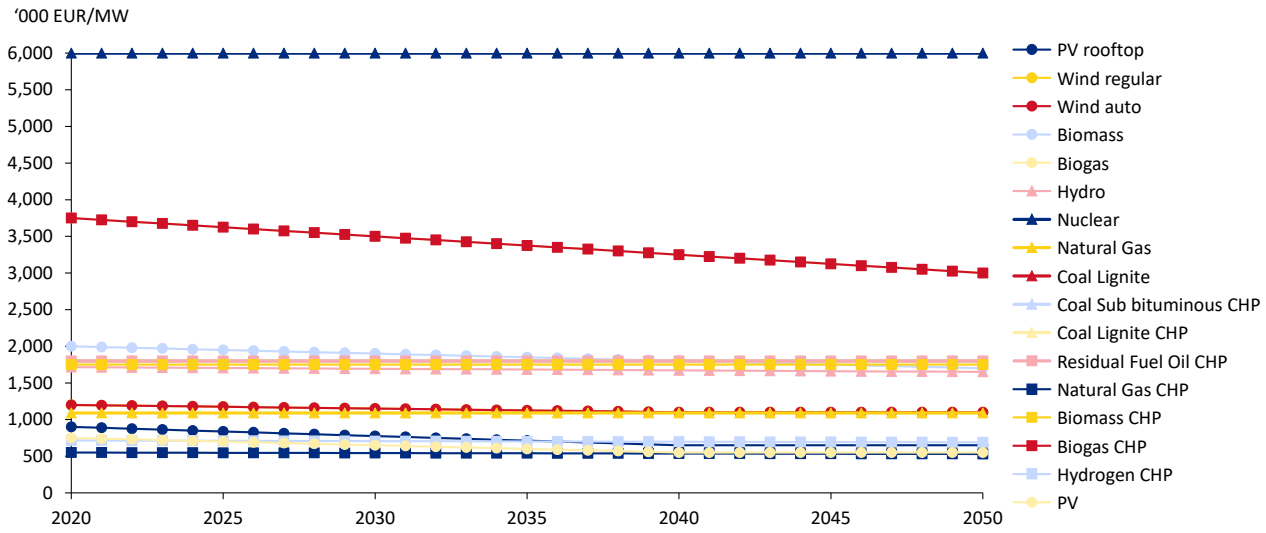
USD (2021) per tonne of CO_2	2030	2040	2050
Stated Policies Scenario			
Canada	54	62	77
Chile, Colombia	13	21	29
China	28	43	53
European Union	90	98	113
Korea	42	67	89
Announced Pledges Scenario			
Advanced economies with net zero emissions pledges[1]	135	175	200
Emerging market and developing economies with net zero emissions pledges[2]	40	110	160
Other emerging market and developing economies	-	17	47
Net Zero Emissions by 2050 Scenario			
Advanced economies with net zero emissions pledges	140	205	250
Emerging market and developing economies with net zero emissions pledges	90	160	200
Other emerging market and developing economies	25	85	180

Source : World Energy Outlook 2022

IV. Technology cost developments

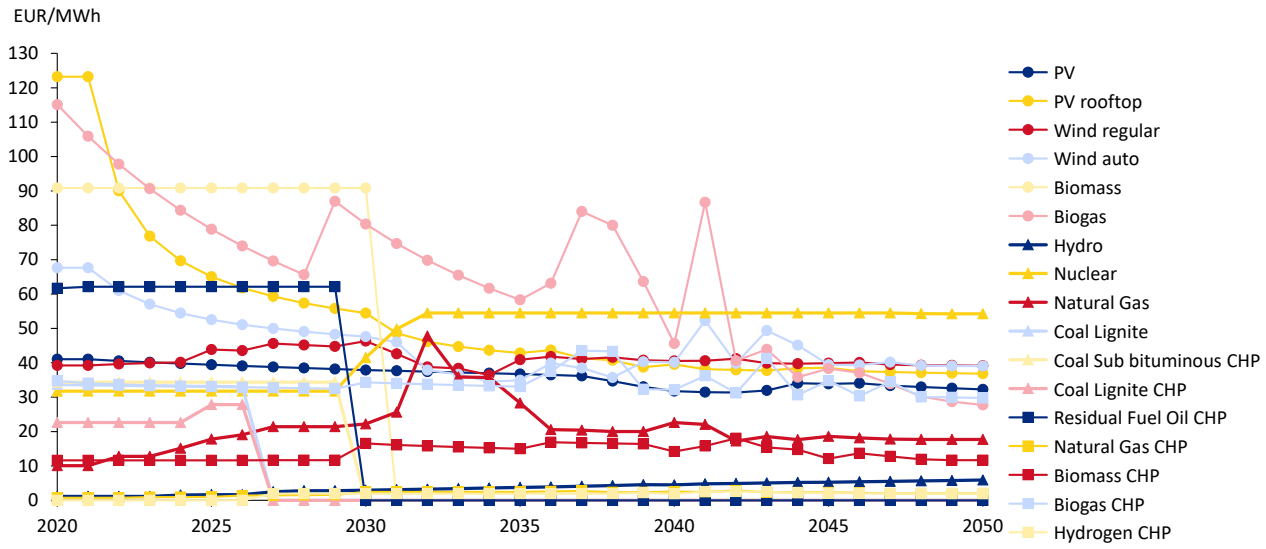
The production cost of RES technologies globally is anticipated to decline, particularly the cost of solar power plants. The investment costs for each technology included in the LEAP Romania model energy planning are presented on Figure 44. The most expensive technology in this regard is nuclear power plants, whereas PV has the lowest investment expenses. However, the production costs of certain technologies depend more on national factors than only investment costs, such as wind and solar irradiation, local natural gas and lignite supply, biogas output, and biomass potential. Figure 45 illustrates the Romanian production costs per technology under the WAM scenario obtained from the model. This cost is calculated by dividing the total production cost of each technology, by the total production of the corresponding technology. Among the lowest production costs are hydroelectric power plants and natural gas CHP power plants, whilst nuclear power plants will be the most costly in 2050. The highest drop in the production cost is for the PV, wind and biogas power plants.

Figure 44. Investment costs per technology ('000 EUR/MW)



Source: LEAP-RO model

Figure 45. Production cost per technology (EUR/MWh)



Source: LEAP-RO model

4.2 Dimension Decarbonisation

4.2.1. GHG emissions and removals

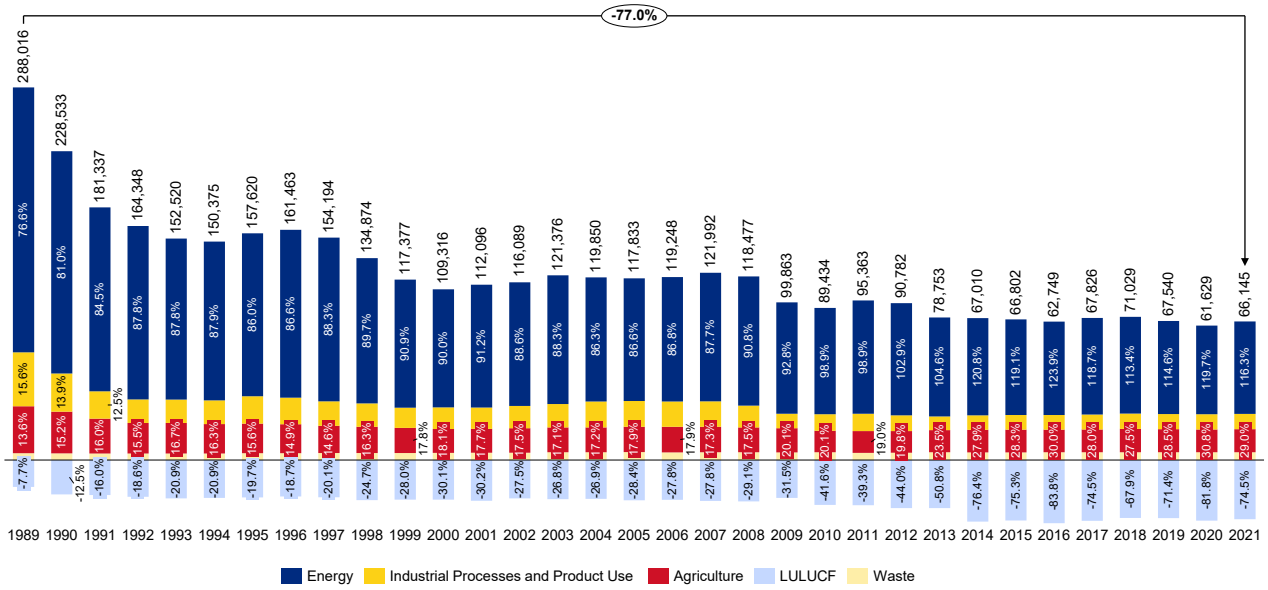
I. Trends in current GHG emissions and removals in the EU ETS, effort sharing and LULUCF sectors and different energy sectors

The GHG emission and removals that Romania reports to UNFCCC in the National Inventory Report are divided into the following main sectors: Energy (including Transport), Industrial Processes and Product Use (IPPU), Agriculture, Land Use, Land Use Change and Forestry (LULUCF) and Waste. The Inventory is prepared in line with the 2006 IPCC GHG Inventory Guidelines, and each sector comprises individual categories and subcategories identified as sources (or sinks) of emissions. According to the National Inventory Report of Romania, the total GHG emissions and removals (net emissions, including the LULUCF sector) were 66.15 Mt CO_2-eq in 2021 (), which represents a reduction of 77% compared to the emission level in 1989.

The greenhouse gas (GHG) emissions and removals that Romania reports to the UNFCCC within its National Inventory Report are categorized into the following primary sectors: Energy (including Transport), Industrial Processes and Product Use (IPPU), Agriculture, Land Use, Land Use Change and Forestry (LULUCF), and Waste. This Inventory adheres to the 2006 IPCC GHG Inventory Guidelines, with each sector encompassing distinct categories and subcategories identified as sources or sinks of emissions.

As stated in Romania's National Inventory Report submitted in 2023, the total GHG emissions and removals (net emissions, including the LULUCF sector) amounted to 66.15 Mt CO_2-eq in 2021 (as depicted in Figure 46). Notably, this signifies a substantial reduction of 77% compared to the emission levels documented in 1989.

Figure 46. GHG emissions and removals (net-emissions) by sector (in kt CO2-eq), 1989-2021



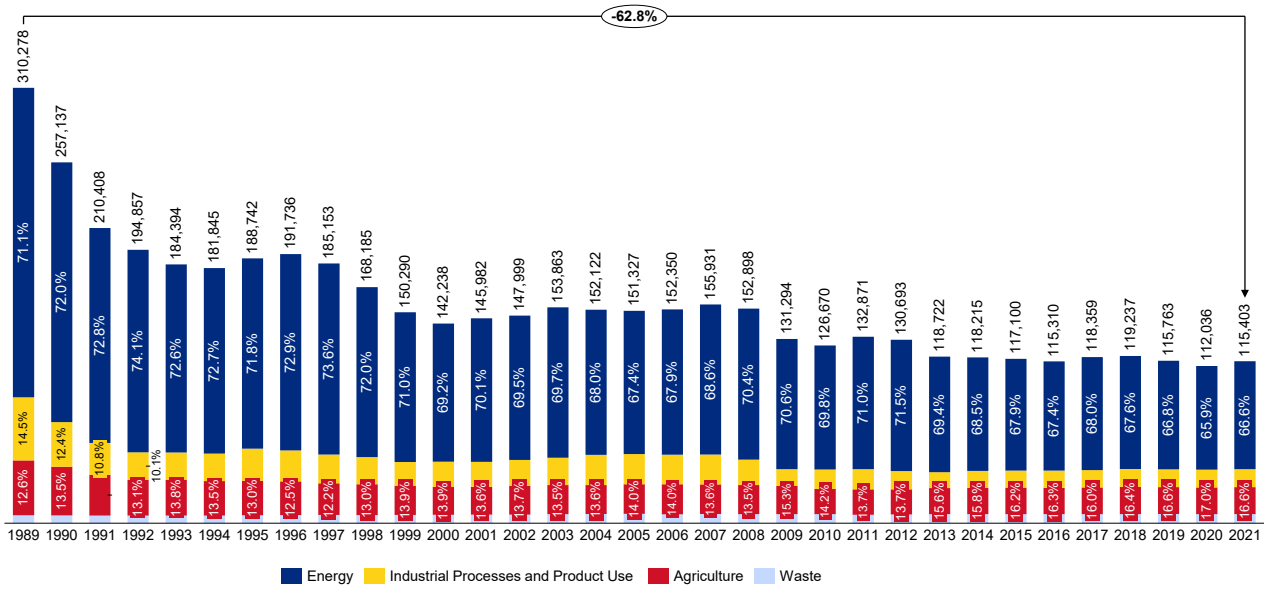
Source: Romania's Greenhouse Gas Inventory 1989 – 2021 submitted to UNFCCC (National Inventory Report - NIR and Common Reporting Format – CRF tables, submitted in April 2023)

If the removals from the LULUCF sector are not accounted for, then the aggregate greenhouse gas (GHG) emissions in 2021 were 115.40 Mt CO2-eq indicating a substantial reduction of 63% compared to 1989 levels (as illustrated in Figure 47). The largest share of emissions originated from the Energy sector (throughout the period 1989-2021), accounting for around 67% of the total emissions in 2021, followed by Agriculture, with nearly 17%, while the Industrial Processes and Product Use (IPPU) sector and the Waste sector contributed around 11% and 5%, respectively (as depicted in Figure 47).

The GHG emissions trend reflected the economic development of the country. During the period from 1989 to 2000, Romania's transition from a centralized economy to a free-market structure, coupled with the reorganization of all economic sectors, the closure of inefficient industries, and the commencement of operations of the first two units at the Cernavoda nuclear power plant, collectively led to a substantial reduction of over 50% in GHG emissions. In the subsequent period between 2000 and 2008, the GHG emissions slightly increased and eventually stabilized due to economic revitalization. Another drop in GHG emissions occurred from 2009 to 2012, attributed to the global financial and economic crisis. From 2013 onward, GHG emission levels remained relatively constant.

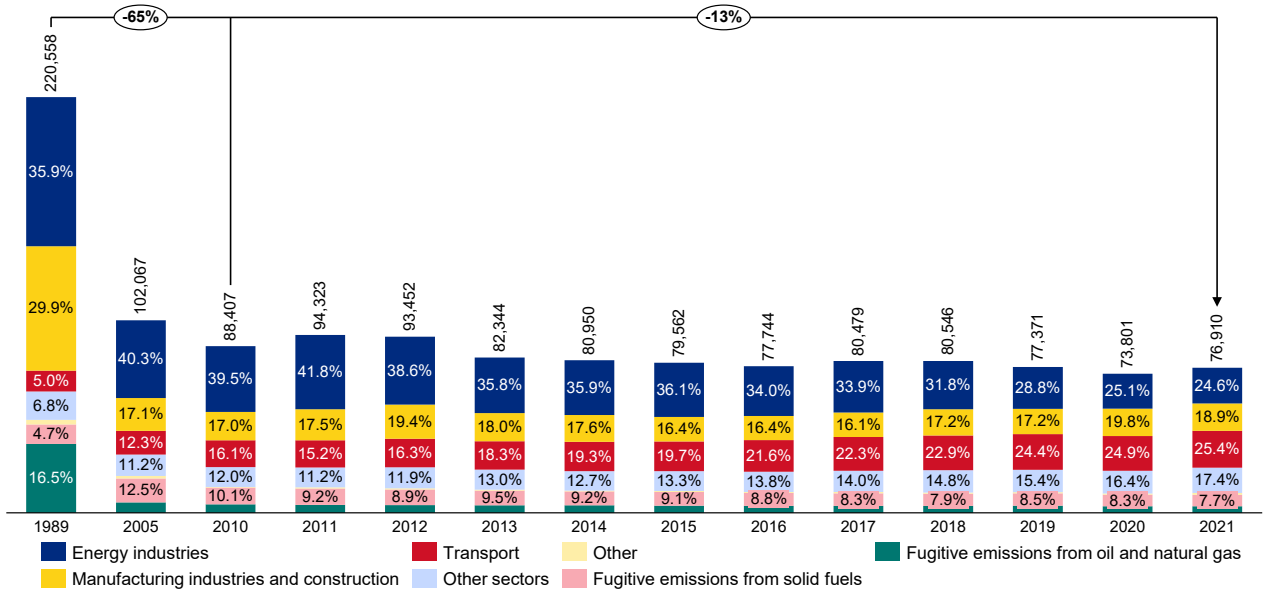
In the Energy sector, the primary sources of emissions are the energy industries (electricity and/or heat production plants) and transport, each contributing roughly 25% to the total emissions in 2021 (as depicted in ***Figure 48*** *Figure 48*). For comparison, in 1989, the manufacturing and construction sector ranked second in contributing to the overall GHG emission levels. Notably, the transport sector exhibited the most pronounced increase in emission share over the analysed period, from 5% in 1989 to 25% in 2021. Meanwhile, between 2010 and 2021, the energy sector's GHG emissions recorded a reduction of approximately 13%.

Figure 47. GHG emissions by sector (in kt CO_2-eq), 1989-2021



Source: Romania's Greenhouse Gas Inventory 1989 – 2021 submitted to UNFCCC (National Inventory Report - NIR and Common Reporting Format – CRF tables, submitted in April 2023)

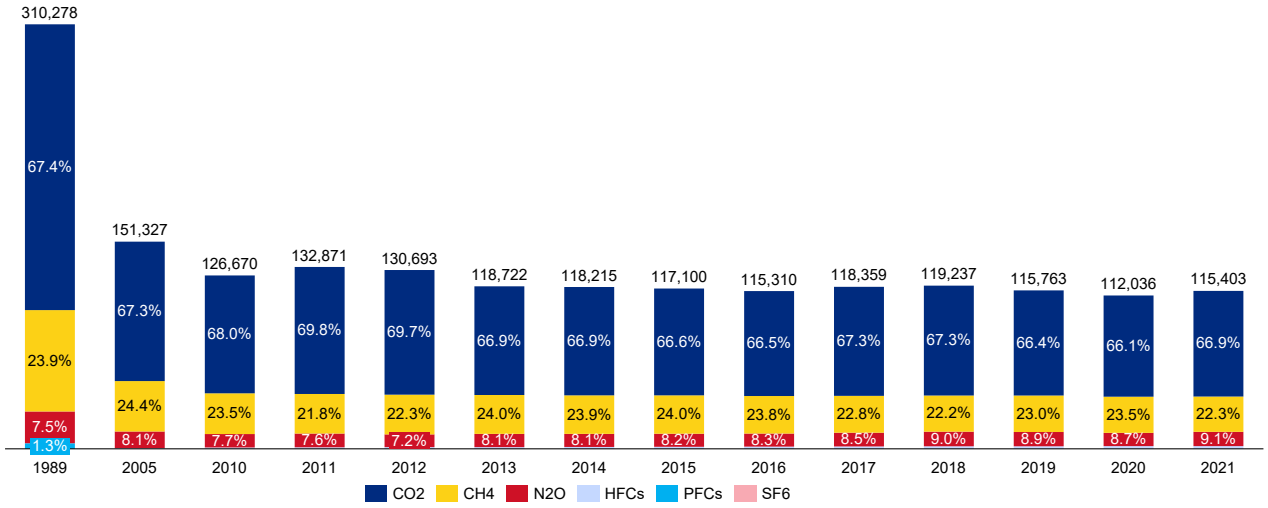
Figure 48. GHG emissions in Energy sector, by category (in kt CO2-eq)



Source: Romania's Greenhouse Gas Inventory 1989 – 2021 submitted to UNFCCC (National Inventory Report - NIR and Common Reporting Format – CRF tables, submitted in April 2023)

Analysing the breakdown of emissions based on gas types, it becomes evident that CO_2 emissions constituted the largest share, with approximately 67% in the year 2021, succeeded by CH_4 emissions with 22% and N_2O emissions with roughly 9%. The remaining greenhouse gases (HFCs, PFCs, SF6) collectively contributed to around 2% of the total greenhouse gas emissions (Figure 49).

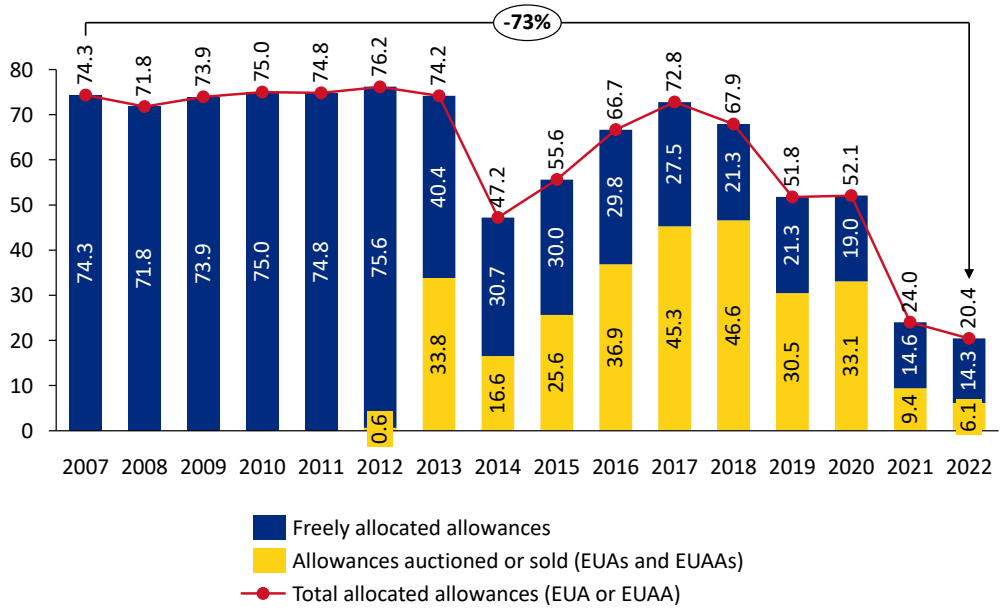
Figure 49. GHG emissions by gas (% share in total)



Source: Romania's Greenhouse Gas Inventory 1989 – 2021 submitted to UNFCCC (National Inventory Report - NIR and Common Reporting Format – CRF tables, submitted in April 2023)

Romania joined the EU and its ETS in 2007, and since then, the total allocated allowances have decreased significantly (i.e., 73%), from 74.3 million t CO_2-eq in 2007 to 20.4 million t CO_2-eq in 2022 (Figure 50). The freely allocated allowances have declined, ranging from 74.3 million t CO_2-eq in 2007 to 14.3 million t CO_2-eq in 2022. Additionally, allowances that were auctioned or sold varied, with the lowest value being 0.6 million t CO2-eq in 2012 and the highest value reaching 46.6 million t CO_2-eq in 2018. In 2022, the auctioned/sold allowances amounted to 6.1 million t CO_2-eq.

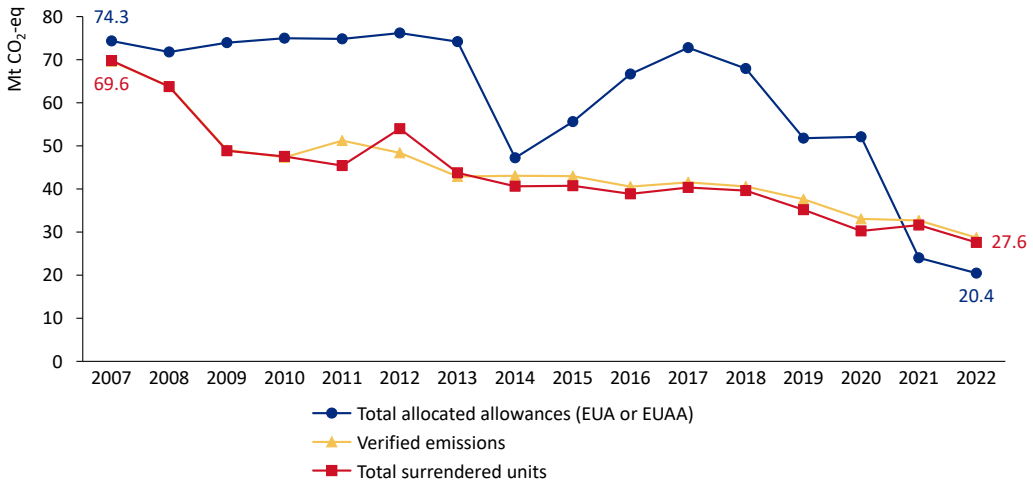
Figure 50. Allocation of the emission reduction allowances (Mt CO2-eq)



Source: EEA, European Union Emissions Trading System (EU ETS) data from European Union Transaction Log (EUTL), (database from July, 2023)

Analyzing the verified emissions reported on the EUTL between 2007 and 2022 reveals a 53% reduction (Figure 51). Emissions decreased from 69.6 million t CO2-eq in 2007 to 28.7 million t CO_2-eq in 2022. The total surrendered units exhibit a similar trend, dropping from 69.8 million t CO_2-eq in 2007 to 27.6 million t CO_2-eq in 2022, representing a decrease of approximately 61%.

Figure 51. EU-ETS data for Romania (Mt CO_2-eq)



Source: EEA, European Union Emissions Trading System (EU ETS) data from European Union Transaction Log (EUTL), (database from July 2023)

II. Projections of sectoral developments with existing national and Union policies and measures at least until 2040 (including for the year 2030)

Based on the current measures in place, Romania is projected to achieve a substantial reduction in its net emissions, with a decrease of 76% by the year 2030, compared to the levels recorded in 1990 (as illustrated in Figure 52). Specifically, its emissions, excluding Land Use, Land Use Change, and Forestry (LULUCF) considerations, are anticipated to drop by 66% (Figure 53). Most of these emission reductions are expected to materialize between 2030 and 2040, a period during which net emissions are forecasted to decline by 83% relative to the 1990 levels or by 72% solely in terms of emissions (excluding LULUCF effects). Looking ahead to 2050, the envisaged reduction from the existing measures will reach 85% for net emissions and 74% for emissions only, with LULUCF sinks excluded from the calculation. The energy sector is projected to exert the most significant influence on emission levels, although measures targeting the industrial and buildings sectors will also play a noteworthy role in reducing emissions.

Figure 52. Decarbonization pathways until 2050 by sectors – with existing measures

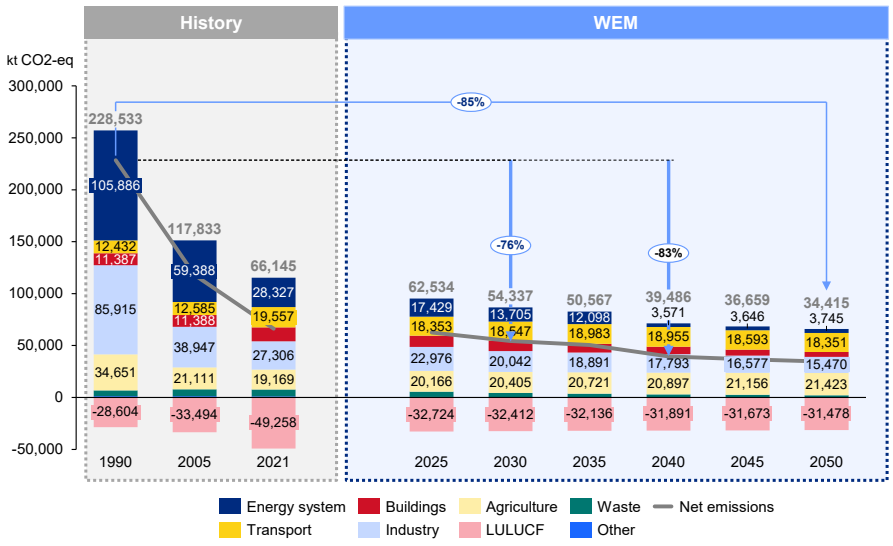
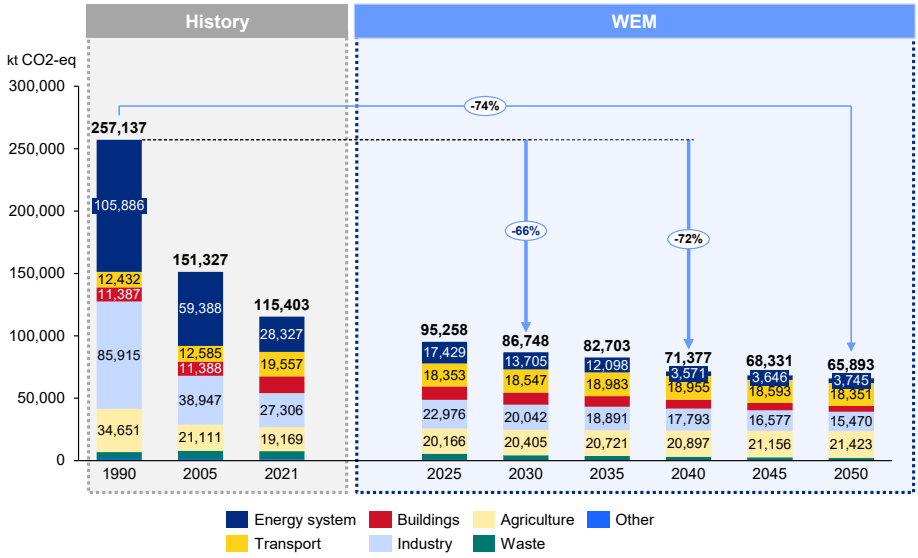


Figure 53. Decarbonization pathways until 2050 without LULUCF by sectors – with existing measures

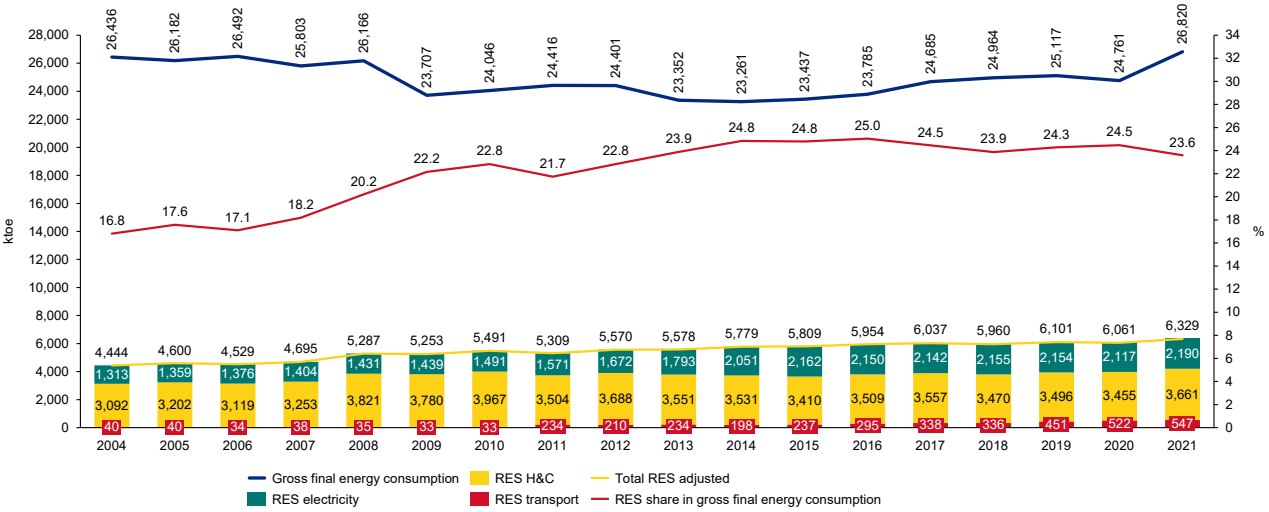


4.2.2. Renewable energy

I. Current share of renewable energy in gross final energy consumption and in different sectors (heating and cooling, electricity and transport) as well as per technology in each of these sectors

The gross final energy consumption from RES in the period 2004-2021 is constantly increasing, so that in 2021 it is more than 40% increased when compared to the 2004 level (as presented in Figure 54). However, there are fluctuations in the gross final energy consumption, which has a decreasing trend in the period up to 2015, after which there is a slight increasing trend, reaching a maximum value in 2021. Part of the reasons for the increased value of the gross final energy consumption in 2021 is because the 2021 heating degree days are by 12% higher than the 2020 value and 6% higher than the 10-years average heating degree days value. This suggests that 2021 was an unusually cold year. This leads to reduction of the RES share in the gross final energy consumption in 2021, although an increasing trend is observed in the overall analyzed period.

