INTEGRATED NATIONAL ENERGY AND CLIMATE PLAN OF ROMANIA

2025-2030 Update

October 2024

Content

List of figures

List of tables

List of abbreviations

ACER	European Union Agency for the Cooperation of Energy Regulators
ACROPO	Competent Authority for the Regulation of Offshore Oil and Gas Operations in the Black Sea
ACUE	Federation of Associations of Energy Utility Companies
ADR	Regional Development Agency
AFEER	Romanian Energy Suppliers Association
AFIR	Agency for Funding Rural Investments
AFM	Environment Fund Administration
AHE	Pump storage
Amcham Romania	American Chamber of Commerce in Romania
ANRE	National Energy Regulatory Authority
ANPM	National Environmental Protection Agency
ANRMPSG	National Regulatory Authority in the Mining, Petroleum and Geological Storage of Carbon Dioxide
ANSVSA	National Sanitary Veterinary and Food Safety Authority
ARPEE	Romanian Association for Promoting Energy Efficiency
BAT	Best Available Technologies
BR4	4th Biennial Report of Romania under UNFCC
BR5	5^{h} Biennial Report of Romania under UNFCC
BRUA	The Development of the Romanian Gas Transmission System along Bulgaria – Romania – Hungary – Austria Route project
CCGT	Combined-Cycle Gas Turbine
CANDU	Canada Deuterium Uranium
CCS	Carbon Capture and Storage
CCU	Carbon Capture and Utilisation

CCUS	Carbon Capture, Utilisation and Storage
CDI	Challenge-Driven Innovation
CESEC	Central and South Eastern Europe Energy Connectivity initiative
CHP	Combined Heat and Power
CINEA	European Climate, Infrastructure and Environment Executive Agency
CNG	Compressed Natural Gas,
CNSP	National Commission for Strategy and Prognosis
DDD	Department of Sustainable Development
DG ENER	Directorate-General for Energy of the European Commission
DG REFORM	Directorate-General for Structural Reform Support of the European Commission
EC	European Commission
EEA	European Environment Agency
EEEF	European Energy Efficiency Fund
EF	Emission Factor
EIB	European Investment Bank
EIS	European Innovation Scoreboard
EMAS	Eco-Management and Audit Scheme
ENTSO-E	European Network of Transmission System Operators for Electricity
ENTSOG	European Network of Transmission System Operators for Gas
ESIF	European Structural and Investment Funds
ESCO	Energy Service Company
EU ETS	European Union Emission Trading System
EUA	European Union Allowance
EUAA	European Union Aviation Allowance

EU	European Union
EUR	Euro
EUTL	European Union Transaction Log
FEED	Front-End Engineering Design
FPPG	Oil and Gas Employers' Federation
GD	Government Decision
GEO	Government Emergency Ordinance
GERD	Gross domestic Expenditure on Research & Development
GHG	Greenhouse Gas
GNM	National Environmental Guard
GO	General Objective
HDD	Heating Degree-Days
HENRO	Electricity Producers Association
HFC	Hydrofluorocarbon
HGV	Heavy Goods Vehicle
HPP	Hydro Power Plant
HU-RO	Hungary – Romania cross-border AC transmission interconnection grid project (TR 259 in ENTSO-E TYNDP 2022)
ICT	Information and Communication Technology
IF	Innovation Fund
INEGES	National Inventory of GHG
INS	National Institute of Statistics
IOGP	International Association of Oil & Gas Producers
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use

JTF	Just Transition Fund
LCV	Light Commercial Vehicle
LEAP	Low Emission Analysis Platform
LEAP_RO	The energy and climate predictions model specifically elaborated for the Romanian LTS and also employed for the updated NECP
LIFE	Financial Instrument for the Environment (L'Instrument Financier pour l'Environnement)
LPG	Liquefied Petroleum Gas
LTS	Long-Term Strategy of Romania
LULUCF	Land Use, Land-Use Change and Forestry
MAC	Mobile Air-Conditioning Systems
MADR	Ministry of Agriculture and Rural Development
MCID	Ministry of Research, Innovation and Digitalization
MDLPA	Ministry of Development, Public Works and Administration
ME	Ministry of Energy
MEAT	Ministry of Economy, Entrepreneurship and Tourism
MF	Modernisation Fund
MIPE	Ministry of European Investments and Projects
MMAP	Ministry of Environment, Waters and Forests
MMSS	Ministry of Labor and Social Solidarity
MPGT	General Transport Master Plan of Romania
Mtoe	Mega tonne oil equivalent
MTI	Ministry of Transport and Infrastructure
NECP	National Energy and Climate Plan
NEEAP	National Energy Efficiency Action Plan (2017)
NIR	National Inventory Report

NPP	Nuclear Power Plant
NSCE	National Strategy for the Circular Economy
NTC	Net Transfer Capability
NZEB	Nearly Zero Energy Building
NZIA	Net-Zero Industry Act
ODS	Ozone-Depleting Substances
OER	Cities Energy in Romania Association
OHL	Overhead Line
OPEED	Designated Operator of the Electricity Market
NC8	Romania's Eighth National Communication under the UNFCCC
NUTS	Nomenclature of Territorial Units for Statistics
PAC	Strategic Plan for Common Agricultural Policy 2023-2027
PAM	Policy and Measure
PCI	Project of Common Interest
PCIDIF	Smart Growth, Digitalization and Financial Instruments Program 2021-2027
PDD	Sustainable Development Program 2021-2027
PDSNT 2022-2031	Development Plan for the National Natural Gas Transport System covering the period 2022-2031
PEO	Education and Employment Program 2021-2027
PNASC	National Action Plan for the implementation of the SNASC during 2023-2030
PNDR	National Rural Development Program 2014-2020
PNI Anghel Saligny	Anghel Saligny National Investment Plan 2022-2028
PNRR	National Recovery and Resilience Plan
PNCDI IV	National Research, Development and Innovation Plan 2022-2027
PP	Power Plant

PR	Regional Programs 2021-2027
PT	Transport Program 2021-2027
PTJ	Just Transition Program 2021-2027
PTTJ	Territorial Just Transition Plan
PV	Photovoltaic
RCI	Regional Competitivity Index
RES	Renewable Energy Source
RES-E	RES in Electricity
RES-H&C	RES in Heating & Cooling
RES-T	RES in Transport
RET	Power Transmission Network
RIS3	Research and Innovation Strategy for Smart Specialization
RON	Romanian Leu
RPIA	Romanian Photovoltaic Industry Association
RWEA	Romanian Wind Energy Association
SCF	Social Climate Fund
SDAC	Single Day-Ahead Coupling
SDG	Sustainable Development Goal
SIDC	Single Intraday Coupling
SEN	National Electricity System
SITC	Standard International Trade Classification
SGG – Coordination Committee of SNRTL	Secretariat-General of the Government – Coordination Committee for monitoring the implementation of the National Long-Term Renovation Strategy
SME	Small and Medium Enterprise
SMI	Smart Metering Inventory

SMR	Small Modular Reactor
SNASC	National Strategy on Adaptation to Climate Change for 2024-2030, with a perspective towards 2050
SNCISI 2022-2027	National Strategy on Research, Innovation and Smart Specialization 2022-2027
SNDDR 2030	Romania's Sustainable Development Strategy 2030
SNRTL	National Long-Term Renovation Strategy to support the renovation of the national stock of residential and non-residential buildings, both public and private, and to gradually transform it into a highly energy efficient and decarbonized building stock by 2050
SNT	Natural Gas National Transmission System
SNTG	"TRANSGAZ" S.A. National Company for Natural Gas Transmission
TAP	Natural Gas Trans Adriatic Pipeline
toe	Tonne Oil Equivalent
TPP	Thermal Power Plant
TSO	Transmission and System Operator
TYNDP	Ten–Year Network Development Plan
UNFCCC	United Nations Framework Convention on Climate Change
UN	United Nations
UEFISCDI	Executive Unit for Financing Higher Education, Research, Development and Innovation
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

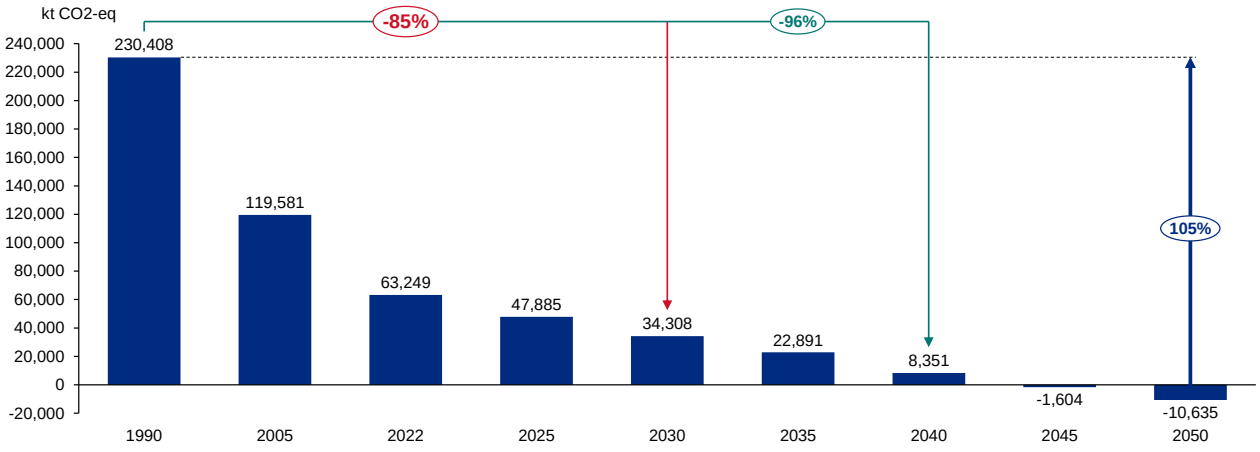
After the EU became a party to the Paris Agreement, it has assumed a prominent position in combatting climate change through its leadership across five key aspects: energy security, reducing carbon emissions, enhancing energy efficiency, strengthening the internal energy market, and promoting research, 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 net GHG emission (including LULUCF) reduction target for Romania is set at 85% by 2030, compared to 1990 levels (Figure 1). Romania has already made significant progress, achieving by 2022 85% of its 2030 target for net GHG emission reduction, with a projection of reaching 93% of the 2030 reduction target by 2025, as reflected in the most recent version (March 2024) of the National Inventory of GHG (INEGES). The long-term goal is to achieve a 96% net GHG emission reduction by 2040 and complete net GHG emission reduction by 2050: 105% lowering net GHG emissions in 2050 compared to 1990 level

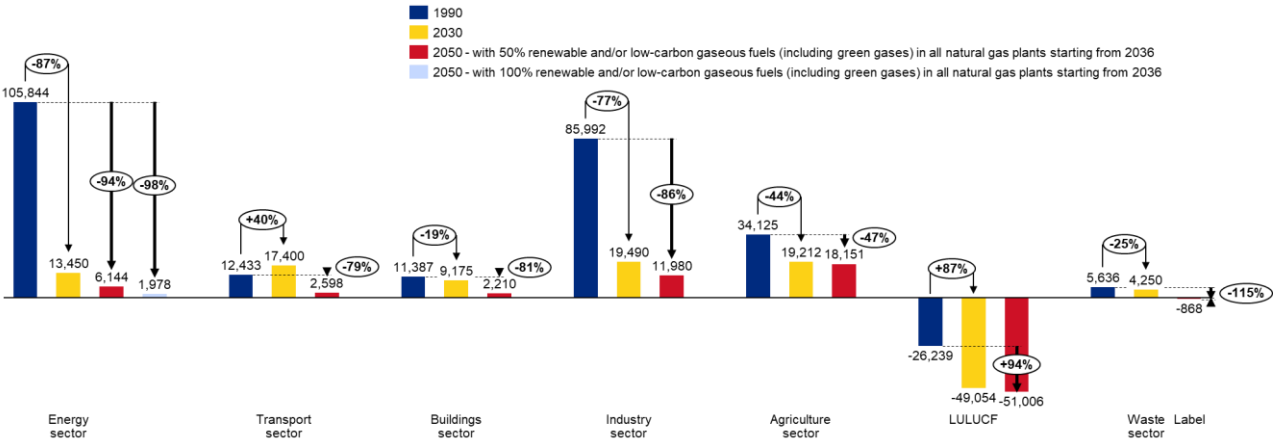
Figure 1. Indicative targets and trajectory for net GHG emissions reduction



Source: 1990,2005, 2022 INEGES (March 2024), 2025-2050 LEAP-RO model

To meet these targets, Romania has established sector-specific goals for 2030 relative to 1990 levels (Figure 2):

Figure 2. Sectoral objectives for lowering GHG emissions in 2030 and 2050 relative to 1990 levels



Source: 1990 GHG inventory, 2030 and 2050 LEAP-RO model. For 2050, 2 scenarios are considered: 50% and 100% renewable and/or low-carbon gaseous fuels (including green gases) in all natural gas plants starting from 2036.

- Energy sector: Aiming for an 87% GHG emission reduction in 2030 compared to 1990, primarily through decommissioning coal and lignite power plants and expanding renewable energy sources (RES)-based capacities.
- Transport sector: Seeking an increase of maximum 40% in GHG emissions in 2030 compared to 1990, primarily by promoting hybrid and electric vehicles, also railway transport through the electrification expansion and infrastructure modernization public passenger transport network by metro expansion and last but not least of the multimodal transport in Romania, especially through the development type RO-LA (Rollende Landstrassen/rolling road) services.
- Buildings sector: Targeting a 19% reduction in GHG emissions in 2030 compared to 1990 through improved building performance and increased use of heat pumps and solar thermal collectors.
- Industry sector: Striving for a 77% GHG emission reduction in 2030 compared to 1990, mainly achieved by replacing fossil fuels with electricity and renewables and enhancing technology efficiency.
- Agriculture: Pursuing a 44% GHG emission reduction in 2030 compared to 1990 through appropriate livestock diet and feed management.
- LULUCF: Aiming for an 87% increase in GHG removals in 2030 compared to 1990, mainly through improved forest fire management.
- Waste: Targeting a 25% reduction in GHG emissions in 2030 compared to 1990 through proper waste reduction, reuse, and recycling.

An important aspect related to the European Commission's recommendation is the LULUCF target for 2030, which requires an additional 2,380 kt CO2 in sinks compared to the 2016-2018 average. The average sinks during this period, according to the new inventory, amount to 48,664 kt CO_2. Therefore, the target for 2030 is set at 51,044 kt CO2. Additional measures should be proposed in the order 2030 target LULUCF target to be achieved. In this version of NECP two measures in the LULUCF sector are introduced which are in line with Romania Forest Strategy adopted in 2022. The first one is the forestation of an addition of 65 thousand ha forest area by 2030 and forestation of urban area of about 350 ha. However, these measures are leading to some improvement in sinks by 2030, but the figure remains below the target. By 2030, the projections are 48,867 kt CO2, which is nearly the same as the 2016-2018 average. The old 2030 target for the LULUCF sector was 34,412 kt CO2, highlighting the major updates and adjustments made in the current GHG inventory, which can be the case with the next inventory too. Overall, the projections show that in 2030 Romania will be 4% below the targeted sinks (Figure 3).

Figure 3. GHG trajectory for LULUCF GHG emissions (with updated inventory)

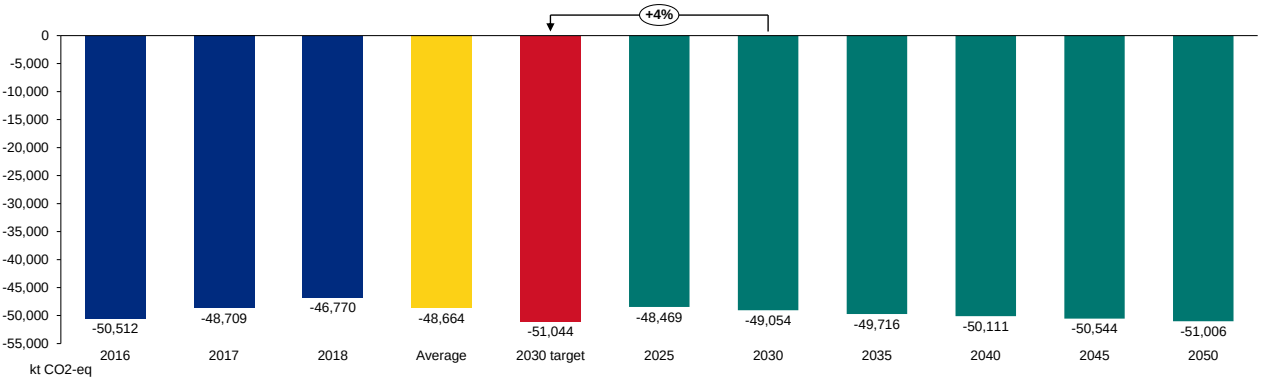
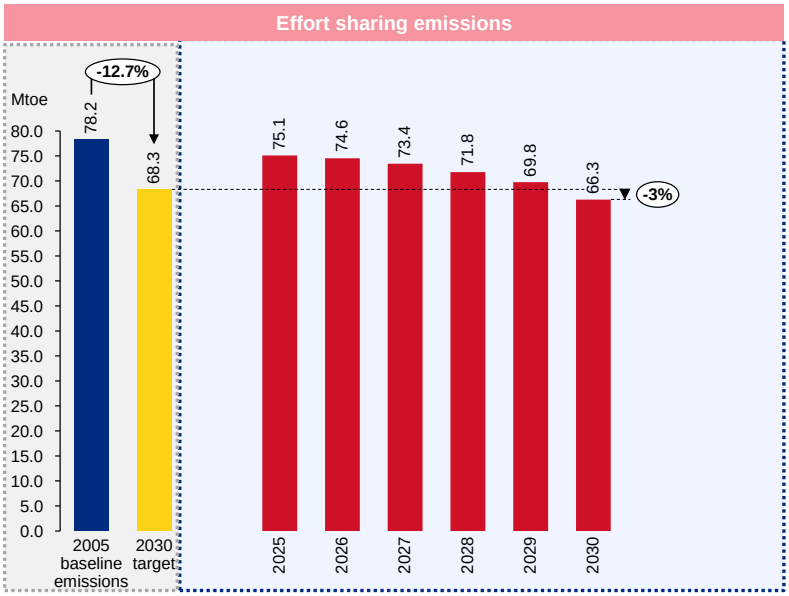


Figure 4 illustrates the effort-sharing emissions from 2025 to 2030. Starting from a baseline of 78.2 Mtoe in 2005, the 2030 target is set at 68.3 Mtoe (12.7% reduction). The emissions are projected to decrease each year, reaching 66.3 Mtoe by 2030, which is a 3% further reduction from the 2030 target. This trend demonstrates a clear commitment to reducing emissions over time in alignment with effort-sharing goals.

Figure 4. Effort sharing emissions

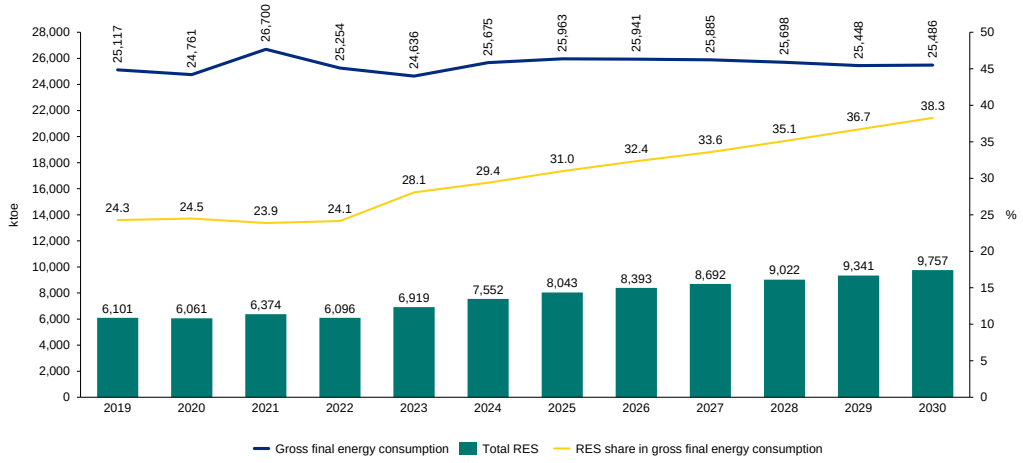


Source: LEAP_RO projections team analyses

Renewable Energy

Romania's objective is to reach at least 38.3% of renewable energy in gross final energy consumption by 2030. Projections indicate that by 2025, this percentage will reach 31.0%. Notably, increased wind and solar energy generation capacities, along with heat pumps for heating and cooling, will contribute significantly (Figure 5).

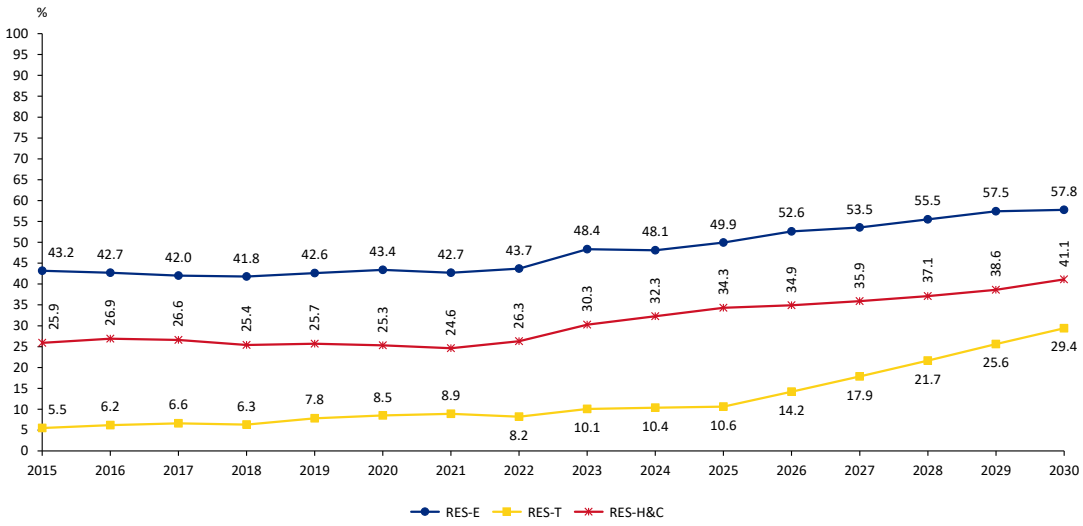
Figure 5. Share of energy from renewable sources in gross final consumption of energy, with an indicative trajectory



Source: 2019-2022 SHARE tool EUROSTAT, 2023-2030 LEAP-RO model
Note: Data after 2023 include heat pumps which are not included in the SHARE tool for the period 2019-2022

The estimated trajectories for the share of RES in the *transport sector* show that it will reach *29.4%* in 2030, which will be obtained mainly by increasing the use of electricity in this sector (Figure 6). The RES share in the *electricity sector* will also increase by 2030, reaching a point of *57.8%* 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 *41.1%* in 2030. Although 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 6. Estimated trajectories for the share of renewable energy in final energy consumption in the electricity, heating and cooling and transport sectors



Source: 2015-2022 SHARE tool EUROSTAT, 2023-2030 LEAP-RO model,
Note: Data after 2023 include heat pumps which are not included in the SHARE tool for the period 2015-2022

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 primary energy target for Romania, according to the recast of the Energy Efficiency Directive from 2023, is set at 30.2 Mtoe. The projections show that this target will be achieved in 2030 with a value of 28.7 Mtoe which is 9% reduction compared to 2022 (as depicted in Figure 7). Similarly, final energy consumption is expected to experience a decrease of 6% (as shown in Figure 8), without a negative impact on productivity, complementary with implementing measures to increase the share of energy produced from renewable sources, achieving an absolute value of 22.5 ktoe in 2030. This means that the target for final energy consumption, also defined according to the recast of the Energy Efficiency Directive from 2023 (22.47 Mtoe), will be achieved.

By 2050, Romania aims to lower its primary energy consumption by 25%, while the final energy consumption is projected to decrease further by 28% compared to the 2022 level of consumption. These targets reflect a dedicated commitment to sustainability and a greener future.