Figure 54. RES share in gross final energy consumption, 2004-2021



When analyzing the RES share in the gross final energy consumption by sectors, the highest percentage is in the electricity sector (Figure 55) in which the RES consumption has increased by around 66% in the period 2004-2021. This is a result of the increased electricity production mainly from wind, but also solar and other RES, as presented in Figure 56. At the same time there is also an increase in the final energy consumption

of electricity, which contributes the RES share in the gross final energy consumption of electricity to reach 42.5% in 2021, while in 2004 it was 28.4%.

Figure 55. Share of RES in gross final energy consumption of electricity and final energy consumption of Heating and cooling and transport sector, 2004-2021

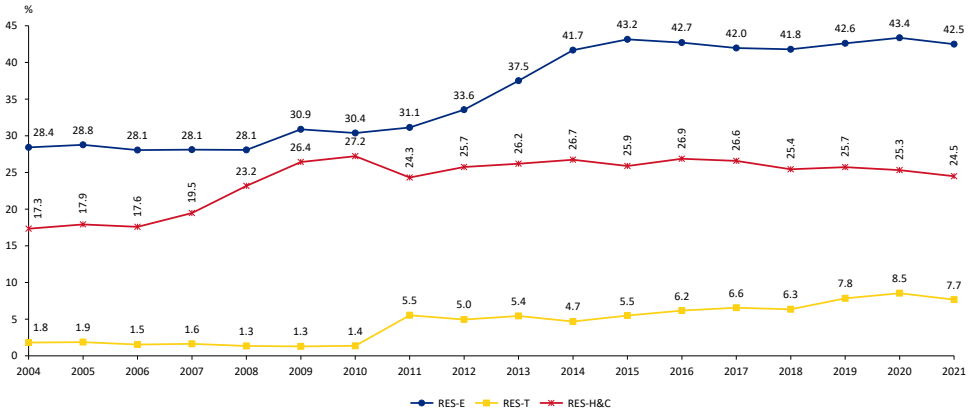
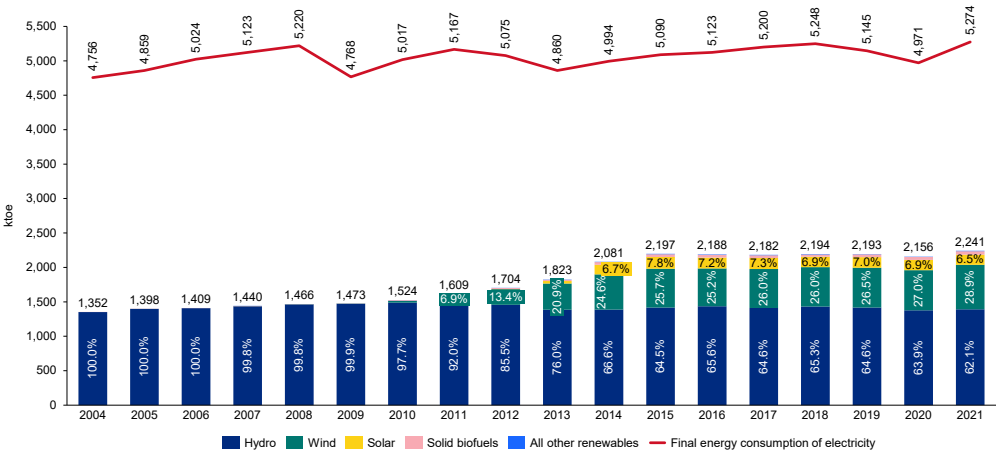
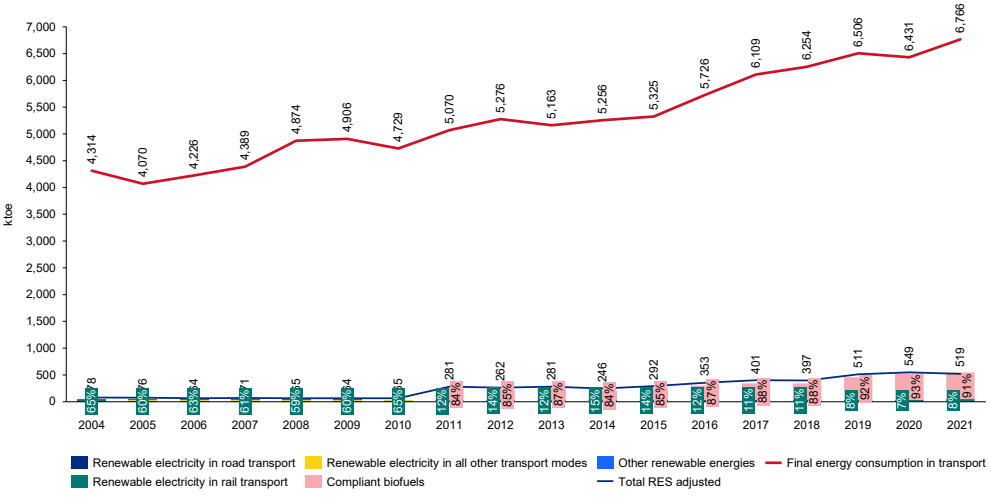


Figure 56. Share by technology in RES consumption of electricity and gross final electricity consumption, 2004-2021



In the transport sector, there is a drastic increase of the final energy consumption by around 57% in the period 2004-2021 (Figure 57). Due to the EU regulations, starting from 2011 the compliant biofuels have a significant role in the RES consumption in the transport sector reaching 91% in 2021. All of these contributes the RES share in the gross final energy consumption in the transport sector to reach 8.5% in 2020 and 7.7% in 2021 (due to the again increased final energy consumption in this sector for 2021) from 1.8% in 2004.

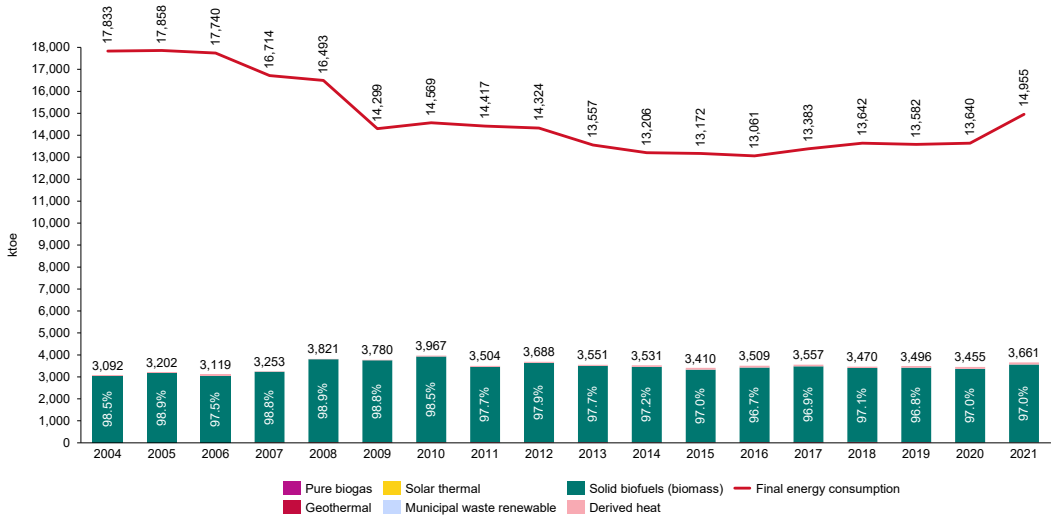
Figure 57. Share by technology in RES consumption of transport and final consumption in the transport sector, 2004-2021



In the heating and cooling sector, the major contributor to the RES consumption is the biomass (Figure 58).

Between 2004 and 2010, the RES share rose in tandem with the growth in biomass consumption. However, in the last ten years, both the final energy consumption for heating and cooling, as well as the consumption of biomass, have been nearly stable. As a result, the percentage of renewable energy sources remained almost constant in the period 2011-2020, with an increase in 2021. The greater value of the gross final energy consumption for heating and cooling in 2021 is due, in part, to the more heating degree days that year, as previously explained.

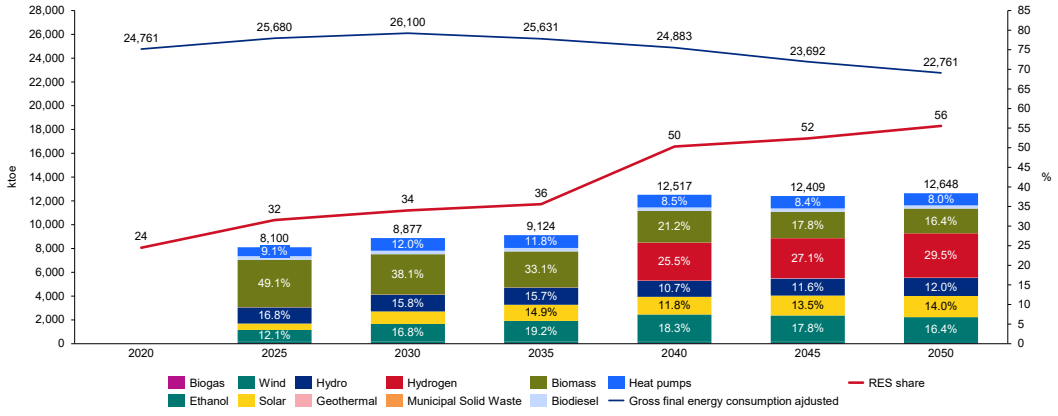
Figure 58. Share by technology in RES consumption of heating and cooling and final energy consumption of Heating and cooling, 2004-2021



I. Indicative projections of development with existing policies for the year 2030 (with an outlook to the year 2040)

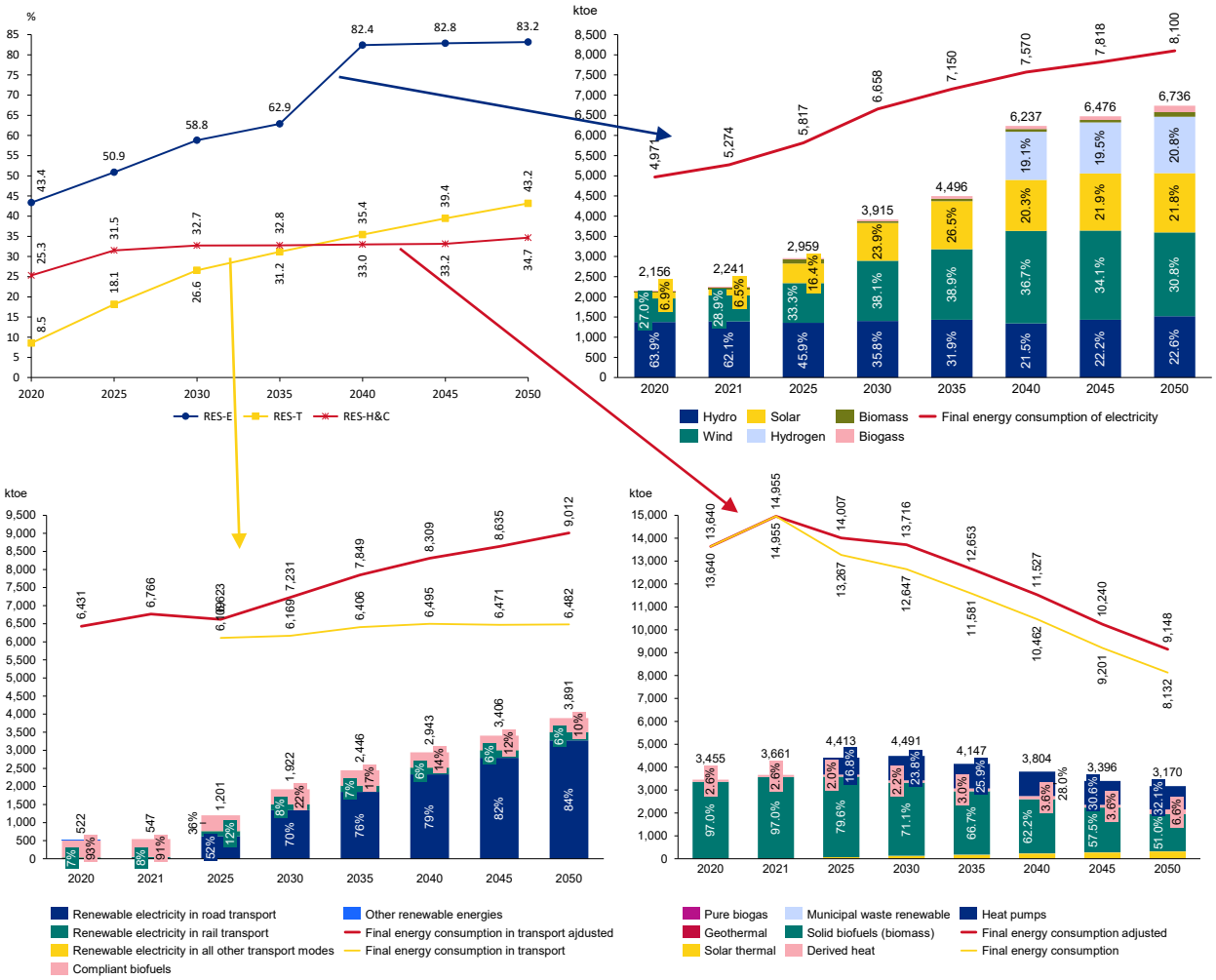
By implementing the existing policies and measures it is expected that the RES share in gross final energy consumption will increase to 34% in 2030 and 56% in 2050 (Figure 59). There are two reasons for this increase in the RES share. On one hand, with the introduction of energy efficiency measures, the gross final energy consumption will be reduced by around 8% in 2050, when compared to 2020. At the same time, the RES consumption will be increased, so that biomass, wind, PV and hydro have the most significant role in 2030. In 2050 the hydrogen will make a major contribution, reaching a share of almost 30% of the RES final energy consumption in 2050, by its use for electricity generation.

Figure 59. Indicative projections of RES share in gross final energy consumption up to 2050



When analyzing by sectors, the RES share in the electricity will reach 58.8% in 2030 and 83.2% in 2050 (Figure 60). The major contributor to this increase is the electricity production from solar and wind in 2030 and additionally from hydrogen in 2050. The RES share in the transport sector will be 26.6% in 2030 and 43.2% in 2050, owing mainly to the increased use of electricity in the road transport sector. In the heating and cooling sector, the RES share is 32.7% in 2030 and 34.7% in 2050. This share is achievable by replacing the biomass with heat pumps for space heating and cooling and using more solar thermal collectors mainly for water heating on one hand, and on the other hand by implementing energy efficiency policies and measures that will significantly reduce the final energy consumption in this sector.

Figure 60. Indicative projections of share of RES in final energy consumption in different sectors (electricity, transport and heating and cooling) as well as share by technology in RES consumption in WEM by 2050

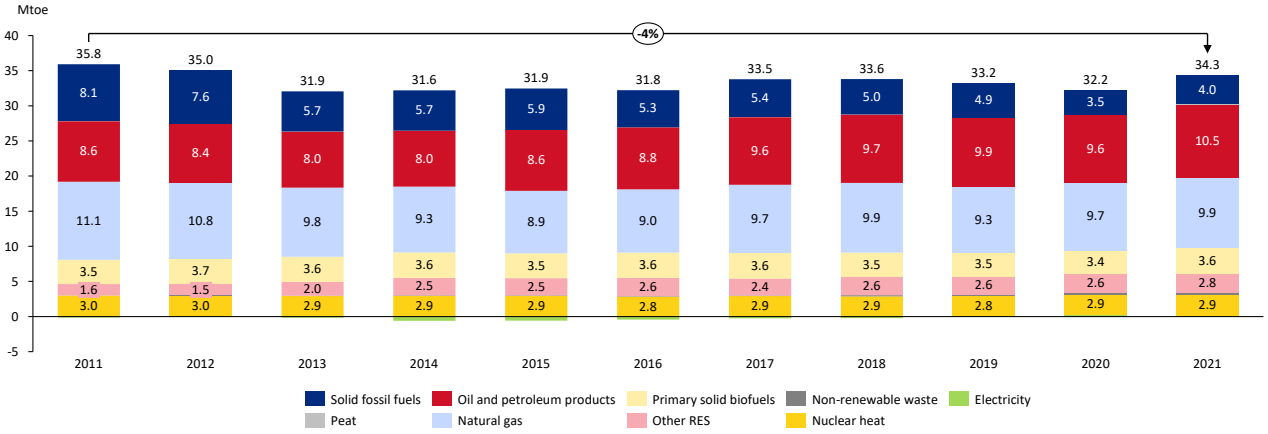


4.3 Dimension Energy efficiency

I. Current primary and final energy consumption in the economy and per sector (including industry, residential, service and transport)

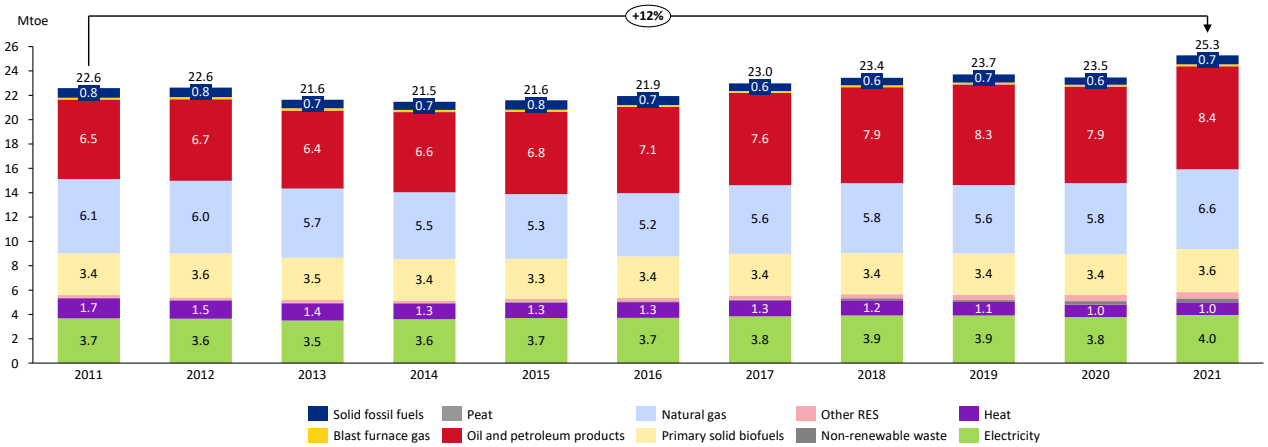
The primary energy consumption in Romania in the period 2011-2021 reveals several trends, although the total primary consumption is has been quite stable (Figure 61). First, the primary consumption of solid fossil fuels (mainly coal) has decreased by more than half, and the consumption of natural gas has decreased by around 10%. On the other hand, the primary consumption of other RES (except biomass – primary solid biofuels) has increased by more than 70% in the analyzed period, due to the increased electricity generation from RES. Additionally, the increased activity in the transport sector contributed to the increase of primary consumption of oil and oil products by more than 20%.

Figure 61. Primary energy consumption by fuels, 2011-2021



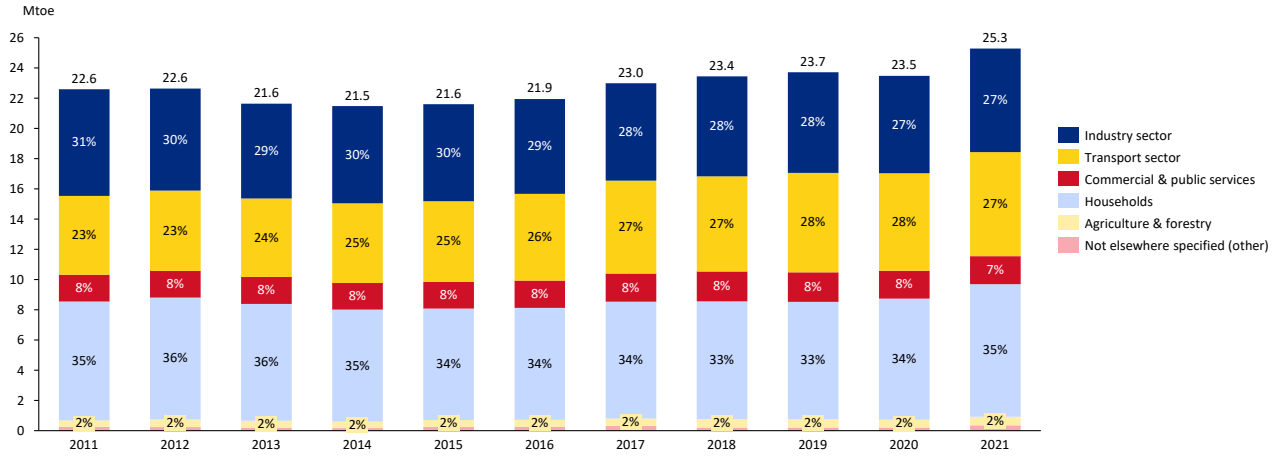
For the energy efficiency sector, it is important to note that while the primary energy consumption remained stable, the final energy consumption has increased by around 12% in the same period (Figure 62). This shows that the efficiency in the energy sector has increased from around 63% in 2011 to 74% in 2021. Regarding the specific fuels, only the final consumption of heat and solid fossil fuels has decreased in the analyzed period. On the other hand, the highest increase in the final energy consumption is for the other RES (excluding biomass) for more than 120% in the period 2011-2021 and for the oil and other oil products for around 30%.

Figure 62. Final energy consumption by fuels, 2011-2021



The previous conclusion about the transport sector, can be confirmed from Figure 63. Namely, the final energy consumption in the transport sector has increased by more than 30%, so its share has increased from 23% in 2011 to 27% in 2021. The share of the industry sector has decreased from 31% in 2011 to 27% in 2021. The share of the final energy consumption in the households and the commercial and public services sector is pretty stable in the analyzed period, with an increase in the absolute values for 2021, mainly due to the higher heating demand.

Figure 63. Final energy consumption by sectors, 2011-2021



II. Current potential for the application of high-efficiency cogeneration and efficient district heating and cooling

The potential for implementing high-efficiency cogeneration, as well as efficient district heating and cooling systems, has been a subject of detailed evaluation in Romania. A comprehensive assessment of this potential was documented in the Report on the assessment of the national potential for the application of high-efficiency cogeneration and efficient district heating and cooling. This report was jointly prepared by the Ministry of Public Works, Development and Administration and the Ministry of the Economy, Energy and the Business Environment. The problem is that the report is outdated, as it dates back to 2015. Nowadays, there are numerous modern tools that, when combined with Geographic Information Systems (GIS), offer a fresh perspective on the district heating system through mapping. This approach is highly user-friendly for policymakers and facilitates better decision-making.

According to the report from 2015 the potential for district heating in 2030 is around 1900 ktoe.

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)

The projections considering the existing energy efficiency policies and measures show that the primary energy consumption will decrease by 4% in 2030 compared to 2019 (Figure 64). At the same time, the final energy consumption will remain at almost the same level (Figure 66). In the long-term plan, the primary energy consumption should be decreased by 17% in 2050, relative to 2011 level, while the final energy consumption will decrease by 10%. The existing policies and measures related to improving the energy performance of the building and the usage of more efficient technologies, will be highly evident in the households sector, whose share in the final energy consumption will be reduced to 30% in 2030 and 18% in 2050. On the other hand, the share of the industry and the transport sector are expected to increase if only the existing policies and measures are implemented, reaching 37% and 32% in 2050, respectively.

Figure 64 Projections of primary energy consumption – WEM

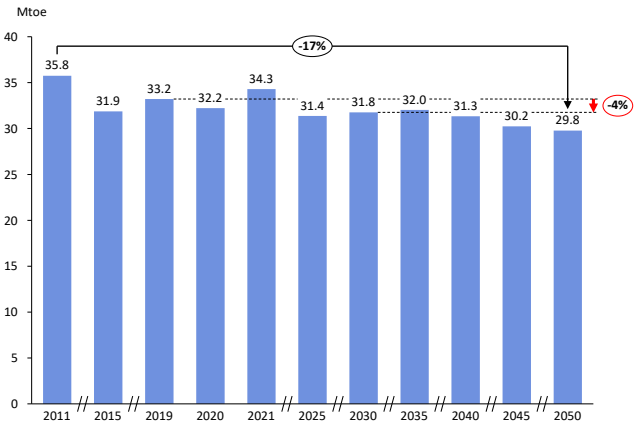
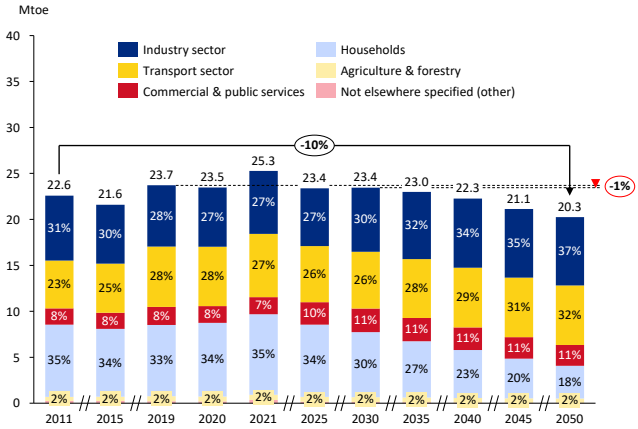


Figure 65. Projections of final energy consumption by sectors – WEM



IV. Cost-optimal levels of minimum energy performance requirements resulting from national calculations, in accordance with Article 5 of Directive 2010/31/EU

In the analyses conducted as part of the NECP under the building renovation, the Scenario 2 from the National Long-Term Renovation Strategy was used. In this strategy it is written that for the purpose of analysing and identifying cost-effective renovation measures and packages, reference buildings considered to be representative of the existing national building stock were selected on the basis of statistical sampling. The selection took into account the most common architectural characteristics, types and climatic zones in Romania. The analysis under the Long-Term Renovation Strategy are conducted in accordance with the methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements, established at EU level. In addition it is written that the methodology and cost comparisons correspond to those defined in Commission Delegated Regulation (EU) No 244/2012 of 16 January 2012 supplementing Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings by establishing a comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements, and the guidelines accompanying the Regulation.