Figure 7. Estimated primary energy consumption trajectory

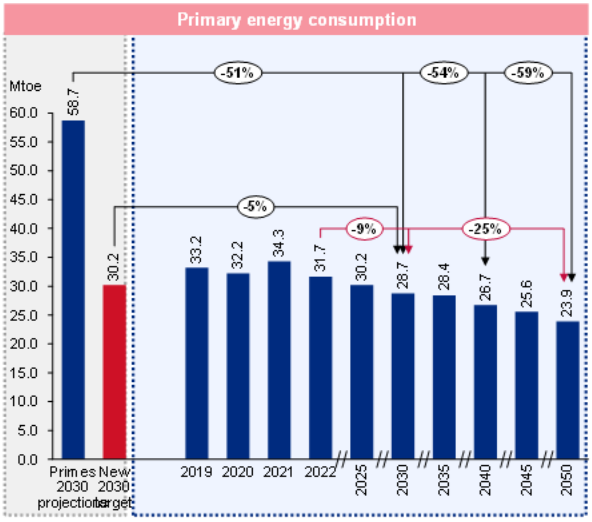
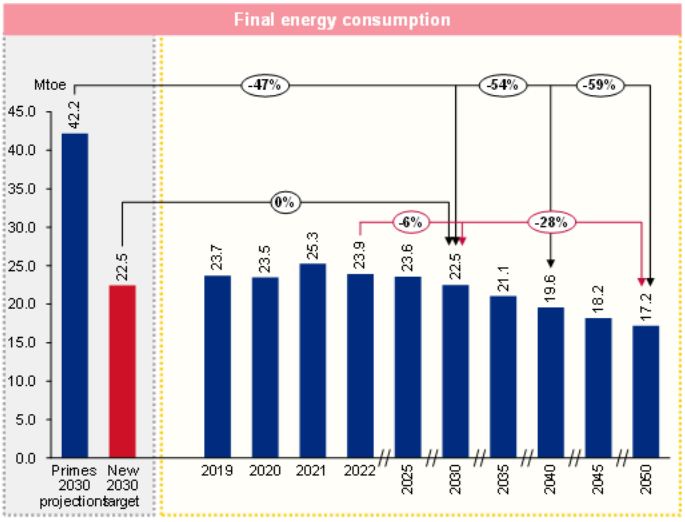


Figure 8. Estimated final energy consumption trajectory



Source: 2019-2022 Energy balance EUROSTAT, 2025-2050 LEAP-RO model

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 32.3 GW, with approximately 76% originating from renewable sources (Figure 18). The plan also includes the construction of new nuclear and natural gas-powered facilities, and

[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.

complete some investments in hydroelectric plants, which will make Romania electricity exporter country of around 4.4 TWh.

Natural Gas Supply: Romania is actively improving its natural gas transmission network, including interconnections, to diversify supplies and reduce dependence on Russia. This involves participating in various projects, such as: Development on Natural Gas Transport System on Romania as part of the Bulgaria-Romania-Hungary-Austria Corridor (BRUA - phase I, II and III), Development on the natural gas pipeline on Romanian territory for taking over natural gas from the Black Sea coast (Black Sea – Podișor), as well as the activity carried out within the Central and South Eastern Europe Energy Connectivity (CESEC) initiative – Vertical Corridor.

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* in order to use electricity in peak hours to address energy demand fluctuations effectively to benefit from the flexibility of consumption and to achieve the objectives of adequacy and flexibility of the system. Additionally, the country is working on *energy storage batteries*, particularly power battery storage with a target of at least 1200 MW or 2400 MWh by 2030 and around 2000 MW by 2035. The use of batteries and hydrogen technology, and the use of pumped storage hydroelectric power plants of around 800 MW by 2030 (CHEAP), under review, is expected to enhance grid stability and support the integration of renewable energy sources. According to Transelectrica data, in 2023, the installed capacity of energy storage was 16.2 MW.

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 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, Innovation and Competitiveness

The National Strategy for Research, Innovation and Smart Specialization 2022-2027 (SNCISI 2022-2027) implements Romania's Vision 2030, built on four (interconnected) pillars, each with its own indicators and targets, which correspond to the four general objectives of the strategy[2]:

OG1. Development of the research, development and innovation system;

OG2. Supporting innovation ecosystems associated with smart specializations;

OG3. Mobilization towards innovation;

OG4. Increasing European and international collaboration.

If considering the overall innovation performance (as mirrored in the European Innovation Scoreboard - EIS), Romania’s goal is to become a moderate innovator (i.e., have an innovation performance between 70% and 100% of the EU average).

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

Table 1. Main pillars of Romania's Vision 2030 within SNCISI 2022-2027

Pillar / Indicator	Target for 2030, compared to 2021
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 (approx. 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 2 provides an overview of how each policy or measure contributes to the various dimensions.

Table 2. Interactions between the policies and measures

	Decarbonizatio	Efficiency	Security	Internal	R&I&C
PAM 1 Phasing out coal TPP	√				
PAM 2 Introduction of renewable hydrogen into the energy system	√				√
PAM 3 Hydrogen production	√				√
PAM 4 Development of new CCGT capacities	√		√		

PAM 5 Promotion of high-efficiency cogeneration capacities	√		√		
PAM 6 Employing carbon capture, utilization and storage (CCUS) technologies	√			√	√
PAM 7 Implementation of the Kigali amendment in the Product uses as substitutes of ODS	√				√
PAM 8 Improvement and efficiency in the industrial processes	√			√	√
PAM 9 Setting a national obligation for CO2 injecting and storing for the oil & gas industry	√			√	√
PAM 10 Reduction of emissions from enteric fermentation	√				√
PAM 11 Improving agricultural residues management	√	√			√
PAM 12 Reduction of methane emission level from manure management and biogas production	√	√			√
PAM 13 Increasing the agrisolar production	√	√			√
PAM 14 Establishing integrated management of forest fires	√				
PAM 15 PV systems in agriculture for irrigation	√	√			√
PAM 16 Renewal of the agricultural machinery and equipment	√	√			
PAM 17 Reduction of municipal waste per capita	√				
PAM 18 Increased recycling and biodegradable waste selection for composting	√				
PAM 19 Optimization of incineration / co-incineration processes	√	√			√
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 Building small hydro power plants	√		√		
PAM 25 Pump storage	√		√		
PAM 26 Rooftop PV	√	√	√		
PAM 27 Installation of solar thermal collectors in the residential sector	√	√	√		
PAM 28 Facilitate the establishment of energy communities					
PAM 29 Increase of the domestic generation capacity from biomass and biogas CHP and PP	√	√	√		
PAM 30 Biogas and biomethane	√	√	√		
PAM 31 Development of the advanced biofuels market	√	√	√		√
PAM 32 Biofuels in aviation and marine transport	√	√			
PAM 33 RFNBO	√	√	√		√
PAM 34 Development of the use of biomass, bioliquids and biogas within the EU-ETS installations based on energy-intensive thermal processes	√	√	√		√
PAM 35 Improve energy performance of public buildings at central level	√	√			
PAM 36 Improve energy performance of public buildings at local level	√	√			
PAM 37 Renovation of residential buildings	√	√			
PAM 38 Renovation of commercial buildings	√	√			
PAM 39 Rehabilitation of public lighting	√	√			
PAM 40 Development of energy services/market, ESCO		√		√	
PAM 41 Green procurement	√	√		√	
PAM 42 Energy audit and energy management	√	√		√	
PAM 43 Increased share of heat pumps	√	√			
PAM 44 Increased use of efficient technologies in the residential sector	√	√			
PAM 45 Replacement of conventional fuels with RES in manufacturing industries	√	√			√
PAM 46 Increase technology efficiency in the industrial sector	√	√			√
PAM 47 Increased share of alternative fueled cars	√	√			

PAM 48 Increased share of alternative fueled buses	√	√			
PAM 49 Modernization of urban public transport	√	√			
PAM 50 Development of the underground transport infrastructure	√	√			
PAM 51 Increased share of alternative fueled trucks	√	√			
PAM 52 Modernization of naval transport	√	√			
PAM 53 Modernization of air transport	√	√			
PAM 54 Modernization and renewal of railway transport	√	√			
PAM 55 Railway rolling stock	√	√			
PAM 56 Alternative mobility	√	√			
PAM 57 Increasing the energy efficiency for the buildings in the transport sector	√	√			
PAM 58 Modernization of road transport infrastructure	√	√			
PAM 59 Support for the expansion and modernization of the electricity distribution network	√	√	√		
PAM 60 Increased use of nuclear energy	√	√	√	√	√
PAM 61 Black Sea Corridor (ENTSO-E TYNDP ID 138)	√		√	√	
PAM 62 Mid-Continental East corridor (ENTSO-E TYNDP ID 144)	√		√	√	
PAM 63 HU-RO (ENTSO-E TYNDP ID 259)	√		√	√	
PAM 64 North CSE Corridor (ENTSO-E TYNDP ID 341)	√		√	√	
PAM 65 Georgia-Romania Black Sea interconnection cable project (ENTSO-E TYNDP ID 1105)	√		√	√	
PAM 66 Increasing the interconnectivity between the Eastern regions of Romania and the rest of SEN	√		√	√	
PAM 67 Integrating the output generated by powerplants in the South and the South-West of Romania	√		√	√	
PAM 68 400kV OHL Suceava-Bălți	√		√	√	
PAM 69 Refurbishment and modernization of the existing substations	√		√	√	
PAM 70 Refurbishment and development of the underground natural gas storage depot Depomureș - Târgu Mureș			√	√	
PAM 71 Increasing the daily extraction capacity in the underground gas storage system (SISG) Bilciurești			√	√	
PAM 72 Modernization of the natural gas storage system infrastructure - Bălăceanca			√	√	
PAM 73 Increasing the underground natural gas storage capacity of the Ghercești deposit			√	√	
PAM 74 Increasing the underground natural gas storage capacity at the Sărmasel deposit (Transylvania)			√	√	
PAM 75 New underground natural gas storage facility Fălticeni (Moldova)			√	√	
PAM 76 Modernization of natural gas infrastructure for enabling the transport of hydrogen	√		√	√	
PAM 77 Creation of new infrastructure for the transport of hydrogen	√		√	√	
PAM 78 Increasing the transmission capacity of SNT and security in natural gas supply	√		√	√	
PAM 79 Increasing the transport capacity of SNT and ensuring the security of natural gas supply throughout the region.	√		√	√	
PAM 80 LNG terminal located on the shores of the Black Sea, interconnection of the SNT to the LNG terminal and the development of the natural gas transport pipeline on Romanian territory for taking over natural gas from the Black Sea shore			√	√	
PAM 81 Development on the Romanian territory of SNT on the Bulgaria-Romania-Hungary-Austria Corridor (BRUA) – Phase II and Phase III			√	√	
PAM 82 Development/Modernization of the natural gas transmission infrastructure and interconnections			√	√	
PAM 83 Development of SMG in order to achieve bidirectional flow on the T2 and T3 pipelines			√	√	

PAM 84 Rehabilitation, modernization and expansion of SNT	√		√	√	
PAM 85 Electric energy storage capacities	√		√	√	
PAM 86 Creating an enabling environment for production and trading of green gases.	√		√	√	
PAM 87 Development and use of a fully-fledged national social assistance IT system				√	
PAM 88 Ensuring the implementation of the just transition process				√	
PAM 89 Ensure the access of energy consumers to diversified, sustainable and accessible sources of energy for lighting, heating and cooling	√	√			
PAM 90 Develop one stop shops	√	√			
PAM 91 Coordinated interministerial committee regarding protecting vulnerable consumers and addressing energy poverty	√	√			

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 the fact that it does not emit greenhouse gases and for its excellent reliability, contributing significantly to the diversity of Romania's energy sources.

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 a climate-neutral economy. The measures considered include increasing the level of employment through investment measures in upskilling, developing skills for green jobs and the circular economy, and/or providing support and active measures to aid job seekers.

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	Law No. 226/2021 from September 16, 2021, with subsequent amendments and additions	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	GEO No. 27/2022 from March 18, 2022, approved with modifications by Law no. 206/2022, with subsequent amendments and additions	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	GEO No. 186/2022 from December 28, 2022, approved with modifications by Law no. 119/2023, with subsequent amendments and additions	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	Law No. 123/2012 from July 10, 2012, with subsequent amendments and additions	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	Law No. 220/2008 from October 27, 2008, with subsequent amendments and additions	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. At the same time, the law will be aligned with Directive (EU) 2023/2413 (Directive RED III) which will be transposed into national legislation in 2025.
GOVERNMENT EMERGENCY ORDINANCE on the decarbonization of the energy sector	GEO No. 108/2022 from June 30, 2022, approved with modifications by Law no. 334/2022, with subsequent amendments and additions	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.

GOVERNMENT EMERGENCY ORDINANCE on carbon capture storage	GEO No. 64/2011, approved with modifications with the Law no. 114/2013, with subsequent amendments and additions	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 CO_2 geological storage, issued in 2015 by ANRMPSG ▪ Procedure for granting the CO_2 geological storage permit issued through Decision 16/2017 of the ANRMPSG 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	Law No 121/2014 from July 18, 2014, with subsequent amendments and additions	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 on Green Public Procurement	Law No. 69/2016 from April 25, 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	Law No. 372/2005 from December 13, 2005, with subsequent amendments and additions	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	GEO No. 195/2005 from December 22, 2005, approved with modifications by Law no. 265/2006, with subsequent amendments and additions	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	GEO No. 92/2021 from August 19, 2021, approved with modifications by Law no. 17/2023, with subsequent amendments and additions	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.

Most relevant recent (2023) EU legislation in the field of energy and climate

Regulation (EU) 2023/956 of the European Parliament and of the Council was issued on the establishment of a carbon border adjustment mechanism (CBAM)

Scope

In order to develop effective measures to combat the risk of carbon leakage, Regulation (EU) 2023/956 on the establishment of a carbon border adjustment mechanism (CBAM) was adopted and entered into force on May 17, 2023. It aims, on the one hand, to avoid the risk of relocating industrial activities outside the European Union - to third countries that do not benefit from a rigorous regulation of the impact on the environment, and on the other hand, to balance the price of goods purchased/imported from third countries with those within the EU internal market, in the perspective of fulfilling the obligations provided for by the Paris Agreement, through the additional taxation of goods imported from such third countries. CBAM thus represents an important pillar of the measures foreseen at EU level through the Green Deal package and functions in practice as an indirect tax corresponding to the carbon footprint of goods imported from outside the EU in certain sectors, namely cement, iron and steel, aluminium, fertilizers and electricity. The mechanism will also include hydrogen, some precursors and downstream products in the mentioned sectors.

Thus, through the Memorandum with the theme: Designation of the national authority for the implementation of the Regulation on the establishment of a border carbon adjustment mechanism (CBAM), approved in the

Government Meeting on August 24, 2023, the Ministry of Finance was the designated authority in this regard, the powers being exercised through a new structure established for this purpose.

As a brief description, the Carbon Border Adjustment Mechanism (CBAM) is a new system regulated by Regulation (EU) 2023/956 of the European Parliament and of the Council of 10 May 2023 on the establishment of a carbon border adjustment mechanism.

It is an essential part of the "Fit for 55" package (reducing net greenhouse gas emissions by at least 55% by 2030).

Through the implementation and operation of this mechanism, incentives are created aimed at causing producers outside the European Union to take measures to reduce emissions.

By confirming that a price has been paid for the carbon emissions generated embedded in the production of certain goods imported into the European Union, CBAM will ensure that the carbon price of imports is equivalent to the carbon price of domestic production and that the EU's climate objectives are not undermined.

This mechanism was created with the aim of providing a level playing field between industries inside and outside the European Union that import products into the EU, so that both pay a similar carbon price.

It is thus intended to be a tool to counter carbon leakage – a situation where industries with high greenhouse gas emissions move their production outside the EU to jurisdictions with less stringent climate policy standards than those of the EU, thus reducing carbon dioxide emissions globally and supporting the objectives of the Paris Agreement.

Another aim of CBAM is to increase climate ambition in non-European countries.

CBAM targets companies importing products considered polluting – cement, iron and steel, aluminum, fertilizers, products based on polymers, hydrogen or ammonia. This mechanism will work through the purchase of certificates by importers. The price of the certificates will be calculated according to the average weekly auction price of the EU ETS certificates, expressed in EUR/ton of CO_2 emitted.

Another objective of the new structure created within the Ministry of Finance is to manage, as the case may be, normative acts through the lens of taxation elements, in order to comply with the EU plan to reduce greenhouse gas emissions by 55% by 2030 and to reach climate neutrality by 2050.

Regulation (EU) 2023/2405 of the European Parliament and of the council of 18 October 2023 on ensuring a level playing field for sustainable air transport (ReFuelEU Aviation)

Scope

This Regulation lays down harmonised rules on the uptake and supply of sustainable aviation fuels (SAF) and it applies to:

1. **aircraft operators** - a person that operated at least 500 commercial passenger air transport flights, or 52 commercial all-cargo air transport flights departing from Union airports in the previous reporting period;
2. **Union airports** - every airport where passenger traffic was higher than 800 000 passengers or where the freight traffic was higher than 100 000 tonnes in the previous reporting period;
3. **Union airport managing bodies** – an airport managing body or where the Member State concerned has reserved the management of the centralised infrastructures for fuel distribution systems for another body, that other body; and
4. **Aviation fuel suppliers that supply**: 1) aviation fuel - drop-in fuel manufactured for direct use by aircraft and/or 2) sustainable aviation fuels (SAF) - aviation fuels that are either synthetic aviation fuels, aviation biofuels or recycled carbon aviation fuels.

Key targets and obligations

- Aviation fuel suppliers shall ensure that all aviation fuel made available to aircraft operators at each Union airport contains the minimum shares of SAF, including the minimum shares of synthetic aviation fuel. From 1 January 2025 (as starting year), each year a minimum share of 2 %, of SAF, while from 1 January 2030, each year a minimum share of 6 % of SAF, from 1 January 2035, each year a minimum share of 20 % of SAF, from 1 January 2040, each year a minimum share of 34 % of SAF, from 1 January 2045,

each year a minimum share of 42 % of SAF and from 1 January 2050, each year a minimum share of 70 % of SAF.

- Union airport managing bodies shall take all necessary measures to facilitate the access of aircraft operators to aviation fuels containing minimum shares of SAF.
- Aircraft operators shall not claim benefits for the use of an identical batch of SAF under more than one greenhouse gas scheme.
- Union airport managing bodies, aviation fuel suppliers and fuel handlers shall, where appropriate, cooperate with their respective Member State for the preparation of the national policy frameworks for the deployment of alternative fuels infrastructure in airports.
- Member States shall designate the competent authority or authorities responsible for enforcing the application of this Regulation and for imposing the fines for aircraft operators, on the Union airport managing bodies, and on aviation fuel suppliers.
- Member States shall lay down the rules on penalties applicable to infringements of this Regulation and shall, by 31 December 2024, notify the Commission of those rules.

Implementation deadline

This Regulation applies from 1 January 2024. However, Articles related to the targets and key obligations shall apply from 1 January 2025.

Regulation (EU) 2023/1804 of the European Parliament and of the council of 13 September 2023 on the deployment of alternative fuels infrastructure, and repealing Directive 2014/94/EU

Scope

This Regulation establishes mandatory national targets leading to the deployment of sufficient alternative fuels infrastructure in the Union for road vehicles, trains, vessels and stationary aircraft. It lays down common technical specifications and requirements on user information, data provision and payment requirements for alternative fuels infrastructure. This Regulation also establishes rules for the national policy frameworks to be adopted by the Member States.

Key targets and obligations

- Member States shall ensure that, in their territory, publicly accessible **recharging stations dedicated to light-duty electric vehicles are deployed** in a way that is commensurate with the uptake of light-duty electric vehicles and that they provide sufficient power output for those vehicles. To that end, Member States shall ensure that, at the end of each year, starting from 2024, the power output targets set forth in the Regulation are met cumulatively.
- Member States shall ensure a **minimum coverage of publicly accessible recharging points dedicated to light-duty electric vehicles and heavy-duty electric vehicles on the road network** in their territory. Operators of recharging points shall, at the publicly accessible recharging points operated by them, provide end users with the possibility to recharge their electric vehicle on an ad hoc basis.
- Member States shall ensure that, in their territory, a minimum number of publicly accessible **hydrogen refuelling stations are deployed** by 31 December 2030. Operators of hydrogen refuelling points shall, at the publicly accessible refuelling points operated by them, provide end users with the possibility to refuel on an ad hoc basis.
- Until 31 December 2024, Member States shall ensure that an appropriate number of publicly accessible **refuelling points for liquefied methane are deployed**, at least along the TEN-T core network, in order to allow heavy-duty motor vehicles using liquefied methane to circulate throughout the Union, where there is demand, unless the costs of doing so are disproportionate to the benefits, including environmental benefits.
- Member States shall ensure that a minimum **shore-side electricity supply for seagoing container ships and seagoing passenger ships is provided** in TEN-T maritime ports (Member States shall take the necessary measures by 31 December 2029 to meet the targets). Targets for shore-side electricity supply in inland waterway ports and targets for supply of liquefied methane in maritime ports are also determined.
- Member States shall ensure that, at all airports of the TEN-T core network and TEN-T comprehensive network, the provision of **electricity supply to stationary aircraft will be ensured** as follows: by 31

December 2024, at all aircraft contact stands used for commercial air transport operations to embark or disembark passengers or to load or unload goods and by 31 December 2029, at all aircraft remote stands used for commercial air transport operations to embark or disembark passengers or to load or unload goods. Member States may exempt airports of the TEN-T network with fewer than 10 000 commercial flight movements per year, averaged over the last three years, from the obligation to supply electricity to stationary aircraft at all aircraft remote stands.

- Member States shall **assess the development of alternative fuel technologies and propulsion systems for rail sections** that cannot be fully electrified for technical or cost-efficiency reasons, such as hydrogen- or battery-powered trains, and, if relevant, any recharging and refuelling infrastructure needs.
- By 31 December 2024, each Member State shall prepare and transmit to the Commission a **draft national policy framework for the development of the market** as regards alternative fuels in the transport sector and the deployment of the relevant infrastructure. By 31 December 2025, each Member State shall draft its final national policy and notify it to the Commission.
- By 31 December 2027 and every two years thereafter, each Member State shall submit to the Commission a **standalone national progress report on the implementation of its national policy framework**. By 31 March 2025 and by 31 March of every year thereafter, Member States shall report to the Commission the total aggregated recharging power output and the number of publicly accessible recharging points deployed and the number of battery electric vehicles and plug-in hybrid vehicles registered on their territory on 31 December of the previous year.
- Member States shall **appoint an Identification Registration Organisation** that shall issue and manage unique identification ('ID') codes to identify at least operators of recharging points and mobility service providers, by 14 April 2025.

Implementation deadline

This Regulation applies from 13 April 2024.

Directive (EU) 2023/1791 of the European Parliament and of the council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (recast)

Scope

This Directive establishes a common framework of measures to promote energy efficiency within the Union to ensure that the Union's targets on energy efficiency are met and enables further energy efficiency improvements. According to the Directive energy poverty is defined as "household's lack of access to essential energy services, where such services provide basic levels and decent standards of living and health, including adequate heating, hot water, cooling, lighting, and energy to power appliances, in the relevant national context, existing national social policy and other relevant national policies, caused by a combination of factors, including at least non-affordability, insufficient disposable income, high energy expenditure and poor energy efficiency of homes".

This Directive lays down rules designed to implement energy efficiency as a priority across all sectors, remove barriers in the energy market and overcome market failures that impede efficiency in the supply, transmission, storage and use of energy. It also provides for the establishment of indicative national energy efficiency contributions for 2030.

Key targets and obligations

- In accordance with the **energy efficiency first principle**, Member States shall ensure that energy efficiency solutions, including demand-side resources and system flexibilities, are assessed in planning, policy and major investment decisions of a value of more than EUR 100 000 000 each or EUR 175 000 000 for transport infrastructure projects, relating to the following sectors: (a) energy systems; and (b) non-energy sectors, where those sectors have an impact on energy consumption and energy efficiency such as buildings, transport, water, information and communications technology (ICT), agriculture and financial sectors.
- Member States shall collectively ensure a reduction of energy consumption of at least 11.7 % in 2030 compared to the projections of the 2020 EU Reference Scenario, so that the Union's final energy consumption amounts to no more than 763 Mtoe. Member States shall make efforts to collectively contribute to the indicative Union primary energy consumption target amounting to no more than

992.5 Mtoe in 2030. For these purposes, each Member State shall set an **indicative national energy efficiency contribution**. Member States shall notify those contributions to the Commission, together with an indicative trajectory for those contributions, as part of the updates of their integrated national energy and climate plans.

- Member States shall ensure that the **total final energy consumption of all public bodies** combined is reduced by at least 1.9 % each year, when compared to 2021. During a transitional period ending on 11 October 2027 this target shall be indicative.
- Each Member State shall ensure that at least 3 % of the **total floor area of heated and/or cooled buildings that are owned by public bodies is renovated** each year to be transformed into at least nearly zero-energy buildings or zero-emission buildings.
- Member States shall ensure that contracting authorities and contracting entities, when concluding public contracts and concessions with a value equal to or greater than the thresholds laid down in public procurement and concessions directives, **purchase only products, services and works with high energy-efficiency performance**, unless it is not technically feasible.
- Each year from 1 January 2021 to 31 December 2030, Member States shall achieve **cumulative end-use energy savings** starting from 0.8 % (from 1 January 2021 to 31 December 2023) ending by 1.9 % (from 1 January 2028 to 31 December 2030).
- New requirements are set forth related to energy efficiency obligation schemes, alternative policy measures, energy management systems and energy audits.
- By 15 May 2024 and every year thereafter, Member States shall require **owners and operators of data centres** in their territory with a power demand of the installed information technology (IT) of at least 500 kW, to make the information set out in the Directive publicly available.
- Member States shall ensure that natural gas final customers and district heating, district cooling and domestic hot water final customers are provided with **competitively priced meters** that accurately reflect the final customer's actual energy consumption.
- Each Member State shall submit to the Commission a **comprehensive heating and cooling assessment**. Member States shall adopt policies and measures which ensure that the potential identified in the comprehensive assessments is realised.
- In order to ensure more efficient consumption of primary energy and to increase the share of renewable energy in heating and cooling supply going into the network, an **efficient district heating and cooling system** shall meet the criteria set forth in the Directive.
- **National energy regulatory authorities** shall apply the energy efficiency first principle in carrying out the regulatory tasks regarding their decisions on the operation of the gas and electricity infrastructure, including their decisions on network tariffs. Member States shall ensure that **gas and electricity transmission and distribution system operators** apply the energy efficiency first principle, in accordance with Article 3 of this Directive, in their network planning, network development and investment decisions.
- Member States shall set up a network ensuring the appropriate level of competences for **energy efficiency-related professions** that corresponds to market needs. Member States shall ensure that certification or equivalent qualification schemes, including, where necessary, suitable training programmes, are available for energy efficiency-related professions including providers of energy services, providers of energy audits, energy managers, independent experts, installers of building elements and providers of integrated renovation works. Member States shall promote the energy services market and access to it for SMEs by disseminating clear and easily accessible information.
- Member States shall facilitate the **establishment of financing facilities**, or the use of existing ones, for energy efficiency improvement measures to maximise the benefits of multiple streams of financing and the combination of grants, financial instruments and technical assistance.
- Member States shall lay down the rules on penalties applicable to infringements of national provisions adopted pursuant to this Directive and shall by 11 October 2025 notify the Commission of those rules.

Implementation deadline

Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with the specific articles and annexes by 11 October 2025. Directive 2012/27/EU is repealed with effect from 12 October 2025, while most of the articles and annexes from this Directive stipulating obligations for the member states shall apply from 12 October 2025.

Directive (EU) 2024/1275 of the European Parliament and of the Council of 24 April 2024 on the energy performance of buildings (recast)

Scope

This Directive promotes the improvement of the energy performance of buildings and the reduction of greenhouse gas emissions from buildings within the Union, with a view to achieving a zero-emission building stock by 2050, taking into account the outdoor climatic conditions, the local conditions, the requirements for indoor environmental quality, and cost-effectiveness

Key targets and obligations

- Each Member State shall establish a national building renovation plan to ensure the renovation of the national stock of residential and non-residential buildings, both public and private, into a highly energy-efficient and decarbonised building stock by 2050, with the objective to transform existing buildings into zero-emission buildings.
- Member States shall apply a methodology for calculating the energy performance of buildings.
- Member States shall ensure that new buildings are zero-emission buildings in accordance with Article 11: (a) from 1 January 2028, new buildings owned by public bodies; and (b) from 1 January 2030, all new buildings.
- Member States shall ensure that the life-cycle GWP is calculated in accordance with Annex III and disclosed in the energy performance certificate of the building: (a) from 1 January 2028, for all new buildings with a useful floor area larger than 1 000 m2; (b) from 1 January 2030, for all new buildings.
- The minimum energy performance standards shall ensure, at least, that all non-residential buildings are below: (a) the 16 % threshold from 2030; and (b) the 26 % threshold from 2033.
- Member States shall ensure that the average primary energy use in kWh/(m2 .y) of the entire residential building stock: (a) decreases by at least 16 % compared to 2020 by 2030; (b) decreases by at least 20-22 % compared to 2020 by 2035; (c) by 2040, and every 5 years thereafter, is equivalent to, or lower than the nationally determined value derived from a progressive decrease in the average primary energy use from 2030 to 2050, in line with the transformation of the residential building stock into a zero-emission building stock.
- Member States shall ensure the deployment of suitable solar energy installations, if technically suitable and economically and functionally feasible, as follows: (a) by 31 December 2026, on all new public and non-residential buildings with useful floor area larger than 250 m2 ; (b) on all existing public buildings with useful floor area larger than: (i) 2 000 m2 , by 31 December 2027; (ii) 750 m2 , by 31 December 2028; (iii) 250 m2 , by 31 December 2030; (c) by 31 December 2027, on existing non-residential buildings with useful floor area larger than 500 m2 , where the building undergoes a major renovation or an action that requires an administrative permit for building renovations, works on the roof or the installation of a technical building system; (d) by 31 December 2029, on all new residential buildings; and (e) by 31 December 2029, on all new roofed car parks physically adjacent to buildings.
- By 29 May 2026, Member States shall introduce a scheme for renovation passports.
- Member States shall lay down requirements to ensure that, where technically and economically feasible, non-residential buildings are equipped with building automation and control systems, as follows: (a) by 31 December 2024, non-residential buildings with an effective rated output for heating systems, air-conditioning systems, systems for combined space heating and ventilation, or systems for combined air conditioning and ventilation of over 290 kW; (b) by 31 December 2029, non-residential buildings with an effective rated output for heating systems, air-conditioning systems, systems for combined space heating and ventilation, or systems for combined air conditioning and ventilation of over 70 kW.
- With regard to new non-residential buildings with more than five car parking spaces and non-residential buildings undergoing major renovation, with more than five car parking spaces, Member States shall ensure: (a) the installation of at least one recharging point for every five car parking spaces; (b) the installation of pre-cabling for at least 50 % of car parking spaces and ducting, namely conduits for electric cables, for the remaining car parking spaces, to enable the installation at a later stage of recharging points for electric vehicles, electrically power-assisted cycles and other L-category vehicle types; and (c) the provision of bicycle parking spaces representing at least 15 % of average or 10 % of total user capacity of non-residential buildings, taking into account the space required also for bicycles with larger dimensions than standard bicycles.

- With regard to all non-residential buildings with more than 20 car parking spaces, Member States shall, by 1 January 2027, ensure: (a) the installation of at least one recharging point for every 10 car parking spaces, or of ducting, namely conduits for electric cables, for at least 50 % of the car parking spaces to enable the installation at a later stage of recharging points for electric vehicles; and (b) the provision of bicycle parking spaces representing at least 15 % of average or 10 % of total user capacity of the building and with space required also for bicycles with larger dimensions than standard bicycles. For buildings owned or occupied by public bodies, Member States shall ensure the installation of pre-cabling for at least 50 % of car parking spaces by 1 January 2033.
- Member States shall, in cooperation with competent authorities, and, where appropriate, private stakeholders, ensure the establishment and the operation of technical assistance facilities, including through inclusive one-stop shops for the energy performance of buildings, targeting all actors involved in building renovations, inter alia, homeowners and administrative, financial and economic actors, such as SMEs, including microenterprises.

Implementation deadline

This Directive entered into force on 20.05.2024. Articles 30, 31, 33 and 34 shall apply from 30 May 2026.

Regulation (EU) 2023/955 of the European Parliament and of the council of 10 May 2023 establishing a social climate fund and amending regulation (EU) 2021/1060

Scope

This Regulation establishes the Social Climate Fund (the 'Fund') for the period from 2026 to 2032. The Fund shall provide financial support to Member States for the measures and investments included in their Social Climate Plans (the 'Plans'). The specific objectives of the Fund shall be to support vulnerable households, vulnerable micro-enterprises and vulnerable transport users, through temporary direct income support and through measures and investments intended to increase the energy efficiency of buildings, decarbonisation of heating and cooling of buildings, including through the integration in buildings of renewable energy generation and storage, and to grant improved access to zero- and low-emission mobility and transport.

Key obligations

- Each Member State shall submit to the Commission its Plan. The Plan shall contain a coherent set of existing or new national measures and investments to address the impact of carbon pricing on vulnerable households, vulnerable micro-enterprises and vulnerable transport users in order to ensure affordable heating, cooling and mobility, while accompanying and accelerating necessary measures to meet the climate targets of the Union. Each Member State shall ensure consistency between its Plan and its updated integrated national energy and climate plan.
- The Fund shall provide financial support to Member States to fund the measures and investments set out in their Plans. Payment of financial support to each Member State shall be conditional upon that Member State achieving the milestones and targets for the measures and investments set forth in this Regulation. Member States shall contribute at least 25 % of the estimated total costs of their Plans.
- Each Member State shall, on a biennial basis, report to the Commission on the implementation of its Plan together with its integrated national energy and climate progress report.

Implementation deadline

This Regulation shall apply from 30 June 2024, the date by which the Member States are to bring into force the laws, regulations and administrative provisions necessary to comply with Directive (EU) 2023/959 amending Directive 2003/87/EC as regards Chapter IVa of Directive 2003/87/EC.

Directive (EU) 2023/959 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union and Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading system

Scope

The green transition requires transformational changes at the level of the economy, including in the sectors where th activity generates an increase in the carbon footprint. In recent years there has been an increase in carbon emissions in the field of transport and buildings, for which, complementary to the ETS policy, the emissions generated by existing buildings (used fuels) and those in the field of transport will be added.

Key obligations

- A larger decrease in greenhouse gas emissions, so that it contributes to avoid dangerous climate change.

Implementation deadline

This Directive shall apply from 2027, with the possibility of postponement until 2028.

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

Dimension 1: Decarbonization

Renewable Energy Sources 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.

Nuclear energy development: Romania has ongoing nuclear energy development projects, such as the re-engineering of Unit 1 at CNE Cernavodă, the construction of two new nuclear units at CNE Cernavodă, the SMR project. All these investments will contribute to the decarbonization of the energy sector, because the technology of generating electricity from nuclear sources has zero GHG emissions. Moreover, nuclear capabilities will provide the base of the generation curve, enabling the safe integration of renewables into the electricity grid.

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.

The relevant national strategic documents that contribute to the decarbonization objectives include:

1. ***Romania's Recovery and Resilience Plan*** that was approved by the European Council on 3 November 2021, and subsequently revised on 8 December 2023 to introduce a REPowerEU chapter. It foresees 66 reforms and 111 investment streams to be taken with the objective to make Romania more sustainable, resilient and better prepared for the challenges and opportunities of the green transition. 44.1% of the planned investments will support the green transition through sustainable transport / urban mobility (through infrastructure for a green and safer urban transport), building renovation (energy-efficiency renovation and seismic consolidation of buildings), biodiversity protection, industry decarbonisation and deployment of renewables (phasing-out of coal and lignite power production, deployment of various renewable energy sources, and hydrogen). The added REPowerEU chapter consists of two new reforms and seven investments to meet the objectives of the REPowerEU, mainly focused on accelerating green energy production, promoting energy efficiency of buildings, and re- and up-skilling the workforce in the field of green energy production.

   The milestones and targets for all measures contained in the plan have to be achieved by August 2026. To implement the measures, Romania may use an overall volume of € 28.5 billion from the EU funds. A separate renovation wave fund will be established to improve energy efficiency of the existing building stock (multi-family buildings and public buildings).

2. ***Romania's National Strategic Plan PAC 2023-2027*** envisages the implementation of interventions aimed at the development of a resilient, sustainable and competitive agricultural sector, compliance with environmental commitments by remunerating farmers who contribute to protecting the environment above the requirements of the basic level and development of socio- balanced economy of the rural area

including GHG reduction objectives and adaptation to the effects of climate change. Through PAC, among other, the following will be supported:

- Non-productive investments in agriculture sector and renewable energy production equipment for domestic use;
- Investments in modern facilities for proper manure management used to reduce the GHG and ammonia footprint, as well as technologies that help support a low-carbon economy, etc.
- Investments in the agri-food sector where secondary component of the investment is production and use of energy from renewable sources, whereby the energy generated will be used exclusively for own consumption without injecting the surplus into the grid;
- Investments that have secondary component - investment within a small farm that will contribute to the proper management of manure and obtaining organic fertilizers from the utilization of biomass;
- Investments made by newly and/or recently established farmers where secondary component of the investment contributes to the reduction of GHG emissions, obtaining organic fertilizers, production and use of renewable energy from biomass.
- Investment in the wine sector according to the Regulation (EU) 2021/2115 establishing rules on support for strategic plans to be drawn up by Member States under the common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD).

3. ***Romania's Just Transition Programme*** is a financial plan that will help the country to transition to a climate-neutral economy by 2050. The PTJ will focus on six counties that are most affected by the transition. Some of the key areas to be supported based on of Romania's PTJ are:
   - Development of renewable energy projects, such as solar and wind farms;
   - Improvement of energy efficiency in buildings, industry, and transport;
   - 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 of workers who are affected by the transition, which will help them to find new jobs in the clean energy sector or other sectors.

   Through the ***Territorial Just Transition Plan***, which is based on the Just Transition Programme and approved by the European Commission in December 2022, six Romanian counties: Dolj, Galaţi, Gorj, Hunedoara, Mureş and Prahova will be financially supported, with the objective to phase out coal by 2032.

4. ***Romania General Transport Master Plan*** was adopted by the Government in September 2016 and it covers a 15-year period (until 2030) providing a clear strategy for the development of Romania's transport sector for the next 20 years. The General Transport Master Plan is a high-level planning instrument for major investments (projects and actions) in the sector. It is a roadmap for sustainable transport development, efficient resource allocation, and improved regional connections, benefiting both Romania's economy and its European neighbors. Sustainable transport planning inherently aligns with broader environmental and energy goals. Therefore, by promoting efficient transport modes, reducing GHG emissions, and enhancing connectivity, the Master Plan indirectly contributes to energy efficiency and climate resilience.

5. ***The National Strategy for Adaptation to Climate Change for the period 2024-2030 (SNASC), with a perspective towards 2050*** and ***the National Action Plan for Adaptation to Climate Change (PNASC)*** are based on several key international and European policy frameworks, including the European Green Deal, the 2021 EU Climate Change Adaptation Strategy, the UNFCCC, and the Paris Agreement, specifically Article 7 which focuses on adaptation, as well as Sustainable Development Goal 13. The SNASC aims to align Romania's climate policies with these commitments and provides strategic guidelines for adaptation to climate change effects, integrating findings from extensive studies on climate variability and projected changes up to 2050. The development of SNASC involved a multi-stage process ensuring scientific and technical accuracy, alignment with existing international, European, and national

strategies, and extensive stakeholder consultations. It incorporates climate data analysis from 1961-2020 and projects future climate impacts using "Representative Concentration Pathways" (RCP) and "Shared Socio-economic Pathways" (SSP) types of scenarios to inform sector-specific strategic objectives.
The SNASC proposes a sectoral and trans-sectoral systemic approach with objectives aligned with European targets, aiming to adapt to the effects of climate change in 13 key sectors. Consistent implementation of strategic adaptation objectives, correlated with other policies and strategies fundamental to Romania's sustainable development, such as energy system resilience, disaster risk reduction, and water resource management, is essential for adapting Romanian society to climate change and mitigating its impact in the medium and long term.
Additionally, the Ministry of the Environment, Water and Forests, in partnership with the National Meteorological Administration, created a national platform for adaptation to climate change known as RO-ADAPT (www.roadapt.ro). This innovative tool supports the development of national and sectoral climate change adaptation policies and strategies. The platform offers a virtual working environment with access to:

- A real-time updated database of climate and non-climate data, accessible through standardized services/APIs;
- An interactive map with an intuitive, bilingual (Romanian and English) interface that allows interactive exploration of data sets published on the platform;
- An advanced geoportal with sophisticated GIS functionalities for data analysis and visualization.

The PNASC operationalizes the strategic objectives outlined in the SNASC, translating them into actionable measures across various sectors at national and local levels. It ensures the continuity of previous adaptation efforts and includes detailed implementation guidelines, timelines, responsible bodies, result indicators, and funding sources. The PNASC adheres to principles of durability, participation, integration, flexibility, evidence-based decisions, priority setting, and international responsibilities, emphasizing effective communication and stakeholder involvement. Responsibilities are clearly defined to ensure cohesive action, with measures categorized into "soft," "green," and "grey" types. The plan prioritizes legislative and policy measures that integrate Nature-based Solutions (NbS) and technological adaptations to enhance resilience across Romania's socio-economic and natural systems.
These documents went through the strategic environmental assessment procedure, as well as the decision-making transparency procedure, and soon the documents will be submitted to the adoption procedure by GD.

6. ***Long Term Strategy (LTS)*** of Romania, adopted by GD 1215/2023, was drafted in accordance with the provisions of Regulation (EU) 2018/1999 of the European Parliament and of the Council of December 11, 2018. STL reflects Romania's long-term vision for reducing GHG emissions, for increasing the absorption level of the carbon sinks, for developing a modern economy and an efficient energy system that contributes to the fulfillment of the commitments assumed by the Paris Agreement.
   Three scenarios were developed and analyzed within Romania's STL: Reference Scenario (REF), Middle Scenario (Middle) and Romania Neutral Scenario (Romania Neutral). The REF scenario was built starting from the targets of the NECP 2021-2030, taking into account a significant increase in the global share of renewable energy sources (RES) in the final gross energy consumption: from 30.7%, as indicated in the current version of the NECP, to 34.3%, in the case of the REF Scenario of the STL. The Neutral Romania scenario, chosen to be implemented, aims to achieve Romania's climate neutrality in 2050, by reducing net emissions by 99% compared to the 1990 level. The Middle Scenario was designed as a middle-way solution between the REF Scenario and the Romania Neutral Scenario.
   The STL provides national and sectoral targets for 2050 and intermediate milestones for 2025, 2030, 2035, 2040 and 2045 for the reduction of GHG emissions, primary energy consumption and final energy consumption and the share of renewable energy sources in gross final energy consumption.

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. 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 by building pipelines and interconnections with neighboring countries and increasing the storage capacities. These investments enhance the 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.

Table 16 in Annex I of this document presents the current policies and measures reported in Annex IX of the 2023 integrated national energy and climate progress report (NECP progress report). At the same time, Table 16 includes the most relevant national legislation on energy and climate.

One of the most important sections of the NECP is focused on energy poverty and it is addressed below.

Current policy and planning documents and legal framework on energy poverty and vulnerable energy consumers

Information on policy and planning documents regarding energy poverty

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;
- Collaboration between ME and MMSS for drafting the national action plan in energy poverty situations, which will define critical situations and categories of consumers that cannot be disconnected from the national grid, as well as procedures for reimbursing electricity operators, based on a specific methodology approved by GD;
- 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 current primary and secondary legislation most relevant for energy poverty and vulnerable energy consumers

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

LAW 226/2021 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** is established by order of the MMSS minister, based on the data provided by the INS and ANRE.

GEO 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.

GEO 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

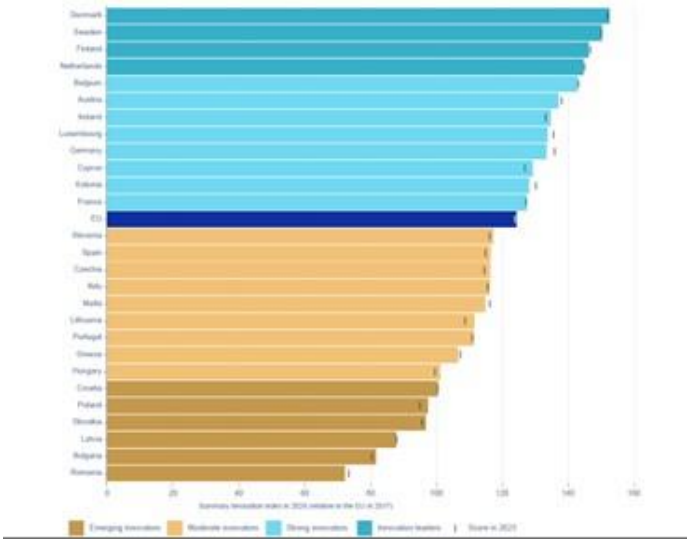
Research and Innovation Funding: Romania has allocated funding for research and innovation in clean energy technologies, being part of the EU research programs aimed at advancing energy innovation.

However, despite these efforts, recent data, such as the Summary Innovation Index from the European Innovation Scoreboard 2024 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 9). It is similar with the EU Regional competitiveness index where all NUTS 2 regions performance is on the bottom of the list, except for the Bucureşti-Ilfov region that is closer to EU average (but still in the lowest-performing group of emerging innovators)[3].

Figure 9. Performance of EU Member States' innovation systems (2023 and 2024)



Source: European Commission, Directorate-General for Research and Innovation, European Innovation Scoreboard 2024, Publications Office of the European Union, 2024, https://data.europa.eu/doi/10.2777/779689

[3] https://projects.research-and-innovation.ec.europa.eu/en/statistics/performance-indicators/european-innovation-scoreboard/eis-2024#/ris

In order to address low innovation potential of the country and to increase competitiveness of the Romanian economy, in 2022, the Government adopted the National Strategy on Research, Innovation and Smart Specialization 2022-2027 (SNCISI 2022-2027), elaborated developed by the Ministry of Research, Innovation and Digitization (MCID). MCID has responsibilities regarding:

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

SNCISI 2022-2027 is strongly correlated Romania's Sustainable Development Strategy 2030 (SNDDR 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, SNCISI 2022-2027 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.

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 cooperates and will continue to cooperate with member states and neighboring states outside EU in terms of market coupling, regulatory alignment, and infrastructure development to facilitate the free cross border flow of electricity and natural gas across borders. An example illustrating the previous statement is the takeover, starting from September 2023, of the management of the national natural gas transport system in the Republic of Moldova (operation, exploitation, dispatching and transport) by the operator of the national natural gas transport system in Romania, National Natural Gas Transmission Company "TRANSGAZ" S.A., through its subsidiary in the Republic of Moldova, Vestmoldtransgaz SRL (VMTG).

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. Maintaining consistency in efforts to reduce emissions and optimizing the monitoring system can prevent "carbon leakage" and uphold a fair competitive environment 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 as well as development of reverse flow infrastructure, 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.

Projects to increase the storage capacity and extraction of natural gas from deposits: Investments in the development of projects to increase the storage capacity and extraction of gas from underground deposits are made by virtue of ensuring the application of Art. 6c of Regulation (EU) 2022/1032 of the European Parliament and of the Council of June 29, 2022 amending Regulations (EU) 2017/1938 and (EC) no. 715/2009 regarding gas storage.

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 (ME)
- Ministry of Environment, Waters and Forests (MMAP)
- Ministry of Economy, Entrepreneurship, and Tourism (MEAT)
- Ministry of Finance
- Ministry of Transport and Infrastructure (MTI)
- Ministry of Agriculture and Rural Development (MADR)
- Ministry of Development, Public Works and Administration (MDLPA)
- Ministry of European Investments and Projects (MIPE)
- Ministry of Labour and Social Solidarity (MMSS)
- Ministry of Education
- Ministry of Research, Innovation and Digitalization (MCID)
- National Institute of Statistics (INS)
- National Commission for Strategy and Prognosis (CNSP)
- The National Regulatory Authority in the field of Energy (ANRE)
- National Agency for Mineral Resources (ANRMPSG)
- Key energy companies such as Transelectrica, Transgaz, OPCOM and Conpet
- Professional business associations and economic operators

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

A total of 32 institutions and organizations, including the European Commission, actively contributed to the revision of the NECP. Their feedback was instrumental in improving the plan’s quality and scope. The European Commission's recommendations provided a basis for further input from other organizations, which were considered and addressed in the final version of the NECP.

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 NECP 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 NECP implementation, including coal region transition and energy efficiency.

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

1. INS
2. ANRE
3. ANRMPSG
4. Transelectrica
5. Transgaz
6. MTI
7. MADR
8. MMSS
9. MDLPA
10. MIPE
11. ME
12. MMAP
13. MEAT

II. Involvement of local and regional authorities

The development process of the NECP is as crucial as its content. It is important to view the creation of the NECP not just as a strategic document exercise but as an opportunity to align national strategies with local realities. In addition, NECP is essential for achieving the EU's 2030 energy and climate objectives, and they must be formulated with input from local authorities, citizens' organizations, the private sector, and other stakeholders through continuous multi-level dialogues and public consultations. 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, as well as participating in the public consultation.

At the same time, through the LIFE NECPlatform project, the "Energy Cities in Romania" Association (OER) organized, between March 2023 and October 2024, dialogue sessions involving several levels of governance and key actors in the process of updating the PNIESC, through the development and facilitating the Energy and Climate Dialogue Platform. The NECPlatform project, co-financed by the European Union under the LIFE contract no. 101076359, aims to support the establishment and management of permanent multi-level dialogue platforms in the climate and energy field. The NECPlatform dialogues were attended by representatives of the Ministry of Energy and the Ministry of Environment, Water and Forests, together with representatives of local public authorities, civil society, and other interested factors. The dialogues addressed the main challenges that Romania has to face in updating and implementing the PNIESC, and the participants in the dialogue debated the challenges regarding the alignment of the updated PNIESC with the recommendations of the European Commission - the increase in the level of ambition regarding Romania's plans and concerns related to the insufficiency of the measures regarding the increase of the share renewable energy, actions and funding sources to support the energy and climate transition.

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

In the process of revising the NECP, various stakeholders, social partners, and civil society organizations played an active role, contributing valuable feedback to enhance the document.

1. AFEER (Romanian Energy Suppliers Association)
2. ARPEE (Romanian Association for Promoting Energy Efficiency)
3. CIROM (Employers' organization in the field of cement and other mineral products production)
4. COGEN Romania
5. FPPG (Oil and Gas Employers’ Federation)
6. OER (Cities Energy in Romania Association)
7. RPIA (Romanian Photovoltaic Industry Association)
8. RWEA (Romanian Wind Energy Association)
9. AmCham Romania (American Chamber of Commerce in Romania)
10. SC Energy-Serv SRL
11. Bankwatch, 2Celsius, Declic, Greenpeace
12. ACUE (Federation of Associations of Energy Utility Companies)
13. Concordia Employers' Confederation.
14. HENRO (Electricity Producers Association)
15. Engie Romania SA
16. IOGP (The International Association of Oil & Gas Producers)
17. EPG (Energy Policy Group)

Three public debates were organized. They were held on February 21, February 28, and March 6, 2024 where representatives from key institutions and organizations, including the Ministry of Energy, Ministry of Research, Innovation and Digitization, CEZ Romania, Bankwatch Romania, WWF Romania, and several others, addressed crucial aspects of Romania's energy transition crucial for developing of the NECP.