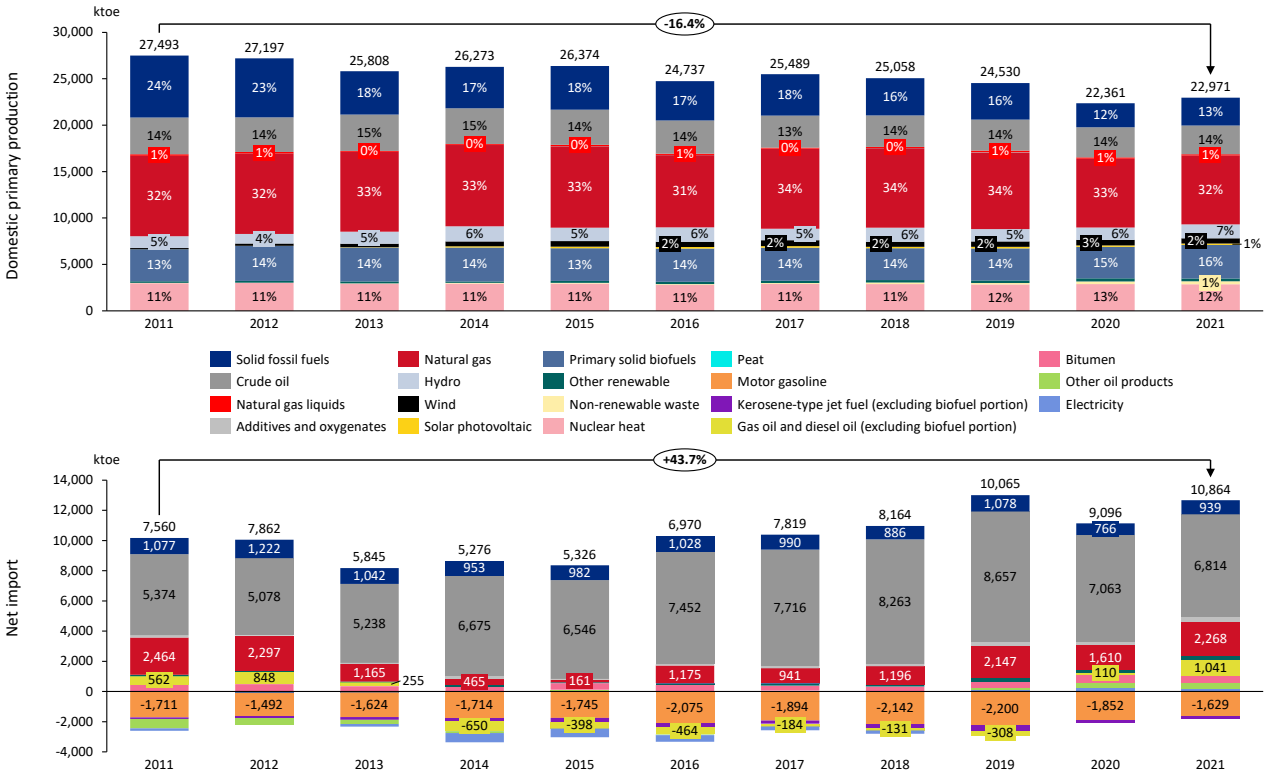
4.4 Dimension energy security

I. Current energy mix, domestic energy resources, import dependency, including relevant risks

Romania's domestic primary production is rather diverse, with natural gas accounting for the majority (32%–33%) of the total (Figure 66). Solid fossil fuels, crude oil, primary solid biofuels, and nuclear heat all have about identical shares in 2021, which contributes for diversifying the energy resources. In the analyzed historical period it is evident that the highest decrease in the domestic production is in the solid fossil fuels, with production falling by more than half by 2021 compared to 2011. Additionally, throughout the studied time, there was a 22% and 14% decrease in the production of crude oil and natural gas, respectively. On the other hand, although wind and solar photovoltaic primary production climbed dramatically during the same time period, their overall shares of the energy mix are 2% and 1% in 2021, respectively. All of these factors together caused the total primary production to decrease by more than 16% between 2011 and 2021.

In parallel to the decrease in domestic primary production, there is an increase in the net import of more than 40% in the period 2011-2021. This import is dominantly based on the quantity of crude oil import, which accounts for around 63% of the net import in 2021. The highest share of export of fuels, has the motor gasoline which is maintained at a similar level throughout the entire period.

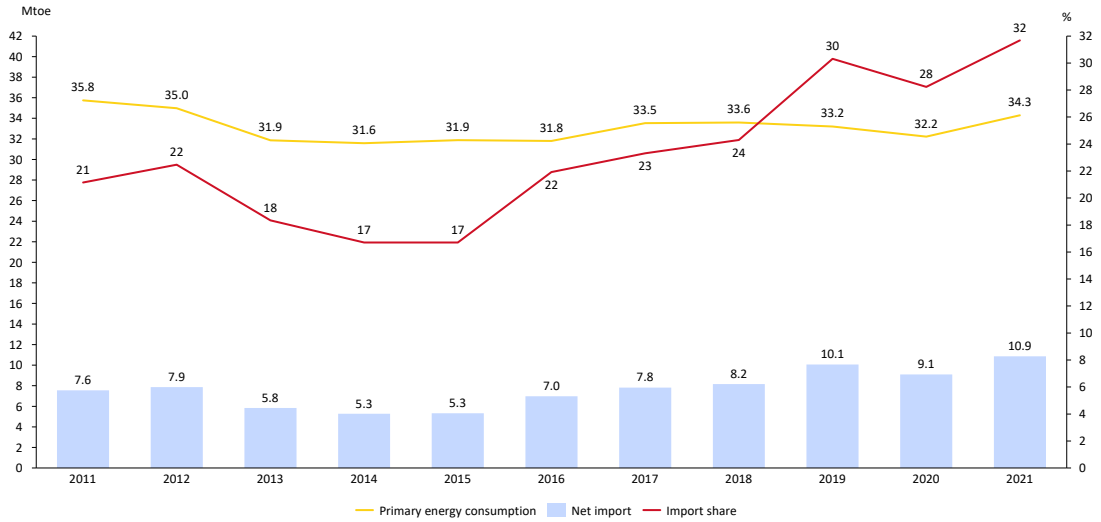
Figure 66. Current energy mix by domestic resources and imports, 2011-2021



Source: EUROSTAT energy balances, project team analysis

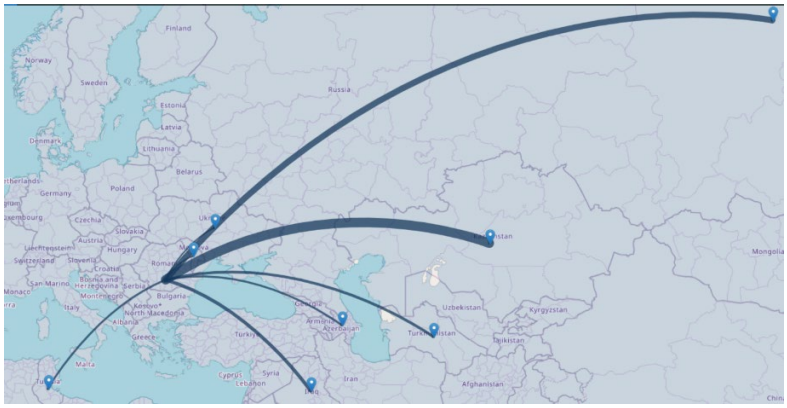
In the latter three years of the studied period, the overall import dependency has increased, reaching 32% in 2021, while in 2011 this percentage was 21% (Figure 67). As previously mentioned, this import is mainly increased due to the import of crude oil. Additional study of the countries from where the import is made is considered in order to evaluate the risk associated with this import. In 2021, around 46% of the crude oil is imported in Romania from Kazakhstan, 27% from Russian Federation and 11% from Iraq (Figure 68). Regarding the import of natural gas, around 78% is from the Russian Federation and around 18% from Bulgaria (Figure 69).

Figure 67. Import dependence, 2011-2021



Source: EUROSTAT energy balances, project team analysis

Figure 68. Countries from which crude oil is imported in Romania - 2021



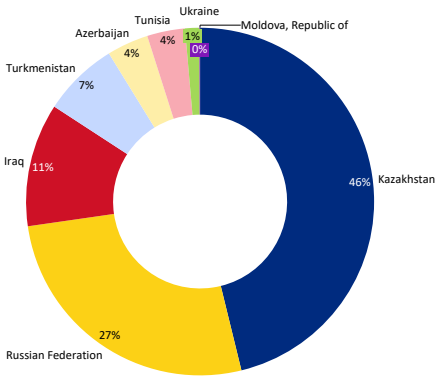
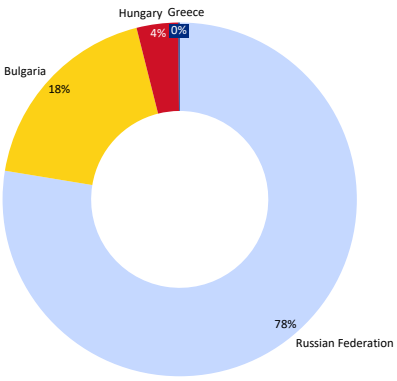
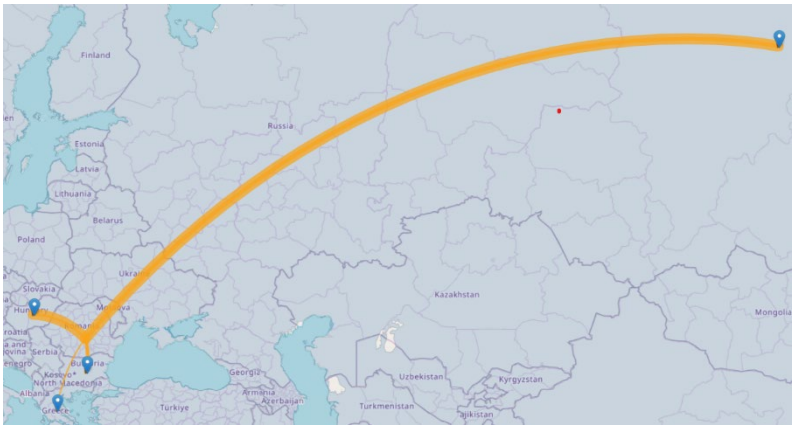


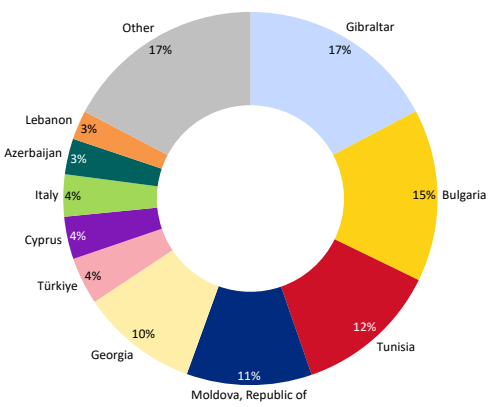
Figure 69. Countries from which natural gas is imported in Romania - 2021





As motor gaseline has the highest share of the export of fuels, Figure 70 shows the countries to which Romania exports motor gaseline in 2021. It can be noted that the export is very diverse and includes many countries, such as Giblartar with 17% share, Bulgaria – 15%, Tunisia 12%, Moldova 11% and Georgia 10%.

Figure 70. Countries to which motor gasoline is exported from Romania - 2021



II. Projections of development with existing policies and measures at least until 2040 (including for the year 2030)

Figure 64 clearly shows that the primary consumption in Romania will decrease. The transition away from coal-fired power plants is underway, but it's important to note that this shift will involve the integration of natural gas and domestically generated renewable energy sources. Additionally, the transportation and industrial sectors are set to go through electrification, which will have a positive impact on the country's energy landscape. As a result of these efforts, Romania anticipates a reduction in its dependence on imported petroleum products. Therefore, the nation is not expected to increase its imports, which is a promising development for its energy sustainability and security.

4.5 Dimension internal energy market

4.5.1. Electricity interconnectivity

I. Current interconnection level and main interconnectors

The percentage value of 7% representing the interconnection capacity, as outlined in the Country Report of Romania for the European Semester of 2017, was computed by a panel of experts established by the European Commission. This calculation was based on the electricity interconnection targets (interconnection target group) and utilized data provided by CNTEE Transelectrica SA from the Winter outlook 2016-2017 half-year adequacy report. The 7% figure was derived by dividing the import NTC value of 1.4 GW by the Net Generation Capacity (NGC) value of 20.23 GW, both of which were considered for January 11, 2017, at 19:00 CET.

In 2020, this indicator experienced a growth to approximately 10-11%. According to ANRE this can be attributed to two primary factors. Firstly, there was an update to the installed capacities in the energy system, specifically incorporating groups with commercial exploitation licenses, as required by ANRE. Secondly, the increase in NTC values at the border with Bulgaria, elevating them from 250-300 MW to 900 MW, resulted from the resolution of internal congestion within the ESO-EAD transmission network.

Romania's government approved an action plan in June 2021, which encompasses cross-border initiatives. As of January 1, 2022, the installed capacity in the power system reached 18,569 MW. For January 2022, the cross-border trade capacity available at Romania's interface had average monthly values of around 2500 MW for exports and 3000 MW for imports (increasing each year Table 10). Consequently, the resulting level of interconnection stands at approximately 13.5% when examining the report from the export capacity perspective, and about 16% for the import capacity. Over recent years, the degree of interconnection has risen in tandem with the growth in available capacity for cross-border trade (increasing from approximately 1500 MW in 2015 to over 2500 MW in 2022) and the decrease in installed capacity in generating units at the power system level.

Table 10. Maximum monthly NTC values (MW)

	2015	2016	2017	2018	2019	2020
RO export	1650	1700	1700	1550	1550	2400
RO import	2100	2150	2450	2200	2450	2700
RO->HU	700	700	700	600	650	700
HU->RO	700	700	700	700	800	700
RO->RS	600	700	700	600	600	600
RS->RO	800	800	800	800	800	800
RO->BG	250	250	250	300	250	900
BG->RO	400	300	300	400	350	800
RO->UA	100	50	50	50	50	200
UA->RO	200	350	650	300	500	400

Source: *Transelectrica, Planul de Dezvoltare a RET perioada 2022- 2031* [Transport-detalii - Transelectrica]

Concerning the attainment of the 15% interconnection goal set for the year 2030, the primary aim is for this target to be accomplished predominantly by executing the PCIs (Projects of Common Interest). Similarly, the objective is to achieve this goal by carrying out the additional renewable energy projects.

Chapter 3.4 outlines the roster of investment projects related to interconnection, detailing the individual contributions of each project toward achieving the overarching goal of elevating the interconnection level to 15% of the total installed capacity by 2030.

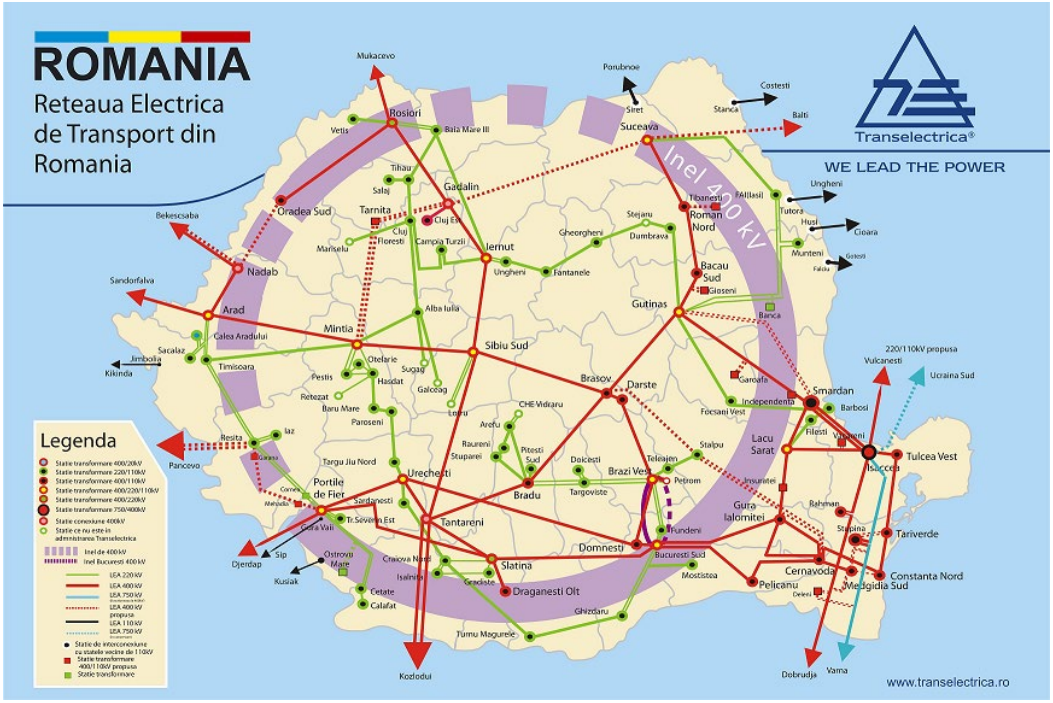
According to the RET Development Plan for the period 2022-2031 the total length of the electricity interconnection lines sum up 489.04 km in the total grid. The current interconnections are listed in Table 11 and presented on Figure 71.

Table 11. Interconnection lines linking the national electricity transmission system to the system of neighboring countries

Order no.	Border	OEL interconnection
1	Bulgaria	400 kV Țânțăreni – Kozlodui OPL
2	Bulgaria	400 kV Stupina – Varna OPL
3	Bulgaria	400 kV Rahman – Dobrudja OPL
4	Serbia	400 kV Iron Gates – Djerdap OPL
5	Serbia	400 kV Reșița – Pancevo OPL
6	Serbia	110 kV Jimbolia – Kikinda OPL
7	Serbia	110 kV Gura Văii – Sip OPL
8	Serbia	110 kV Ostrovu Mare – Kusjak OPL
9	Hungary	400 kV Arad – Sandorfalva OPL
10	Hungary	400 kV Nadab – Bekescsaba OPL
11	Ukraine	400 kV Roșiori – Mukachevo OPL
12	Ukraine	110 kV Siret - Porubnoe
13	The Republic of Moldova	400 kV Isaccea – Vucănești OPL
14	The Republic of Moldova	110 kV Stânca – Costești OPL
15	The Republic of Moldova	110 kV Cioara – Huși OPL
16	The Republic of Moldova	110 kV Țuțora – Ungheni OPL
17	The Republic of Moldova	110 kV Falciu – Goteşti OPL

Source: *Transelectrica, Planul de Dezvoltare a RET perioada 2022- 2031* [Transport-detalii - Transelectrica]

Figure 71. Current situation of the electricity transmission grid in Romania



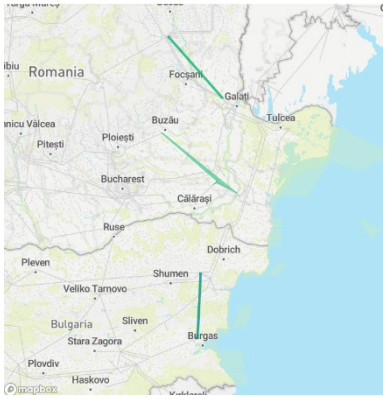
Source: Transelectrica, [Transport-detalii - Transelectrica]

II. Projections of interconnector expansion requirements (including for the year 2030)

The projects related to interconnector expansion are in details given in chapter 3 (PAM xx-xx). Here a summary list is presented:

Black Sea Corridor (TYNDP ID 138)

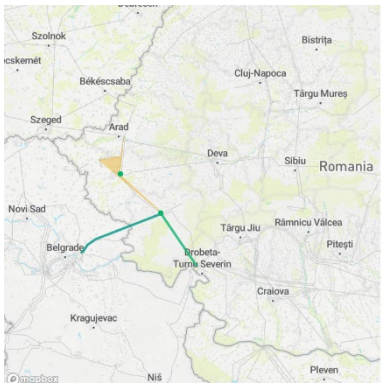
Commission year: 2024



This project allows transfer of generation from Western cost of the Black Sea towards consumption and storage centers in Central Europe and South-Eastern Europe. It consists of one 400kV double circuit OHL Cernavoda-Stalpu with in/out connection of one circuit in Gura Ialomitei, one 400 kV double circuit OHL Smardan-Gutinas in Romania and also the new 400 kV OHL Dobrujda-Burgas in Bulgaria.

Mid-Continental East corridor (TYNDP ID 144)

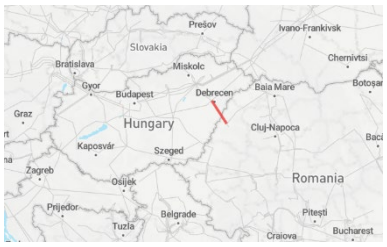
Commission year: 2029



The main aim of this project is increasing the transmission capacity along the East-West corridor in the South-Eastern and Central Europe, simultaneously contributing to the market integration in the region of interest and enhancing the integration of large renewable sources in the Banat region. The project consists of one double circuit 400 kV interconnection line between Serbia and Romania and reinforcement of the network along the western border in Romania: one new simple circuit 400 kV line from Portile de Fier to Resita and upgrade from 220 kV double circuit to 400 kV double circuit of the axis between Resita and Arad, including upgrade to 400 kV of three substations along this path: Resita, Timisoara, Sacalaz.

HU-RO (TYNDP ID 259)

Commission year: 2030



400 kV interconnection line between Hungary and Romania. In Romania, the following internal investments are necessary associated to this project:

- new 400/220 kV transformer in substation Rosiorireconductoring 220 kV OH line Urechesti-Tg. Jiu-Paroseni- Baru Mare-Hasdat

North CSE Corridor (TYNDP ID 341)

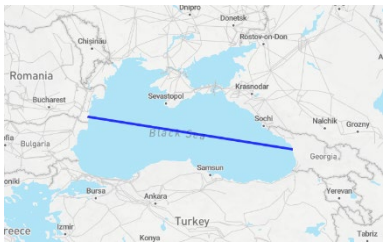
Commission year: 2029

This project includes a segment of the new significant corridor in the East-to-West direction, boasting the massive cross-border impact on the boundary between Serbia and Romania. It will enhance the market integration in the region, allowing the lower difference in marginal energy costs, connection of huge capacities of RES that have applied for connection in the observed area and affect the security of supply in the aforementioned region by increasing the available balancing capacity. This project will consist of three investments. The

investments of this project are SS 400/110 Belgrade 50, OHL 400 kV SS Belgrade 50 - WPP Cibuk and doubling existing OHL 400 kV Portile de Fier (RO) - Djerdap 1 (RS).

Georgia-Romania Black Sea interconnection cable project (TYNDP ID 1105)

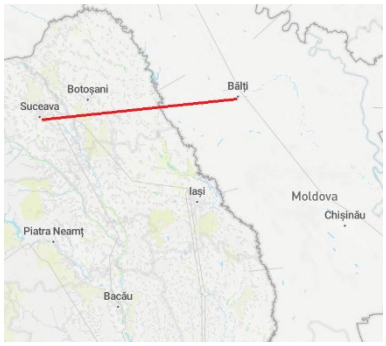
Commission year: 2029



Georgia-Romania Black Sea submarine interconnection project will connect Georgian power system (and South Caucasus region) to Synchronous grid of Continental Europe. It will assist energy security of EU and Caucasus region, support development of RES, increase transit opportunities and trade options between EU and South Caucasus region. Based on preliminary data, the project consists of: construction of double-circuit 500 kV between existing 500 kV SS Jvari and new 500 kV SS Anaklia, two-pole 500 kV DC submarine cable Anaklia-Constanta, construction of 500/500 kV DC converter station with installed capacity of 2x500 MW at Anaklia substation.

Romania-Moldova

Commission year: 2028



The Project will improve the energy security for Moldova by accelerating the ongoing integration with ENTSO-E and facilitate the development of regional integration as Moldova will introduce a new route for electricity exchange.

Source: https://tyndp2022-project-platform.azurewebsites.net/projectsheets/transmission; https://www.ebrd.com/work-with-us/projects/esia/moldova-romania-power-interconnection-phase-ii.html

4.5.2. Energy transmission infrastructure

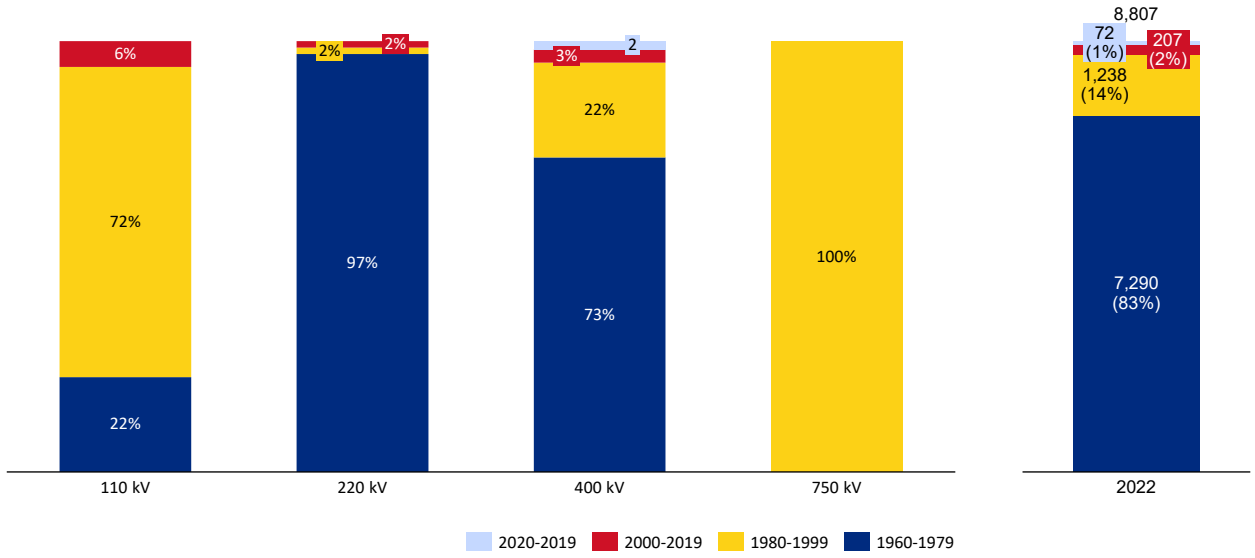
I. Key characteristics of the existing transmission infrastructure for electricity and gas

According to the latest version of ANRE annual report (2022), the electricity transmission grid (ETG) consists of overhead power lines (OPL) with rated voltage of 750 kV, 400 kV, 220 kV and 110 kV and power stations with voltage above 400 kV/220 kV, summing up 8,904.62 km of total length of the electricity transmission grid and interconnection lines summing up 489.04 km in total.

As per the most recent annual report of ANRE (2022), the electricity transmission grid (ETG) is composed of overhead power lines (OPL) with designated voltages of 750 kV, 400 kV, 220 kV, and 110 kV. Additionally, there are power stations operating at voltages 400 kV/220 kV contributing to a total length of 8,904.62 km for the electricity transmission grid, along with interconnection lines that amount to a total of 489.04 km.

Out of the entire length of the OPL, 83% became operational from 1960 to 1979, and 14% became operational from 1980 to 1999 (Figure 72). Only 3% of the OPL are commission after 2000. The level of utilization of the transmission lines (calculated as a percentage between duration of the operating period and standard lifetime, 48 years) shows that the lines constructed in the period 1960-1979 are 4% over the standard lifetime of usage while the lines constructed in the period 1980-1999 are at the level of 78% of its standard lifetime. These lines need to be kept at an optimal operational state through the implementation of suitable maintenance programs.

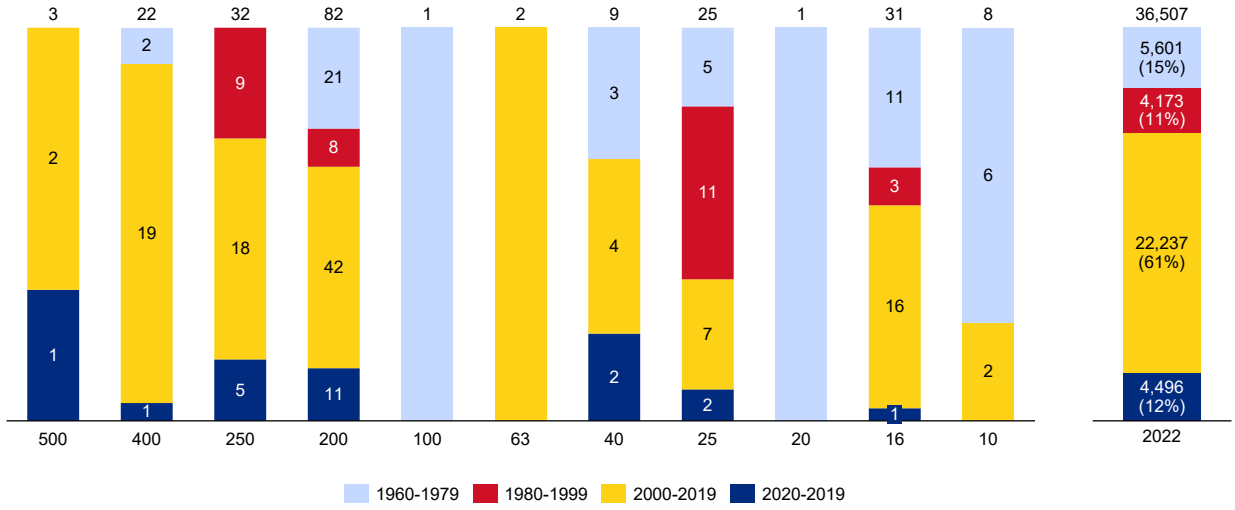
Figure 72. The LEA distribution by voltage levels, length and commissioning periods



Source: ANRE annual report 2022

Unlike the transmission lines, the condition of the substations is significantly better and only 26% of them are older than 2000 (Figure 73). The level of utilization of the substations (calculated as a percentage between duration of the operating period and standard lifetime, 24 years) shows that almost all substations commissioned before 2000 are over the standard lifetime of usage.

Figure 73. The number and installed power in substations (MVA)



Source: ANRE annual report 2022

Natural gas transmission infrastructure

According to the latest version of ANRE annual report (2022), natural gas transmission system is accomplished via main pipelines and supply connections, spanning a total length of 13,978 km. These pipelines have diameters ranging from 25 mm to 1200 mm. Moreover, the associated facilities, equipment, and machinery are in place, designed to function at pressures ranging between 6 bar and 63 bar. This infrastructure serves the purpose of receiving extracted natural gas from production areas, underground storage facilities, and imports, facilitating its conveyance. The goal is to ultimately deliver this gas to end-users within both domestic and international natural gas markets. Notably, SNTGN Transgaz SA operates an international transit pipeline that operates under a pressure of 54 bar.

The main components of the National Natural Gas Transport System (NTS) are:

- 13,978 km of main pipelines and natural gas supply connections, of which 183.5 km are transit pipelines, and 481 km are related to the BRUA main;
- 1,148 gas measurement control stations / 1,254 measurement directions;
- 10 physical interconnection points with adjacent transport systems
- 6 physical entry/exit points connected to storage warehouses;
- 2 measuring stations located on the transit pipeline
- 59 valve control stations/technological nodes (SCV, NT);
- 6 gas measuring stations for import/export;
- 8 gas compression stations (GCS);
- 1,057 cathodic protection stations (CPS);
- 1,054 gas odorization stations (GOS).

ANRE in the annual report of 2022 presents that more that 55% of the natural gas transmission network is older than 40 years, while just 9% is up to 10 years old (Figure 74). The situation with the other components of the transmission network is much better and they are between 10 and 20 years old (Table 12).

Figure 74. Length of the transmission network by year of commission

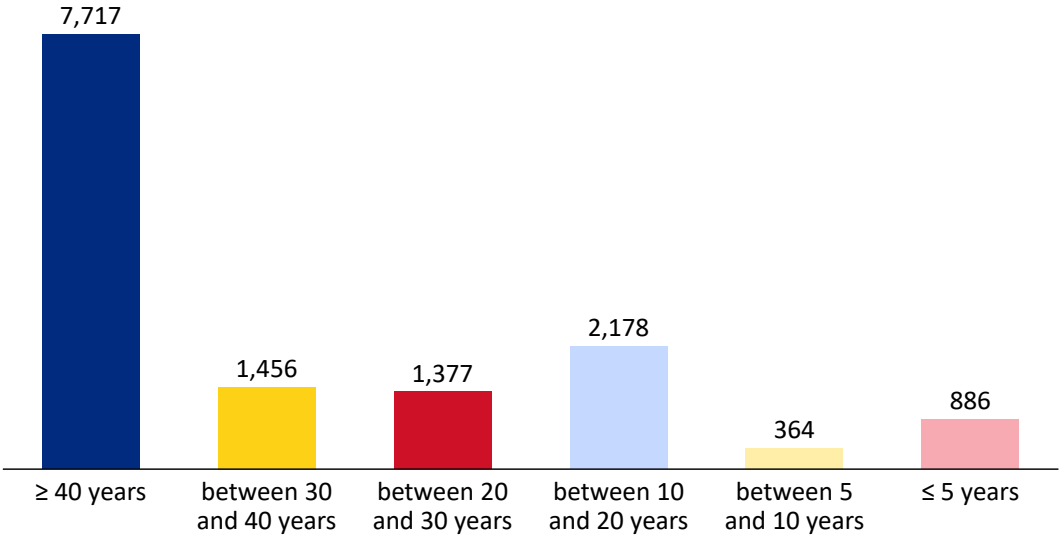


Table 12. Components of the transmission network by year of commission

	Number of measurement directions related to measurement regulation stations (SRM)	Number of gas odorization stations (SOG)	Number of import/export gas measurement regulation stations (SMG)	Number of cathodic protection stations (SPC)	Number of valve control stations (SCV-NT)	Number of gas compression stations (SCG)
≥ 40 years	155	18	1	5	11	0
between 30 and 40 years	59	25	0	4	0	0
between 20 and 30 years	396	271	3	14	3	0
between 10 and 20 years	530	430	0	926	14	0
between 5 and 10 years	52	214	1	71	24	0
≤ 5 years	62	96	1	37	7	8
TOTAL	1.254	1.054	6	1.057	59	8

As of December 31, 2022, the 28 licensed natural gas distribution operators, authorized by ANRE, possessed a collective network of natural gas distribution pipelines and interconnected links spanning a total length of 58,594 km. Among these, polyethylene networks constituted the predominant share at 68.15%, having notably experienced significant expansion over the past two decades.

Hence, out of the entire 58,594 km network, a significant portion exceeding 29% comprises networks established within the last decade, while approximately 35% fall within the age bracket of 10 to 20 years. Conversely, over 27% consists of pipes and connections that have been in service for 20 to 30 years, while merely around 8% are aged beyond 30 years. Comparatively, in just one year period (2021-2022) the national natural gas distribution grid extended by 2,496 km, reflecting a growth rate of 4.45% when compared to 2021.

II. Projections of network expansion requirements at least until 2040 (including for the year 2030)

The project for expansion of the network are provided in the Chapter 2.

4.5.3. Electricity and gas markets, energy prices

I. Current situation of electricity and gas markets, including energy prices

In accordance with Law no. 123/2012, as of January 1, 2021, the regulated tariffs that applied to residential customers have been eliminated. Consequently, electricity supply prices for households are no longer set by ANRE; instead, they are determined freely, influenced by market demand and supply dynamics.

Simultaneously, starting from January 1, 2021, ANRE retains its regulatory authority concerning the approval of prices and tariffs in the electricity sector. This authority pertains exclusively to regulated tariffs for network services, which encompass transport service tariffs, system service tariffs, distribution service tariffs, and reactive electricity prices.

Before the electricity market was liberalized, which occurred on December 31, 2020, among the total 8,924,187 consumption sites belonging to residential customers, 34% of them had entered into contracts for electricity supply under a competitive framework. Until December 31, 2022, subsequent to the electricity market liberalization, an analysis of data provided by electricity suppliers reveals that 61% of the entire count of consumption sites owned by residential customers have entered into contracts for electricity supply in a competitive framework.

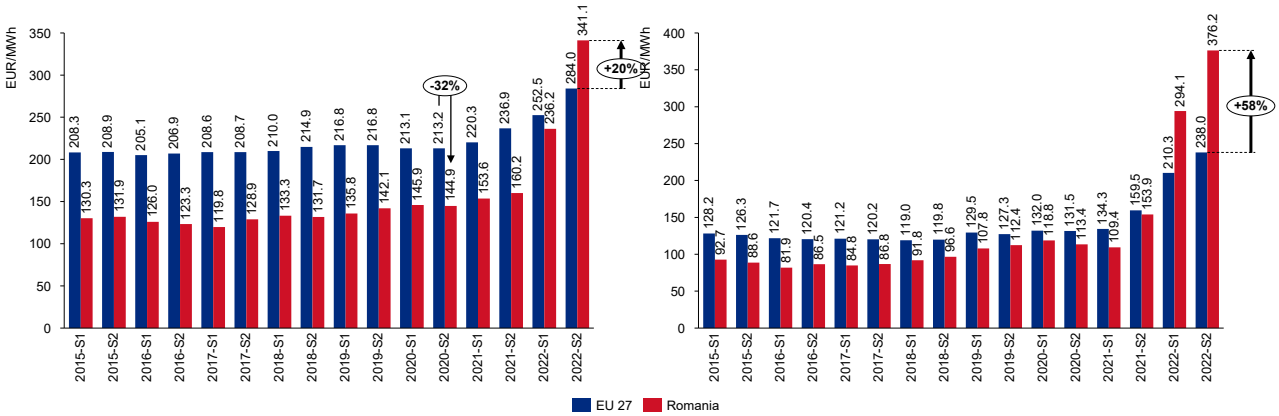
As of January 1, 2022, in accordance with the provisions of Law no. 123/2012, the universal service is exclusively guaranteed to residential customers and is offered by electricity suppliers who have entered into competitive market contracts with these residential customers. The provision of universal service is governed by a standardized contract framework established and approved by ANRE.

Electricity suppliers are mandated to publicize their universal service offerings and to engage in electricity supply contracts if they receive requests from eligible customers seeking universal service. The pricing for customers receiving universal service is determined by each supplier, guided by competitive criteria. It is essential that this pricing remains reasonable, competitive, easily comparable, transparent, and non-discriminatory.

Due to the electricity market liberalization in Romania, there has been a notable surge in electricity prices for residential customers. In the second half of 2022, the electricity price for households in Romania is approximately 20% higher than the EU average, a situation that contrasted with the period prior to 2020 (Figure 85). Additionally, the electricity prices for non-household consumers in 2022 also surpass the EU average, as shown in (Figure 86).

Figure 75. Trend in electricity prices for household consumers - bi-annual data Consumption from 2 500 kWh to 4 999 kWh - band DC

Figure 76. Trend in electricity prices for non-household consumers - bi-annual data Consumption from 2 000 MWh to 19 999 MWh - band ID



In the first half of 2022, up to June 23, 2022, the providers acting as suppliers of last resort were appointed by ANRE. This selection was conducted from the pool of existing suppliers in the energy market, employing competitive procedures as outlined in ANRE Order no. 188/2020. In accordance with the stipulations outlined in the order, ANRE has designated a total of 6 suppliers of last resort for the year 2021. In March 2022, Tinmar

Energy SA, citing developments in the energy market, legislative uncertainties, and flawed implementation of enacted laws, which collectively made it impossible to fulfill the obligations associated with the status of supplier of last resort, formally requested to have this status revoked.

The situation with the electricity is mirrored to the natural gas price too (Figure 77 and Figure 78).

Figure 77. Trend in natural gas prices for household consumers - bi-annual data 20 GJ to 199 GJ - band D2

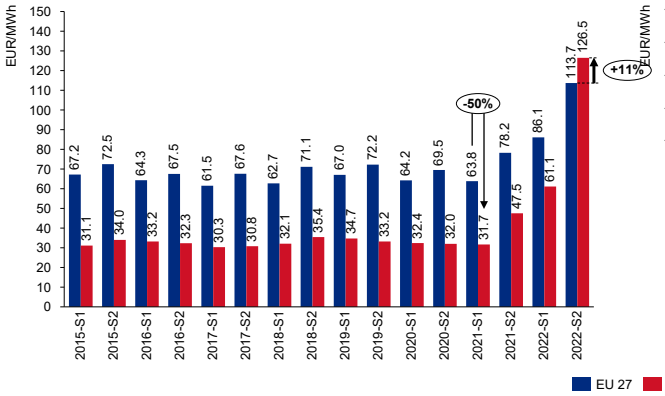
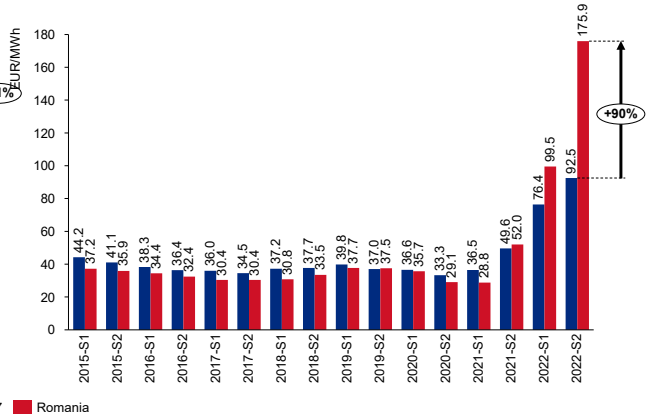


Figure 78. Trend in natural gas prices for non-household consumers - bi-annual data Consumption from 10 000 GJ to 99 999 GJ - band I3



II. Projections of development with existing policies and measures at least until 2040 (including for the year 2030)

Assuming that the costs associated with the transmission and distribution network remain consistent with present pricing, the forecasts for electricity prices in the WEM scenario indicate a gradual uptick in prices up to the year 2030. This upward trend can be attributed primarily to the investments made in new natural gas power plants. Nevertheless, beyond the year 2030, significant alterations in pricing are not anticipated. The electricity prices are expected to stabilize, reflecting a period of relative price constancy.

4.6 Dimension research, innovation and competitiveness

I. Current situation of the low-carbon-technologies sector and, to the extent possible, its position on the global market (that analysis is to be carried out at Union or global level)

The low-carbon-technologies sector in Romania is still in its early stages of development, but it has the potential to grow significantly in the coming years. Romania has a number of strengths in this sector, such as a skilled workforce with a strong background in science and engineering, a favorable investment climate, and a strategic location in Central Europe. However, the sector also faces some challenges, such as a lack of investment, a lack of coordination between different stakeholders, and a lack of awareness of the benefits of low-carbon technologies. Despite these challenges, the low-carbon-technologies sector in Romania is expected to grow significantly in the coming years, driven by the increasing demand for low-carbon products and services, the availability of funding from the EU and other international organizations, and the commitment of the Romanian government to promoting low-carbon technologies.
In terms of its position on the global market, Romania is still a relatively small player in the low-carbon-technologies sector. However, the country has the potential to become a more significant player in the years to come, due to the factors mentioned above, as well as the country's strategic location and its access to a large market.
As examples of low-carbon technologies that are being developed in Romania: solar energy, wind energy, hydropower, geothermal energy, and energy efficiency are present and being used. These are just some of the low-carbon technologies that are being developed in Romania.

- Solar energy: Romania has a lot of potential for solar energy, with an average of 2,000 hours of sunshine per year. The country has over 20 of solar energy projects being developed[4][5]
- Wind energy: Romania also has a lot of potential for wind energy, with an average wind speed of 5-7 m/s. In 2021, wind energy generated about 16% of Romania's electricity. As of 2021, the installed capacity of onshore wind energy in Romania was 3,013 MW. The share of wind and other renewables in Romania's electricity generation mix is expected to rise by 35% by 2030. In January 2023, Vestas announced the closing of a turbine deal with DTEK Renewable International Moldova Eolian for the Ruginosa wind project with 600 MW capacity in Romania[6]
- Hydropower: Romania has a number of rivers, which makes it a good location for hydropower projects. The country has a total installed hydropower capacity of more than 6,500 MW, which accounts for around 20% of its electricity generation.[7]
- Geothermal energy: Romania has a number of geothermal resources, which can be used to generate electricity and heat homes and businesses. The country has a total installed geothermal heating capacity of 150 MW, which produced heat is used is district heating.
- Energy efficiency: There are a number of energy efficiency projects being developed in Romania, which aim to reduce the country's energy consumption. These projects include the installation of energy-efficient appliances and lighting, the insulation of buildings, and the use of renewable energy sources.

The low-carbon-technologies sector in Romania has the potential to create jobs, boost economic growth, and improve the country's environmental performance. The government and the private sector need to work together to ensure that the sector realizes its full potential.

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

In the realm of research and innovation spending focused on low-carbon technologies, the current landscape showcases a dynamic interplay between public and private sectors. Public research funding, often channeled through governmental initiatives and international collaborations, serves as a foundational pillar for fostering advancements in sustainable technologies. Countries worldwide are allocating substantial resources to support projects aimed at reducing carbon emissions and mitigating climate change. Concurrently, private entities, driven by a growing recognition of the economic and environmental benefits of low-carbon solutions, are also investing significantly in research and development efforts. This dual-pronged approach reflects a

[4] Photon Energy connects two new solar power plants to the Romanian grid | Romania Insider (romania-insider.com)
[5] 20 Biggest Solar Projects in Romania - SolarFeeds Magazine
[6] Romania Wind Energy Market Trends (mordorintelligence.com)
[7] https://www.statista.com/statistics/864411/total-hydropower-capacity-in-romania/

collective commitment to addressing global environmental challenges. Pertaining to the intellectual property landscape, the number of patents related to low-carbon technologies has witnessed a steady rise in recent years. Innovators are actively seeking patent protection for novel clean energy solutions, carbon capture technologies, and sustainable materials, reflecting the increasing urgency to transition to greener alternatives. In tandem with patent filings, the number of researchers dedicated to exploring low-carbon technologies has been on the upswing. This surge in research personnel signifies a growing expertise and interest in sustainable innovation across academia, research institutions, and industrial settings, signifying a collaborative effort to pioneer a more sustainable future.

In Romania, the current landscape of research and innovation spending on low-carbon technologies is characterized by a combination of public and private investment. According to data from the Romanian Ministry of Research, Innovation and Digitalization, the country has made significant strides in increasing its research and development (R&D) expenditures, with a particular emphasis on sustainable technologies even though data shows this is not the case. The level of research and innovation spending in Romania is low, compared to other countries in the EU. However, there is a growing interest in low-carbon technologies, and the government is committed to increasing investment in this area. The number of patents granted in Romania is also relatively low, but there is a growing number of startups and SMEs developing low-carbon technologies. The number of researchers in Romania is also low, but there is a strong focus on training and education in this area.

Private R&D spending in Romania is relatively low, compared to other countries in the EU. In 2020, the average for the EU was 1.24% of GDP. In 2020, Romania granted 1,248 patents. Of these, 488 were granted to domestic applicants, and 760 were granted to foreign applicants and as for number of researchers, according to the 2021 Romanian R&D Scorecard8 , there were a total of 122,198 researchers in Romania in 2020. Of these, 93,062 (76.1%) worked in the public sector and 29,136 (23.9%) worked in the private sector., Romanian companies are progressively recognizing the strategic value of investing in low-carbon technologies. Businesses spanning energy, manufacturing, and transportation sectors are channeling resources into research and development of cleaner alternatives. While comprehensive private sector spending data is not always readily available, the country's increasing participation in international sustainability projects signifies a positive trend.

According to the 2023 EU Innovation Scoreboard Romania shows a weak performance on Climate change related indicators with below average share of material resources coming from recycled waste materials, a below average reduction in greenhouse gas emissions, and a below average score on environmental innovation. Private investment in low-carbon technologies is relatively low in Romania. This is due to a number of factors, including the lack of a clear policy framework, the lack of access to finance, and the lack of awareness of the benefits of low-carbon technologies.

There is also a lack of coordination between different stakeholders in the low-carbon-technologies sector. This makes it difficult to develop and implement policies and strategies that promote the sector.

Combining this with the lack of awareness of the benefits of low-carbon technologies among businesses and consumers. This makes it difficult to create demand for low-carbon products and services.

The low-carbon-technologies sector in Romania is facing a number of challenges, including:

- Low level of investment: Private investment in low-carbon technologies is relatively low in Romania. This is due to a number of factors, including the lack of a clear policy framework, the lack of access to finance, and the lack of awareness of the benefits of low-carbon technologies.
- Lack of coordination: There is a lack of coordination between different stakeholders in the low-carbon-technologies sector. This makes it difficult to develop and implement policies and strategies that promote the sector.

[8] chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://ec.europa.eu/research-and-innovation/sites/default/files/rio/report/PSF_background_report_final_23Nov_2021.pdf

- Lack of awareness: There is a lack of awareness of the benefits of low-carbon technologies among businesses and consumers. This makes it difficult to create demand for low-carbon products and services.

The low-carbon-technologies sector in Romania has the potential to create jobs, boost economic growth, and improve the country's environmental performance. The government and the private sector need to work together to ensure that the sector realizes its full potential. In conclusion, Romania's research and innovation landscape reflects a notable commitment to advancing low-carbon technologies. Public and private investments, coupled with an increasing number of researchers and patent activities, collectively underscore the nation's dedication to sustainable innovation and its role in addressing global environmental challenges.

III. Breakdown of current price elements that make up the main three price components (energy, network, taxes/levies)

Within the intricate fabric of energy economics, a comprehensive understanding of the components that constitute pricing is essential for both informed decision-making and strategic planning. These fundamental components, illuminate the nuanced interplay between market dynamics, infrastructure expenses, and regulatory frameworks that collectively shape the pricing structure within the energy sector. Through this exploration, a clearer comprehension of the intricate pricing emerges, offering stakeholders a foundation upon which to navigate the complex landscape of energy economics.

The electricity price in Romania is made up of three main components: energy, network, and taxes/levies. The energy price component includes the cost of the electricity generated, as well as the cost of transporting and distributing the electricity to consumers. The network price component includes the cost of maintaining and operating the electricity transmission and distribution networks. The taxes/levies component includes the cost of various taxes and levies, such as the value-added tax (VAT), the excise duty, and the renewable energy surcharge.

According to a recent study by the Romanian Energy Regulatory Authority, the energy price component accounts for around 60% of the average electricity bill, the network price component accounts for around 25%, and the taxes/levies component accounts for around 15%. The specific breakdown of the price components can vary depending on the supplier and the region.

The government of Romania has taken a number of steps to reduce the cost of electricity for consumers. These steps include:

- Subsidizing the cost of electricity for low-income households.
- Introducing a renewable energy surcharge, which is used to fund the development of renewable energy projects.
- Introducing a green certificate system, which allows businesses to offset their carbon emissions by investing in renewable energy projects.

The government is also working to improve the efficiency of the electricity transmission and distribution networks, which will help to reduce the cost of electricity for consumers.

- Energy: The energy price component includes the cost of the electricity generated, as well as the cost of transporting and distributing the electricity to consumers. The energy price component is the largest component of the electricity bill, accounting for around 60% of the total price.
- Network: The network price component includes the cost of maintaining and operating the electricity transmission and distribution networks. The network price component is the second largest component of the electricity bill, accounting for around 25% of the total price.
- Taxes/levies: The taxes/levies component includes the cost of various taxes and levies, such as the value-added tax (VAT), the excise duty, and the renewable energy surcharge. The taxes/levies component is the smallest component of the electricity bill, accounting for around 15% of the total price.

The specific breakdown of the price components can vary depending on the supplier and the region. However, the general breakdown outlined above is representative of the average electricity bill in Romania.

Here are some additional details about each of the price components:

- Energy: The cost of the electricity generated is determined by a number of factors, including the type of fuel used, the efficiency of the power plant, and the market price of electricity. The cost of transporting and distributing the electricity is also determined by a number of factors, including the distance that the electricity has to travel and the capacity of the transmission and distribution networks.
- Network: The cost of maintaining and operating the electricity transmission and distribution networks is determined by a number of factors, including the age and condition of the networks, the number of customers served, and the cost of labor and materials.
- Taxes/levies: The cost of various taxes and levies is determined by the government. The specific taxes and levies that are applied to electricity can vary depending on the country.

The government of Romania has taken a number of steps to reduce the cost of electricity for consumers. These steps include:

- Subsidizing the cost of electricity for low-income households.
- Introducing a renewable energy surcharge, which is used to fund the development of renewable energy projects.
- Introducing a green certificate system, which allows businesses to offset their carbon emissions by investing in renewable energy projects.

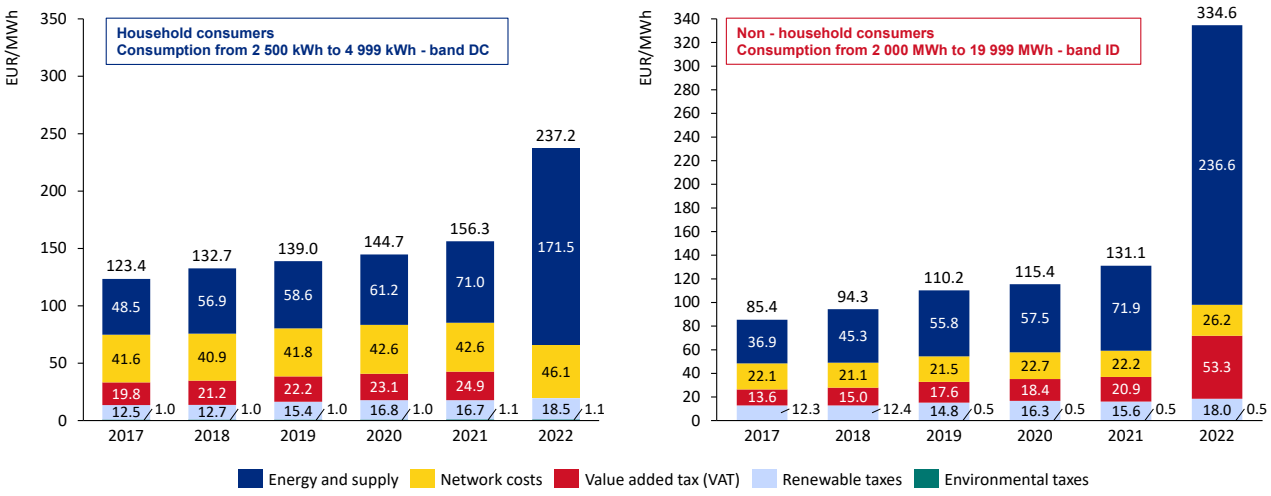
The government is also working to improve the efficiency of the electricity transmission and distribution networks, which will help to reduce the cost of electricity for consumers.

Electricity

Figure 79 illustrates the complete pricing structure of electricity supplied to typical household and non-household consumers. The final electricity price for customers encompasses:

- Energy and supply costs (consisted of the costs of generation, aggregation, balancing energy, customer services, after-sales management, and other supply costs).
- Network costs, encompassing transmission and distribution network charges.
- Various taxes, fees, levies, and additional charges, which, in the context of Romania, include Value Added Tax (VAT), renewable taxes, and environmental taxes.

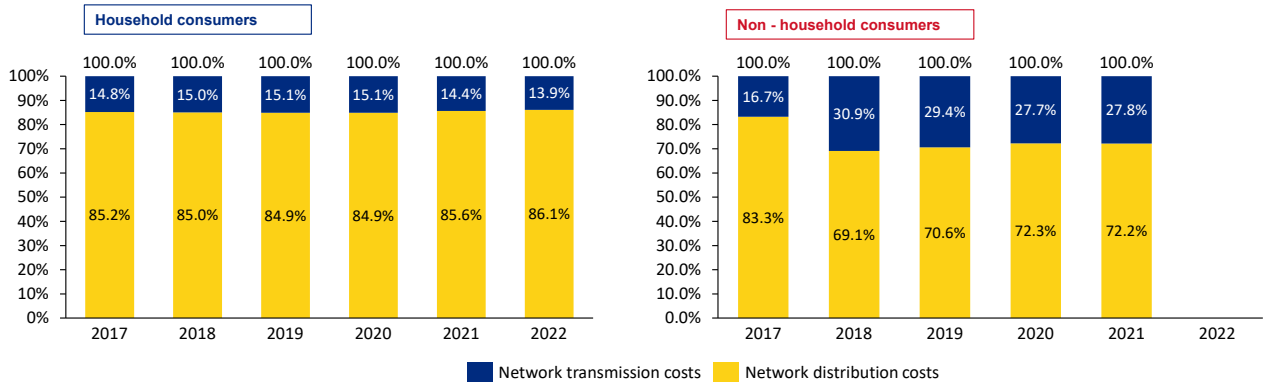
Figure 79. Breakdown electricity prices by components for household and non-household consumers



Source: Eurostat (Annual data on share for transmission and distribution in the network cost for gas and electricity)

Most of the network costs for the household consumers, approximately 85% to 86%, are allocated to the distribution network, as depicted in Figure 81. The remaining 14% to 15% pertain to the transmission network. In the case of non-household consumers, the proportion of distribution network costs increased from around 17% in 2017 to roughly 28% to 31% within the 2018-2021 timeframe. Simultaneously, the share of transmission network costs decreased from 83% in 2017 to about 69% to 72% between 2018 and 2021.

Figure 80. Share of transmission and distribution in the network costs for electricity



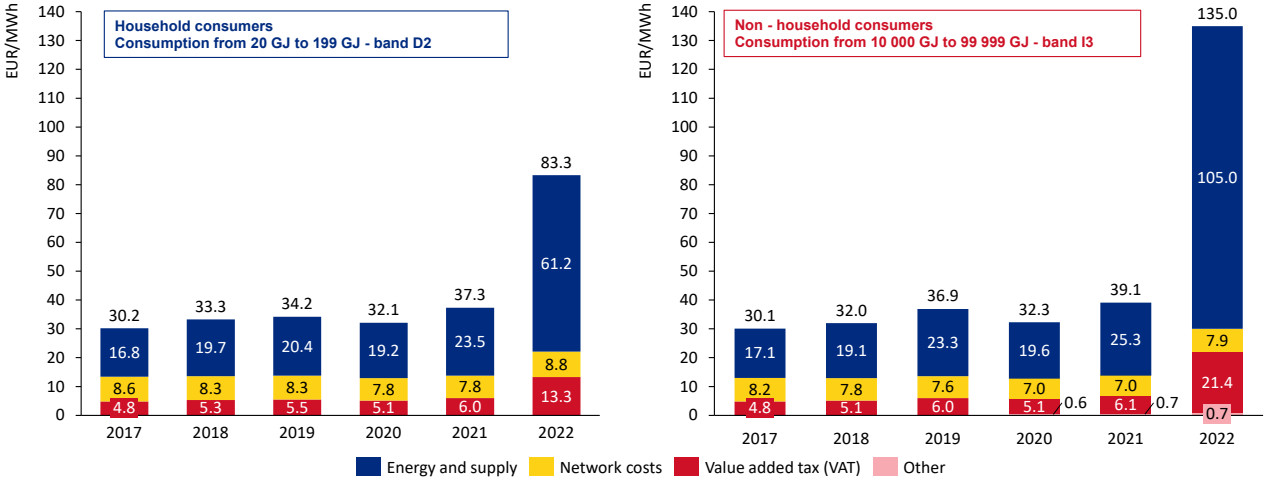
Source: Eurostat (Annual data on electricity prices components for household and non-household consumers),

Note: Data for 2022 are not available for non-household consumers

Natural gas

The composition of price constituents for natural gas follows the same structure observed in electricity (as shown in Figure 81) for the period 2017 and 2022. As per the Eurostat definition, the energy and supply expenses encompass the commodity price for natural gas paid by the supplier or the cost of natural gas at the point of entry into the transmission system, including, if applicable, additional expenses borne by end-users like storage costs and costs relating to the sale of natural gas to final customers.