The first public debate focused on integrating prosumers and the impact of the Neptun Deep gas field on energy security. The Ministry of Energy committed to revising gas capacity projections and enhancing data on renewable heating projects amid concerns about the growing dependence on gas-fired power plants and their alignment with European renewable policies. Bankwatch Romania criticized the expansion of fossil gas networks and the need for more detailed data on combined heat and power capacities, pushing for a transition to renewable energy. CEZ Romania emphasized the importance of aligning the NECP with infrastructure investment plans to improve grid efficiency and integrate renewable resources. Other participants, including ORSE and SEEI Technology, advocated for addressing energy poverty and clarifying long-term strategies for alternative energy sources like hydrogen. The Ministry of Research, Innovation, and Digitization was urged to align hydrogen strategies with ongoing initiatives. RPIA and EPG called for improved policies, investment estimates, and updated modeling to better reflect the transition from fossil fuels to renewables.

The second public debate involved a broader range of stakeholders, including the Ministry of Environment, Waters, and Forests, the Ministry of Development, Public Works, and Administration, and organizations such

as SAMER and CONCORDIA. The discussions emphasized a coordinated approach to meet decarbonization targets, with the Ministry of Energy outlining support for renewable investments and advancements in geothermal energy and industrial heat pumps. Bankwatch Romania expressed concerns about natural gas inclusion and the need for renewable central heating projects. The Organization of Women Entrepreneurs and CEZ Romania focused on support for SMEs and attracting private investment. WWF Romania raised issues about biomass and hydropower projects, urging compliance with environmental standards. The Ministry of Energy, alongside the Ministry of Environment, Waters and Forests, is drafting a CCUS strategy. ORSE proposed a tripartite working group for energy poverty, while CONCORDIA stressed the need for regulatory frameworks for hydrogen technology and electricity distribution modernization. The National Union of Transporters from Romania discussed challenges related to green truck costs and infrastructure, seeking subsidies and better charging networks.

The third public debate highlighted the necessity for detailed NECP reports covering 2024-2030 and 2030-2050, addressing trends in electricity consumption and production, renewable energy transitions, and funding strategies. Discussions included energy poverty, market distortions, smart metering by 2035, and energy storage limitations, with potential solutions like the Tarnita Hydropower plant mentioned. The importance of involving Romanian research institutions in enhancing competitiveness was emphasized, alongside addressing discrepancies between NECP data and draft strategy figures. The need for a long-term strategic vision and alignment with European regulations, particularly regarding electric vehicle charging incentives and system efficiency, was also underscored.

In addition to the public consultation, the institutions and organisations have provided feedback and suggestions for Romania's NECP and highlighted several key focus areas across different chapters and PAMs. The focus was around decarbonisation, improving RES, EE, building and transport, energy security, and enhancing research and innovation. Below is a summary of the most commented chapters and PAMs, along with general themes identified from the input received:

The chapters with major feedback were:

1. Chapter 1.2: This chapter, which deals with foundational energy policies and strategies, received feedback on incorporating measures related to decarbonization, nuclear energy, and RES.
2. Chapter 2.1.2: Stakeholders focused on the statistics and projections of energy consumption, particularly emphasizing renewable energy targets and data accuracy.
3. Chapter 2.3: Comments addressed energy security, including nuclear energy, renewables, and carbon pricing strategies, reflecting the importance of integrating energy security with market operations.
4. Chapter 2.4.1 & 2.4.3: These sections attracted feedback regarding research, innovation, and competitiveness, emphasizing the need for strategic alignment with the Just Transition Programme.
5. Chapter 3: Stakeholders highlighted the importance of storage, the Electric Transmission Network, and market integration for achieving 2030 energy targets.
6. Chapter 4.5.2 & 4.5.3: Feedback in these chapters focused on energy efficiency, particularly in the building sector, and the integration of new technologies like heat pumps.

The key PAMs that were discussed were:

- PAMs 1, 7, 8, 9: These measures were commonly addressed, focusing on coal phase-out, natural gas plants, energy efficiency, and transition strategies for traditional energy sectors.
- PAMs 14, 15, 16: These measures were highlighted for their role in supporting agricultural and rural development as part of the energy transition.
- PAMs 22, 23, 25, 26, 85: Feedback emphasized renewable energy deployment, such as solar (including solar on rooftop), wind and hydro and energy storage
- PAMs 46, 47, 48, 49, 50, 55: Comments addressed the electrification of transport and the importance of investing in green mobility to meet climate goals.

- PAMs 12, 30, 31, 32: Stakeholders recommended improvements in waste management and biofuels, including biomethane and SA, and RFNBO production and use.
- PAMs 28, 87, 88, 89, 90, 91: These measures were discussed in the context of energy poverty and community energy initiatives, with suggestions for enhanced support and integration.

And some of the general themes that most of the organizations and institutions were focused on were:

- Decarbonization and Energy Security: Feedback highlighted the necessity of robust decarbonization policies, including the role of nuclear energy, hydrogen, and carbon capture and storage (CCS) in achieving energy security.
- Infrastructure and Grid Modernization: Comments stressed the need for modernizing infrastructure, including enhancing storage capacity and improving grid integration for renewables.
- Just Transition: Many comments emphasized the importance of a just transition, focusing on reskilling workers and supporting communities affected by the shift to cleaner energy sources.
- Research and Innovation: There was a significant focus on aligning NECP with innovation and competitiveness strategies to foster new technologies and renewable energy solutions.

However, the majority of organizations highlighted the following PAMs and gave some recommendations for improvement.

- Increasing the RES targets in the final gross energy consumption until 2030
- Introducing fuels from renewable sources of non-biological origin (RFNBO)
- Hydrogen (PAM 2, PAM 3)
- Setting a mandatory target for CO_2 injection and storage for the oil and gas industry (PAM 9)
- Improving the management of agricultural residues (PAM 11)
- Replacement of conventional fuels with RES in manufacturing industries (PAM 45)
- Increasing the share of passenger transport vehicles powered by alternative fuels (PAM 48)
- Increasing the share of freight transport vehicles powered by alternative fuels (PAM 51)

The Ministry of Energy initiated a Working Group for the development of energy communities in Romania and launched the invitation for interested entities to join. The purpose of the Working Group for Energy Communities is to address the required specific amendments of the legislative framework that would enable electricity consumers in Romania to benefit from renewable energy produced within an energy community they are part of.

Stakeholders, including consumers, non-governmental organisations, local communities, industry and the public sector, are encouraged to join this working group to contribute to the development of a modern and flexible legislative framework, as well as learning from good practice from those who have already implemented an energy community model in Romania.

The first meeting of the group was organised by Ministry of Energy and took place on the 4th of June 2024. Approximately 40 associations, organizations, universities, individuals and local authorities participated in the first meeting.

IV. Consultations of other Member States

To be finalized after completion of the overall process.

V. Iterative process with the Commission

The draft version of the NECP was submitted to the European Commission, which provided essential and constructive feedback. These comments were crucial in enhancing the quality of Romania's NECP. The recommendations guided significant updates, aligning the plan with EU standards and ensuring more accurate

and reliable data. As a result, the revised document now better reflects Romania's economic realities and strengthens its commitment to sustainability goals.

The European Commission made several recommendations for Romania's NECP, which included increasing the share of renewable energy, enhancing energy efficiency, and achieving specific GHG emission reduction targets.

GHG Emissions: The Commission recommended Romania set a clear path to achieve the LULUCF (Land Use, Land-Use Change, and Forestry) target of -2380 kt CO2eq by 2030. The updated NECP indicates Romania will achieve carbon neutrality by 2040 and negative emissions by 2050, with forest absorption exceeding emissions. New measures include additional forestation and decreased biomass consumption for heating.

Renewable Energy: The Commission recommended Romania raise its ambition for renewable energy sources to at least 41% by 2030. Romania's updated NECP increased the renewable energy share to 38.3% from the draft's 36.2%, mainly through increased heat pump usage and decreased gas consumption. In addition, new measures included in the current version of the NECP focus on biomethane blending into the natural gas pipeline, projected to reach a 5% share by 2030 (according to relevant legal provisions and in parts of the system where the technical conditions allow it). However, reaching the 41% target is challenging.

Heating and Cooling: Romania was advised to provide a long-term plan for renewable energy deployment, including specific targets for buildings, industry, and renewable fuels of non-biological origin (RFNBOs). The updated NECP projects a 41.1% renewable energy share in heating and cooling by 2030, improved from 36.3% in the draft. The plan emphasizes heat pump deployment and better statistical data to include heat from heat pumps in the energy balance. Additionally, the target of at least 1% for renewable fuels of RFNBO (including green hydrogen) in the transport sector in 2030, stipulated in Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652 (Directive RED III), will be achieved using hydrogen. The renewable energy share in the industry has also been met by using hydrogen.

Energy Efficiency: The Commission highlighted the need for clearer quantification of energy savings across sectors. Romania's updated NECP targets a final energy consumption of 22.47 Mtoe by 2030. The primary energy consumption target is set at 30.2 Mtoe, with new projections showing a reduction to 28.4 Mtoe

Energy Security: The NECP addresses the need to reduce dependence on Russian fossil fuels by incorporating the Neptun Deep natural gas project, which is expected to contribute to zero imports by 2030 and eventual exports by 2050. This project is significant for Romania's energy security objective and economic prospects.

These updates reflect Romania's commitment to aligning its energy and climate policies with EU targets, addressing Commission recommendations, and enhancing national strategies for sustainable development.

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.
- **Natural gas storage system development projects**: they aim to ensure security of supply at the national level as well as through the mechanism of sharing the storage capacity for third parties (Memorandum with the Republic of Moldova promoted/supported by the Ministry of Energy).

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 contribution of Romania to the elaboration of the energy efficiency policies within the Enhancing the Implementation and Monitoring and Verification practices of 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 and the contribution of the Romanian side to the implementation of the Development on Natural Gas Transmission System on Romania as part of the Bulgaria-Romania-Hungary-Austria Corridor (BRUA - phase I, II and III) and Development on the natural gas pipeline on Romanian territory for taking over natural gas from the Black Sea coast (Black Sea – Podișor) projects, as well as the activity carried out within the Central and South Eastern Europe Energy Connectivity (CESEC) initiative – Vertical Corridor, are presented.

With relevance to the **Energy Infrastructure** dimension – the projects currently listed in the Ten-Year Network Development Plan 2022 (the latest version is TYNDP 2024) of the European Network of Transmission System Operators for Electricity (ENTSO-E) and the European Network of Transmission System Operators for Gas (ENTSOG), as well as relevant Projects of Common Interest (PCI's) from the 5th projects of common interest (PCI) list, 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

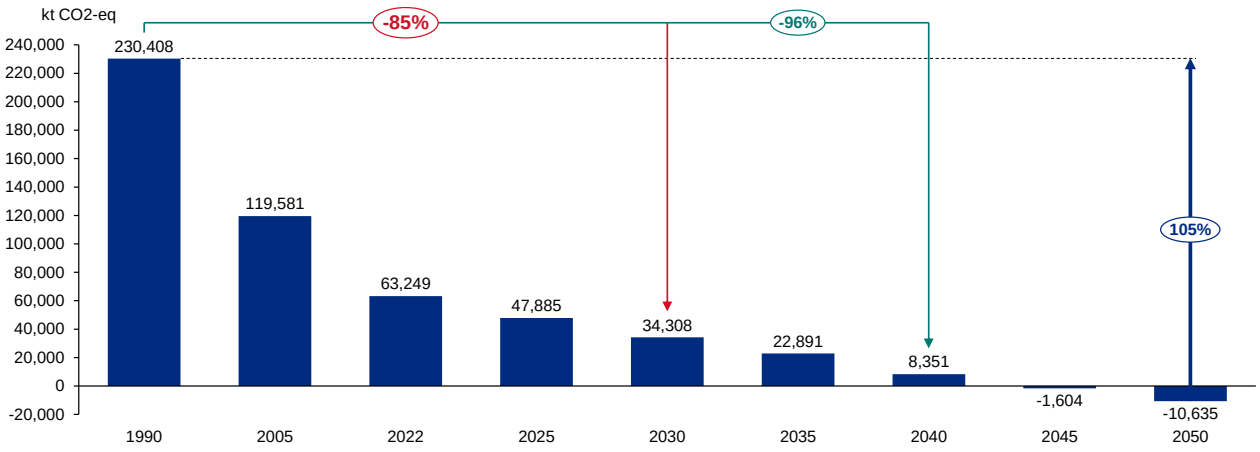
2.1 Dimension decarbonisation

2.1.1. GHG emissions and removals

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

The economy wide net GHG emission reduction target for Romania is 85% in 2030 compared to the reference of 1990 (Figure 10). The indicative trajectory shows that, by 2022, Romania has already achieved a reference point of 85% of the total net GHG reduction target set for 2030 and it will achieve 93% of the 2030 target by 2025. For 2040, the goal is to reach around 96% net GHG emission reduction while the goal for 2050 is to reach 105% net GHG emission reduction, compared to the 1990 level.

Figure 10. Indicative targets and trajectory for net GHG emissions reduction



Source: 1990,2005, 2022 GHG inventory, 2025-2050 LEAP-RO model

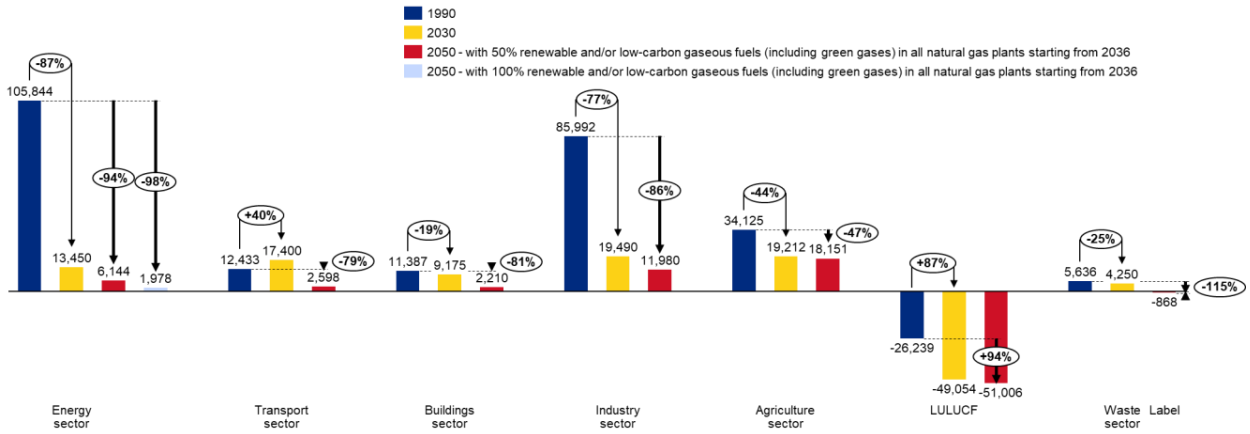
II. Where applicable, other national objectives and targets consistent with the Paris Agreement and the existing long-term strategies. Where applicable for the contribution to the overall Union commitment of reducing the GHG emissions, other objectives and targets, including sector targets and adaptation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

In order to achieve the target for GHG emissions reduction, sectoral ***objectives*** are set for *2030* relative to 1990 level (Figure 11):

- *Energy sector* – 87% GHG emission reduction in 2030 compared to 1990 (mainly through the gradual decommissioning of coal and lignite fired power plants and building RES capacities)
- *Transport sector* – no more than 40% GHG emission increase in 2030 compared to 1990 (mainly by increasing the share of hybrid, plug-in hybrid and electric vehicles), also railway transport through the electrification expansion and infrastructure modernization, public passenger transport network by metro expansion and last but not least of the multimodal transport in Romania, especially through the development type RO-LA (Rollende Landstrassen/rolling road) services.
- *Buildings sector* - 19% GHG emission reduction in 2030 compared to 1990 (mainly by improving the buildings performance and increasing the share of heat pumps and solar thermal collectors)
- *Industry sector* – 77% GHG emission reduction in 2030 compared to 1990 (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* – 44% GHG emission reduction in 2030 compared to 1990 (by appropriate Livestock diet and feed management)
- *LULUCF* – 87% GHG removals increase in 2030 compared to 1990 (mainly through appropriate forest fires management)
- *Waste* – 25% GHG emissions reduction in 2030 compared to 1990 (by proper reduction, reusage and recycling of the waste)

Figure 11. Sectoral objectives for lowering GHG emissions in 2030 and 2050 relative to 1990 levels



Source: 1990 GHG inventory, 2030 and 2050 LEAP-RO model. For 2050, 2 scenarios are considered: 50% and 100% renewable and/or low-carbon gaseous fuels (including green gases) in all natural gas plants starting from 2036.

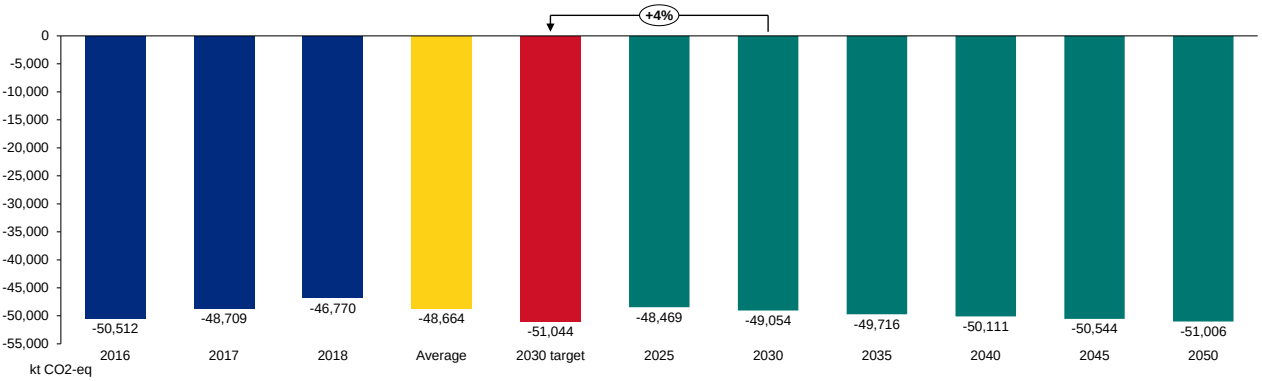
Concerning adaptation to climate change, the SNASC outlines strategic objectives for 13 key vulnerable sectors to ensure sustainable adaptation to climate change in Romania. These sectors include Water Resources, Forests, Biodiversity and Ecosystem Services, Population, Public Health and Air Quality, Education, awareness, research, innovation and digitalization, Cultural Heritage, Localities, Agriculture and Rural Development, Energy, Transport, Tourism and Recreational Activities, Industry, and Insurance. For instance, the objectives for Water Resources include reducing the risk of scarcity and flood risk reduction. For Forests, the objectives involve adapting forest management to climate change impacts and expanding forested areas. In the Energy sector, increasing the resilience of the energy sector and critical infrastructure is prioritized. Each objective aligns with broader European goals and is designed to integrate climate adaptation into sectoral and cross-sectoral policies effectively. The table with the strategic objectives and their correlation with the five dimensions of the NECP is given in Annex III of this document.

In addition, the PNASC details specific measures to implement the strategic objectives identified in the SNASC, categorized into "soft measures," "green measures," and "grey measures." Soft measures include policy, legislative, social, research, management, and financial initiatives. Green measures promote Nature-based Solutions (NbS) to enhance resilience using ecosystem services. Grey measures involve technological and engineering solutions for adapting infrastructure and society. These measures are prioritized to emphasize soft measures where feasible, followed by green and then grey solutions. Each measure is linked to the corresponding strategic objectives, specifying implementation periods, responsible bodies, funding sources, and result indicators to ensure effective adaptation to climate change.

An important aspect related to the European Commission's recommendation is the LULUCF target for 2030, which requires an additional 2,380 kt CO_2 in sinks compared to the 2016-2018 average. The average sinks during this period, according to the new version of the INEGES (March 2024), amount to 48,664 kt CO_2. Therefore, the target for 2030 is set at 51,044 kt CO_2. Additional measures should be proposed in the order 2030 target LULUCF target to be achieved. In this version of NECP two measures in the LULUCF sector are introduced which are in line with Romania Forest Strategy adopted in 2022. The first one is the forestation of an addition of 65 thousand ha forest area by 2030 and forestation of urban area of about 350 ha. However, these measures are leading to some improvement in sinks by 2030, but the figure remains below the target. By 2030, the projections are 48,867 kt CO_2, which is nearly the same as the 2016-2018 average. The old 2030 target for the LULUCF sector was 34,412 kt CO_2, highlighting the major updates and adjustments made

in the current GHG inventory, which can be the case with the next inventory too. Overall, the projections show that in 2030 Romania will be 4% below the targeted sinks (Figure 12).

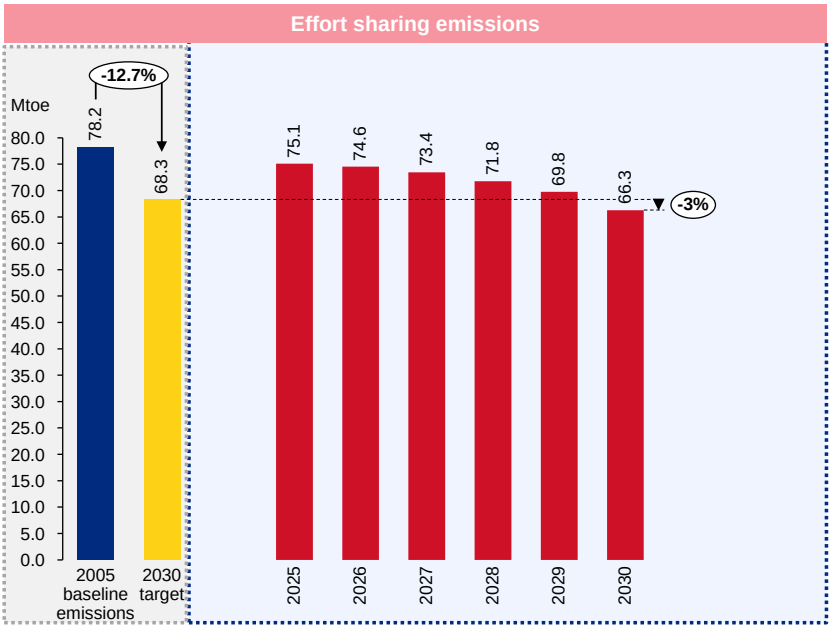
Figure 12. GHG trajectory for LULUCF GHG emissions (with updated inventory)



Source: 2016, 2017, 2018 INEGES (March 2024), 2025-2050 LEAP_RO Model

Figure 13 illustrates the effort-sharing emissions from 2025 to 2030. Starting from a baseline of 78.2 Mtoe in 2005, the 2030 target is set at 68.3 Mtoe, (12.7% reduction). The emissions are projected to decrease each year, reaching 63.1 Mtoe by 2030, which is an 8% reduction from the 2030 target. This trend demonstrates a clear commitment to reducing emissions over time in alignment with effort-sharing goals.

Figure 13. Effort sharing emissions



Source: LEAP_RO projections team analyses

According to the Recommendation of the European Commission (COM) / 18.12.2023 on the updated draft version of the NECP, Romania should take measures to "Identify the amount of CO_2 emissions that could be captured annually until 2030, including the source of the respective emissions, provide details on how the captured CO_2 will be transported and identify the total CO_2 storage capacity and CO_2 injected volumes available by 2030".

Considering the fact that the Ministry of Energy coordinates the process of updating the NECP, an analysis was initiated at its level, based on the data provided by some of the interested parties in CCUS, data from which the following conclusions can be drawn:

- the duration of the implementation of a project on the entire value chain (capture/transport/storage) is between 6 and 7 years

- it is estimated that there is a need to capture CO_2 of approx. 62 million t/year (of which at least 26 million t/year in the steel and cement/lime industries)
- it is estimated that up to approx. 16 million t/year of CO_2 can be transported via pipelines (source CONPET)
- geological CO_2 storage capabilities of at least 9 million t/year are estimated.

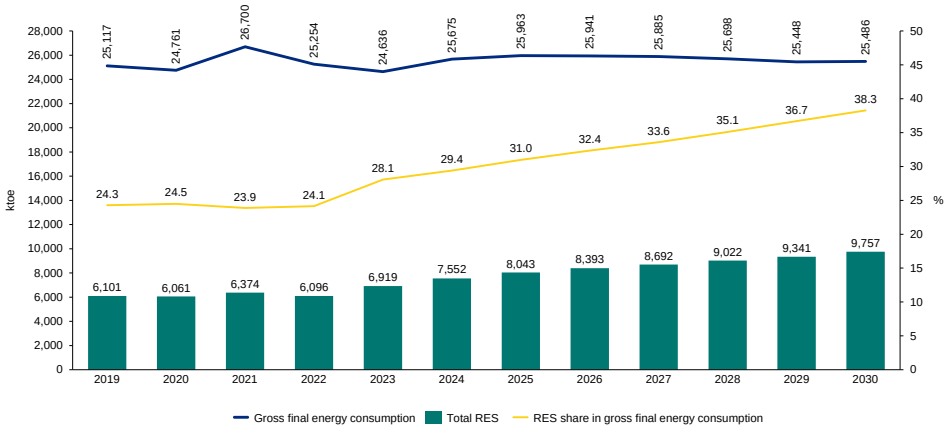
Given the above, a strategic vision should be drafted for achieving and funding the proposed objectives, and also complying with the quotas imposed by the provisions of the EU Net Zero Industry Act (Regulation (EU) 2024/1735) (NZIA).

2.1.2. Renewable energy

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

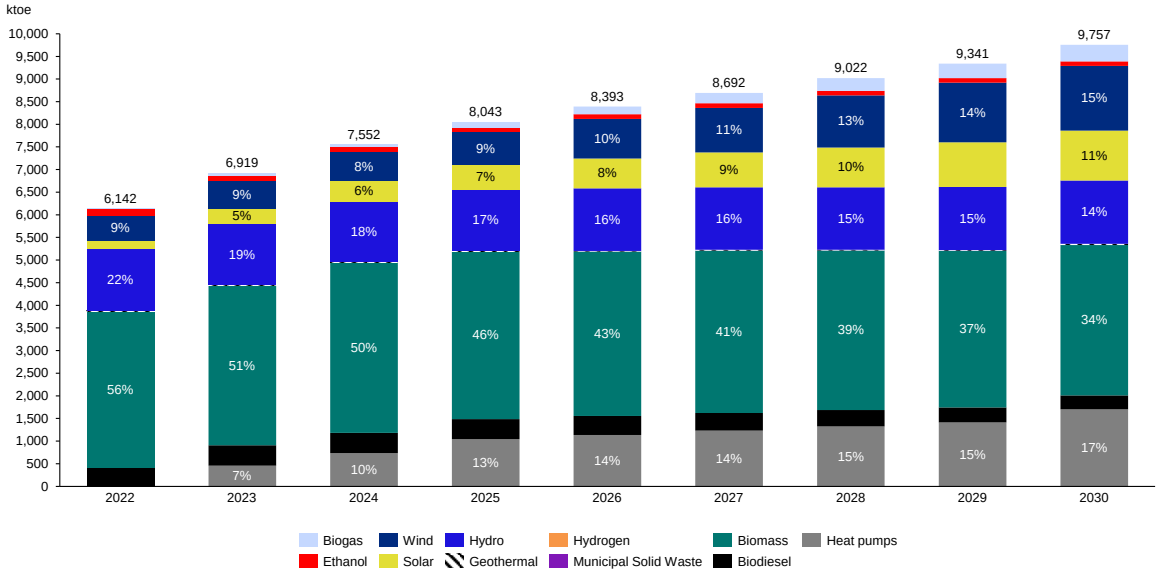
The national objective for the share of renewable energy in the gross final consumption of energy by 2030 is 38.3% (as depicted in Figure 14). According to the indicative trajectory, it is anticipated that, by 2025, the RES share in gross final energy consumption will reach 31%. The highest contribution for reaching this objective is due to increasing the installed capacities for electricity generation based on wind and solar energy , as well as to increasing the heat pumps usage for heating and cooling (Figure 15). The biomass will remain to have dominant role, but its share from total RES will decrease from 56% in 2022 to 34% in 2030. The projected RES target is already ambitious given existing growth rates. The planned increase in wind, solar and heat pump capacities, as well as the electrification of the transport and industry sectors are significant but insufficient to reach the 41% target, so achieving the 41% RES by 2030 is challenging. Additionally, technological, economic, and infrastructural barriers further limit the rapid expansion needed to meet this higher target. For 2020-2022, heat pumps were not included in the statistical data, although they were installed and employed at national level. Starting from 2023, heat pumps (existing and new) are considered as technology used in heating and cooling.

Figure 14. Share of energy from renewable sources in gross final consumption of energy, with an indicative trajectory



Source: 2019-2022 SHARE tool EUROSTAT, 2023-2030 LEAP-RO model
Note: Data after 2023 include heat pumps which are not included in the SHARE tool for the period 2019-2022

Figure 15. Consumption of RES and share of RES by fuel, with an indicative trajectory



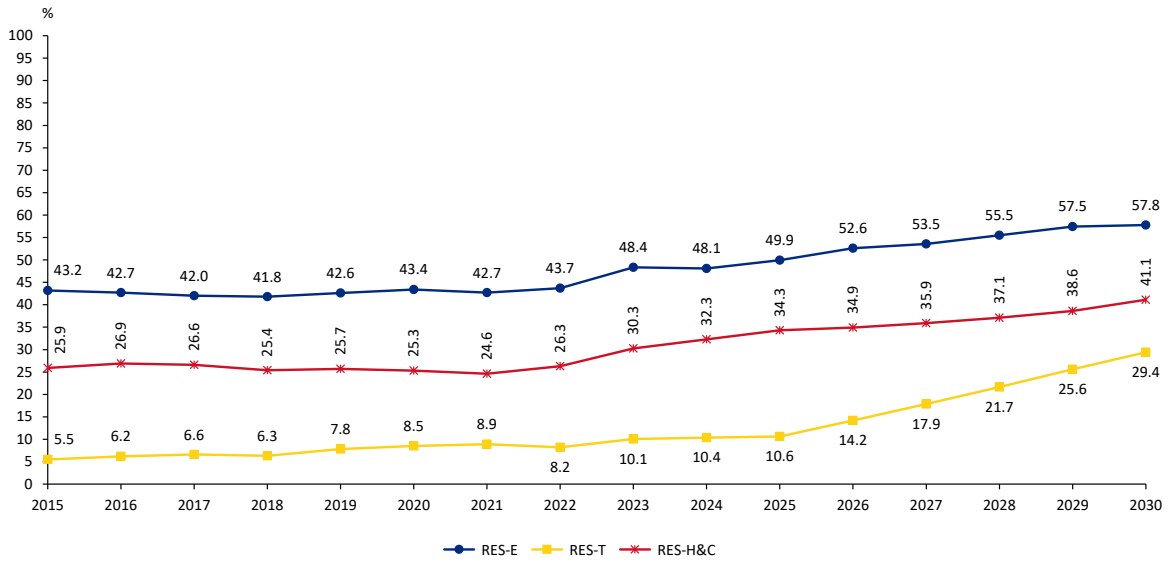
Source: 2022 SHARE tool EUROSTAT, 2023-2030 LEAP-RO model

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 the mandatory target of 29% in 2030, stipulated in the Directive (EU) 2023/2413 (Directive RED III), will be met by Romania, which aims for a *29.4%* share in 2030, by increasing the use of electricity in this sector (Figure 16). The RES share in the *electricity sector* will also increase by 2030, reaching *57.8%* in 2030, as a result of the construction of new RES (mainly wind and solar)-based 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 *41.1%* in 2030. Although 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.

The target for *heating and cooling* for 2021-2025 mandates an annual increase of 0.8% in the RES, totaling a 4% increase over this period (RES Directive). Official data shows that the RES share in heating and cooling was 26.3% in 2020, implying a target of 30.3% by 2025. NECP calculations project a RES share of 34.3% in 2025, exceeding this target. For 2026-2030, the target requires an annual increase of 1.1%, leading to a 2030 target of 39.8%, which Romania is on track to achieve with a projected 41.1% RES share.

Figure 16. Estimated trajectories for the share of renewable energy in final energy consumption in the electricity, heating and cooling and transport sector

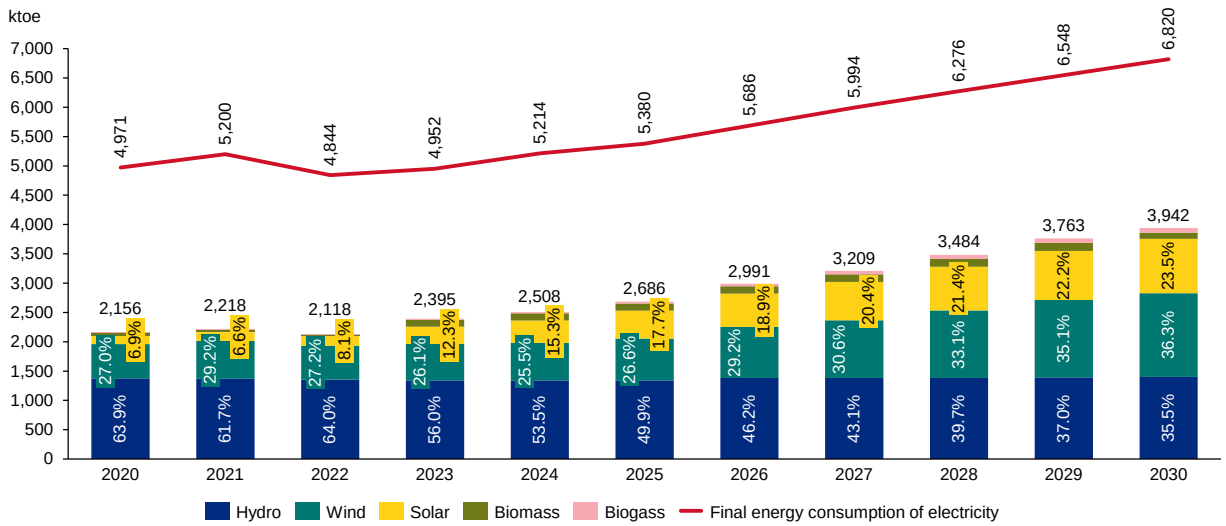


Source: 2015-2022 SHARE tool EUROSTAT, 2023-2030 LEAP-RO model
Note: Data after 2023 include heat pumps which are not included in the SHARE tool for the period 2015-2022

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

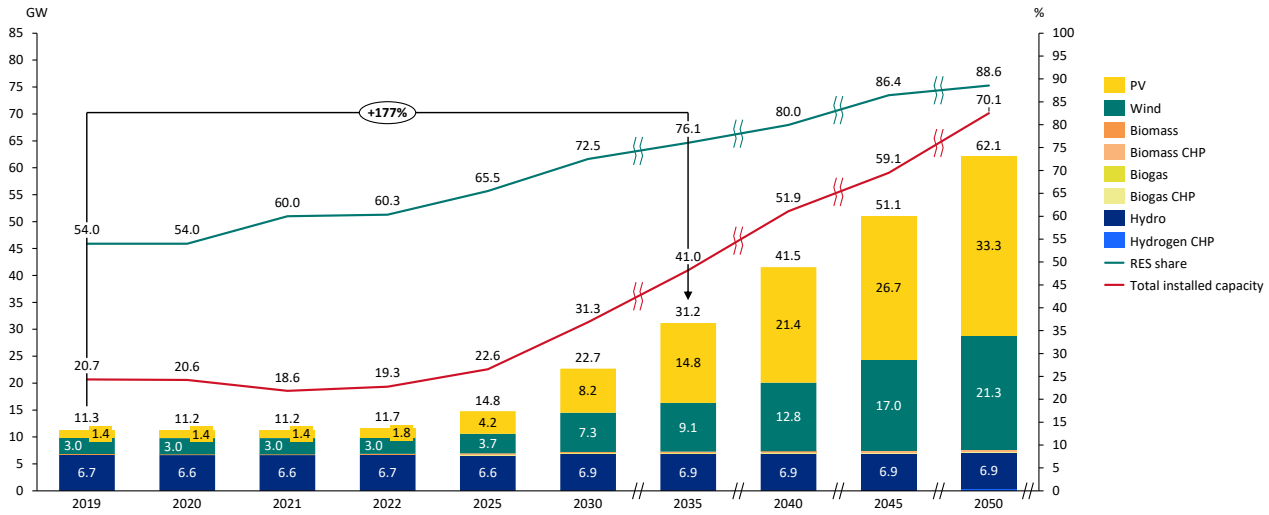
As previously stated, in order to reach the objective for the RES share in the electricity sector, the major component are the construction of new solar and wind capacities (Figure 17 and Figure 18). Therefore, it is assumed that the share of electricity generated from hydro power plants in the gross final energy consumption will be reduced from around 64% in 2020 to 35.5% in 2030. On the other hand, wind will have the highest share, of around 36%, followed by solar, with around 24% share, in the gross final energy consumption. This can be achieved by building and installing a total of around *33.3 GW of solar power plants* (both on land and on rooftops) and *21.3 GW of wind power plants in 2050*.

Figure 17. Estimated trajectory by RES technology in gross final energy consumption, electricity sector



Source: 2020-2022 SHARE tool EUROSTAT, 2023-2030 LEAP-RO model

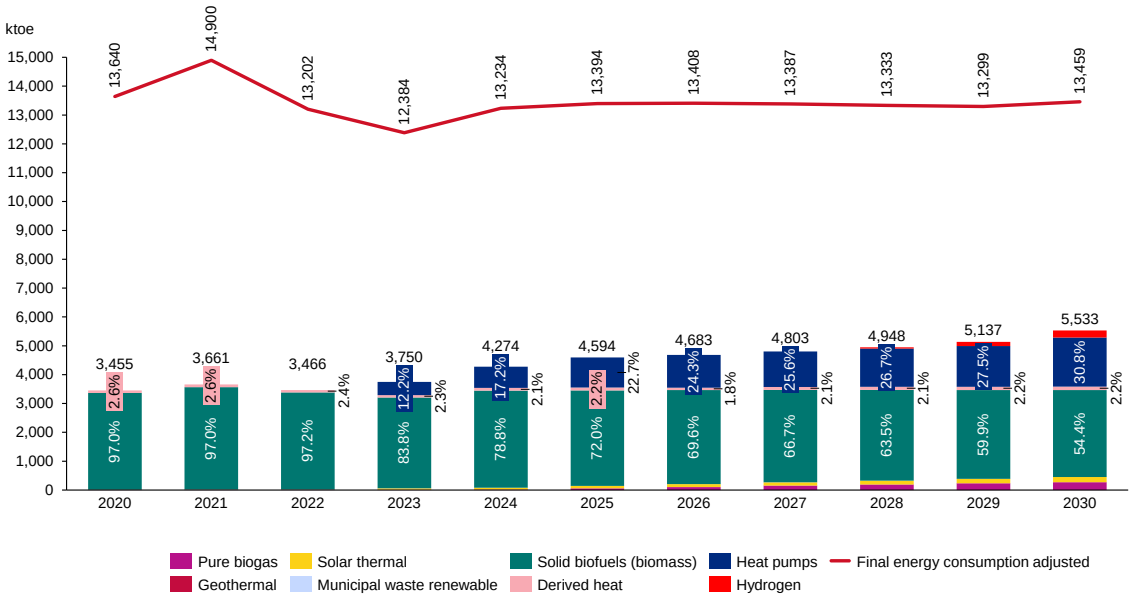
Figure 18 Trajectory of the installed capacity from RES for electricity production, by technology



Source: 2019-2022 SHARE tool EUROSTAT, 2025-2050 LEAP-RO model
Note: Starting from 2036, all natural gas plants will switch to use at least 50% of renewable and/or low-carbon gaseous fuels (including green gases) which will lead to additional "RES" capacities and GHG emission level reduction. In the above graphs, after 2035, by natural gas one means natural gas, biomethane and renewable hydrogen.

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 19). As previously 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 54.4% in 2030. On the other hand, the share of heat pumps, which are also recognized as a renewable technology, will reach 30% in 2030. For 2020-2022, heat pumps were not included in the statistical data, although they were installed and employed at national level. Starting from 2023, heat pumps (existing and new) are considered as technology used in heating and cooling.

Figure 19. Estimated trajectory by RES technology in gross final energy consumption, heating and cooling sector

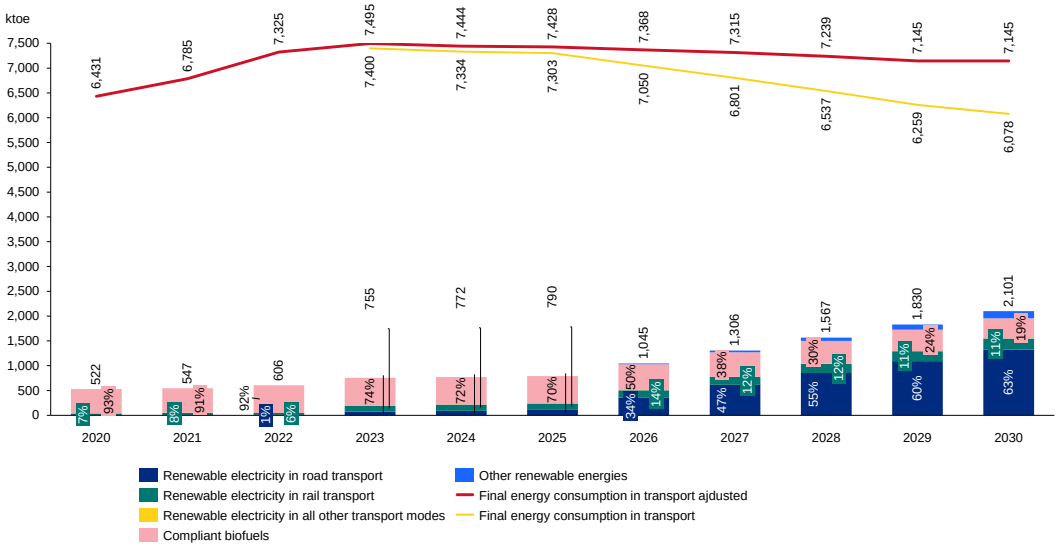


Source: 2020-2022 SHARE tool EUROSTAT, 2023-2030 LEAP-RO model
Note: Data starting from 2023 include heat pumps which are not included in the SHARE tool for the period 2020-2022, the percentages on the figure refer to the share of RES in the total gross final energy consumption produced only from RES

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 in the final energy consumption of this sector (Figure 20). Additionally, the biofuels compliant with Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources will also have a significant role, with a share of 19% of the RES consumption in transport in 2030. It is important to emphasize that the 2030 target of 1% renewable fuels of non-biological origin (RFNBO), stipulated in Directive (EU) 2023/2413 (Directive RED III), will be achieved, as hydrogen consumption is projected to reach 2% of the final energy consumption in the transport sector.

The adjusted final energy consumption in the transport sector is calculated according to Directive (EU) 2018/2001 and the EUROSTAT Share tool. Specifically, the share of renewable electricity consumed in the transport sector is considered to be four times its energy content when supplied to road vehicles. When supplied to rail transport, it is considered to be 1.5 times its energy content.

Figure 20. Estimated trajectory by RES technology in final energy consumption, transport sector



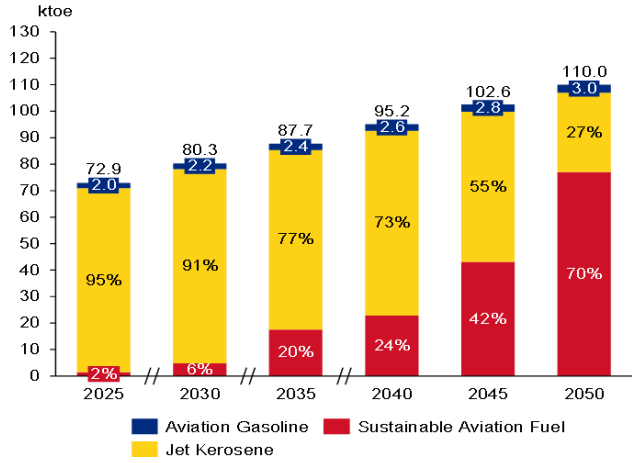
Source: 2020-2022 SHARE tool EUROSTAT, 2023-2030 LEAP-RO model

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, the final energy consumption in transport presented in

Figure 20 *also includes the electricity consumption in the transport sector presented in* Figure 17.

The recommendations from the comments received during public consultation regarding aviation obligations have been addressed. Starting in 2025, 2% of sustainable aviation fuels will be introduced. This percentage will increase to 6% by 2030, 20% by 2035, 42% by 2045, and 70% by 2050. These steps are outlined in Figure 21, which shows the estimated trajectories for final energy consumption in aviation and the introduction of sustainable aviation fuels up to 2050. This plan ensures that the aviation sector steadily increases its use of sustainable fuels, aligning with long-term environmental goals. Furthermore, it is anticipated that starting from 2028 sustainable aviation fuels will be produced in Romania.

Figure 21. Estimated trajectories for final energy consumption in the aviation and the introduction of Sustainable aviation fuels (new results for the period up to 2050)



Source: LEAP-RO model

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 22). The consumption in 2030 of the biomass will slightly decrease in comparison to 2021, but its share will remain around 85% throughout the analyzed period. On the other hand, the projections for the sinks of the forestry sector are conservative (Figure 23). 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 23 for the period 2019-2021 are according to the Romanian NIR from 2024 in which a revision of the sinks was made for the whole period up to 2022. However, the lower risk data should be taken into consideration, therefore the absorptions from this sector should not be less than 29,700 $ktCO_2$-eq in 2030. Almost the overall biomass will be produced in Romania.

Figure 22. Estimated trajectory on bioenergy demand, disaggregated by fuels

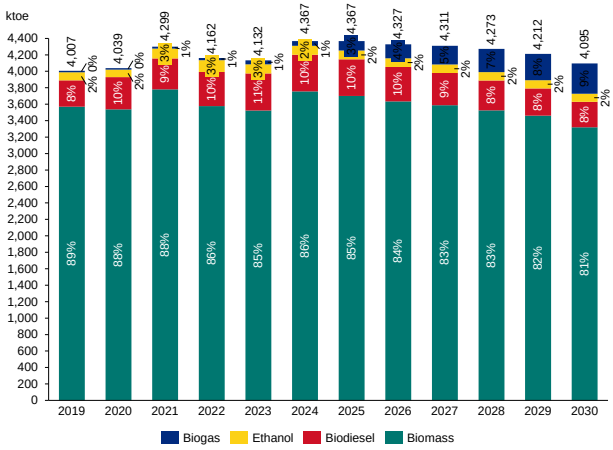
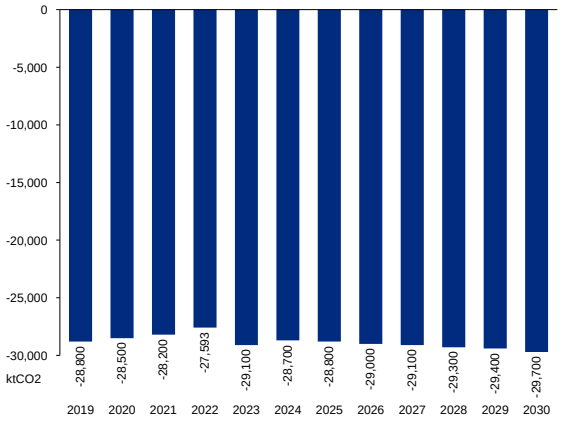


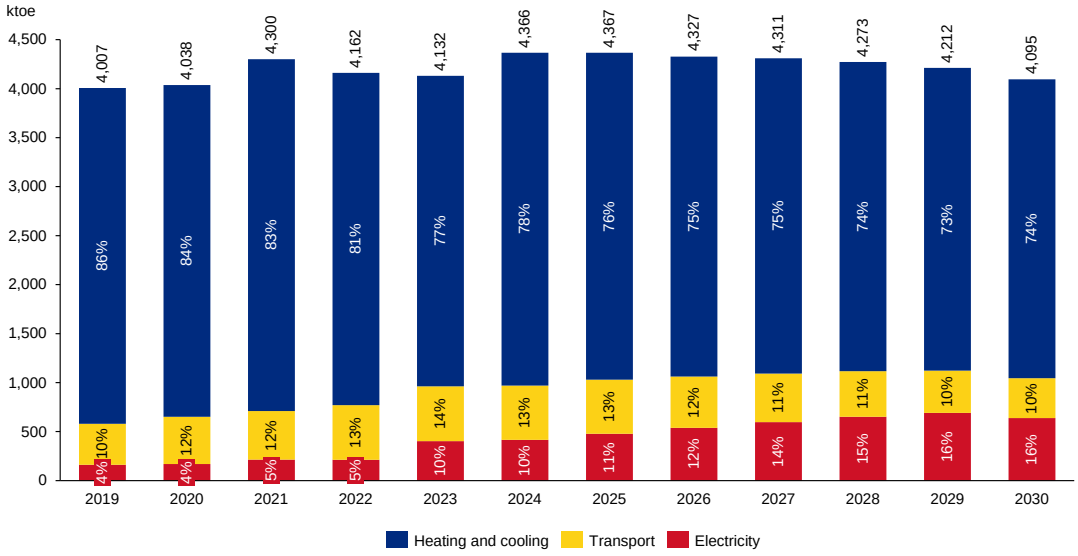
Figure 23. Estimated trajectory on sinks in forestry sector from LULUCF



Source: 2020-2022 SHARE tool EUROSTAT, 2023-2030 LEAP-RO model

When analysing by sectors, as expected, most of the bioenergy demand is used for heating and cooling due to the use of biomass (Figure 24). The objective is to reduce the share of this sector by 2030 to 74%, while increasing the share of the electricity sector due to the electricity generation from biomass and biogas.