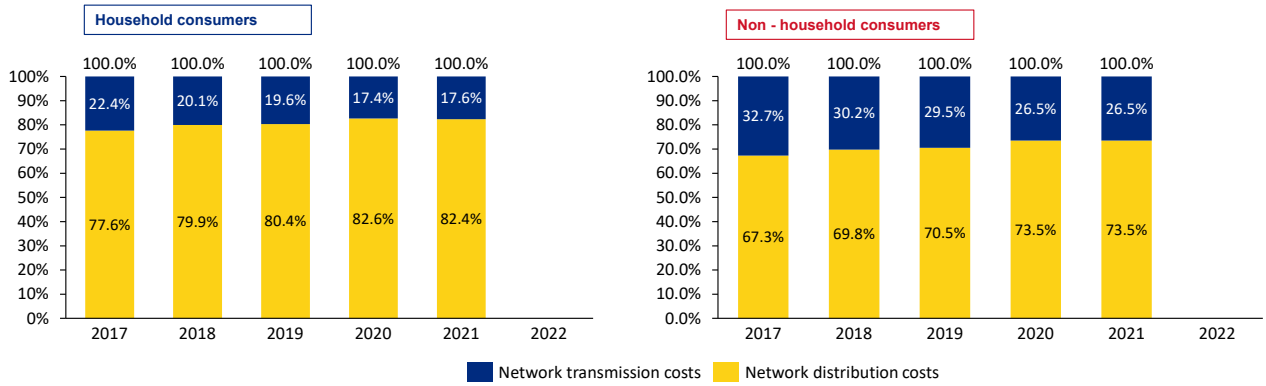
Figure 81. Breakdown of gas prices by components for household and non-household consumers



Source: Eurostat (Annual data on gas prices components for household and non-household consumers)

In the case of household consumers, the proportion of expenditure within the total network costs for gas allocated to the transmission network decreased from 22% to 17% between 2017 and 2021, while the distribution network costs rose from 78% to almost 83%, as illustrated in Figure 82. A comparable trend is evident among non-household consumers, with network transmission costs declining from nearly 33% in 2017 to 26.5% in 2021, while network distribution costs increased from approximately 67% to 73.5% from 2017 to 2021.

Figure 82. Share of transmission and distribution in the network costs for natural gas



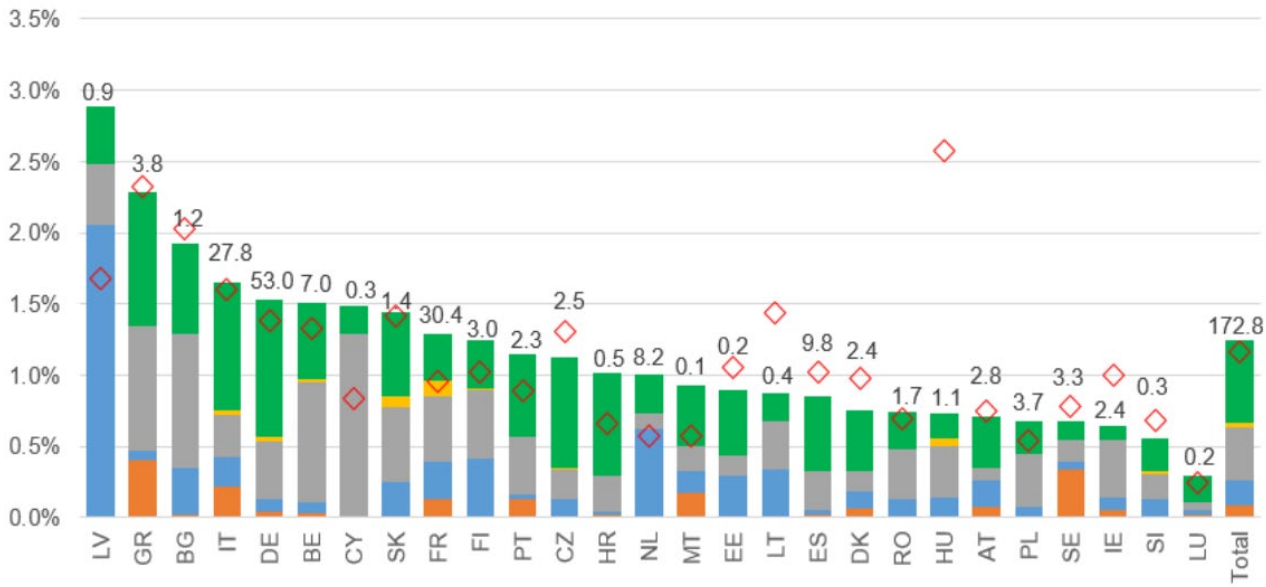
Source: Eurostat (Annual data on electricity prices components for household and non-household consumers),

Note: Data for 2022 are not available

IV. Description of energy subsidies, including for fossil fuels

According to this 2022 Report on Energy Subsidies in the EU, from the commission to the European Parliament and the Council, the energy subsidies in Romania increased in the period 2015-2020, reaching about 0.75% of the GDP in 2020. Additionally, most of the subsidies are still for fossil fuels, but a significant part of the subsidies are for RES.

Figure 83. Subsidies for different energy sources, as percentage of GDP in 2015 and 2020, and in billion euros in 2020



Source: 2022 Report on Energy Subsidies in the EU, from the commission to the European Parliament and the Council[9]

According to the Law no. 226 / 2021 on the establishment of social protection measures for vulnerable energy consumer, the financial social protection measures consist of aid to meet minimum energy needs and are:

a) aid for heating the dwelling;
b) aid for energy consumption to cover part of the household's energy consumption throughout the year;
c) aid for the purchase within a dwelling of energy-efficient equipment necessary for lighting, cooling, heating and providing hot drinking water, for replacing technically and morally outdated household

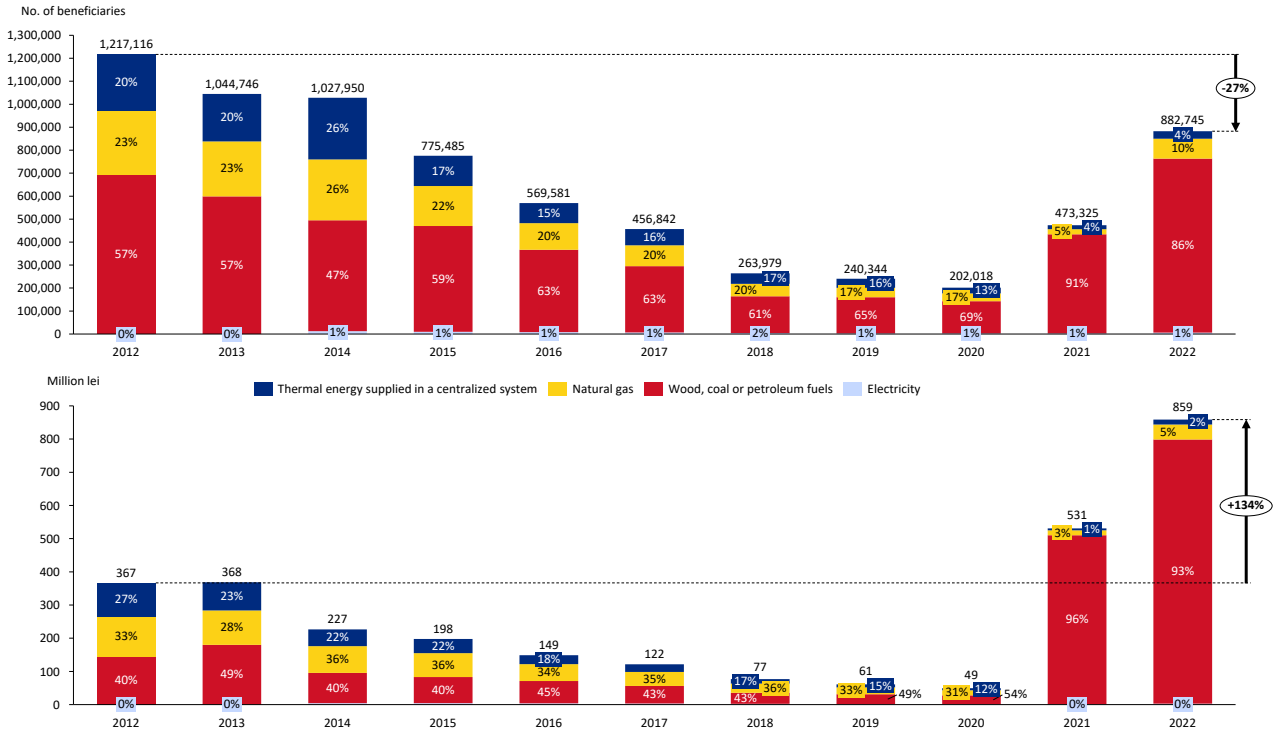
[9] *https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022DC0642#:~:text=Energy%20subsidies%20as%20a%20percentage,most%20Member%20States%20as%20well*

appliances with energy-efficient household appliances, and for the use of energy-intensive means of communication;

d) aid for the purchase of products and services to increase the energy performance of buildings or to connect to energy sources.

The subsidies for heating for vulnerable consumers are for four types of heating systems (centralized heating energy; natural gas; electricity; solid and/or petroleum fuels). The annual data for the number of beneficiaries and the total budged that is paid as aid for heating for vulnerable consumers is presented in Figure 62. As shown, there is a change in the trend after 2021, which is mainly due to the fact that the Law 226/2021 applied from 1st of November 2021, the date from which Emergency Ordinance 70/2011 on social protection measures during the cold season was repealed.

Figure 84. Number of beneficiaries and funds received as home heating aid



5. ASSESSMENT OF IMPACTS OF PLANNED POLICIES AND MEASURES WITH EXISTING POLICIES AND MEASURES

5.1 Impacts of planned policies and measures described in section 3 on energy system and GHG emissions and removals, including comparison to projections with existing policies and measures (as described in section 4).

I. Projections of the development of the energy system and GHG emissions and removals as well as, where relevant of emissions of air pollutants in accordance with Directive (EU) 2016/2284 under the planned policies and measures at least until ten years after the period covered by the plan (including for the last year of the period covered by the plan), including relevant Union policies and measures.

When including all of the sectors in which there are GHG emissions and removals, the difference between the WEM and WAM scenarios in 2030 is 9% (Figure 85). However, by implementing additional measures the difference between the scenarios is more than 90% in 2050. The removals considered for both scenarios from the LULUCF sector for the whole analyzed period are the same. Consequently, the difference in both scenarios when analyzing only the GHG emissions is 5% in 2030 and 47% in 2050.

Figure 85. Difference between net GHG emissions in WEM and WAM scenario (including LULUCF)

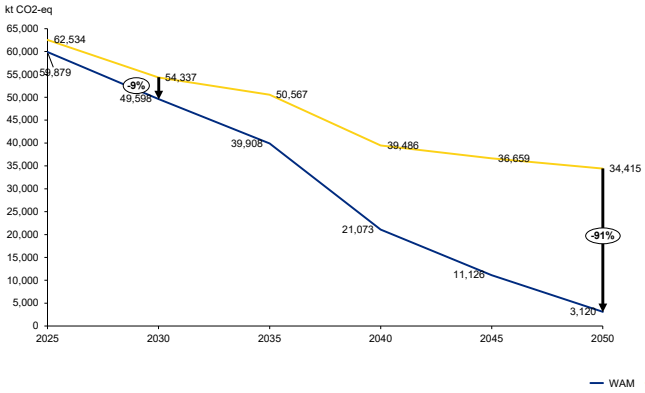
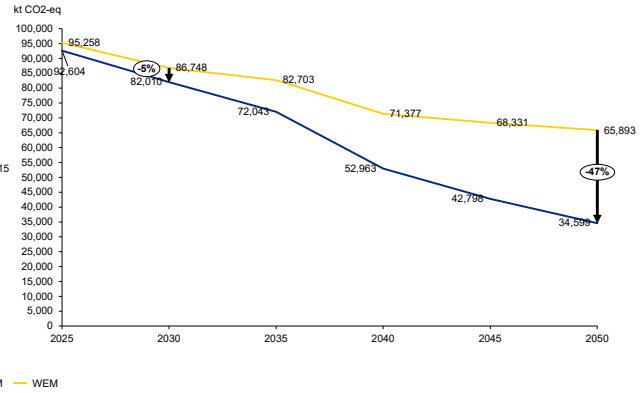


Figure 86. Difference between GHG emissions in WEM and WAM scenario (excluding LULUCF)



Additional measures in the Transport sector must be implemented in order to achieve this more ambitious goal, as defined in the WAM scenario (Figure 94 and Figure 95). Furthermore, the Industry sector has also significant role in the additional emission mitigation, followed by measures implemented in the Agriculture, Energy System, Buildings and Waste.

Figure 87. GHG emissions and removals (and net-emissions) by sectors in WAM

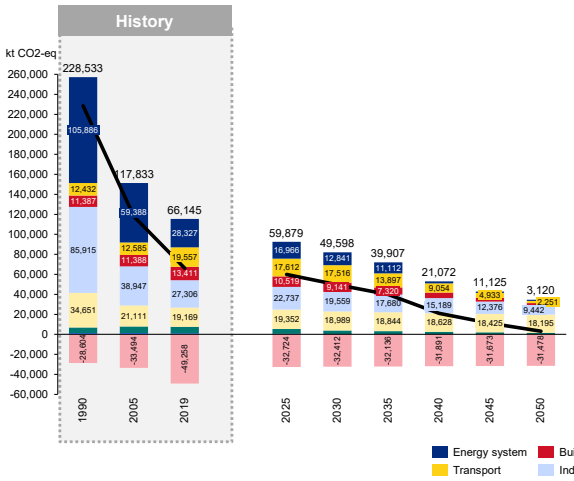
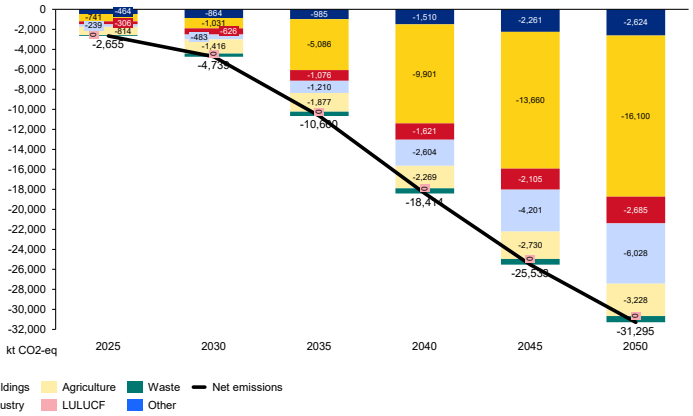


Figure 88. Difference between GHG emissions in WEM and WAM scenario by sectors



If the LULUCF sector is taken into account, the GHG intensity varies by 9% in 2030 and 91% in 2050 between the two scenarios, which corresponds to the difference in GHG emissions since the anticipated GDP is the same for both scenarios (Figure 89). Similarly, the difference in the GHG intensity in both scenarios is 5% in 2030 and 47% in 2050 if the LULUCF sector is not included (Figure 90).

Figure 89. Difference between the GHG intensity in WEM and WAM scenario (including LULUCF)

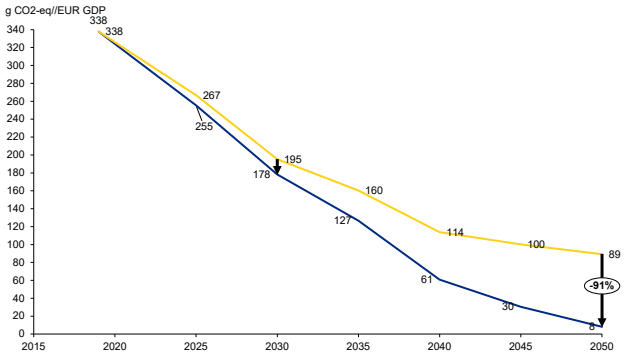
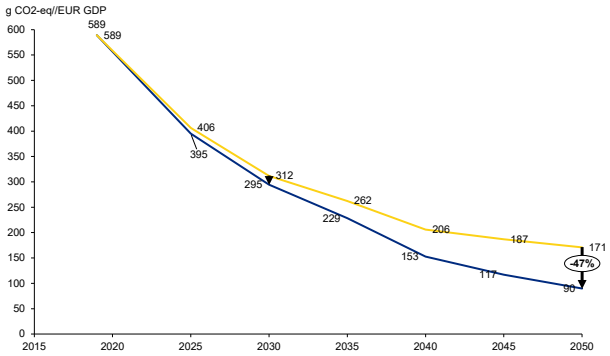
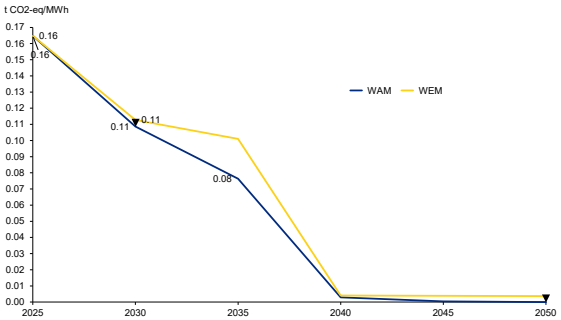


Figure 90. Difference between the GHG intensity in WEM and WAM scenario (excluding LULUCF)



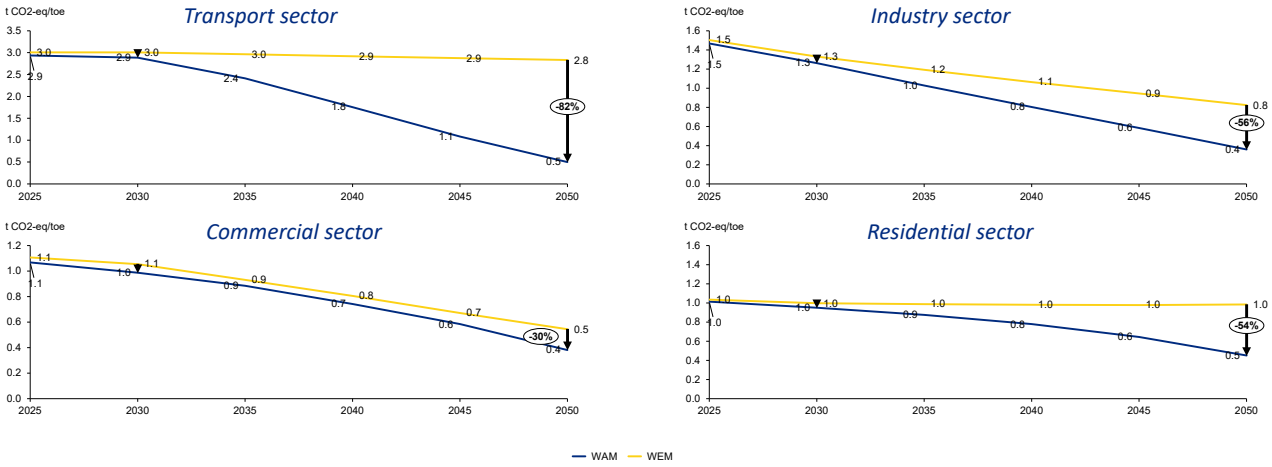
When analyzing by sectors, due to the increased electricity generation from renewable sources (mainly wind and PV), there is a slight difference in the GHG intensity of domestic power and heat generation between the two scenarios (Figure 91). However, these differences are minimal in 2030, as well as in 2050, when this sector is almost completely decarbonized in both scenarios.

Figure 91. Difference between GHG intensity of domestic power and heat generation



In line with the previous discussion, the Transport sector has the biggest difference in terms of GHG intensity, with an increase of 82% in 2050, which means that much more drastic measures are implemented in the WAM scenario in order to decarbonize this sector (Figure 92). Following behind are the sectors: industry, with a difference of 56% in 2050; residential, with a difference of 54%; and commercial, with a difference of 30%. However, it should be emphasized once more that the differences in 2030 are minimal for all of the sectors.

Figure 92. Difference between GHG intensity by sectors



Regarding the RES share in the gross final energy consumption, the WEM and WAM scenarios differ slightly in 2030, i.e. the share should be at least 34% (Figure 96), which is in line with the EU commission target set for Romania. However, the difference in 2050 is much higher. In the scenario with existing measures, the RES share will reach 56% in 2050, while with additional measures it will reach 86%. Generally, this difference, as show in Figure 97, in mainly due to two reasons. First, the hydrogen consumption is much higher in the WAM scenario, which in turn requires higher wind and solar capacity for its production. Second, there is a decreased consumption of biomass in the WAM scenario, as well as, drastic increase in the heat pumps used for heating and cooling.

Figure 93. RES share in gross final energy consumption – Comparison between WAM and WEM scenarios

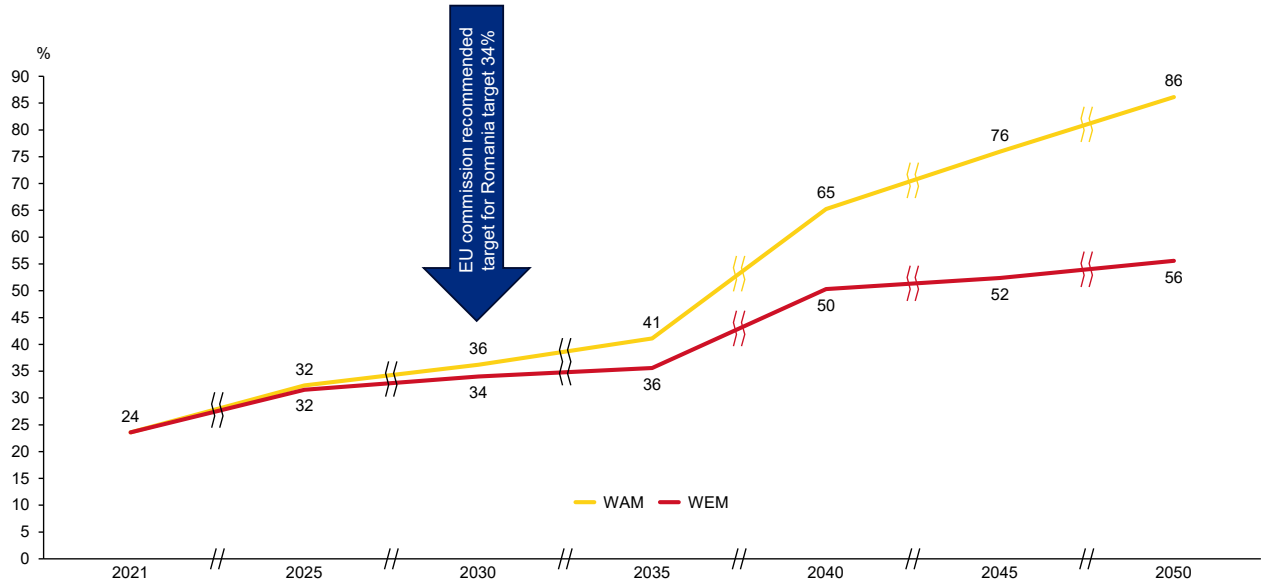
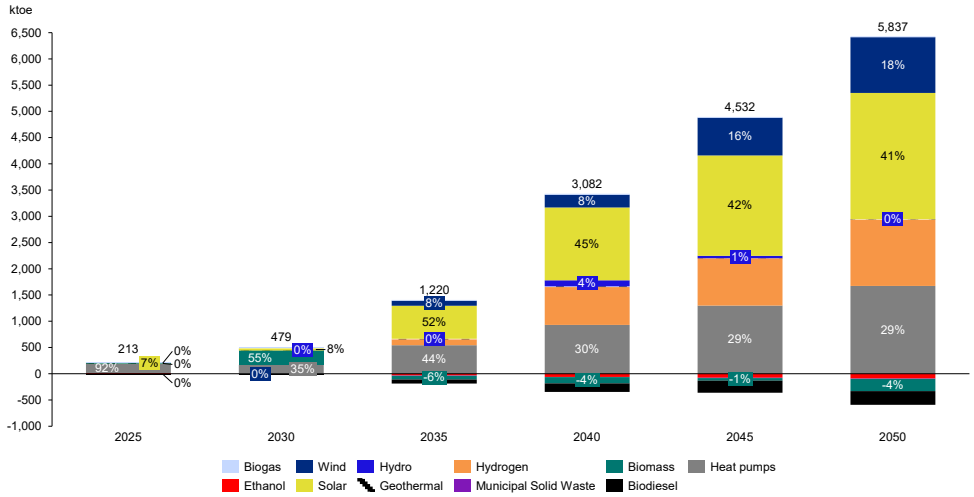


Figure 94. RES energy consumption – difference between WAM and WEM scenarios



When analyzing by sectors, there is no major difference between RES share in the gross final electricity consumption throughout the whole analyzed period up to 2050. The increased RES share in this sector, in the WAM scenario, is mainly due to the increased use of wind and solar, as well as, hydrogen for electricity generation.

Figure 95: RES share in gross final electricity consumption – Comparison between WAM and WEM scenarios

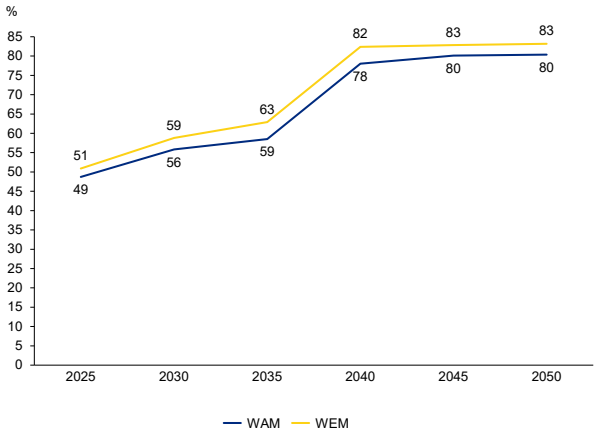
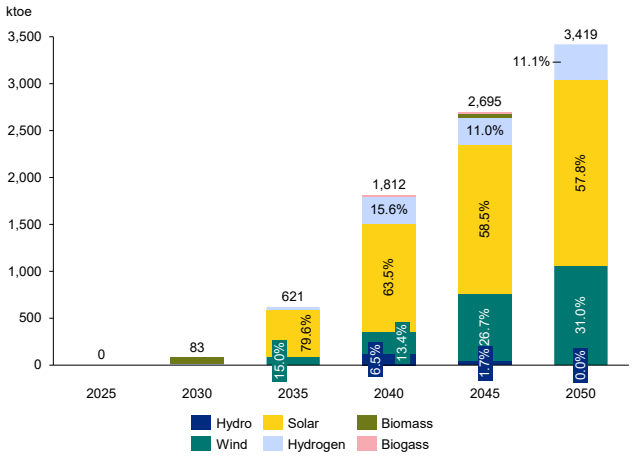


Figure 96. RES electricity – difference between WAM and WEM scenarios



In order to increase the RES share in gross final consumption in the heating and cooling sector in the period after 2025, there is a need for drastic additional measures, as shown in the WAM scenario (Figure 97 and Figure 98). These measures mainly include replacing the biomass with heat pumps, central heating and solar thermal capacity in the whole period, as well as the use of hydrogen in this sector in the period after 2030. By implementing this additional measures, the RES share in this sector can be increased from 33% in 2030 to 36%, or from 35% in 2050 to 76%.

Figure 97: RES share in gross final consumption in H&C sector – Comparison between WAM and WEM scenarios

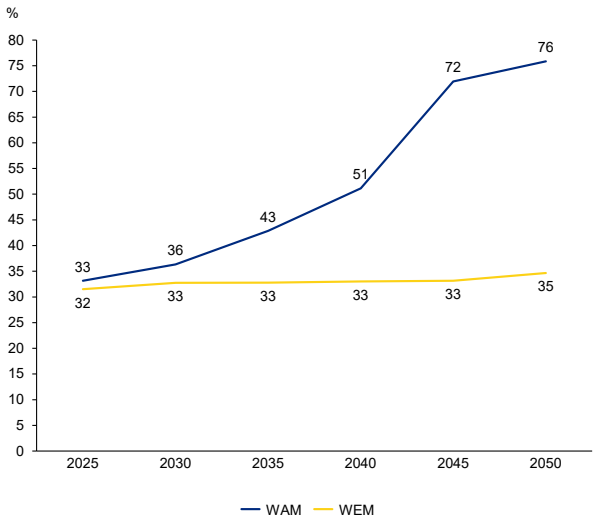
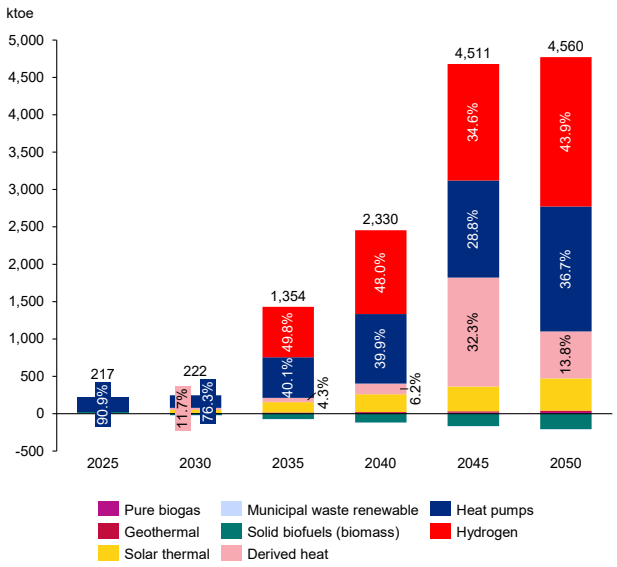


Figure 98. RES energy consumption in H&C sector – difference between WAM and WEM scenarios



The situation for the RES share in the transport sector for 2030 is similar in both scenarios. i.e., it is 27% in the WEM scenario and 30% in the WAM scenario (Figure 99 and Figure 100). The difference is due to increased use of electricity in the rail transport and the use of compliant biofuels. However, in order to significantly increase the RES share in the transport sector in the following period, additional measures are needed for electrification of the road transport, which will contribute the RES share to reach 95% in 2050 in the WAM scenario.

Figure 99: RES share in final consumption in transport sector – Comparison between WAM and WEM scenarios

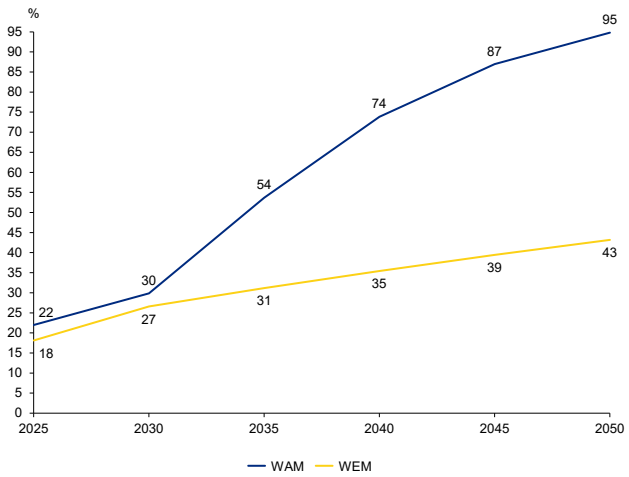
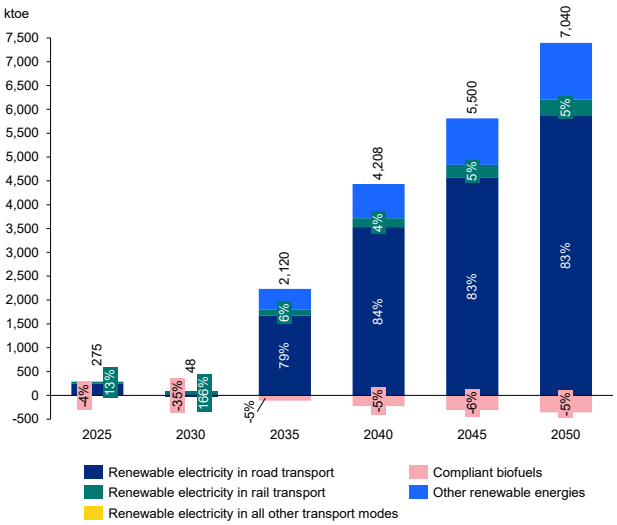


Figure 100. RES energy consumption in transport sector – difference between WAM and WEM scenarios



There is a slight difference in the primary energy consumption between both scenarios, although the consumption by fuels is very different (Figure 101, Figure 102 and Figure 103). The more intensive electrification in the WAM scenario requires more primary consumption of renewable sources, but on the other hand in the WEM scenario instead of RES, more crude oil is used (for oil products consumption in the country, but also for export).

Figure 101. Primary Energy Consumption – Comparison between WEM and WAM scenarios

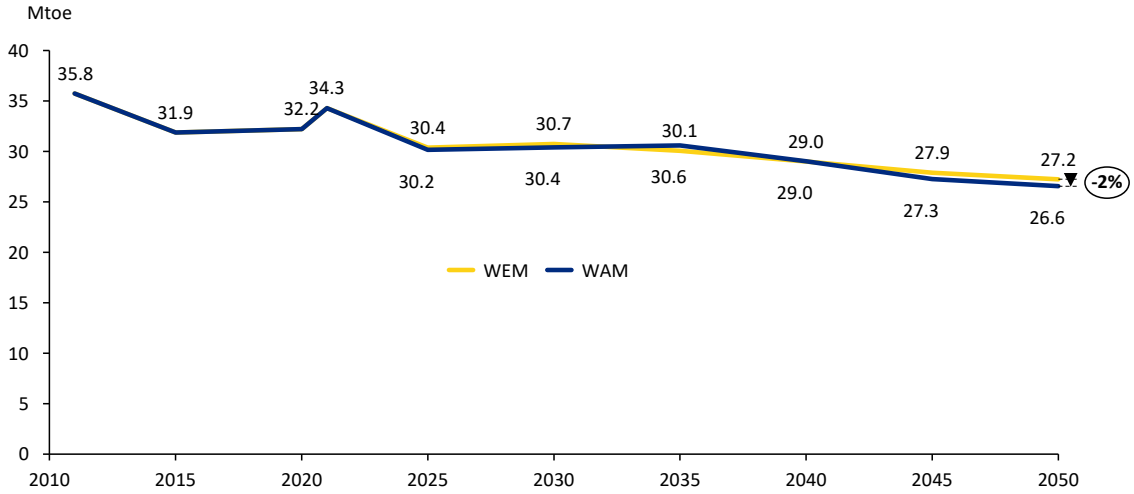


Figure 102. Primary energy consumption by fuels – WAM scenario

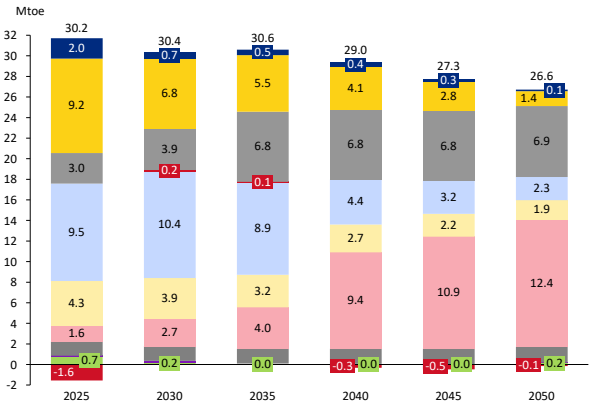
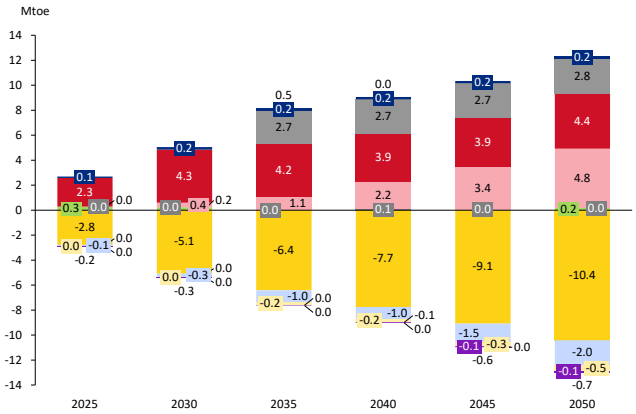
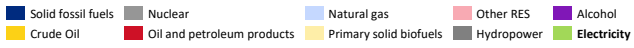


Figure 103. Difference in Primary energy consumption by fuels –between WEM and WAM scenarios





The total difference in the final energy consumption in both scenarios reaches 15% in 2050, while in 2030 it is only 1% (Figure 74). However, there is a difference in the fuels used, i.e., in the WAM scenario there is a reduced need for oil and petroleum products, as well as, natural gas, but on the other hand increased use of electricity and other RES (which mainly refers to hydrogen and solar energy) (Figure 105 and Figure 106).

Figure 104. Final Energy Consumption – Comparison between WEM and WAM scenarios

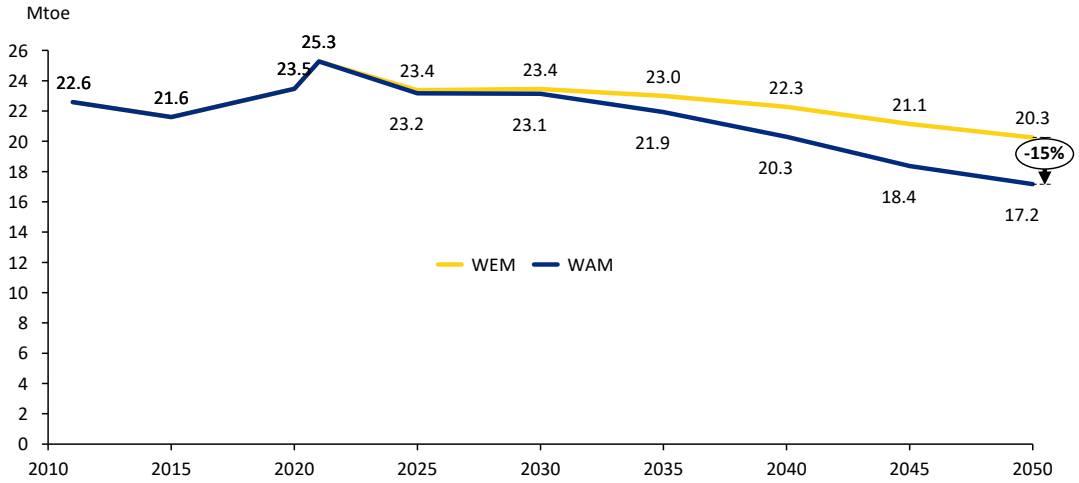


Figure 105. Final energy consumption by fuels –WAM scenario

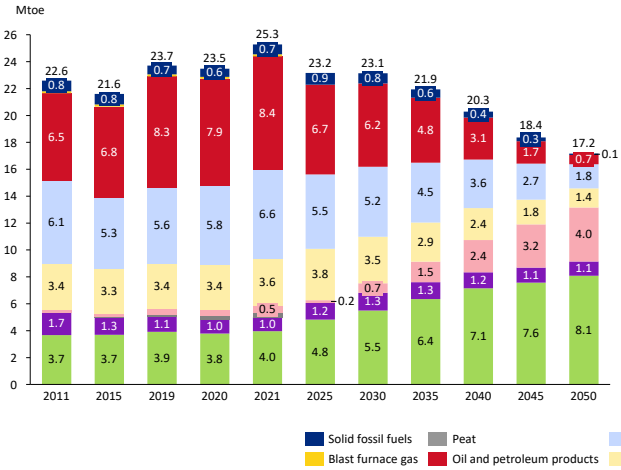
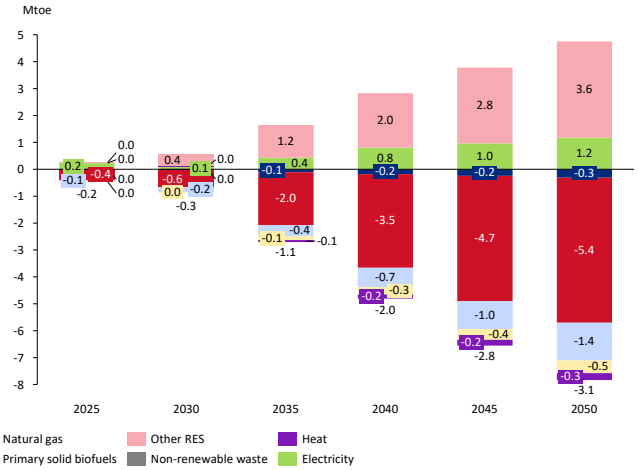


Figure 106. Difference in Final energy consumption by fuels –between WEM and WAM scenarios



The energy efficiency first principle is implemented when developing the two scenarios. This contributes to the reduced final energy consumption, which, when comparing the two scenarios is mostly notable in the Transport sector (Figure 109 and Figure 110). This is achieved by the higher degree of electrification of this sector, which also means that there will be more efficient vehicles in the WAM scenario, which can be achieved only by lowering the lifetime of the vehicles. The increased use of more efficient technologies in the Household sector, such as the heat pumps, will contribute the difference in the final energy consumption of this sector in both scenarios to be 27%. The difference in the other sectors is not so high, which means that in both scenarios the most efficient technologies are assumed.

Figure 107. Final energy consumption by sectors – WAM scenario

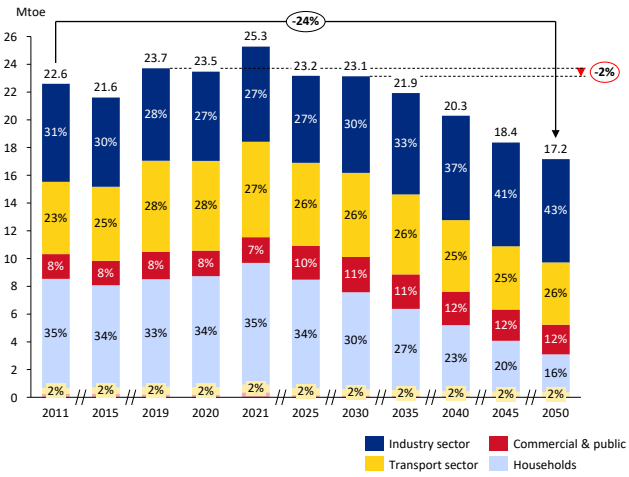
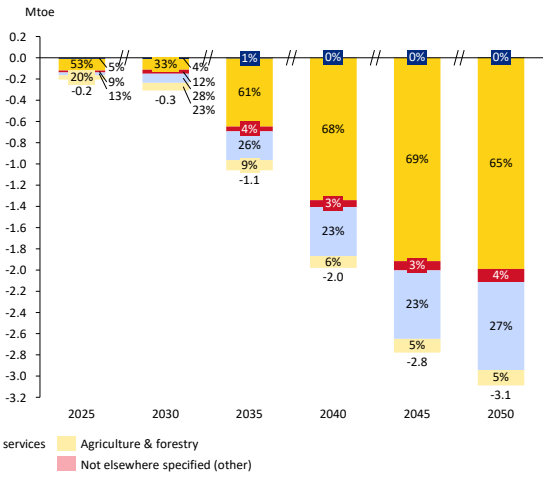


Figure 108. Difference in Final energy consumption by sectors–between WEM and WAM scenarios



The highest share in the final non-energy consumption in both scenarios have the bitumen and the natural gas (Figure 109 and Figure 110). However, their consumption in the WEM scenario is more than double, when compared to the WAM scenario.

Figure 109. Final non-energy consumption by fuels – WAM scenario

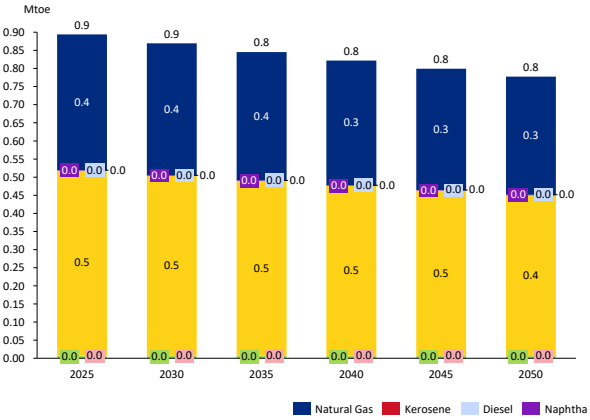
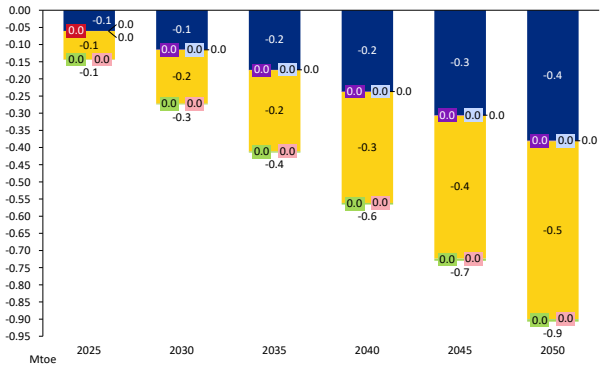


Figure 110. Difference in Final non-energy consumption by fuels – between WEM and WAM scenarios



The difference in the primary and final energy intensity in both scenarios is in accordance with the results for the primary and final energy consumption, since the same GDP projections are assumed in both scenarios (Figure 111 and Figure 112).

Figure 111: **Primary energy intensity of the overall economy**

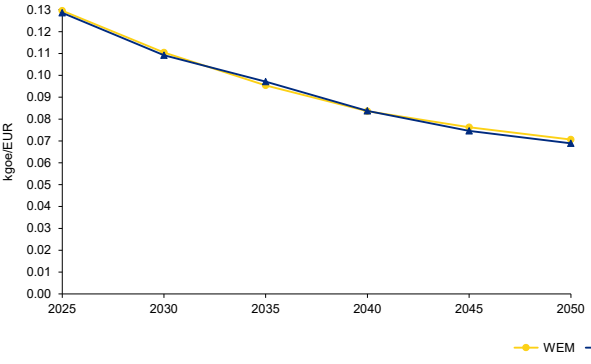
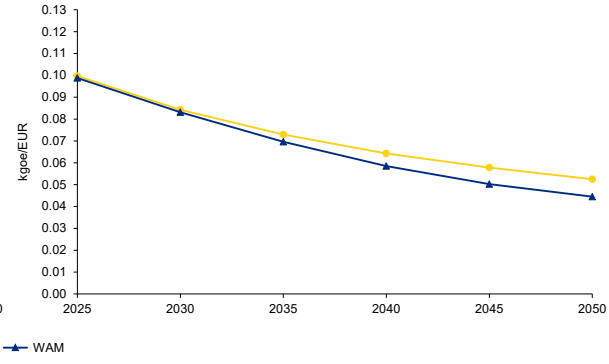


Figure 112. **Final energy intensity of the overall economy**



As also discussed previously, the higher rate of electrification of all sectors in the WAM scenario, contributes to increased electricity generation (Figure 113 and Figure 114). This additional electricity in the WAM scenario is mainly produced from renewable sources (PV and wind), but additional support from nuclear power plants, as well as, hydrogen CHP is also needed in order to reach the required level of electrification. This additional hydrogen CHP capacity is also going to be used for heat generation, which is the major difference with the WEM scenario, in which hydrogen is not used (Figure 115 and Figure 116). It should be noted that in certain time periods due to the required electricity generation from the CHP, there may be excess heat produced.

Figure 113: **Electricity generation by technology – WAM scenario**

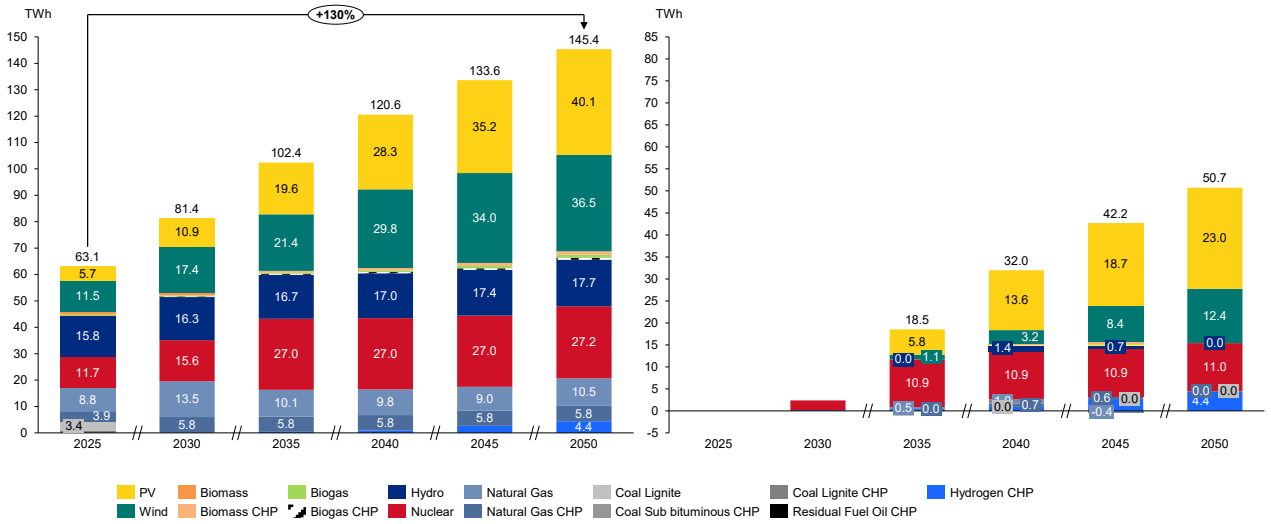


Figure 114. Difference in **Electricity generation by technology – between WEM and WAM scenarios**

Figure 115: **Heat generation by technology and consumption – WAM scenario**

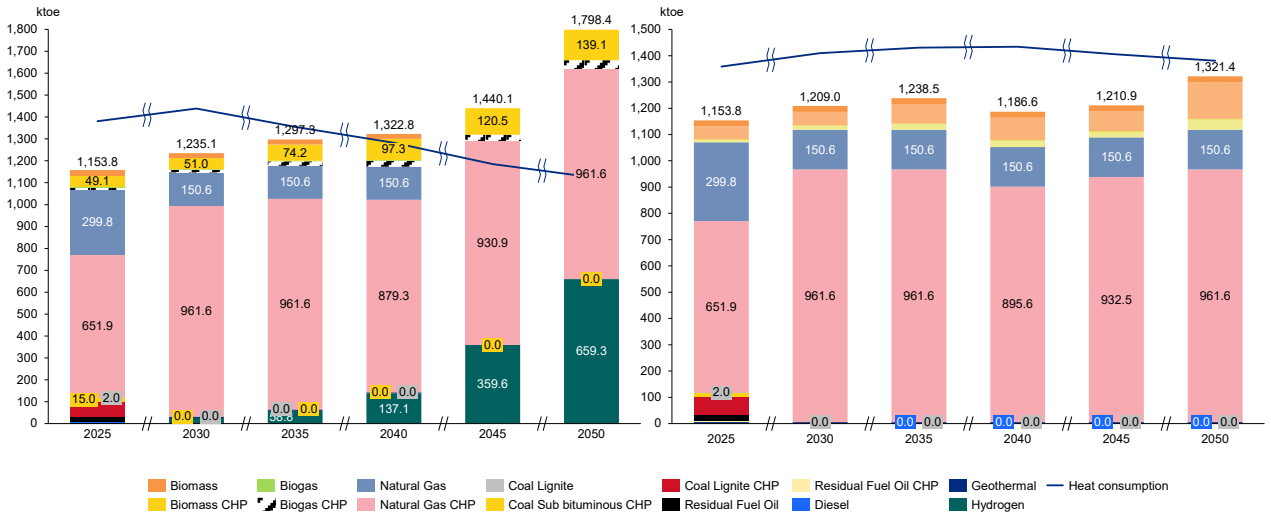


Figure 116. **Heat generation by technology and consumption – WEM scenario**

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

Figure 104 illustrates that the attainment of the targets is contingent upon the full implementation of all policies and measures. Executing the scenario with additional policies and measures would lead to a 15% reduction in the final energy consumption compared to the scenario with existing policies and measures. It is crucial to emphasize that the updated version of the NECP adheres to the fundamental principles of energy efficiency. In fact, abiding by these principles not only helps mitigate the risk of increased expenditures but also holds the potential for substantial cost savings.

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

The proposed policies and measures are designed to align with the established national targets and objectives, and will additionally contribute to achieving the EU goals. Table 11 provides an overview of how each policy or measure contributes to the various dimensions.

Table 13. Interactions between the policies and measures

	Decarbo...	Efficienc...	Energy ...	Internal ...	R&I&C
PAM 1 Phasing out coal TPP	√	√	√	√	√
PAM 2 Introduction of green hydrogen into the energy system	√	√	√	√	√
PAM 3 Development of new CCGT capacities	√	√	√	√	√
PAM 4 Promotion of high-efficiency cogeneration capacities	√	√	√	√	√
PAM 5 Employing CCUS technologies	√			√	√
PAM 6 Implementation of the Kigali amendment in the Product uses as substitutes of ODS	√				√
PAM 7 Improvement of the industrial processes	√				
PAM 8 Setting an obligation for CO2 injecting and storing for the oil & gas industry	√				√
PAM 9 Reduction of emissions from enteric fermentation	√				
PAM 10 Increasing agricultural residues management	√				
PAM 11 Reduction of methane emission level from manure management and biogas production	√				√
PAM 12 Increasing the agrisolar production	√	√	√	√	√
PAM 13 Establishing integrated management of forest fires	√				
PAM 14 PV systems in agriculture	√				
PAM 15 Renewal of the agricultural machinery and equipment	√	√	√		
PAM 16 Establishment of agricultural associations	√				
PAM 17 Reduction of municipal waste per capita	√				
PAM 18 Increased recycling and biodegradable waste selection for composting	√				√
PAM 19 Improved incineration / co-incineration	√	√	√	√	√
PAM 20 Landfill gas flaring	√	√	√	√	√

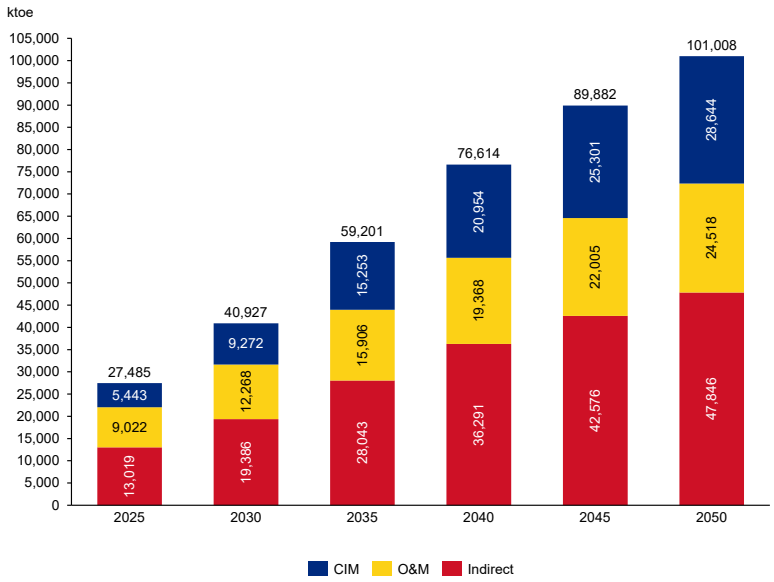
PAM 21 Improved wastewater treatment	√				√
PAM 22 Increase of the domestic generation capacity from PV power plants	√	√	√	√	√
PAM 23 Increase of the domestic generation capacity from wind	√	√	√	√	√
PAM 24 Small hydro power plant	√	√	√	√	√
PAM 25 Rooftop PP	√	√	√	√	√
PAM 26 Installation of solar thermal collectors in the residential sector	√	√	√	√	√
PAM 27 Increase of the domestic generation capacity from Biomass and biogas CHP and PP	√	√	√	√	√
PAM 28 Development of market for more advance biofuels	√	√	√		√
PAM 29 Improve energy performance of public buildings at central level	√	√	√		√
PAM 30 Improve energy performance of public buildings at local level	√	√	√		√
PAM 31 Renovation of residential buildings	√	√	√		√
PAM 32 Renovation of commercial buildings	√	√	√		√
PAM 33 Rehabilitation of public lighting	√	√	√		
PAM 34 Development of energy services/market, ESCO	√	√	√		
PAM 35 Green procurement	√	√	√		
PAM 36 Energy audit and energy management	√	√	√		
PAM 37 Increased share of heat pumps	√	√	√		
PAM 38 Increased use of efficient technologies in the residential sector	√	√	√		
PAM 39 Replacement of conventional fuels with RES in manufacturing industries	√	√	√		
PAM 40 Increase technology efficiency in the industrial sector	√	√	√		
PAM 41 Increased share of alternative fueled cars	√	√	√		
PAM 42 Increased share of alternative fueled buses and trains	√	√	√		
PAM 43 Modernization of urban public transport	√	√	√		
PAM 44 Extension of the subway in Bucharest	√	√	√		
PAM 45 Increased share of alternative fueled trucks	√	√	√		
PAM 46 Modernization of railway, subway, naval and air transport	√	√	√		
PAM 47 Alternative mobility	√	√	√		
PAM 48 Support for the expansion and modernization of the electricity distribution network	√	√	√		
PAM 49 Increased use of nuclear energy	√	√	√		
PAM 50 Black Sea Corridor (TYNDP ID 138)	√		√	√	
PAM 51 Mid-Continental East corridor (TYNDP ID 144)	√		√	√	
PAM 52 HU-RO (TYNDP ID 259)	√		√	√	
PAM 53 North CSE Corridor (TYNDP ID 341)	√		√	√	
PAM 54 Georgia-Romania Black Sea interconnection cable project (TYNDP ID 1105)	√		√	√	
PAM 55 Increasing the interconnectivity between the eastern areas and the remaining of the interconnected power system.	√		√	√	

PAM 56 Integrating the output generated by powerplants in other areas (South, South-West, etc.)	√		√	√	
PAM 57 400kV OHL Suceava-Bălți	√		√	√	
PAM 58 Refurbishment and modernization of the existing substations	√		√	√	
PAM 59 Increasing the Natural Gas in Central-Eastern and South-Eastern Europe	√		√	√	
PAM 60 Daily withdrawal capacity increase in Bilciurești underground gas storage system (UGS)	√		√	√	
PAM 61 Electric energy storage capacities	√		√	√	
PAM 62 Development and use of fully-fledged national social assistance information system	√		√	√	
PAM 63 Ensuring implementation of just transition process	√		√	√	√

5.2 Macroeconomic and, to the extent feasible, the health, environmental, employment and education, skills and social impacts, including just transition aspects (in terms of costs and benefits as well as cost-effectiveness) of the planned policies and measures described in section 3 at least until the last year of the period covered by the plan, including comparison to projections with existing policies and measures

One of the social benefits of the decarbonization process of the society is the creation of green jobs. In the LTS, calculations on the number of green jobs which will be created as a result of its implementation are made according to the methodology presented in the paper “Jobs Impact of Green Energy”, published by Jaden Kim and Adil Mohommad in May 2022 as International Monetary Fund working paper , which is based on scientific research from a number of authors. By applying the cited methodology, more than 100,000 new green employment will be created by the year 2050 with the realization just on some of the proposed policy and measures (Figure 117). Most newly generated green jobs will be direct jobs and will be due to the manufacturing, construction, installation, operation and maintenance of the green technologies. The greening of the economy will also be facilitated through indirect jobs that do not require specialized green knowledge or duties. For instance, new jobs will be created when materials employed for green technologies manufacturing are produced, when these products are handled, and when they are sold.