Figure 24. Estimated trajectory on bioenergy demand, disaggregated between heat and electricity

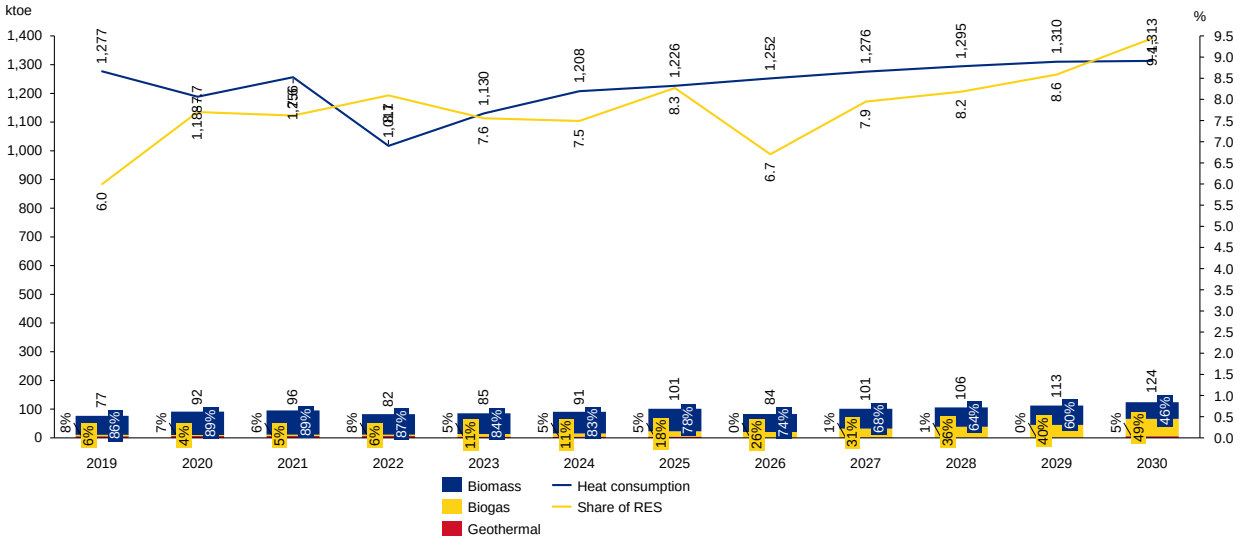


Source: 2020-2022 SHARE tool EUROSTAT, 2023-2030 LEAP-RO model

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 increase after 2022 until 2030. 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 9.4% in 2030 (Figure 25).

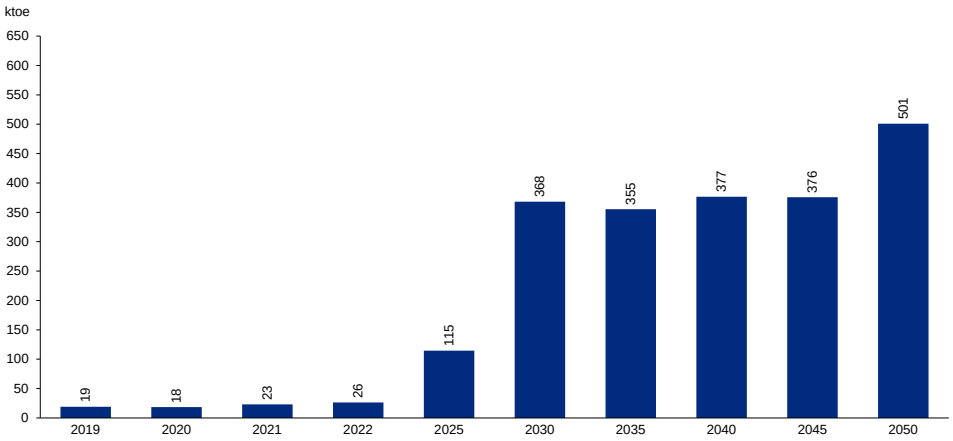
Figure 25. Estimated trajectory on share of RES in district heating



Source: 2020-2022 SHARE tool EUROSTAT, 2023-2030 LEAP-RO model

According to the biomethane study of Romania conducted by the EBRD, waste and manure recovery and plant residues play crucial roles for biomethane production. This study found that there is a potential in Romania for biomethane production. To increase the overall share of RES and to decrease the methane emissions in this NECP an objective of achieving 5% share of biomethane in natural gas network by 2030 and 10% by 2050 is envisaged (according to relevant legal provisions and in parts of the system where the technical conditions allow it). This initiative will further enhance the role of biomethane in Romania's energy mix and support long-term sustainability goals. The projections shows that from the waste and agriculture sectors around 501 ktoe biomethane can be produced by 2050 (Figure 26).

Figure 26. Estimated trajectory on biogas/biomethane production

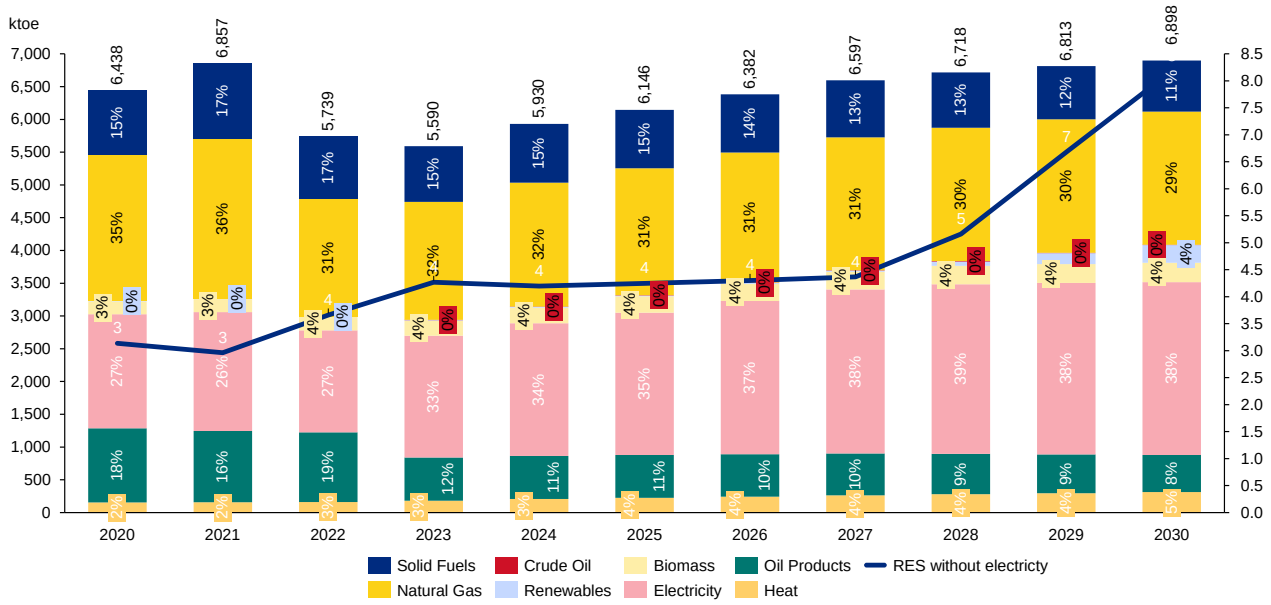


Source: 2019-2022 EUROSTAT energy balance, 2023-2030 LEAP-RO model

To promote the use of renewable energy in the heating and cooling sector, the RES directive proposes a separate target for the industry sector. From 2021 to 2025, Romania must increase the share of renewable energy in the industry sector by at least 0.8 percentage points annually on average. For the period from 2026 to 2030, the target is an annual average increase of at least 1.1 percentage points. The RES Directive outlines various rules for achieving this target, and for Romania, electricity from RES sources should be counted.

Based on the Directive's percentages and the 2020 RES share in the industry sector, the target for Romania for 2030 is 14.1%. Biomass consumption is projected to increase by 50% compared to 2020 levels, and hydrogen is expected to reach almost 4% share by 2030. However, these measures alone will only achieve an 8.2% RES share. To meet the 14.1% target, the use of RES electricity in the industry sector will be necessary.

Figure 27. Estimated trajectory on RES in industry



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"[4]).

The primary energy target for Romania, according to the recast of the Energy Efficiency Directive from 2023, is set at 30.2 Mtoe. The projections show that this target will be achieved in 2030 with a value of 28.7 Mtoe which is 9% reduction compared to 2022 (as depicted in Figure 28). Similarly, final energy consumption is expected to experience a decrease of 6% (as shown in Figure 29), without a negative impact on productivity, complementary with implementing measures to increase the share of energy produced from renewable sources, achieving an absolute value of 22.5 ktoe in 2030. This means that the target for final energy consumption, also defined according to the recast of the Energy Efficiency Directive from 2023 (22.47 Mtoe), will be achieved.

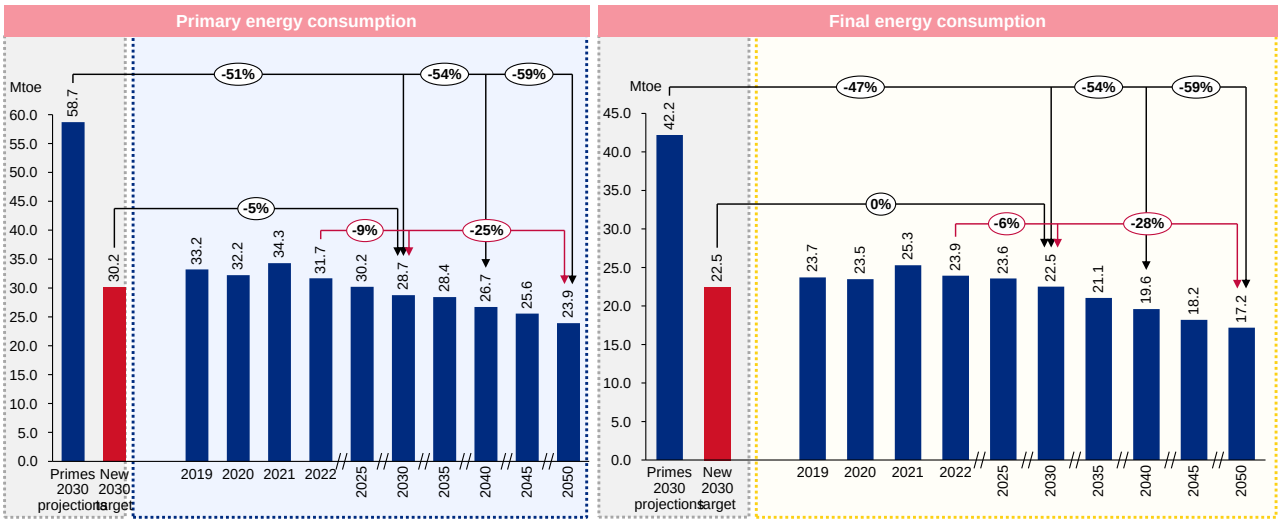
Compared to the reference 2030 projections established by the Primes model, Romania's energy efficiency goal by 2030 is to achieve a remarkable 51% reduction in primary energy consumption and a corresponding 47% reduction in final energy consumption (Figure 28 and Figure 29), with no negative impact on the productivity. This target is complementary to that regarding the share of RES in gross final energy consumption. By 2050, Romania aims to lower its primary energy consumption by 25%, while the final energy consumption is projected to decrease further by 28% compared to the 2022 level of consumption. These targets reflect a dedicated commitment to sustainability and a greener future.

More details on the energy efficiency, by sectors and by fuel type, is included in Chapter 4 and Chapter 5.

Figure 28. Estimated primary energy consumption trajectory

Figure 29. Estimated final energy consumption trajectory

[4] 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.



Source: 2019-2022 Energy balance EUROSTAT, 2025-2050 LEAP-RO model

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 10,116.5 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

Table 5 outlines the indicative milestones targeting the building sector. Following the recommended scenario in the National Long-Term Renovation Strategy to support the renovation of the national stock of residential and non-residential buildings, both public and private, and to gradually transform it into a highly energy efficient and decarbonized building stock by 2050 (SNRTL) adopted by GD no. 1034/2020, with subsequent amendments and completions, 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)

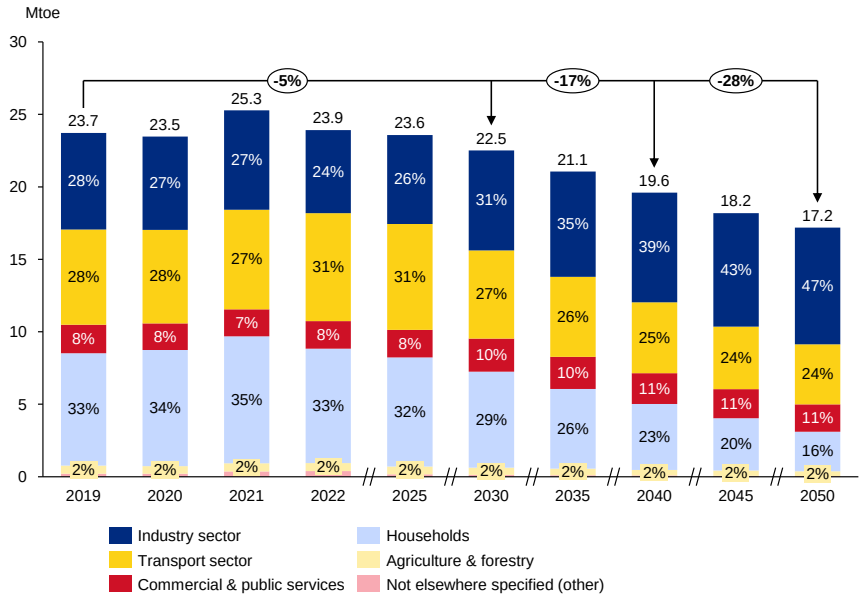
Increase in NZEB buildings	1%	4%	23%
Decrease in worst performing buildings	19%	23%	26%
CO_2 reduction	24%	50%	80%
Total CO_2 emissions	7.50 Mton	4.93 Mton	1.99 Mton

Source: EU Commission Staff Working Document - Analysis of the national long-term renovation strategies (2022).[5], and National long-term renovation strategy[6]

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 30) 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 2022 to 29% by 2030, further dropping to 16% by 2050. In contrast, the industrial sector's share is projected to rise, reaching 31% by 2030 and 47% by 2050. While the share of the transport sector's consumption in the overall final energy consumption undergoes a slight change, decreasing from 31% in 2022 to 27% by 2030 and 24% by 2050, the actual consumption in absolute terms is anticipated to decrease by around 18% by 2030 and nearly 44% by 2050.

Figure 30. Final energy consumption by sector



Source: 2019-2022 Energy balance EUROSTAT, 2025-2050 LEAP-RO model

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

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

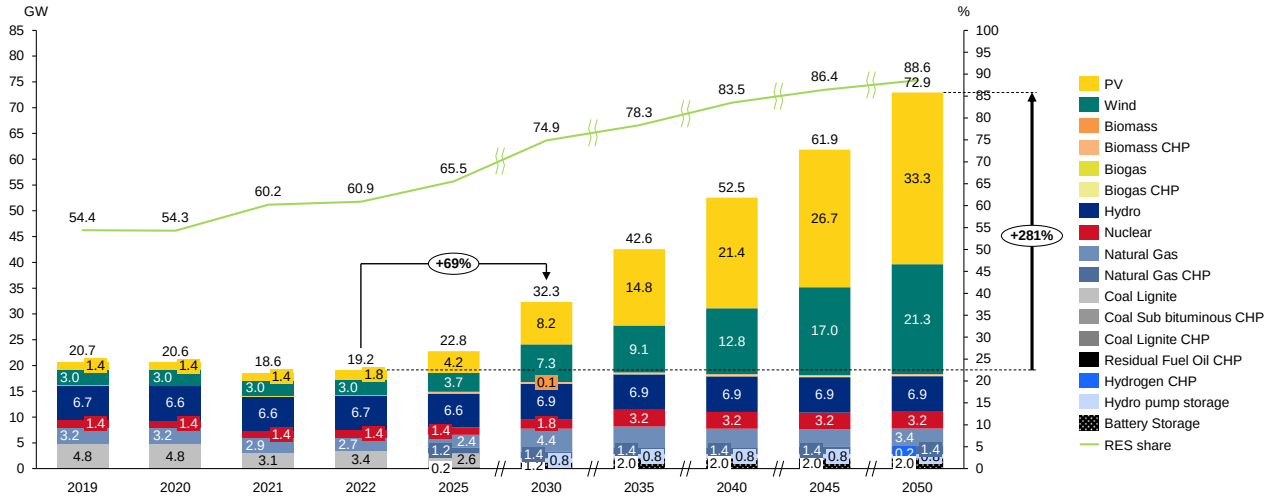
[6] https://energy.ec.europa.eu/system/files/2021-04/ro_2020_ltrs_en_version_0.pdf

promote the distinct aims of energy security. This mainly includes 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 31, the target for 2030 is to achieve an installed capacity of 32.3 GW, marking a 68.2% increase from 2022. Of this projected capacity in 2030, roughly 75% will originate from renewable sources, ensuring the utilization of domestic resources for electricity generation.

Figure 31. Indicative objective for the installed capacity for electricity generation



Source: 2019-2021 Energy balance EUROSTAT, 2025-2050 LEAP-RO model
Note: Starting from 2036, all natural gas plants will switch to use at least 50% of renewable and/or low-carbon gaseous fuels (including green gases) which will lead to additional "RES" capacities and GHG emission level reduction. In the above graphs, after 2035, by natural gas one means natural gas, biomethane and renewable hydrogen.

Furthermore, the objective of Romania is to build, by 2030, new small modular reactors (SMRs) on nuclear energy with total installed capacity of 462 MW. In addition to these, Romania also plans to build 2 new units at CNE Cernavodă of 700 MW each, to be commissioned in 2031 and 2032, respectively, and to renovate Unit 1 at CNE Cernavodă by 2029. Additionally, the goal is by 2030 to construct 2.6 GW natural-gas powered CCGT and around 900 MW of natural-gas powered CHP.

The objective is to maintain electricity net imports at their current level of below 5% by 2030 and to export around 4.4 GWh after 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 European BRUA (phase I, II and III) and Central and South Eastern Europe Energy Connectivity (CESEC) initiative – Vertical Corridor (CESEC).

In parallel with the development of the natural gas transport infrastructure, the development projects of the natural gas storage system are also supported. 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 extraction and transportation from Black Sea deposits.

The first natural gas from the Neptun Deep project, gas exploited by OMV Petrom and Romgaz in the Black Sea, will be transported through the Tuzla-Podisor pipeline starting in the fall of 2027. Estimated natural gas

volumes of approximately 8.16 billion m^3 are expected to be annually delivered from the Neptun Deep perimeter to the national natural gas transmission network.

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 88), among the highest energy import dependance of Romania is for crude oil, natural gas and solid fossil fuels. In 2021, the import of crude oil was 68%, and just in one year it rose to 75% (2022). According to CNSP projections, domestic crude oil production will decline further in the coming years. Due to reduced oil consumption, particularly in the transport sector, the objective for 2030 is to maintain the import dependency on crude oil at the 2022 level. After 2030, this dependency is expected to decrease to 33% by 2045. This reduction can be achieved primarily through the electrification of transport and industry, leading to a lower demand for crude oil. Regarding the countries from which crude oil is imported, as shown in Figure 90, 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.

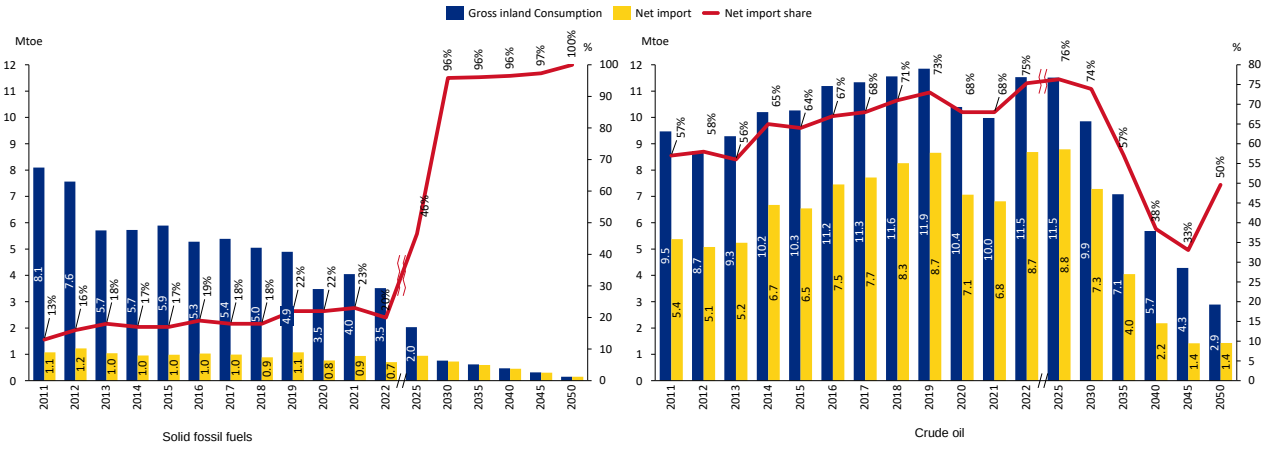
The *goal* for the share of import of *solid fossil fuels for electricity and heat production for 2030* is to be *0%*. This is a result of the decommissioning of the coal power plants, so that there will be no need for import. In addition, the coal consumption in the other sectors will decrease by time and in 2050 it is projected that it will be almost zero. The net import share in 2021 is 23%.

Due to the construction of new natural gas-fired plants and storage facilities, as well as the opening of the Neptun Deep project, Romania's net import share of natural gas is expected to *be negative* in 2030. This means that in 2030, Romania will export more natural gas than it imports. This negative net import is projected to continue until 2040, when the Neptun Deep project is scheduled for decommissioning. However, in the period when there is positive net import on natural gas 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. For the development of the gas transport infrastructure, considering the geostrategic dimension and the rapid pace of development required, combined with the lack of non-reimbursable financing from public sources (which is granted only for the transport of up to 100% hydrogen), it is necessary to include the chapter on financial support.

In recent years, Romania's overall import dependence has been around 30% (+/- 2%). The reduction in energy consumption and the launch of the Neptun Deep project are expected to significantly decrease net imports. Projections indicate that between 2035 and 2040, Romania will become a net exporter of energy. This shift will enhance Romania's energy security.

Figure 32. Import dependency of solid fossil fuel (historical and projections by 2050)

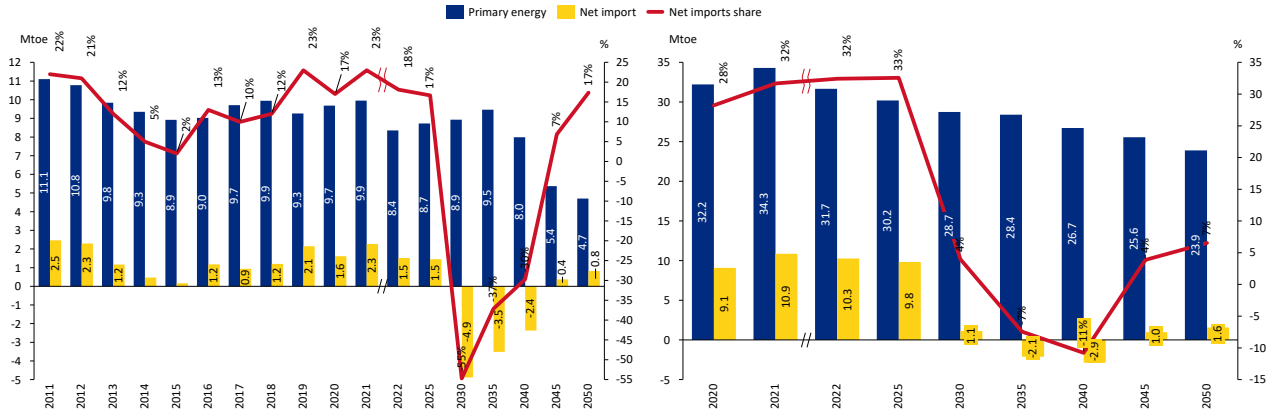
Figure 33. Import dependency of crude oil (historical and projections by 2050)



Source: 2011-2022 Energy balance EUROSTAT, 2030 LEAP-RO model

Figure 34. Overall import dependency (historical and projections by 2050)

Figure 35. Import dependency of natural gas (historical and projections by 2050)



Source: 2011-2022 Energy balance EUROSTAT, 2030 LEAP-RO model

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 in order to use electricity in peak hours to effectively address consumption 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 1200 MW or 2400 MWh of power battery storage by 2030.The installation of the batteries and 800 MW of hydro pump storage will significantly enhance the system's flexibility, as shown in the additional flexibility analyses conducted in the NECP (Figure 36). It is projected that, by 2035, 2,000MW batteries will be installed and, by 2040, 4,500 MW of installed battery capacity will be required to meet future demands and PV and wind production. This increased flexibility will enable more efficient hydrogen production (Figure 37). 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.

Figure 36. Electricity generation on hourly level (2030)

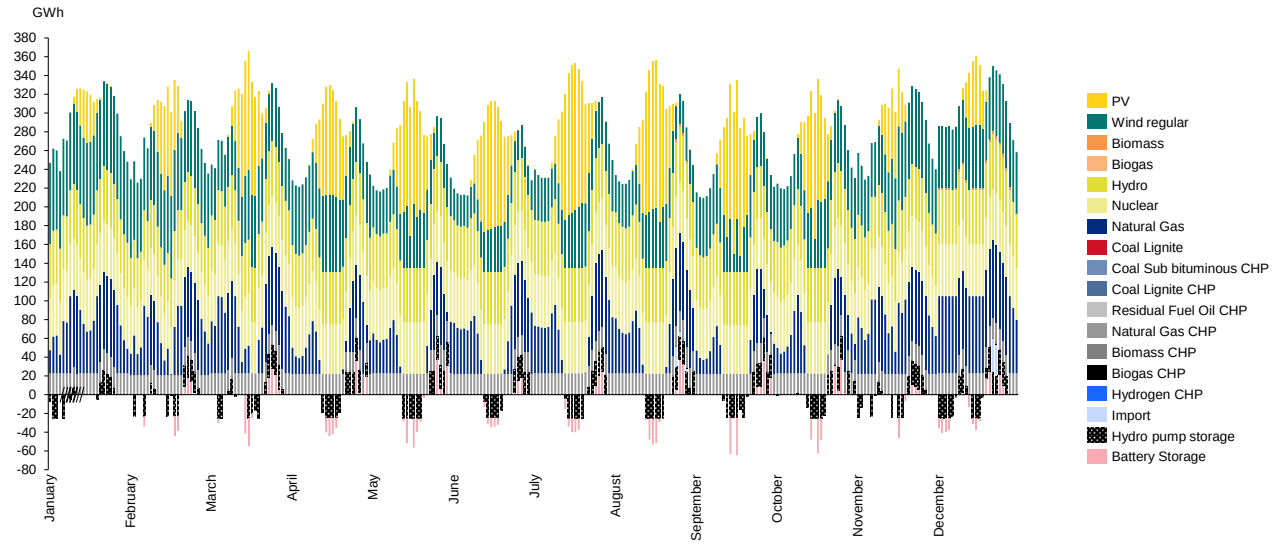
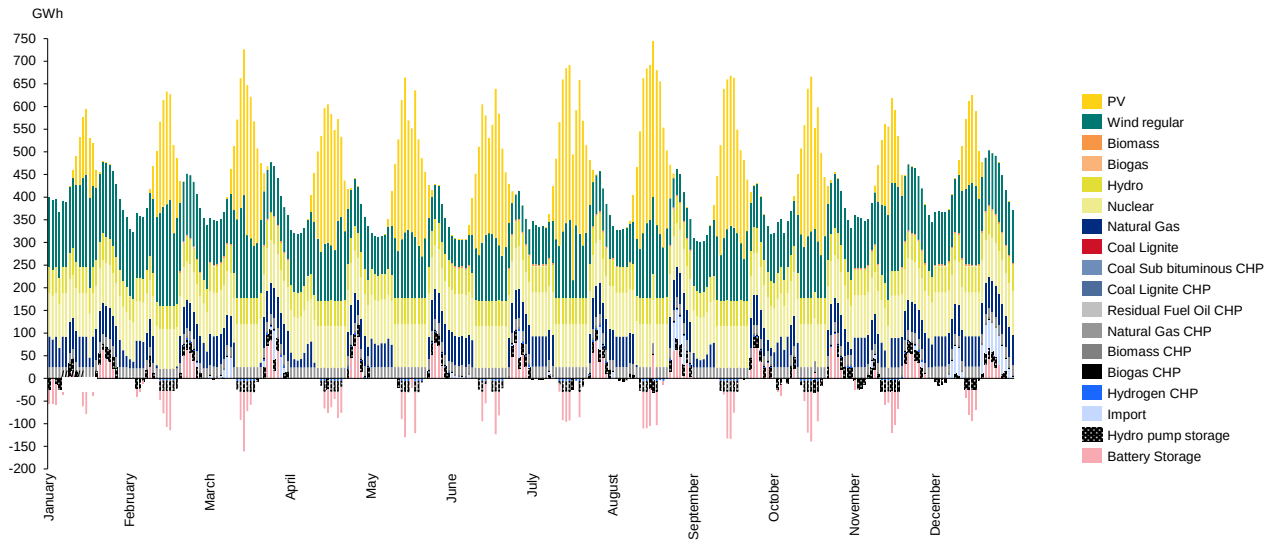


Figure 37. Electricity generation on hourly level (2040)



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, EU member states must ensure the annual increase in capacity for interzonal trade until reaching a minimum capacity at the end of 2025. In the case of Romania, these provisions concern cross-border trade at the borders of Romania (RO) – Hungary (HU) and RO – Bulgaria (BG) which will increase according to the linear trajectory presented below, provided in the "2022 – 2031 Power Transmission Network (RET) Development Plan" elaborated by Transelectrica, a document that also includes a table, presented below, on the evolution of net interconnection capacities (NTC) until 2030.

Table 6. Net transfer capacity, 2021-2025 (HU and BG borders)

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

Source: Transelectrica, 2022 – 2031 Power Transmission Network (RET) Development Plan

Table 7. Net transfer capacity, 2025 and 2030 (all borders)

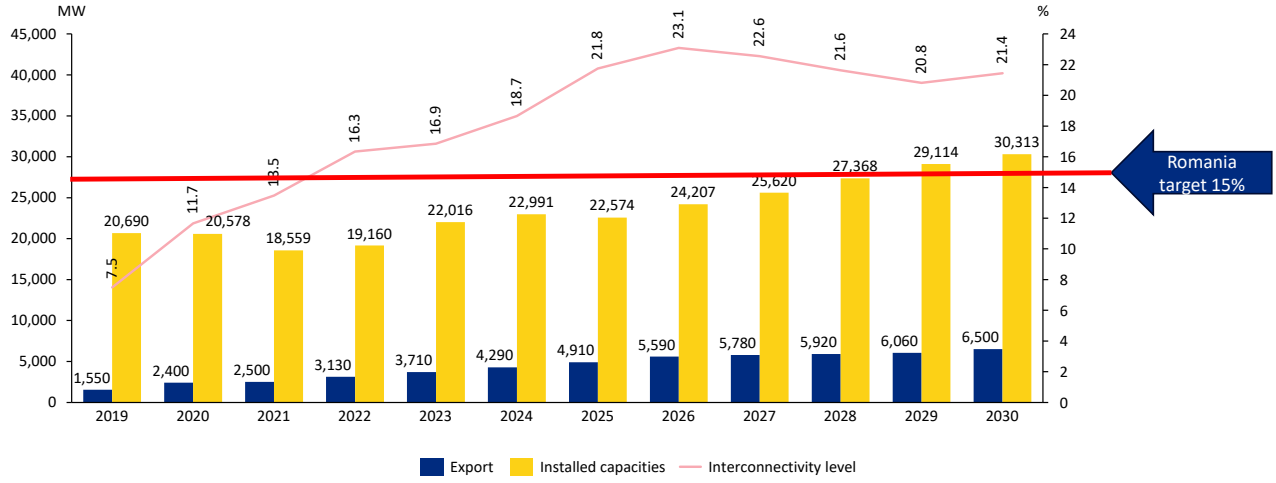
	2025	2030
RO import/export	5510	7450
RO-HU	1520	1700
RO-BG	2190	2600
RO-RS	1000	2000
RO-UA	400	400
RO-MD	400	750

Source: *Transelectrica*

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 32.3 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 38). This implies that the expansion of installed capacity should run in parallel with the augmentation of cross-border capacity.

Figure 38. Interconnectivity level of Romania up to 2030



Source: ANRE, annual reports, 2022-2030 LEAP-RO model

(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 difference between Romania and Bulgaria, as well as the price difference between Romania and Hungary, exceeded 2 EUR/MWh, while in 2020 it was lower than 1 EUR/MWh.

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

Source: ENTSO – E

(2) Nominal carrying capacity of interconnections below 30% of peak load;

(3) Nominal transmission capacity of the interconnections below 30% of the installed power of energy production from renewable sources;

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 2022 – 2031 RET Development Plan drafted by Transelectrica and in the 2024 – 2033 SNT Developed Plan drafted by Transgaz

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, Romania is an integral part of the priority corridor *Gas interconnections on the North-South Corridor in Central Europe and South-Eastern Europe («NSI EastGas»)* which aims to develop/improve natural gas interconnections in the North-South and East-West direction. This initiative is supported within the fifth European list of projects of common interest (PCI) where the following projects were approved:

- BRUA - phase II, TRA-A-1322
- Black Sea – Podișor, TRA-F-362
- Increasing the daily extraction capacity in the Bilciurești underground gas storage system (SISG) UGS-F-311
- Increasing the storage capacity - DepomureșUSG-A-233

More details about each project are provided in chapter 3.4. The main objective of Romania, in order to increase the level of interconnectivity and to diversify the supply of natural gas, is the realization of 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 considerably improve the security of supply. More details on these measures are provided in Chapter 3.4

In accordance with the compliance requirements outlined in Article 22 of European Directive CE/73/2009, which mandates the annual development of a 10-year Development Plan for all natural gas transmission system operators in the European Union (TYNDP of ENTSOG), SNTGN Transgaz SA Mediaş, acting as the technical operator of Romania's National Natural Gas Transmission System, has made the Development Plan for the National Natural Gas Transport System covering the period 2024-2033 (PDSNT 2024-2033). This document describes the developmental trajectories of the Romanian natural gas network and outlines the major projects the company aims to undertake over the next decade. The primary objective is to foster a high level of transparency concerning the evolution of the National Natural Gas Transportation System, enabling market participants to access timely information on existing and planned transportation capacities. This facilitates informed decision-making through public consultations, especially in relation to investments in the natural gas transport network to meet market demands.

The projects outlined in this plan are designed to:

- Ensure the safety of natural gas supply.
- Enhance the interconnectedness of the national natural gas transport network with the European network.
- Improve the flexibility of the national natural gas transport network.
- Facilitate the connection of applicants to the natural gas network.

In recent years, hydrogen has emerged as an increasingly appealing option for achieving decarbonization within the energy sector, aligning with the climate targets set by the EU. Ongoing studies underscore the advantages of decarbonization within a hybrid energy system.

Some of the projects in PDSNT 2024-2033 are included in the Hydrogen and Natural Gas TYNDP 2024 of ENTSOG, which includes the following projects concerning Romania:

- Romania – Serbia Interconnection - TRA-A-1268
- Development on the Romanian territory of the NTS (BG–RO-HU-AT)-Phase II - TRA-A-1322
- Further enlargement of the BG—RO—HU—AT transmission corridor (BRUA) phase 3 - TRA-N-959
- Eastring – Romania - TRA-A-655
- Development on the Romanian territory of the Southern Transmission Corridor - TRA-F-362
- Upgrading GMS Isaccea 2 and GMS Negru Voda 2 - TRA-N-602
- Upgrading GMS Isaccea 3 and GMS Negru Voda 3 - TRA-N-888
- Interconnection between NTS and the Black Sea LNG Terminal - TRA-N-1080

Capacity increase at RO-BG IP Ruse Giurgiu - TRA-N-603

Other projects are part of PDSNT 2024-2033:

- Development-Modernization of the natural gas transport infrastructure in the North-West area of Romania
- Black Sea LNG Terminal
- Monitoring, control, and data acquisition system for the cathodic protection stations in the Natural Gas National Transmission System
- SCADA system development for the Natural Gas National Transmission System

Other development projects:

- Natural gas transmission pipeline for supplying Mintia CHP (including other industrial and residential consumers)
- Increasing the transmission capacity of the Natural Gas National Transmission System and the security supply of Electrocentrale Isalnita Subsidiary (Dolj county) and Electrocentrale Turceni Subsidiary (Gorj county)
- Jupa - Băile Herculane - Orșova – Prunișor natural gas transmission pipeline
- Mihai Bravu – Siliștea natural gas transmission pipeline and its transformation in Godevilable pipeline
- Tetila - Horezu – Râmnicu Vâlcea natural gas transmission pipeline
- Ghercești – Jitaru natural gas transmission pipeline
- Black Sea shore LNG Terminal
- Natural Gas National Transmission System extension
- Rehabilitation and modernization of the natural gas transmission infrastructure (Pipelines, Technological Nodes, Compression Stations, SMGs).

Within an integrated energy framework, hydrogen exhibits the potential to facilitate the decarbonization of various sectors, including industry, transportation, power generation, and buildings throughout Europe. The EU Hydrogen Strategy outlines the measures to translate this potential into reality, emphasizing investments, regulatory frameworks, market development, as well as research and innovation.

In the transition towards a net-zero energy system at the EU level, hydrogen and biomethane are poised to play a pivotal role in a synergistic blend with renewable electricity, leveraging Europe's existing and well-established energy infrastructure. Anticipating this shift, SNTGN Transgaz SA, in its development strategy as the operator of the natural gas transport system, **envisions the integration of hydrogen from renewable sources with low carbon emissions into the natural gas transport system**. This strategic approach aims to align with the current European Directives, Strategies, and Agreements in effect. In order to achieve these objectives, SNTGN Transgaz SA will actively collaborate with the decision-making institutions/authorities for drafting legislative proposals and technical regulations and will apply the legal provisions in the field of hydrogen and/or biomethane injection.

SNTGN Transgaz SA, supported by funding from the European Investment Bank (EIB), has executed the Decarbonization and Climate Strategy. This comprehensive strategy encompasses a set of initiatives aimed at curtailing greenhouse gas emissions to meet the established decarbonization targets in the short-term (2030), medium-term (2040), and long-term (2050) Strategy. As an integral component of this strategy, an Investment Plan has been formulated to facilitate the implementation of measures crucial to the decarbonization process.

The **main objective** for Transelectrica and Transgaz is to realized their development plans and strategies. The implementation of the proposed measures will greatly improve the security of supply. More details about the measure are provided in Chapter 3.4.

The projects regarding the transport of hydrogen included in the TYNDP 2022 of ENTSOG are the following:

- Isaccea - Jupa corridor modernization for hydrogen transport - HYD-N-640
- Giurgiu - Nădlac corridor modernization for hydrogen transport - HYD-N-999
- Black Sea – Podișor Pipeline modernization for hydrogen transport - HYD-N-608
- Onești – Ungheni corridor modernization for hydrogen transport - HYD-N-625
- Romania - Serbia Interconnection modernization for hydrogen transport - HYD-N-648
- Coroi - Mediesu Aurit corridor modernization for hydrogen transport - HYD-N-730
- Negru Voda – Isaccea corridor modernization for hydrogen transport - HYD-N-756
- Vadu – T1 pipeline modernization for hydrogen transport - HYD-N-647
- Giurgiu-Podișor–Bibești-Jupa-Horia-Nădlac pathway for hydrogen transport

- Marea Neagră – Podișor pathway for hydrogen transport

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 has achieved the marked integration process for 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. However, 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 the installed power is less than or equal to 500 kW, final consumers can participate in organized electricity markets exclusively through aggregators.

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 the prosumers at the end of 2023 achieved a capacity of around 1.4 GW or around 107000 prosumers. 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 of 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, its ability to inject or absorb electricity in the network in a short enough time to meet the needs of power regulation, 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 has set a specific target of installing 1200 MW of battery storage capacity by 2030, with potential for storage of 2400 MWh and 2000 MW by 2035. Adequate public funding (from sources such as PNRR and MF) 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 measure 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 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%[7] 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.

At national level, as provided in law 226/2021, energy poverty is defined as: “ the impossibility of the single person/family who, for reasons of health, age, insufficient income or isolation from energy sources, requires social protection measures and additional services to ensure at least their minimum energy needs, i.e. the

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

single person's/family's minimum energy consumption for lighting, optimal cooling and heating of the home, supporting cooking facilities and providing hot water in the home, using means of communication that involve the use of energy or powering medical devices to support life or to improve the health of people".

Romania aims to significantly improve the aforementioned indicator by ensuring the access of energy consumers to diversified, sustainable and accessible sources of energy for lighting, heating and cooling corroborated with the establishment of targeted measures to decrease the energy poverty level and protect the vulnerable consumers, as well as by consolidating an energy poverty governance system to measure, monitor and update the energy poverty objectives periodically. Romania aims to decrease the share of households affected by energy poverty, targeting a reduction of the "Inability to keep home adequately warm" indicator to 9.8% by 2030.

Romania thus aims to implement the following objectives alongside with specific actions which have the potential to decrease the energy poverty level by 2030:

Objective 1: Ensure the access of energy consumers to diversified, sustainable and accessible sources of energy for lighting, heating and cooling.

- Action 1: Facilitate the access to electricity through sustained electrification programmes for isolated households, finalize the national electrification, the development of electricity transmission and distribution systems, and through the creation of micro-grids. Additionally, this action aims to increase the share of RES-E, as well as the share of RES-H&C, especially through decentralized solutions. Romania will allocate EU and national funds towards decentralized systems of electricity and heat production from renewable sources and storage as well as towards connecting consumers to SACET, together with the decarbonisation of the heating agent production source.
- Action 2: Implement projects based on low carbon emission heating-cooling systems, especially in rural areas (replacing wood-burning stoves with efficient ones, using sustainable biomass, heat pumps, etc.) and decarbonise the centralized heating system in urban areas

Objective 2: Targeted measures to decrease the energy poverty level and protect the vulnerable consumers

- Action 1: Develop one-stop shops at local public administrations level and at county level with the aim to provide information and technical advisory related with energy efficiency in buildings and with utilisation of renewables to energy consumers, prosumers, natural and legal persons, including energy communities, potential beneficiaries of investments, regarding investment programmes financed through European funds, state budget, as well as other legal constituted sources. Additionally, the one-stop shops will perform analysis to identify energy-poor households that must further be prioritized by potential subsequent investment programmes
- Action 2: Develop energy self-sufficient villages, through customized solutions for each community, especially through the use of local resources. In this regard, throughout the Working Group for Energy Communities the Ministry of Energy will enable not only electricity consumers but also local authorities to establish energy communities.
- Action 3: Consolidating the income-support and heating-aid measures to improve targeting and act as transitional support instruments taking into account the energy-poor households identified by the analysis perform by the one-stop shops.

Objective 3: Consolidating an energy poverty governance system to measure, monitor and update the energy poverty objectives periodically

Action 1: Coordinated interministerial committee regarding protecting vulnerable consumers and addressing energy poverty. The proposed structure of the energy poverty action group is the following:

1. Representatives of key ministries
2. Representatives of the academic environment

A systematization of the currently collected data as per Law 123/2012 and other implemented measures, in one common database managed by the interministerial committee, which can be employed for sustained statistical analysis, diagnose, prognose, policy-making more generally, monitoring, reporting.

In this context, the interministerial committee will be also responsible to assess the level of energy poverty and identify the related barriers to tackle energy poverty in Romania. Corroborated with the complexity of energy poverty it is therefore required to also monitor the following indicators:

- Low Income High Cost (LICH): the LIHC indicator indicates households that, after paying their energy bill, fall below the poverty line. In other words, it shows those households that are forced to make a choice between energy costs and other monthly living costs.
- 10%: 10% indicator identify the proportion of households for which the share of energy expenses exceeds 10% of the family income.
- Low absolute energy expenditure (M/2): the M/2 indicator represents the share of households whose absolute energy expenditure is below half the national median or, in other words, the M/2 indicator thus indicates a state of hidden energy poverty, where households constrain their energy consumption in order to achieve savings in the family budget, consuming abnormally little energy compared to the average of national households.
- High share of energy expenditure in income (2M): the 2M indicator represents the proportion of households whose share of energy expenditure in income is more than twice the national median, therefore the 2M indicator helps to identify cases of overconsumption and potential energy efficiency problems.

Through the REPowerEU chapter, Romania allocated EUR 1.2 bn. to address energy poverty, particularly to increase the energy efficiency and develop the RES production:

- Voucher scheme to accelerate the installation of RES capacities in individual households (EUR 610,762,268)
- Voucher scheme to improve energy efficiency in individual households (EUR 559,651,395)
- Implement one-stop shops to provide energy advisory services in the field of energy efficiency and energy production from RES to prosumers (EUR 431,438)

At the same time, support measures for energetically vulnerable groups identified by Regulation no. 955/2023 establishing the Social Fund for Climate (FSC), respectively vulnerable households, vulnerable micro-enterprises and vulnerable transport users, will be provided within the national Social Climate Plan (SCP), which is currently being developed and which must be sent to COM by June 30, 2025.

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 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.[8]

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%[9]. However, there is still much work to be done. The

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

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

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 55% by 2030, compared to 1990 levels.
- Increase energy efficiency by at least 38% by 2030.
- Increase the share of renewable energy to at least 42,5% 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[10][11]

- 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 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 energy landscape. For example, Romania has set up a number of research and development centers in the energy sector, such as the Romanian Research & Development Institute for Gas Turbines (COMOTI - which has, as main research direction, environmental protection and energy by producing high efficiency electrical and thermal energy, such as the development of the first cogenerative thermoelectric power plants in Romania (e.g. the plants at SC TERMICA SA – Botoşani and SC PETROM – Suplacu de Barcău), which open the perspective of supplying thermal energy both for domestic and industrial consumption) and the National Research-Development Institute for Electrochemistry and Condensed Matter (INCEMC). 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.

[10] staff_working_document_assessment_necp_romania_en_0.pdf (europa.eu)
[11] necp_factsheet_ro_final_0.pdf (europa.eu)

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.”[12]

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 2024 released on 9th of July 2024 Romania is part of the group of “Emerging Innovators”, but on the bottom of the list from all EU countries (Figure 39).

The performance of the Romanian Summary innovation index is at 37.4% of the EU average relative to 2017 (EU average is 110)[13]. In addition, the performance is increasing at a rate lower than that of the EU (only 1.5%- points increase of summary index over the period 2017-2024, comparing to EU average of 10%-points) which means that the country’s performance gap to the EU is becoming larger.

According to the EIS 2024 Romania country profile the biggest weaknesses of the country can be found in following 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)

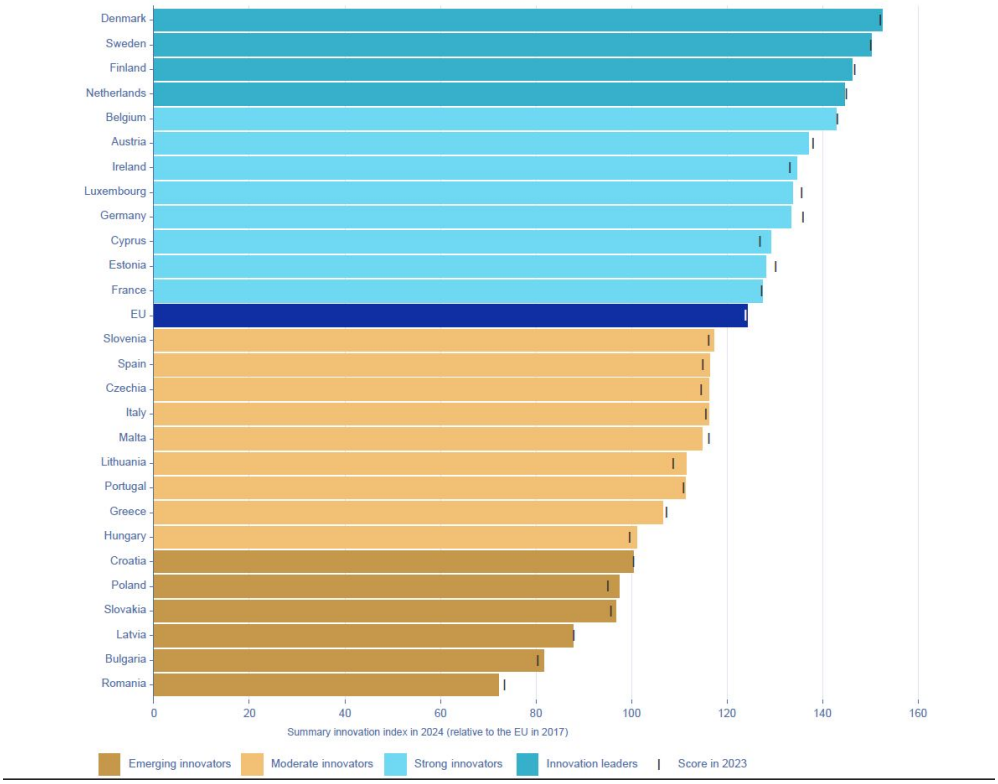
In addition, comparing Romanian status 2024 vs. 2017 it can be noticed that the indicators with the strongest decrease in this period are:

- Environment-related technologies (Development of environment-related technologies, as a percentage of all technologies)
- Non-R&D innovation expenditures (as a percentage of turnover)
- New doctorate graduates (New doctorate graduates in science, technology, engineering and mathematics (STEM) per 1000 population aged 25-34).