Figure 117. Number of green jobs


ktoe
105,000
100,000
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75,000
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20,000
15,000
10,000
5,000
0
27,485
5,443
9,022
13,019
40,927
9,272
12,268
19,386
59,201
15,253
15,906
28,043
76,614
20,954
19,368
36,291
89,882
25,301
22,005
42,576
101,008
28,644
24,518
47,846
2025
2030
2035
2040
2045
2050
CIM
O&M
Indirect

5.3 Overview of investment needs

I. Existing investment flows and forward investment assumptions with regard to the planned policies and measures

The overall investments in the energy sector, which require the most extensive and costly interventions, reach approximately 2,132 billion euros (Figure 118, Figure 119). Among these investments, a substantial portion is for a comprehensive overhaul of the transportation sector, whereas achieving decarbonization in the electricity generation sector represents one of the more cost-effective sectors. To provide context, the total cumulative investments in this sector for the whole period 2023-2050 align with the investment levels expected in the industrial sector during the 2026-2030 timeframe.

Figure 118: **Investments needed in the electricity generation**

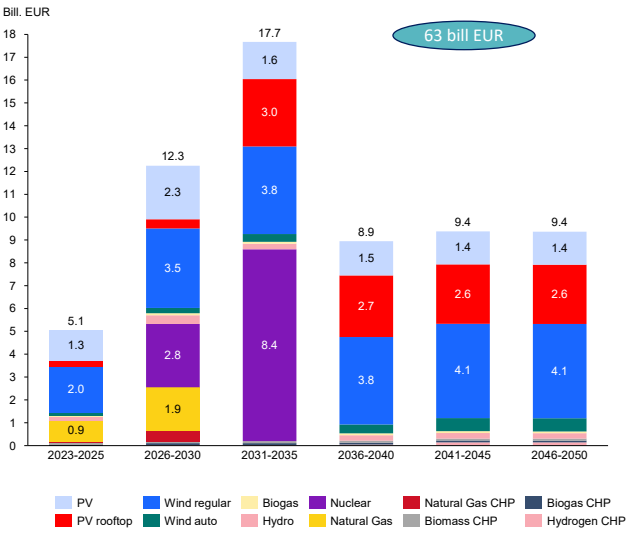
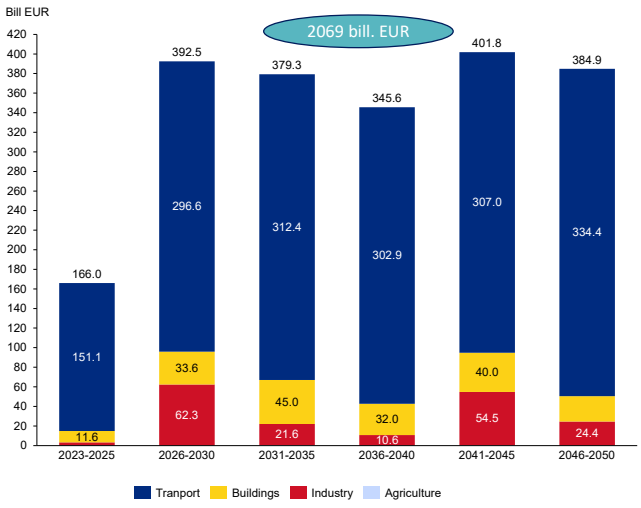


Figure 119. **Investments needed in the energy demand sector**



II. Sector or market risk factors or barriers in the national or regional context

The implementation of policies and measures typically involves multiple institutions, making it crucial to enhance cooperation between these entities and increase their capacities to achieve the established targets and objectives. This collaborative approach is also instrumental in expediting and simplifying processes and procedures for investors.

Apart from enhancing institutional capacities and fostering cooperation among them, it's imperative to secure substantial funding for realization of the proposed policies and measures. Furthermore, specific policies and measures necessitate revisions in legal and regulatory frameworks, so it is necessary much better collaboration among political parties. In the realm of energy efficiency, particularly critical measures include obligation schemes, alongside initiatives like electrifying the transportation sector and introducing hydrogen, particularly for heavy-duty vehicles.

Ensuring security of supply primarily hinges on the construction of new interconnection infrastructure for electricity, natural gas, and oil. Such infrastructure can significantly contribute to diversifying supply routes and reducing dependence on imports from the Russian Federation. Additionally, a potential risk arises if the decommissioning of existing coal-fired power plants doesn't align with the simultaneous commissioning of new wind, solar, and natural gas facilities, which will transit to hydrogen-based operations after 2036.

III. Analysis of additional public finance support or resources to fill identified gaps identified under point ii.

A substantial portion of the funds for the realization of the policy and measures originates from private investors, underscoring the critical need to establish conducive conditions that facilitate easier, seamless, and timely investments.

5.4 Impacts of planned policies and measures described in section 3 on other Member States and regional cooperation at least until the last year of the period covered by the plan, including comparison to projections with existing policies and measures

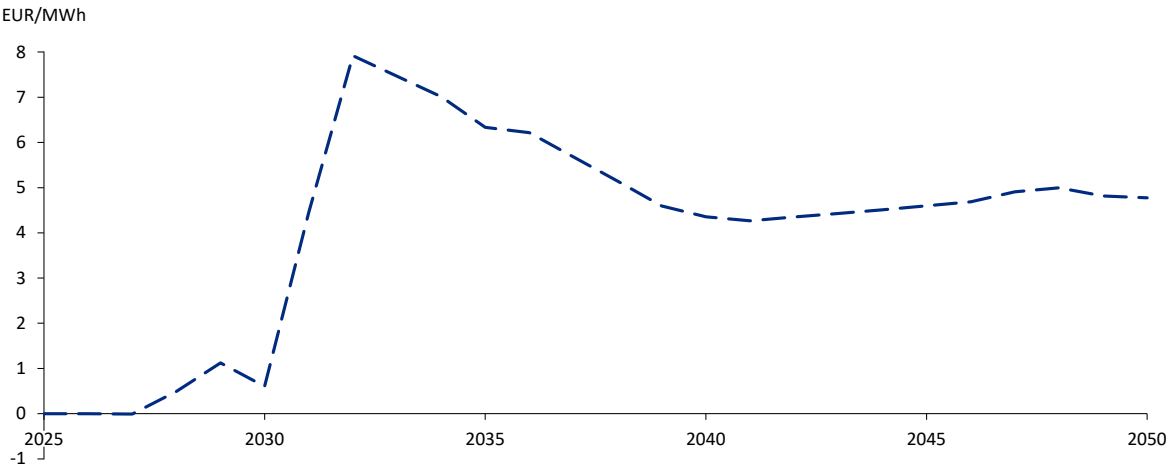
I. Impacts on the energy system in neighbouring and other Member States in the region to the extent possible

Due to the modernization efforts in Romania's energy system and the phased-out utilization of coal, along with a reduction in the reliance on natural gas for electricity generation, which is set to be completely phased out by 2036 as outlined in the document, there arises a pressing need to construct a substantial number of solar and wind power facilities. Considering the current low interconnectivity level in Romania, approximately at 11%, failure to enhance this aspect could have repercussions on pricing. Excess electricity might remain constrained within Romania's borders, unless hydrogen production becomes a viable option. On the other hand, in periods of demand surpassing supply due to inadequate interconnectivity, electricity importation would not be feasible. These dynamics have the potential to significantly impact electricity rates in Romania, notwithstanding the broader anticipation that Romania won't heavily depend on imports. Consequently, as articulated in both the measures and objectives, a substantial elevation of the interconnectivity level is imperative.

II. Impacts on energy prices, utilities and energy market integration

Taking into account the modeling characteristics of the WAM scenario, which include higher rate of electricifation of all sectors, which leads to an increase in electricity consumption, and therefore greater need for electricity generation, the investment flow into power plants and electricity grids will surpass the estimates for the WEM scenario. This will lead to an average electricity price difference of 5 EUR/MWh after 2030 (Figure *120*).

Figure 120: Difference in electricity production price between WAM and WEM sceanrion



III. Where relevant, impacts on regional cooperation

This document underscores the significance of regional collaboration, especially in construction of new interconnectivity lines as well as fostering collaboration with other countries in aligning policies on EN level that can contribute to achieving the targets and objectives. This collaboration serves not only to draw insights from their implemented policies and measures but also to facilitate advancements in Research and Innovation for the development and implementation of cutting-edge technologies.

ANNEX I

Table 14. Policies and measures already implemented and reported in Annex IX of NECP progress report

PaM number	Relevant Union dimension(s) affected	Name of PaM or group of PaMs	Short description
1	Decarbonisation: GHG emissions and removals	GD no. 739/2016 approving the National Climate Change and Low Carbon Green Growth Strategy for period 2016 – 2030 and the National Action Plan for implementation of the National Climate Change and Low Carbon Green Growth Strategy for period 2016 – 2020	The National Climate Change and Low Carbon Green Growth Strategy for period 2016 – 2030 (National CC/LCGG Strategy) and the National Action Plan 2016 - 2020, as programmatic documents for the period 2016 - 2020 – 2030, including the roadmap for 2050, establish the Romania's operational actions for GHG emissions mitigation and climate change adaptation. The main objective of the National CC/LCGG Strategy is to reduce the GHG emissions from economic activities in alignment with EU targets and to adapt to the effects of climate variability and change, both current and future.
2	Decarbonisation: GHG emissions and removals	GD no. 877/2018 aproving Romania's Sustainable Development Strategy 2030	Defines the national framework for implementing 2030 Agenda for Sustainable Development and promotes the development of Romania by focusing on three dimensions – economic, social and environmental. Details on strategic objectives, as well as actions forseen per each sector, are presented in PaMs Report (chapter 3.1 Information on WEM projection scenario)
3	Decarbonisation: GHG emissions and removals	Law no. 278/2013 on industrial emissions, including Decisions establishing best available techniques (BAT) conclusions under Directive 2010/75/EU	Setting permit conditions for IPPC installations, in accordance with BAT Conclusions.
4	Decarbonisation: GHG emissions and removals	GD no. 780/2006 establishing the scheme for greenhouse gas emission allowance trading, with with subsequent amendments (including GD no. 393/2020)	"Reduction of GHG emissions from ETS installation, within the period 2007-2030. The national emissions reduction commitment is part of the EU's commitment to reduce GHG emissions related to ETS sector (for 2021-2030 period: 43.9 % lower than in 2005)."
5	Decarbonisation: GHG emissions and removals	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	Establishes the Romania's GHG emission limit for 2030, compared to 2005 level and the annual emission allocations at national level till 2030.
6	Decarbonisation: GHG emissions and removals	Law no. 220/2008 on establishing the promotion system for the production of energy from renewable energy sources, amended by Law no. 139/2010 and GEO no. 163/2022	Establishes system for promoting electricity produced from renewable energy sources (wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases). The national indicative contribution for 2030 is established through PNIESC 2021-2030.

7	Energy efficiency;Decarbonisation: GHG emissions and removals	Law no. 121/2014 on energy efficiency, with further amendments	The Law establishes the legal framework and policy measures for energy efficiency for the whole chain (primary resources, manufacturing, distribution, supply, transport and final consumption) for meeting the strategic objective of the National Energy Policy to improve energy efficiency. The national indicative contribution regarding energy efficiency for 2030 is established through PNIESC 2021-2030.
8	Energy efficiency;Decarbonisation: GHG emissions and removals	GD 1076/2021 for approval of the 2021-2030 Integrated National Energy and Climate Plan (PNIESC)	The Plan, defining Romania's role and contribution to achieve the EU's objectives on climate change, integrates the objectives and directions established by relevant energy and climate change strategies and by programmatic documents initiated by other ministries / authorities. Details on measures forseen per each sector are presented in PaMs Report (chapter 3.1 Information on WEM projection scenario)
9	Energy efficiency;Decarbonisation: GHG emissions and removals	GD no. 203/2019 approving the Fourth National Action Plan for Energy Efficiency (NAPEE 2017 - 2020)	NAPEE IV proposes significant measures to improve energy efficiency for the energy supply system and final energy consumer, taking as reference NAPEE III, and establishes the energy savings expected to be achieved by 2020. Details on measures forseen per each sector are presented in PaMs Report (chapter 3.1 Information on WEM projection scenario)
10	Energy efficiency;Decarbonisation: GHG emissions and removals	Romania's National Recovery and Resilience Plan (PNRR)	The PNRR ensures an optimal balance between EU priorities and Romania's development needs, in the context of recovery after the COVID-19 crisis, and containing interventions designed to support the implementation of the PNIESC 2021-2030. Details on measures forseen per each sector are presented in PaMs Report (chapter 3.1 Information on WEM projection scenario)
11	Energy efficiency;Decarbonisation: GHG emissions and removals	National programs for local and regional development	National programmes for local and regional development aiming to improve the transport sector (infrastructure, vehicles, non-motorized transport), the buildings sector (extending the connectivity to the natural gas transport system, “Photovoltaic Green House”) and the waste sector (wastewater management systems).
12	Decarbonisation: GHG emissions and removals	National Energy Strategy for 2019 - 2030 period, with the perspective of 2050	The national strategic investments presented by the Strategy are the following: - Completion of groups 3 and 4 from NPP Cernavoda, with an installed capacity of 720 MW each (one group to be put into operation by 2030); by investment implementation, an additional energy input in the energy system of about 11 TWh, as well as an increase in installed capacity by 1,440 MW, shall be ensured; - New 600 MW group on lignite, with supercritical parameters, to enter in production after 2020; the group will be provided starting with 2035 with technology of capture, transport and geological storage of CO2 (CSC) ; - Construction of the Tarnița-Lăpuștești Pumped Hydropower Plant, with a capacity of 1000 MW that could balance the electric power system for durations between 4-6 hours; - Construction of the Turnu Măgurele-Nicopole Hydrotechnical Complex of approx. 2,200 GWh / year, by the Danube river arrangemet on the sector downstream of the Portile de Fier I and II, until immediately downstream of the confluence with the Olt River, within the cooperation between the governments of Romania, Bulgaria and Serbia.
13	Decarbonisation: GHG emissions and removals	GEO no. 64/2011 on the geological storage of carbon dioxide, approved by Law no. 114/2013	Reduction of CO2 emissions using CCS Technologies

14	Energy efficiency;Decarbonisation: GHG emissions and removals	GD no. 1090/2013 for establishing measures to apply Commision Regulations (EU) no. 327/2011, no. 206/2012 and no. 547/2012, implementing Directive 2009/125/EC establishing a framework for the setting of ecodesign requirements for energy-related products	Ecodesign requirements for ventilators, air conditioning appliances and ventilators, water pumps
15	Energy efficiency;Decarbonisation: GHG emissions and removals	GD no. 219/2007 on the promotion of cogeneration based on useful heat demand, amended by GD no. 846/2015	Promoting and developing high-efficiency cogeneration, based on the useful thermal energy demand and on saving primary energy on the energy market, in order to increase energy efficiency and to improve the safety of energy supply; establishes the support schemes and guarantees of origin for electricity produced in high-efficiency cogeneration
16	Energy efficiency;Decarbonisation: GHG emissions and removals	GEO no. 53/2019 for the approval of the multiannual program for financing investments for the modernization, rehabilitation, refurbishment and extension of the district heating system	The 2019-2027 District Heating Program, which updates the “Heating 2006 – 2020 heat and comfort” Program, finances new investment projects and undergoing projects for modernization, rehabilitation, renovation and expansion of district heating systems by rehabilitating the heating production units, primary heating transport network, heating points or thermal modules in the building and hot water/heating distribution networks.
17	Internal energy market	Law no. 123/2012 on electricity and natural gas	Law no 123/2012 establishes the frame of the settlements for the unfolding of the activities in electricity and natural gas sectors. Law no. 123/2012 contains the working principle of electricity market and natural gas market, access to the electricity and natural gases network, the realization method of adapters contracts, the method of certifying the operators that function in transportation network, etc. Also, the law promotes the electricity produced from RES and high cogeneration through support schemes in accordance with EU legislation.
18	Energy efficiency;Decarbonisation: GHG emissions and removals	GD no. 57/2011 establishing measures to apply the Regulation (EC) no. 1221/2009 on the voluntary participation of organizations in a Community eco-management and audit scheme (EMAS)	Optimizing the production processes, reducing the impact on the environment and efficient resource use.
19	Energy efficiency;Decarbonisation: GHG emissions and removals	Modernization of the industrial sector	This PaM includes a set of additional measures included in planned Operational Programmes 2021-2027, focused on improving energy efficiency at the level of industrial consumers. Also, the EU Package of proposals "Fit for 55" was considered, focusing on increasing the share of energy from renewable sources in final energy consumption of industrial sector. Details on measures forseen are presented in PaMs Report (chapter 3.2 Information on WAM projection scenario, 3.2.1 Energy sector - Energy consumption)
20	Energy efficiency;Decarbonisation: GHG emissions and removals	Modernization of the energy sector to cover the demand for electrical and thermal power	This PaM includes a set of additional measures included in planned Operational Programmes 2021-2027, focused on improving energy efficiency and increasing the share of renewable energy. Also, he EU Package of proposals "Fit for 55" was considered, focusing on increasing the share of energy from renewable sources and implementation of energy efficiency measures for reduction of primary and final energy consumption. Details on measures forseen are presented in PaMs Report (chapter 3.2 Information on WAM projection scenario, 3.2.1 Energy sector - Energy supply)

21	Decarbonisation: GHG emissions and removals	GD no. 666/2016 for aproving the General Transport Master Plan (GTMP)	GTMP, that analyses the major objectives of national transport sector, is a planning strategic instrument for major investments (projects and actions)
22	Decarbonisation: GHG emissions and removals	GD no. 1312/2021 for the approval of the Investment Program for the Development of Transport Infrastructure for the period 2021-2030	The Program updates the GTMP implementation strategy and specifies the needs for the development of transport infrastructure in Romania
23	Decarbonisation: GHG emissions and removals	GD no. 985/2020 for the approval of the Railway Infrastructure Development Strategy 2021-2025	The strategy details the transport general strategy for the railway sector, presented by the GTMP
24	Decarbonisation: GHG emissions and removals	GD no. 1302/2021 for the approval of the Action Program for the development of railway infrastructure and the modal transfer to the railway of passenger and freight transport flows	The program includes measures to increase railway freight traffic and the number of railway passengers
25	Decarbonisation: GHG emissions and removals	GEO no. 40/2011 on the promotion of non-polluting and energy-efficient road transport vehicles, amended by GEO no. 9/2013	Promotion of non-polluting and energy efficient road transport vehicles, and improving the contribution of the transport sector to the environment, climate and energy policies. For the purchase of road transport vehicles, contracting authorities (that are under an obligation to apply the procurement procedures provided by GEO 34/2006) and operators (who fulfill public service obligations) shall consider the energy and environment impact throughout their life, at least by setting technical specifications for energy and environmental performance or using of the impacts (energy consumption, CO2 emissions, emissions of NOx, NMHC and particulate matter) as rating factors in the award criterion.
26	Decarbonisation: GHG emissions and removals	GEO no. 71/2021 regarding the promotion of non-polluting road transport vehicles, supporting the low-emission mobility, repealing the GEO no. 40/2011 and Law no. 37/2018 regarding the promotion of ecological transport	Promoting of non-polluting road transport vehicles, energy-efficient vehicles and improving the contribution of the transport sector to the EU environmental, climate and energy policies. Replaces GEO no. 40/2011.
27	Decarbonisation: GHG emissions and removals	GEO no. 80/2018 relating to the quality of petrol and diesel fuels and introducing a mechanism to monitor and reduce greenhouse gas emissions, with subsequent amendment (Law no. 311/2018)	Reducing GHG emissions generated by the use of gasoline and diesel during the life cycle in order to reduce their negative effects on public health and the environment. In order to achieve the target, suppliers have the following obligations regarding fuels marketed to the final consumer: - diesel: biofuel content of at least 6,5% of the total volume traded in a calendar year;
28	Decarbonisation: GHG emissions and removals	Regulation (EU) 2019/1242 setting CO2 emission performance standards for new heavy-duty vehicles	Update of EU CO2 standards for trucks according to EU regulation

29	Decarbonisation: GHG emissions and removals	GD no. 116/2020 for establishing measures to apply Regulation (EU) 2018/956 on the monitoring and reporting of CO2 emissions from and fuel consumption of new heavy-duty vehicles and Regulation (EU) 2019/631setting CO2 emission performance standards for new passenger cars and for new light commercial vehicles	Establishes CO2 emissions performance requirements for new passenger cars and for light commercial vehicles in order to contribute to achieving the Union's target of reducing its GHG emissions in 2020-2030 period.
30	Decarbonisation: GHG emissions and removals	GD no. 53/2012 for establishing measures to apply Regulation (EC) no. 1222/2009 on the labelling of tyres with respect to fuel efficiency and other essential parameters	Establishes the legal and institutional framework for direct implementation of Regulation (EC) no. 1222/2009
31	Decarbonisation: GHG emissions and removals	GD no. 1417/2022 for establishing of measures for application of Regulation (EU) 2020/740 on the labeling of tyres with respect to fuel efficiency and other parameters, amending Regulation (EU) 2017/1.369 and repealing Regulation (EC) no. 1222/2009	Establishes the legal and institutional framework for direct application of Regulation (EU) 2020/740 on the labelling of tyres
32	Decarbonisation: GHG emissions and removals	GO no. 15/2002 concerning the application of use and passage toll for national road network in Romania, with subsequent amendments (including Law no. 241/2022)	Establishes the value of passage tolls and concession fees for recovering construction, operation and maintenance costs.
33	Decarbonisation: GHG emissions and removals	Regulation (EC) no. 715/2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6), with subsequent amendments	Establishes the limit values for stages Euro 5 and Euro 6 in order to reach the EU objectives on air quality.
34	Decarbonisation: GHG emissions and removals	Law no. 155/2005 amending GEO no. 12/1998 regarding Romanian railway transport and the reorganization of the Romanian National Railway Company	Foreign railway transport operators and international groups, holding a license in an EU member state, have the right to access, under reasonable terms, the Romanian railway infrastructure, for the purpose of using any type of goods railway transportation services.
35	Decarbonisation: GHG emissions and removals	Law no. 34/2017 on deployment of alternative fuels infrastructure	Establishes minimum requirements for the development of alternative fuel infrastructure, including recharging points for electric vehicles and refueling points for compressed natural gas, liquefied natural gas and hydrogen, to be implemented through national policy frameworks, and common technical specifications for recharging and refueling points, as well as user information requirements.

36	Decarbonisation: GHG emissions and removals	Modernization of the transport system	This PaM includes a set of additional measures included in planned Operational Programmes 2021-2027, focused on the development of the transport infrastructure for assuring the connectivity at the national level and between EU countries, increasing the efficiency of Romanian railways, developing the green public transport and improving the efficiency of vehicles fleet. Also, the EU Package of proposals "Fit for 55" was considered, focusing on increasing the share of energy from renewable sources in final energy consumption of transport sector. Details on measures forseen are presented in PaMs Report (chapter 3.2 Information on WAM projection scenario, 3.2.1 Energy sector - Transport)
37	Decarbonisation: GHG emissions and removals	Law no. 372/2005 regarding the energy performance of buildings, with subsequent amendments	Promoting measures to increase the energy performance of buildings, considering the exterior climate conditions and the location, the interior comfort requirements, at optimal level related costs and energy performance requirements
38	Decarbonisation: GHG emissions and removals	GD no. 55/2011 establishing ecodesign requirements for energy-related products, including EU Regulation related to ecodesign requirements for space heaters, domestic local space heaters, solid fuel boilers, solid fuel local space heaters	Ecodesign requirements applicable to energy-related products, including specific constraints on solid fuel, gas and liquid fuel boilers and stoves: standards on CO, PM and NOx emissions and energy efficiency as is established by Commission Regulation (EU) No 813/2013, Commission Regulation (EU) 2015/1188, Commission Regulation (EU) 2015/1189, Regulation (EU) 2015/1185
39	Decarbonisation: GHG emissions and removals	GD no. 217/2012 establishing the requirements for the identication by labelling and standard product information of the consumption of energy and other resources by energy-related products, amending GD no. 1039/2003.	Requirements on the labelling and energy efficiency of household refrigerating appliances, with regard to their placement on the market
40	Decarbonisation: GHG emissions and removals	GD no. 917/2012 establishing measures to apply Regulations (EU) no. 1059/2010, no. 1060/2010, no. 1061/2010, no. 1062/2010 and no. 626/2011, supplementing Directive 2010/30/EU	Requirements on the labeling and energy efficiency of certain consumer goods (household dishwashers/washing machines, household refrigerating appliances, TV sets, air conditioning installations)
41	Decarbonisation: GHG emissions and removals	GD no. 1490/2009 establishing measures for the implementation of the Regulations (EU) no. 1275/2008, no. 107/2009, no. 244/2009, no. 245/2009 and no. 278/2009, implementing Directive 2005/32/EC.	Ecodesign requirements for: electrical and electronic household and office appliances, signal conversion units, lamps for household use, fluorescent lamps, external supply sources.

42	Decarbonisation: GHG emissions and removals	GD no. 580/2011 establishing measures for the implementation of the Regulations (EC) no. 640/2009, no. 641/2009, no. 642/2009 and no. 643/2009, implementing Directive 2009/125/EC with regard to ecodesign requirements for energy-related products, amending GD no. 1039/2003 regarding labelling and energy efficiency requirements for household refrigerating appliances	Ecodesign requirements for: electric engines, circulator pumps, TV sets, household refrigerating appliances
43	Decarbonisation: GHG emissions and removals	Strategy to stimulate investments in renovating residential and commercial buildings, both public and private, existing at national level (April 2014, updated in 2017)	The draft strategy, in line with the requirements of Article 4 of Directive 2012/27/EU on energy efficiency, establishes the key successive stages for renovating the national building patrimony
44	Decarbonisation: GHG emissions and removals	GD no. 1034/2020 for approval of National Long-term Renovation Strategy to support the renovation of the national residential and non residential building stock, public and private, into a highly efficient and decarbonized buiding stock by 2030	The National Long-term Renovation Strategy promotes the renovation of the national residential and non residential building stock, public and private, into a highly efficient and decarbonized buiding till 2050, facilitating the cost-effective transformation of existing buildings into buildings with almost zero energy consumption. The strategy includes a roadmap with measurable measures and progress indicators established at national level, which includes indicative milestones for 2030, 2040 and 2050 and specifies their contribution to meet the EU's energy efficiency targets.
45	Decarbonisation: GHG emissions and removals	Modernization of the residential sector	This PaM includes a set of additional measures included in planned Operational Programmes 2021-2027 and support schemes to increase the connection rate to centralized thermal energy supply systems, to promote the use of renewable energy sources and to equip residential buildings with high energy performance equipment. Also, the EU Package of proposals "Fit for 55" was considered, focusing on increasing the share of energy from renewable sources in final energy consumption of residential sector. Details on measures forseen are presented in PaMs Report (chapter 3.2 Information on WAM projection scenario, 3.2.1 Energy sector - Energy consumption)
46	Decarbonisation: GHG emissions and removals	Modernization of the services sector	This PaM includes a set of additional measures included in planned Operational Programmes 2021-2027 and support schemes to promote the use of renewable energy sources. Also, the EU Package of proposals "Fit for 55" was considered, focusing on increasing the share of energy from renewable sources in final energy consumption of service sector and implementation of energy efficiency measures for reduction of final energy consumption, through renovation of buildings owned by public bodies. Details on measures forseen are presented in PaMs Report (chapter 3.2 Information on WAM projection scenario, 3.2.1 Energy sector - Energy consumption)
47	Decarbonisation: GHG emissions and removals	Modernization of the agricultural sector	Support schemes to promote the use of renewable energy sources (solar panels, heat pumps).
48	Decarbonisation: GHG emissions and removals	Directive 40/2006/EC (MAC Directive) on emissions from air conditioning systems of the motor vehicles	MAC Directive provides the gradual replacement of air-conditioning systems using HFC-134a. It also limit the possibility of retrofitting motor vehicles with air conditioning systems designed to contain fluorinated greenhouse gases with a global warming potential higher than 150 and prohibit the charging of the air conditioning systems with such gases.

49	Decarbonisation: GHG emissions and removals	Regulation (EU) no. 517/2014 related fluorinated greenhouse gases	Regulation lays down rules on the containment, use, recovery and destruction of F gases and prohibits the sale of certain products containing F-gases. Also, sets an annual limit on the overall climate impact of HFC which will be phased out between 2015 and 2030.Annual limit for HCF quantities placed on the market in 2030 represent 21% of 2009-2012 levels.
50	Decarbonisation: GHG emissions and removals	The Amendament of the Montreal Protocol on substances that deplete the ozone layer, adopted in Kigali, on the XXVIII at Conference of Parties	The Kigali Amendment sets emission limits for substances in category F (HFCs and HCFCs) by 2045. Each Party shall also establish and implement a licensing system for the import and export of new, used, recycled and recovered controlled substances.
51	Decarbonisation: GHG emissions and removals	National Competitiveness Strategy 2021-2027	Enables the development of a coherent action plan regarding the implementation and evaluation of public policies that is coordinates at the level of the institution, with the aim of increasing Romania's economic competitiveness, mainly targeting economic fiels, research and development, education, labour market, public institution, and regulation. The objectives of the strategy aim at the industrial modernization of enterprioses, including by supporting the mechanisms of the circular economy and the collaborative economy and supporting the digital transformation process (Industry 4.0) to increase the degree of competitiveness of enterprises.
52	Decarbonisation: GHG emissions and removals	Strategy for Circular Economy 2030	The general objective of the National Strategy on Circular Economy in Romania is to provide the framework to guide the country in its efforts to transition to Circular economy through the implementation of the Action Plan. The success indicator of this transition is the decoupling of economic development from the use of natural resources and environmental degradation. The overall objective of the strategy is closely linked to the Sustainable Development Goals (SDGs) of the UN 2030 Agenda and the global climate goals, as well as the new EU goals of the Circular Economy Action Plan (PAEC), in line with the principles and actions promoted within the EU Green Deal.
53	Decarbonisation: GHG emissions and removals	Water Law no. 107/1996	Preserving, developing and protecting water resources, defense against flooding, gradual reduction of underground water pollution and prevention of subsequent pollution, preserving and protecting aqueous ecosystems. The Water Law no. 107/1996 sets up the obligation and establishes the legal framework for the development of water branch management plans that are intended to: - prevent deterioration, improve and restore the surface of water bodies, achieve good chemical and ecological status and reduce pollution from discharges and emissions of hazardous substances; - protect, enhance and restore the state of underground water, prevent their pollution or damage and ensure the balance between consumption and recharge.
54	Decarbonisation: GHG emissions and removals	National Rural Development Programme 2014-2020 (PNDR 2014-2020)	PNDR 2014-2020 adresses the following strategic priorities: - Restructuring and increasing the viability of agricultural holdings; - Sustainable management of natural resources and combating the climate change;
55	Decarbonisation: GHG emissions and removals	Order no. 226/235/2003 for the approval of the Strategy regarding the organization of the activity of improvement and exploitation of meadows at the national level, in the medium and long term	The order includes the technical, organizational and economic-financial measures necessary for the improvement of the meadows must be included in the framework of pastoral arrangements drawn up for each pasture.

56	Decarbonisation: GHG emissions and removals	GD no. 964/2000 on the approval of the Action Plan for water protection against pollution with nitrates of agricultural origin	Approves the Action Plan for water protection against the pollution with nitrates from agricultural sources
57	Decarbonisation: GHG emissions and removals	Order no. 344/708/2004 approving the technical rules on environment protection, particularly soil protection, when using sludge in agriculture	"Establishes the concentration of heavy metals in soil to which sludge is applied, concentration of the heavy metals in sludge, the maximum annual concentration of heavy metals which may be introduced into cultivated soils and the criteria for evaluation of soil suitability in sludge application. Promoting the use of sewage sludge on agricultural land reduce the level of applied synthetic fertilisers."
58	Decarbonisation: GHG emissions and removals	GD no. 1261/2007 establishing measure for implementation of the Regulation (EC) no. 2003/2003 relating to fertilisers	Established the institutional framework for the direct implementation of Regulation (EC) no. 2003/2003 relating to fertilisers, and determines and sanctions misdemeanors against the fertilizers regulations
59	Decarbonisation: GHG emissions and removals	GEO no. 3/2015 approving payment schemes applicable in agriculture within the period 2015-2020, with subsequent amendments	Approves payment schemes, as support and guarantee mechanisms for farmers and economic operators, namely direct payment schemes and national transitional aid, applicable in agriculture within the period 2015-2020. The direct payment schemes are: single area payment scheme; redistributive payment; payment for benefic agricultural practices for climate and environment; payment for young farmers; coupled support scheme; simplified scheme for small farmers. The transitional national aids are granted for vegetable and livestock areas within the annual budgets allocated to the Ministry of Agriculture and Rural Development.
60	Decarbonisation: GHG emissions and removals	The new Common Agricultural Policy (2023-2027)	CAP is a key tool for supporting resilience in the farming sector and rural areas, providing food security and enabling the transition to sustainability. All farmers receiving CAP income support must comply with a set of statutory management requirements and basic standards for environment and climate GAECs, called 'conditionality'. These conditions were considerably strengthened compared to the 2014-2022 CAP, among others by including upgraded 'greening' requirements.
61	Decarbonisation: GHG emissions and removals	GD no. 1571/2022 establishing the general framework for the implementation of interventions related to the plant and animal husbandry sectors within the Strategic CAP Plan 2023-2027, financing from the European Agricultural Guarantee Fund and the state budget.	CAP Plans support a wide range of interventions addressing the specific needs of Member States and their territories. Designed in line with a new result- and performance-oriented approach, they aim to deliver tangible results in relation to EU-level CAP specific objectives, while contributing to the European Green Deal. For the first time, each CAP Plan defines a strategy covering all the main CAP funded instruments: direct payments, support for rural development and interventions specific to certain market sectors. Romania's Plan is aligned with the EU's environmental and climate ambitions and aims at mitigating and adapting to climate change, sustainable development, efficient management of natural resources (water, soil, air) and conservation of biodiversity and landscapes.
62	Decarbonisation: GHG emissions and removals	Order 352/636/54/2015 for the approval of the rules regarding eco-conditionality within the schemes and support measures for farmers in Romania, with subsequent amendments.	The rules regarding eco-conditionality within the schemes and support measures for farmers in Romania.

63	Decarbonisation: GHG emissions and removals	Order no. 269/2020 of the Ministry of the Environment, Waters and Forests through which the general guide applicable to the stages of the environmental impact assessment procedure, the guide for environmental impact assessment in a cross-border context and other specific guidelines for different fields and categories of projects were approved	With the Order no. 269/2020 of the Ministry of the Environment, Waters and Forests were approuved the general guide applicable to the stages of the environmental impact assessment procedure, the guide for environmental impact assessment in a cross-border context and other specific guidelines for different fields and categories of projects such as the guide for facilities for the intensive breading of farm animals, including meat poultry, egg-laying poultry, pigs and sows.
64	Decarbonisation: GHG emissions and removals	WD 13341/2022 EU Methane Action Plan - EEAS	The EU commitment to the Global Methane Pledge rests on a long-term policy goal to reduce greenhouse gas emissions towards climate neutrality by 2050, which will require further deep CH4 emission reductions building on a solid abatement record over the last decades. In WAM scenario is expected to improving the feed quality for livestock, increase methane recovery from anaerobic fermentation of manure, modern methods of fertilizer application, according with EU Methan Action Plan.
65	Decarbonisation: GHG emissions and removals;Energy efficiency	National Rural Development Programme 2014-2022 (PNDR 2014-2022)	It is a non-reimbursable EU financial instrument to support rural development and unlock rural economy and life. It contributes to the implementation of rural development priorities to meet national strategic objectives and EU CAP objectives. A large number of measures and sub-measures included in the PNDR have an implicit potential to support GHG reduction and adaptation actions in LULUCF.
66	Decarbonisation: GHG emissions and removals	Government Decision no. 739/2016 for the approval of the Romania's national strategy regarding climate change and economic growth based on low carbon emissions (NSCCE)	Promoting the transfer of knowledge and advisory services on climate change issues between farmer; Investment support for farm modernization; Promoting good agricultural practice; Promoting carbon sequestration in agriculture.
67	Decarbonisation: GHG emissions and removals	Joint Order no. 352/636/54/2015 on cross-compliance in support schemes and measures for farmers in Romania	Increasing the cropland and grassland quality throug is SOC increases in mineral soils; Reduction of GHG emission levels.
68	Decarbonisation: GHG emissions and removals	National Support Program in the Wine Sector	The important activities provided for in the "National Support Program for Vineyards and Wine Producers for the period 2019-2023", in the context of climate change, refer to the conversion of varieties, including grafting, relocation of vineyards, replanting as a result of mandatory deforestation, phytosanitary or sanitary products , as well as the modernization of vineyards
69	Decarbonisation: GHG emissions and removals	GD on the organisation, management and use of permanent pasture land in support of the implementation of GEO 34/2013, in accordance with Regulation 1234/2007 EC	It focuses on improving the management of grazing land and conserving its total area as of 1 January 2007, although without land conversion restrictions.

70	Decarbonisation: GHG emissions and removals	Romania's National Strategy for Sustainable Development 2030 (GD 754/2022; GD 877/2018)	The strategy supports the development of Romania on three main pillars, namely economic, social and environmental. The strategy aims to strengthen Romania's capacity to adapt and resilience to combat the dangers of climate change and natural disasters by integrating measures to mitigate and adapt to climate change and natural disasters in both national strategies and policies and in planning and increasing the level of climate change education and awareness.
71	Decarbonisation: GHG emissions and removals	EU Farm to Consumer Strategy	Is one of the key actions in the European Green Deal, helping to achieving EU climate neutrality by 2050, a strategy that takes into account the evolution of the current EU food system towards a sustainable model.
72	Decarbonisation: GHG emissions and removals	EU Biodiversity Strategy for 2030	It is the cornerstone of biodiversity protection in the EU. The main actions to be taken by 2030 include: (i) the creation of protected areas covering at least 30% of the EU's land and sea area, extending the coverage of existing Natura 2000 areas; (ii) restoring degraded ecosystems across the EU by 2030 through a number of specific commitments and measures, including a 50% reduction in pesticide use and associated risk by 2030 and the planting of 3 billion trees across the EU; (iii) allocating EUR 20 billion per year to protect and promote biodiversity through EU funds and by mobilizing national and private sources of funding; (iv) creating an ambitious global biodiversity framework.
73	Decarbonisation: GHG emissions and removals	Government Decision no. 1076/2021 for the approval of the National Integrated Plan in the field of energy and climate change 2021-2030	Following the EU's accession to the Paris Agreement and with the publication of the Energy Union Strategy, the Union assumed an important role in combating climate change, through the 5 main dimensions: energy security, decarbonization, energy efficiency, the internal energy market and research, innovation and competitiveness.
74	Research, innovation and competitiveness	Decision No. 933/2022, National Strategy of 20 July 2022 for research, innovation and smart specialization 2022, 2027	The strategy foresees the concept of bioeconomy through seeds and genotypes improvement as well as advanced technologies, which contributes to the development of the forest sector, agroforestry, hunting management, and cropland ecology.
75	Decarbonisation: GHG emissions and removals	Decision no. 195/2022 for the approval of the State Aid Scheme regarding the support of investments intended to promote the production of energy from less exploited renewable sources, namely biomass, biogas, geothermal energy, and the State Aid Scheme regarding the support of investments in high-efficiency cogeneration	It is designed as an aid scheme regarding investments promoting energy production from less exploited renewable sources, such as biomass, biogas, and geothermal energy, and acquisitions in high-efficiency cogeneration energy-producing installations. In principle, the goal is targeted towards a more efficient economy regarding resources. Moreover, it stresses the achievement of EU objectives regarding the use of energy from renewable sources, the increase in production, the share of energy from renewable sources, and the reduction of carbon emissions in the atmosphere.
76	Decarbonisation: GHG emissions and removals	Law no. 254 of July 20, 2022 for the amendment and completion of the Land Fund Law no. 18/1991 and other normative acts	The land fund law is updated with the possibility of placing investment objects on quality class III, IV, and V agricultural lands. The specific investment has to be the production of electric energy from renewable sources: production capacity of solar energy, wind energy, energy from biomass, bioliquids, and biogas on agricultural land located outside the village with a maximum area of 50 ha.

77	Decarbonisation: GHG emissions and removals	Law no. 248 of July 20, 2022 regarding the approval of the Government's Emergency Ordinance no. 143/2021 for the amendment and completion of the Electricity and Natural Gas Law no. 123/2012, as well as for the modification of some normative acts	The amendment and completion of the Electricity and Natural Gas Law no. 123/2012 encourages the production of electrical energy from renewable sources. It guarantees that the produced energy is received into the national grid. Participation in energy sector activities of local energy communities is ensured. At the same time, prosumers are exempted from the obligation to purchase annual and quarterly green certificates provided in Law no. 220/2008 for electricity produced from renewable sources and used at the place of production for their own final consumption. At the same time, the same producers can conclude directly negotiated contracts only with the final consumer suppliers for the sale of green certificates issued for the electricity produced and delivered.
78	Decarbonisation: GHG emissions and removals	Decision No. 1.172 of September 21, 2022 for the approval of the National Strategy for Forests 2030	The strategy will provide the necessary tools for implementing decisions regarding efficient resource use and cascading use of wood, dependence on primary resources, and harmful emissions, simultaneously changing the economic model and creating the premises for increasing the number of new jobs. Moreover, it foresees the establishment of a more accurate data about wood and forests, increasing the use of wood and enhancing ecosystem services, supporting initiatives on cross-sectoral coordination and capacity building between actors in the forest sector, regulating timber control through a chain of custody instrument (SUMAL).
79	Decarbonisation: GHG emissions and removals	National Recovery and Resilience Plan (PNRR), 2021-2026	The plan tackles forestry in Part 2 - Forests and biodiversity protection with investments towards afforestation and reforestation, enhancing and establishing new tree nurseries, updated management plans for strictly protected habitats; forest restoration and species conservation as well as watershed protection. It also supports the implementation of other national policies such as PNIESC 2021-2030 and National forest strategy 2030.
80	Decarbonisation: GHG emissions and removals	Law no. 211/2011 regarding waste management, with subsequent amendments	Establishes requirements for preventing and reducing the adverse impact of the generation and management of waste. Starting with 2012, the public local authorities shall assure the separate collection for at least paper, metal, plastic and glass. Also, till 2020, the produces and the local public authorities shall achieve a preparation level for reuse and recycling (at least 50% of the total waste mass - paper, metal, plastic, glass from municipal waste) and a preparation level for reuse, recycling and other recovery operation (at least 70% of the non hazardous waste mass from construction and demolition activities).
81	Decarbonisation: GHG emissions and removals	GEO no. 92/2021 regarding waste management, approved by Law no. 17/2023	The GEO establishes measures to prevent and reduce the generation of waste, to reduce the adverse effects determined by the generation and management of waste and to reduce the general effects determined by the use of resources and to increase the efficiency of their use, for ensuring the transition to a circular economy and guaranteeing long-term competitiveness. Repeals Law no. 211/2011 regarding waste management
82	Decarbonisation: GHG emissions and removals	GD no. 942/2017 approving the National Waste Management Plan	Includes clear and coherent measures to achieve the objectives of preparation for reuse and recycling of waste
83	Decarbonisation: GHG emissions and removals	Law no. 249/2015 regarding the method of managing packaging and packaging waste, with subsequent amendments	Establishes the measures intended to prevent the production of packaging waste, the reuse of packaging, recycling and other forms of recovery of packaging waste and, consequently, the reduction of the final disposal of such waste

84	Decarbonisation: GHG emissions and removals	GEO no. 5/2015 regarding waste from electric and electronic equipment	Establish measures to protect the environment and public health by preventing or reducing the negative effects of the generation and management of waste electrical and electronic equipment, by reducing the overall effects of the use of resources and by improving the efficiency of the use of these resources,
85	Decarbonisation: GHG emissions and removals	GD no. 349/2005 on landfill of waste, amended and supplemented by GD no. 201/2007 and GD no. 1292/2010	Establishes the national targets concerning the reduction of the quantities of biodegradable waste landfilled, comparing to the year 1995, in line with transition period. Also, establishes the compliance calendar for the existing landfills (41 non-compliant municipal landfills in operation between 2013-2017, shall stop operating by 2017).
86	Decarbonisation: GHG emissions and removals	GEO no. 2/2021 on landfill of waste	The GEO, repealing the GD no. 349/2005, establishes the legal framework for carrying out the activity of waste storage, by progressively reducing the disposal by storage of waste that can be recycled or recovered and introduces measures to prevent and reduce negative effects on the environment and population health
87	Decarbonisation: GHG emissions and removals	Law no. 181/2020 regarding the management of compostable non-hazardous waste	Establishes the legal framework for carrying out non -hazardous compostable waste management activities, by recycling/reuse the anaerobic compost/digestion option, in order to protect human health and the environment.
88	Decarbonisation: GHG emissions and removals	GD no. 188/2002 for the approval of certain norms concerning the conditions of discharging the waste water into aquatic environment, with subsequent amendments	"Establishes the requirements concerning the collection systems, treatment and discharge of waste water, in line with the transition periods: - collection of urban waste water - compliance to be ensured by December 31st 2013 (agglomerations with more than 10,000 inhabitants), respectively by December 31st 2018 (agglomerations with less than 10,000 inhabitants); - treatment and discharge of urban waste waters – compliance to be ensured by December 31st 2015 (agglomerations with more than 10.000 inhabitants), respectively by December 31st 2018 (agglomerations with less than 10.000 inhabitants)."
89	Decarbonisation: GHG emissions and removals	Improving solid waste management	This PaM includes a set of additional measures included in planned Operational Programmes 2021-2027, focused on improving solid waste management, through efficient waste management in order to accelerate the transition to the circular economy. Details on measures forseen are presented in PaMs Report (chapter 3.2 Information on WAM projection scenario, 3.2.5 Waste sector)
90	Decarbonisation: GHG emissions and removals;Energy efficiency;Internal energy market	Combustion in Energy Industry and Manufacturing and Construction Industry sectors WEM (with existing measures)	Reduction of GHG emissions in Energy Industry and Manufacturing and Construction Industry sectors
91	Decarbonisation: GHG emissions and removals;Energy efficiency	Transport WEM (with existing measures)	Reduction of GHG emissions in Transport sector
92	Decarbonisation: GHG emissions and removals;Energy efficiency	Other sectors (services, residential, agriculture)	Reduction of GHG emissions in Other sectors
93	Decarbonisation: GHG emissions and removals	Industrial Processes and Product Use sector	Reduction of GHG emissions in Industrial Processes and Product Use sector
94	Decarbonisation: GHG emissions and removals	Agriculture	Reduction of GHG emissions in Agriculture sector
95	Decarbonisation: GHG emissions and removals	LULUCF WEM (with existing measures)	Reduction of GHG emissions in LULUCF sector

96	Decarbonisation: GHG emissions and removals;Energy efficiency	Waste WEM (with existing measures)	Reduction of GHG emissions in Waste sector
97	Energy efficiency;Decarbonisation: GHG emissions and removals	Combustion in Energy Industry and Manufacturing and Construction Industry sectors WAM (with additional measures)	Reduction of GHG emissions in Energy Industry and Manufacturing and Construction Industry sectors
98	Decarbonisation: GHG emissions and removals	Transport WAM (with additional measures)	Reduction of GHG emissions in Transport sector
99	Decarbonisation: GHG emissions and removals	Other sectors (services, residential, agriculture)	Reduction of GHG emissions in Other sectors
100	Decarbonisation: GHG emissions and removals	Industrial Processes and Product Use sector	Reduction of GHG emissions in Industrial Processes and Product Use sector
101	Decarbonisation: GHG emissions and removals	Agriculture	Reduction of GHG emissions in Agriculture sector
101	Decarbonisation: GHG emissions and removals	Agriculture	Reduction of GHG emissions in Agriculture sector
102	Decarbonisation: GHG emissions and removals;Research, innovation and competitiveness	LULUCF WAM (with additional measures)	Reduction of GHG emissions in LULUCF sector
103	Decarbonisation: GHG emissions and removals	Waste WAM (with additional measures)	Reduction of GHG emissions in Waste sector

ANNEX II

Implementation of the Directive 2009/31/EC of the European Parliament and of the Council Of 23 April 2009 on the geological storage of carbon dioxide

Main features and requirements in the Directive 2009/31/EC on the geological storage of carbon dioxide

The purpose of the Directive 2009/31/EC of the European Parliament and of the Council Of 23 April 2009 on the geological storage of carbon dioxide (hereinafter: CCS Directive) is to establish a legal framework for the environmentally safe geological storage of carbon dioxide (CO2) to contribute to the fight against climate change, thus preventing, and, where this is not possible, eliminating as far as possible negative effects and any risk to the environment and human health.
According to the CCS Directive, carbon capture consists of the capture of CO2 from industrial installations, its transport to a storage site and its injection into a suitable underground geological formation for the purposes of permanent storage. However, Carbon capture and storage should not serve as an incentive to increase the share of fossil fuel power plants and should not lead to a reduction of efforts to support energy saving policies, renewable energies and other safe and sustainable low carbon technologies, both in research and financial terms.

According to the CCS Directive, EU Member States are entitled to determine the areas within their territory from which storage sites may be selected. The selection of the appropriate storage site is crucial to ensure that the stored CO2 will be completely and permanently contained. Member States should, in selecting storage sites, take account of their geological characteristics, for example seismicity, in the most objective and effective way possible. A site should therefore only be selected as a storage site, if there is no significant risk of leakage, and if in any case no significant environmental or health impacts are likely to occur. The storage of CO2 in the water column should not be permitted.

The selection of the site shall be result of the exploration activity based on the permit. Permits shall be granted on the basis of objective, published and non-discriminatory criteria. In order to protect and encourage exploration investments, exploration permits should be granted for a limited volume area and for a limited time during which the holder of the permit should have the sole right to explore the potential CO2 storage complex. If no activities are carried out within a reasonable time, the exploration permit shall be withdrawn and can be granted to other entities. Storage sites must be operated on the basis of a storage permit. The storage permit should be the core instrument to ensure that the substantial requirements of this Directive are met and that geological storage therefore takes place in an environmentally safe way. In the granting of the storage permit, priority should be given to the holder of the exploration permit over competitors, as the former will generally have made substantial investments.

National legislation and regulation on exploration and geological storage of carbon dioxide

The CCS Directive in Romania has been transposed through Law 114/2013 on approval of Government Emergency Ordinance 64/2011, given to the fact that GEO 64/2011 that was in effect prior to adoption of the law only provided a minimal institutional set-up and it was lacking procedures such as authorization, monitoring, and control. In that respect, the Law 114/2013, together with specific procedures for granting exploration and storage permits for CO2 geological storage sites issued by National Agency for Mineral Resources (ANRM) as competent authority both for CO2 geological storage and for hydrocarbon operations, provides the general legal framework for safe geological storage of carbon dioxide.

The Law 114/2013 shall be implemented by the following sub laws and procedures issued subsequently:

I. **Procedure for granting the exploration permit for CO2 geological storage**, issued in 2015 by ANRM as a competent authority for CCS operations, set up a dedicated service for CO2 geological storage in 2013, which coordinates the elaboration of procedures for granting exploration and storage permits. According to this Procedure operators may ask for ANRM an opportunity analysis for underground CO2 storage in a selected perimeter. In case the analysis is favourable, ANRM issues a selection of offers for that perimeter. Alternatively, the agency can issue a list of opportune perimeters and call for exploration offers. The selection of offers is based on a set of criteria established by ANRM, with the most favorable bidder further negotiating for supplemental exploration works and a plan for environmental restoration. Once the final documents are agreed upon, ANRM issues the exploration permit and puts it up for 30 days for public consultations. The final exploration permit is issued by ANRM for the duration of works proposed in the offer, with a 2-year possible extension for additional works, if needed for evaluating the capacity of the storage complex.

II. **Procedure for granting the CO2 geological storage permit** issued through Decision 16/2017 of the ANRM President. According to this Procedure, the holder of an exploration license can directly obtain the storage permit if it submits the application during the validity of the exploration license and provided it has met all exploration obligations (at a minimum, technical documentation on the planned storage site and its spatial delimitation). The owner of a petroleum agreement can also directly obtain a CO2 storage permit if it submits the application before the end of the agreement, provided all the conditions specified in it were fulfilled. In case there is neither exploration license holder nor eligible owner of a petroleum agreement, ANRM can grant storage permits competitively, by means of a bidding process. This process is detailed in ANRM Procedure 16/2017, but no bidding process has taken place or been published to date. ANRM is obliged to notify the European Commission within 30 days of the tender completion by sending the request for storage permit, accompanied by all the related documents. In up to four months,

the European Commission shall issue a non-binding opinion. ANRM takes this non-binding opinion into consideration, modifies the draft storage permit if necessary, and initiates public consultation (lasting for 30 days). In 15 days from the end of public consultation, ANRM may include public proposals in the draft storage permit.

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III. **Guideline for preparing the documentation by operators/owners: Notification regarding the abandonment of offshore wells and disaffecting the facilities** issued in December 2018 by ACROPO (Regulatory Authority for Offshore Petroleum Operation in the Black Sea). ACROPO was established in 2016 with the task of regulating and monitoring the safety of offshore petroleum operations, as well as to counsel ANRM on granting future of offshore petroleum licences in the Black Sea. The Guidelines are mandatory for operators, owners, and subcontractors with activities in the Black Sea who must document any substantial changes brought to an offshore facility, as well as moving away from a fixed facility. Such operations bring an opportunity to reuse depleted offshore hydrocarbon wells in different ways, including CO2 injection and storage.

National Institutional framework

In Romania, the central public authorities have sole legal competence for framing and implementing policies on geological storage of CO2.

- **ANRM** is under the direct coordination of the Romanian Government. Given the similarities and notable experience in standardizing the oil and gas extraction activities, ANRM stands as the main implementing authority for capture and geological storage of CO2, being responsible for issuing exploration and storage licenses, developing specific procedures, registering the granted storage permits, approving responsibility transfer and verifying compliance with the legal requirements during operation, closure, and post-closure periods. As a rule, ANRM also coordinates the assessment of the storage sites and the available storage capacity. According to the reasoning document for GEO 64/2011, ANRM's attributions and competencies shall be enlarged. However, to this date the CO2 geological service is still underdeveloped, with no more than two persons running the office.
- **ANRE** is mandated to issue transport licences for CO2 while ensuring transparent and non-discriminatory access to the CO2 transport networks. To this date, no standing order has been the subject of public consultation or approval.
- **Local authorities** (City Hall, County Council) play an essential role, conducive to the issuance of building permits for transport pipelines or any plans for site construction under their jurisdiction.
- **The Ministry of Environment, Waters and Forests** has a rather supervisory role, with no substantial attributions.
- **The National Guard on Environment** (NGE) is responsible for monitoring sites through routine and impromptu inspections.
- **The National Environmental Protection Agency** (ANPM) approves the monitoring plans proposed by operators.
- **The Ministry of Energy** develops and implements the National Energy Strategy or any other strategic or programmatic document related to the energy sector.
- **The Ministry of Economy**'s role is underdetermined for CCS/CCU projects, although back in 2010, the Ministry of Economy, Trade and Business Environment was the main authority responsible for the GETICA CCS pilot project, and should have drafted and approved the support schemes for CCS technologies.

Conclusions and next steps

Following the transposition of the CCS Directive and subsequent legislative acts, no new central institution was set up for the implementation of the geological storage of CO2 in Romania. The legislation in force and the existing governance structure appears very fragmented. For every phase of the process, several hurdles must be overcome. Due to the novelty of the capture technology and lack of experience at institution level,

various challenges are expected for the environmental impact assessment, which is critical to the issuance of the building permits.

In case of leakage and non-compliance with the existing standards, ANRM is the empowered institution that can impose measures to the detriment of the Ministry of Environment, Waters and Forests. The National Environmental Guard (NEG) is in charge of routine investigation, whereas the ANRM will take any necessary measures following these investigations. The division of responsibilities between the National Environmental Guard and the ANRM is an unusual institutional arrangement and may affect the effectiveness of intervention in the case of harm caused to the environment or human health by storage projects.

Law 255/2010 on expropriation for public utility purposes should be amended to include CCS projects as projects of public utility, which would reduce the bureaucratic burden of the terms and procedures for obtaining required approvals. The provisions of this law do not apply to the environmental permitting procedures.

So far, no exploration permit for CO2 storage has been issued, although the secondary legislation for granting exploration permits and storage permits has been established.

It should be noted that CCS and CCU are notably absent from Romania's national energy strategy and National Energy and Climate Plan 2021-2030. Two carbon capture and utilization projects were proposed as part of Romania's Recovery and Resilience Plan, involving the injection of hydrogen into gas turbines, capturing CO2 released from combustion, and transporting it to local greenhouses for use. The rationale behind these projects, proposed as hydrogen demonstrators, is unclear, and indeed they have been criticized for lack of transparency in establishing the implementing consortium.

Neither GEO 64/2011, nor Law 114/2013 contain any provisions for offshore storage projects. Such terms are not even mentioned in the content of the legislation. Most likely though, in practice, distinct regulations will have to be put in place for offshore projects.

Romania does not yet have specific regulations and standards for CO2 wells or for the reuse of oil wells. Romanian regulatory acts only establish the conditions for temporary and permanent abandonment of wells, the lifting of abandonment and the transfer of assets between hydrocarbon license holders.

Technical projects for conservation and abandonment (including technical ones for lifting the abandonment/conservation of wells) drawn up by the holder, plus the approvals/agreements issued by the ANRM do not contain data about the geological resources and oil reserves within the commercial deposit.

The transfer of rights is permitted only for hydrocarbon operations so far. The title holder of any oil agreement may transfer its acquired rights and obligations to another operator with the explicit approval of ANRM.

According to GEO 64/2011, the development works of CO2 transport and storage are of national interest, which may help reduce the permitting timeframe; however, care must be taken in "fast-forwarding" projects of national interest and bypassing public engagement phases. An understanding of the legal framework related to full chain CCS technologies should be continuously enhanced through knowledge transfer workshops and conferences at international, EU and national level, including requirements for public consultation and public awareness. The aims of CCS knowledge-sharing and communication strategy are developing an appropriate legal framework through institutional capacity-building, and raising public awareness on to the role of CCS in mitigating climate change.

The opportunities for public participation in decision-making on CCS are weak and unsatisfactory. There is no dedicated public body in Romania responsible for dealing with public engagement in CCS projects, and the opportunities for participation of local communities and non-governmental organisations are rather limited.

Institutional capacity needs to be improved for the permitting process, with key local authorities and agencies to be involved from the early stages of the process. The environmental authorities must decide upon the divided or integrated approach of the CCS components. For a coherent approach, the establishment of small

inter-ministerial working groups, and the elaboration of action plans assigning responsibilities at ministerial level would be considered as advisable.