Figure 39. Performance of EU Member States’ innovation systems (2023 and 2024)

[12] 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

[13] https://projects.research-and-innovation.ec.europa.eu/en/statistics/performance-indicators/european-innovation-scoreboard/eis-2024#/eis/countries/RO?perf_indicators=4



Source: European Commission, Directorate-General for Research and Innovation, European Innovation Scoreboard 2024, Publications Office of the European Union, 2024, https://data.europa.eu/doi/10.2777/779689

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

- Population involved in lifelong learning (Percentage population aged 25-64 participating in lifelong learning)
- Scientific publications among the top 10% most cited (Scientific publications among the top 10% most cited)
- Broadband penetration (Number of enterprises with a maximum contracted download speed of the fastest fixed internet connection of at least 100 Mb/s)
- 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 (SNCISI 2022-2027) prepared by the Ministry for Research, Innovation and Digitalization (MCID)[14]. The strategy is based on 4 main pillars:

[14] 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

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

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.

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

SNCISI 2022-2027 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 SNCISI 2022-2027 and are presented in the text below.

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

SNCISI 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 (Table 8)[15]. 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 8. 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	Proportional increase
• Research productivity (articles/researchers)	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***	

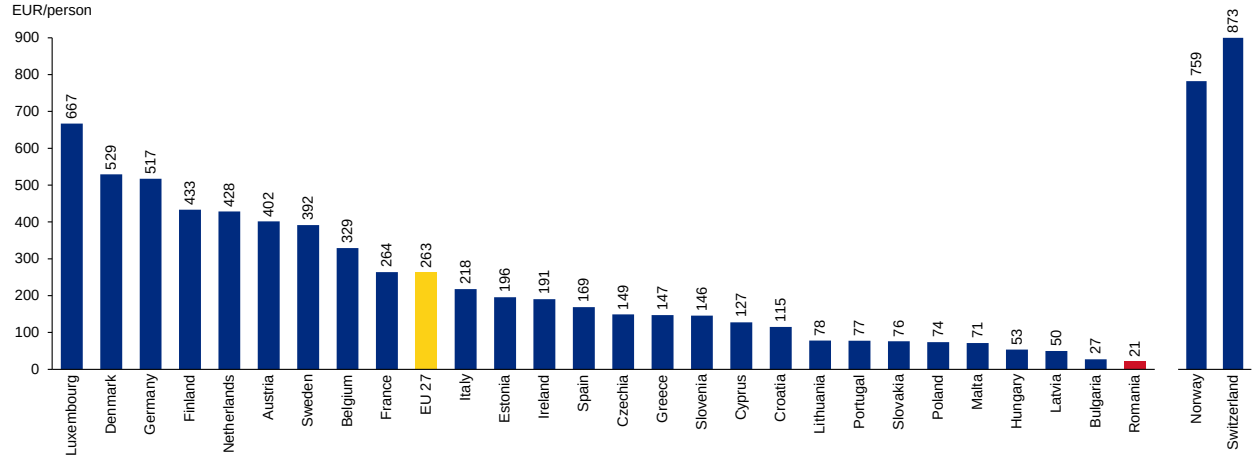
• Funding drawn from the Horizon Europe Program	Double - compared to funding drawn from Horizon 2020 (about 500 mill. euros between 2022 and 2027)
• Number of international scientific co-publications per one million inhabitants	Increase from 284 to 600 (current EU average: 1172)
• Public financing allocated 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**	/

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

Romania spends less, in per capita terms (EUR 20.9, Figure 40) but also as a % of GDP (0.46%), in research and development (R&D), according to Eurostat data. Romania ranks last in the European Union related to this indicator.

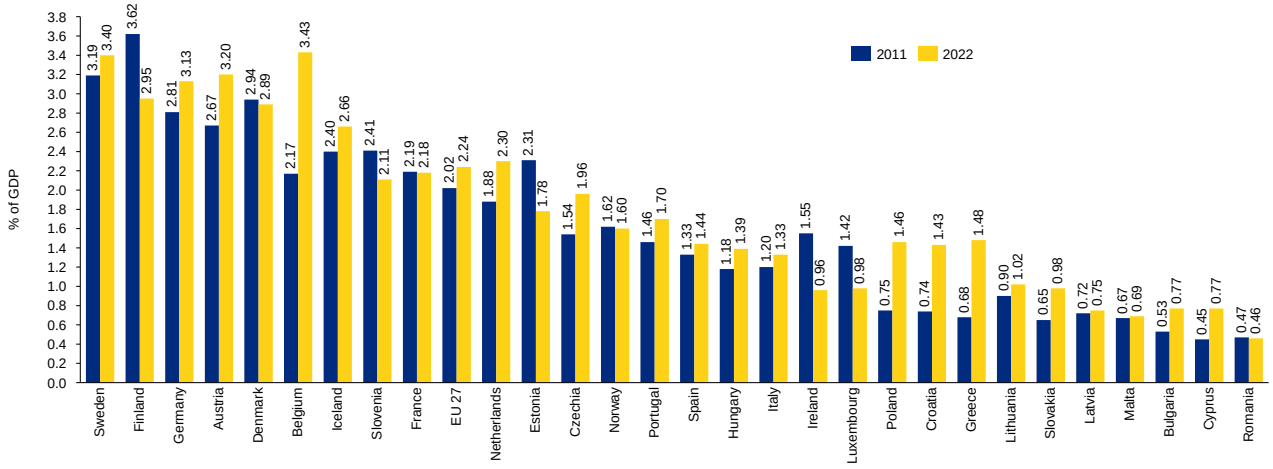
Related to gross domestic expenditure in R&D, Romania is also on the bottom of the list among EU countries (Figure 41, Figure 42).

Figure 40. Government budget allocation for R&D, 2022



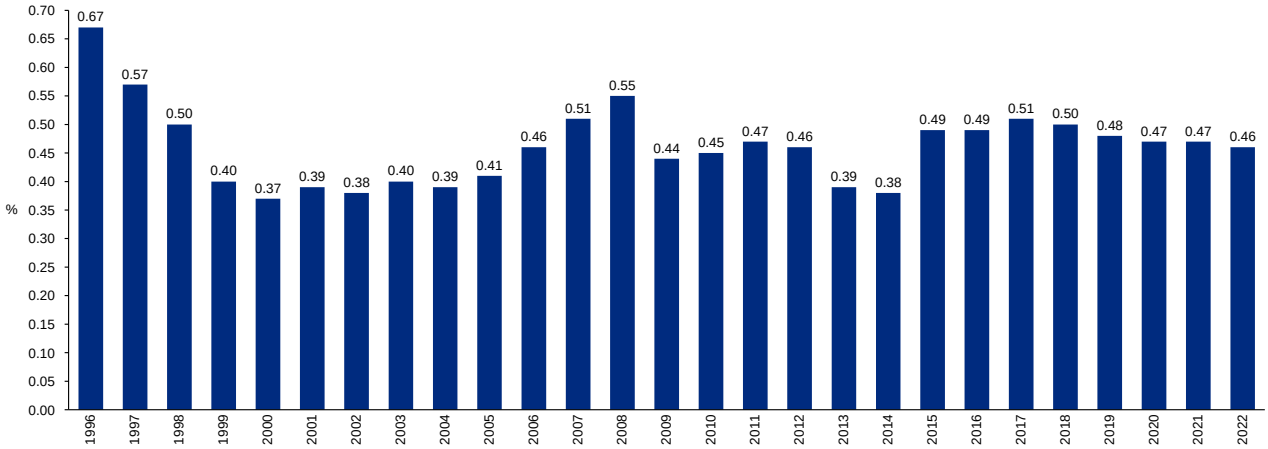
Source: EUROSTAT, data on government budget allocations for R&D (GBARD), Statistics | Eurostat (europa.eu) , team analyses

Figure 41. Gross domestic expenditure on R&D for 2011 and 2022



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

Figure 42. Gross domestic expenditure on R&D for the period 1996 - 2022



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

However, Romania within the SNCISI 2022-2027 as a strategic option set very optimistic goal **to increase R&D public spending to reach 1% of GDP by 2027.** The SNCISI 2022-2027 has been developed in line with European and national policies and strategies. The Strategy is strongly correlated with the Romania's Sustainable Development Strategy 2030 (SNDDR 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

In SNCISI 2022-2027, 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 SNCISI 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 development of the concept of Smart Grid and 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 the above-mentioned targets within the priority areas of the SNCISI 2022-2027, 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.

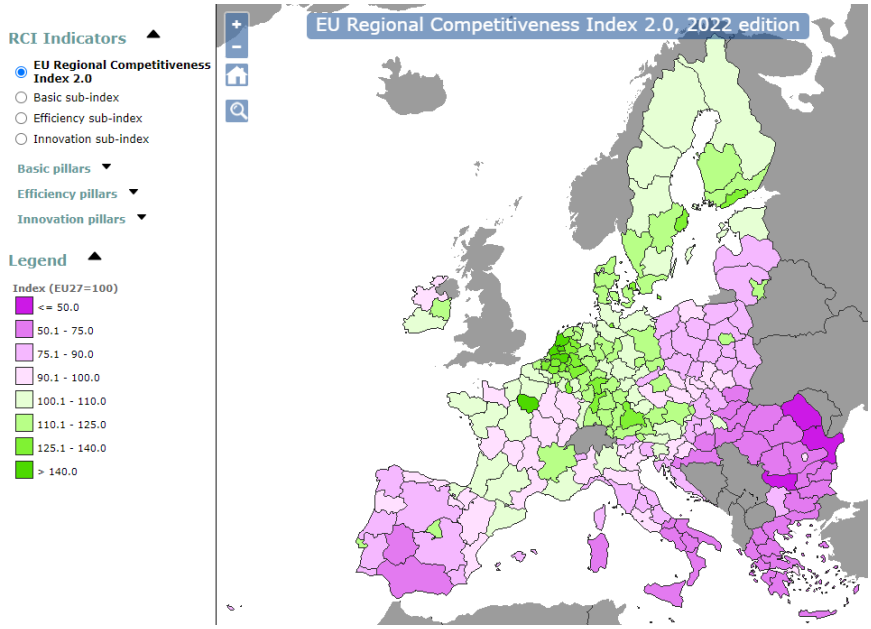
In addition, the Climate Change Fund should also play an important role in the future, which will be used, inter alia, to finance R&D and demonstration projects in the field of energy to explore the use of hydrogen and technologies for the production and use of electricity from RES, aimed at reducing 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[16]. 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 43 and Figure 44 present the position of NUTS 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.

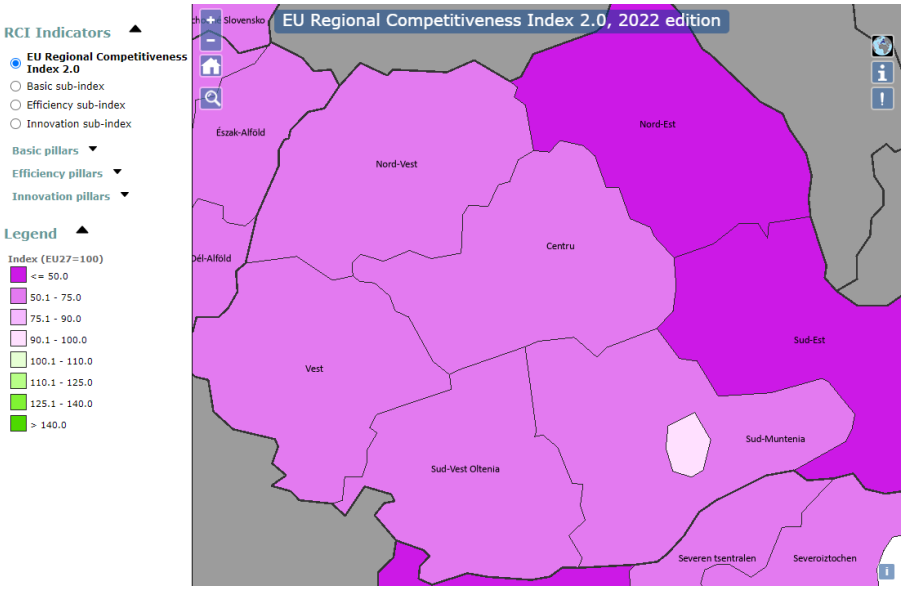
Figure 43. EU Regional Competitiveness index 2.0. (2022 edition)

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



Source: https://ec.europa.eu/regional_policy/assets/regional-competitiveness/index.html#/

Figure 44. Romania's NUTS-2 regions position on Regional Competitiveness Index 2.0 (2022 edition)



Source: https://ec.europa.eu/regional_policy/assets/regional-competitiveness/index.html#/

SNCISI 2022-2027 directly address low level of competitiveness of Romania. Together with the regional Research and Innovation Strategies for Smart Specialization (RIS3), developed by the 8 Regional Development Agencies (ADR), 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 the SNCISI 2022-2027 and of the 8 RIS3 were 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. Table 9 presents Romania's smart specialization areas both as national and regional level.

Table 9. Romania's Smart Specialization Areas

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

Source: SNCISI 2022-2027 and the 8 RIS3

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 plants
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	• LTS • PNRR • GEO 108/2022 on the decarbonization of the energy system • Law 334/2022 for approving GEO 108/2022 • Just Transition Program 2021-2027 (PTJ) and Territorial Just Transition Plan (PTTJ)
Methodology	Bottom-up modeling and optimization using the LEAP-RO model developed and employed for the elaboration of the LTS IPCC Methodology
Assumptions	It is envisaged that: • 1.695 MW were decommissioned on 31.12.2021 • 330 MW were decommissioned on 01.06.2023 • 330 MW were put in stand-by on 01.06.2023 • 1,425 MW will be decommissioned by 31.12.2025 • 1,140 MW will be decommissioned / put in stand-by by 31.12.2025 According to the Restructuring Plan of Oltenia Energy Complex, in order to replace the lignite-based power capacities that will be closed and in order not to jeopardize the safety of SEN, new investments in natural gas and RES-based power plants will be made.
Status of implementation	Under implementation
• Steps taken	Closed capacities: • 1,695 MW on 31.12.2021 • Decommissioning of Energy Unit no. 3 (330 MW) from the Rovinari Thermal Power Plant, starting from 01.06.2023, and putting under control Energy Unit no. 7 (330 MW) from the Turceni Thermal Power Plant for the period 01.06.2023 - 31.12.2025. • Continuation of the phase-out 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		• 1,425 MW will be decommissioned by 31.12.2025 • 1,140 MW will be decommissioned / put in stand-by by 31.12.2025 According to the Restructuring Plan of Oltenia Energy Complex, in order to replace the lignite-based power capacities that will be closed and in order not to jeopardize the safety of SEN, new investments in natural gas and RES-based power plants will be made.		
	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)			~8000	~1100
	Other	Primary energy savings (ktoe)		2300	340
	Finance	Budget	N/A		
		Source of finance	/		
	Implementing entity		• ME • MMAP • Private investors		
	Monitoring entity		• ME		
	Relation with other dimensions				

PAM 2 Introduction of renewable hydrogen into the energy system

Main objective: Decarbonisation of the energy system
Description: All natural gas-powered plants (CCGT, CHP) will be 50% ready for renewable gases (renewable 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	• LTS • PNRR • Law on the integration of hydrogen from renewable and low-carbon sources in the industry (for example: transition from BF-BOF to H2-DRI-EAF) 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 • Draft of the 2024-2030 National Hydrogen Strategy – under elaboration • COMMISSION DELEGATED REGULATION (EU) 2022/1214 of 9 March 2022 amending Delegated Regulation (EU) 2021/2139 as regards economic activities in certain energy sectors and Delegated Regulation (EU) 2021/2178 as regards specific public disclosures for those economic activities			
Methodology	Bottom-up modeling and least-cost optimization using the LEAP-RO model. IPCC Methodology			
Assumptions	100% renewable hydrogen CCGT and CHP by 2036			
Status of implementation	Planned			
• Steps taken	Preparation of the 2024-2030 National Hydrogen Strategy and of the Action Plan for its implementation			
• 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)		430	2615
Emissions reduction (Gg CO_2-eq)			The effect will be after 2035	
Other	Primary energy savings (ktoe)			

Finance	Budget	M€
	Source of finance	Modernisation Fund – MF, Just Transition Program – PTJ, Innovation Fund – IF, Private sources
Implementing entity	• ME • MMAP • Private investors	
Monitoring entity	ME	
Relation with other dimensions	Research, innovation, and competitiveness	

*Note: New CCGT on natural gas should be hydrogen ready

PAM 3 Hydrogen production

Main objective: Increase the RES share
Description: Encourage the use of hydrogen in the industrial sector, with the ultimate goal of integrating into the EU's renewable hydrogen trade market. Romania has the opportunity to join specific European programs designed to support this transition. By participating, Romania can leverage its significant potential for producing hydrogen with a reduced carbon footprint. This participation would position Romania advantageously in the growing renewable hydrogen market. Ultimately, this strategy aims to enhance Romania's industrial capabilities and contribute to EU-wide sustainability goals.

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

Relevant planning documents, legal and regulatory acts	• LTS • PNRR • Law on the integration of hydrogen from renewable and low-carbon sources in the industry (for example: transition from BF-BOF to H2-DRI-EAF) 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 • Draft of the 2024-2030 National Hydrogen Strategy – under elaboration • COMMISSION DELEGATED REGULATION (EU) 2022/1214 of 9 March 2022 amending Delegated Regulation (EU) 2021/2139 as regards economic activities in certain energy sectors and Delegated Regulation (EU) 2021/2178 as regards specific public disclosures for those economic activities
Methodology	Bottom-up modeling and least-cost optimization using the LEAP-RO model. IPCC Methodology
Assumptions	
Status of implementation	Planned
• Steps taken	Preparation of the 2024-2030 National Hydrogen Strategy and of the Action Plan for its implementation
• Steps envisaged	• Replacement of technologies

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020-2021	2025	2030
Emissions reduction (Gg CO_2-eq)		/	336
Other: Primary energy savings (ktoe)		/	245

Finance – Budget	M€
Finance – Source of finance	FM, PTJ, National Resilience and Recovery Plan – PNRR, IF, Private sources
Implementing entity	• ME • MMAP • MEAT • Private investors
Monitoring entity	ME
Relation with other dimensions	Research, innovation, and competitiveness

PAM 4 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	• LTS • PNRR • GEO 108/2022 on the decarbonization of the energy system • Law 334/2022 for approving GEO 108/2022
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)			113.9	692.7
Other	Primary energy savings (ktoe)		120	732

Finance	Budget	2400 M€
	Source of finance	MF, Private sources
Implementing entity		• ME • MMAP • Private investors
Monitoring entity		ME
Relation with other dimensions		Energy security

PAM 5 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	• LTS • PNRR • 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 2024 • 52 MW (CET Constanta) starting from 2025 • 295 MW (CET Craiova) starting from 2026 • 70 MW (others) starting from 2026. • 50 MW (CET Progresu) starting from 2028 • 34 MW (CET Grozavesti) starting from 2029 • 300 MW (CET Sud Vitan) starting from 2030
Status of implementation	Under implementation
• Steps taken	• Setting-up Key Program 5 (High-efficiency cogeneration and modernization of district heating networks - Support for the modernization and construction of high-efficiency cogeneration plants and modernization of district heating networks) within the GEO no. 60/2022 regarding the establishment of the institutional and financial framework for the implementation and management of the funds allocated to Romania through the Modernization Fund, as well as for the modification and completion of some normative acts
• Steps envisaged	• Construction of CHP according to the plan at Assumptions

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020-2021	2025	2030
Progress	Additional installed capacity (MW)		132	900
Emissions reduction (Gg CO_2-eq)			35	238
Other	Primary energy savings (ktoe)		37	252

Finance	Budget	1350 M€
	Source of finance	MF, PDD, PNRR, Private sources
Implementing entity		• ME • MMAP • Private investors
Monitoring entity		ME
Relation with other dimensions		Energy security

PAM 6 Employing carbon capture, utilization and storage (CCUS) technologies

Main objective: Promotion and co-financing of CCUS for vast emission reduction
Description: By employing the CCUS technologies in the Mineral industry in which Cement production is included (as defined in NC8), at least 50% of the emissions will be captured by 2050. CCUS technologies will also be employed in all the other energy-intensive / hard-to-abate industries to reduce GES emission level.

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

Relevant planning documents, legal and regulatory acts	• LTS • GEO no. 64 on the geological storage of carbon dioxide (Official Gazette of Romania no. 461 on 30 June 2011) • Communication COM Industrial Carbon Management of 06.02.2024
Methodology	Bottom-up modeling using the LEAP-RO model and IPCC Methodology
Assumptions	By 2050, at least 50% of the emissions in the Mineral industry will be captured
Status of implementation	Under implementation
• Steps taken	• Initiating the update of the existing legislation (transposition of the CCS directive) • Establishment of the inter-institutional working group on capture, transport and geological storage of CO_2
• Steps envisaged	• Assessment of geological storage potential, including prospecting of storage sites and experimental projects at local levels with small CO_2 volumes, supported by European and national funds. • Development of a comprehensive national carbon management strategy, integrating CCUS in alignment with other strategies such as hydrogen while emphasizing geological storage potential and detailing internal storage capacity, projected injection volumes up to 2030/2050, transport infrastructure, and financing mechanisms. • Establishing an appropriate regulatory framework and new legislation in line with European and national targets, including the implementation of the EU Net Zero Industry Act (NZIA Regulation), declaring CCUS projects as strategic, and implementing a simplified authorization process. • Development of financing and co-financing feasibility studies, focusing on onshore storage and potential industrial hubs for CCUS projects. • Presentation of available funding sources for CCS, ensuring quick access to European funds and utilizing EU ETS revenues for advancing CCS in Romania. • Enhancing institutional capacity for CCUS development, including funding attraction, project monitoring, and participation in knowledge exchange at European and international levels by 2025. • Development of a program for public involvement to raise awareness about the necessity of CCUS technologies, their benefits for CO_2 reduction, and their economic advantages while considering cross-border dimensions. • Opening financing opportunities through the Modernization Fund for CO_2 capture, transport, use, and storage projects until 2025. • Ensuring necessary insurance for CO_2 transport infrastructure advancement and co-financing at least three CCUS projects by 2027.

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020 – 2021	2025	2030
Progress Documents adopted		• National Carbon Management Strategy (CCUS Strategy) • Opening financing opportunities through the Modernization Fund for CO_2 capture, transport, use, and storage projects until 2025.	Ensuring necessary insurance for CO_2 transport infrastructure advancement and co-financing at least three CCUS projects by 2027.
Emissions reduction (Gg CO_2-eq)			2,583 kt (2050)*

Other	Primary energy	Depends on where the storage facilities where will be located, the capturing, transporting, and storing CO_2 can increase energy consumption
Finance	Budget	At least 750 M€ public funding until 2027 for entities implementing CCUS technologies and developing CO2 transport infrastructure
	Source of finance	MF, IF, European Energy Efficiency Fund – EEEF, Private sources, Commercial loans
Implementing entity		• ANRMPSG • MEAT • ME • MMAP • Companies with majority state capital, large generators of CO_2 emissions (CEO Oltenia) and companies that can provide transport through pipes (Conpet, Transgaz) or storage of CO_2 • Private investors
Monitoring entity		MEAT, ME, MMAP, ANPM, ANRMPSG, ANRE
Relation with other dimensions		Internal energy market, Research, innovation, and competitiveness

* For the mineral industry only

PAM 7 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	• LTS • Law no. 30/2020 on the 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	• Regulatory framework established
• Steps envisaged	• Enhancing infrastructure for monitoring and reporting HFC

Indicators	Value in the last reporting year	Indicative trajectory		Target value
	2020 – 2021	2020	2025	2030
Emissions reduction (Gg CO_2-eq)			not more than 1510	Not more than 1090

Finance	Budget	/
	Source of finance	Private sources
Implementing entity		• MMAP • Private investors
Monitoring entity		MMAP
Relation with other dimensions		Research, innovation, and competitiveness

PAM 8 Improvement and efficiency in the industrial processes

Main objective: Alignment of EF in industrial sector according to BR4 and BR5 and NC8 submitted to UNFCCC.
Description: Romania is taking significant steps to improve industrial processes and reduce emissions. In cement production, the emission factor will be per ton of clinker. Additionally, the steel industry aims to lower its emission factor by adopting electric arc furnace (EAF) and direct reduced iron-electric arc furnace (DRI-EAF) technologies.

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

Relevant planning documents, legal and regulatory acts	• LTS • BR • NC • NSCE
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions	• In the cement production, EF level (calculated on the basis of CaO and MgO content originating from carbonates) will be lowered from 0.52 to 0.49 tCO_2/t clinker, according to NC8. • 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 BR4. • 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 BR4. • 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 BR4. • The annual growth rate of soda ash production will be 1.8%, in accordance with BR4. • The EF in the steel production will lower from 1.01 tCO_2/t to 0.3 tCO_2/t in 2030, as a result of employing electric arc furnace (EAF) and DRI-EAF technologies.
Status of implementation	Under implementation
• Steps taken	• Employing EAF and DRI-EAF technologies.
• Steps envisaged	• Industrial strategy update, 2024 • Development of the Green Deal Industrial Plan, 2024 • The opening of the financing axis according to Key Program 7 of the Modernization Fund for projects of modernization at BAT level

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020 – 2021	2025	2030
Progress – Documents adopted		• Industrial strategy update • Development of the Green Deal Industrial Plan	
Emissions reduction (Gg CO_2-eq)			1700

Finance – Budget	/
Finance – Source of finance	MF, IF, Private sources, Commercial loans
Implementing entity	• MEAT • ME • MMAP • Private investors
Monitoring entity	MMAP, ANPM, MEAT
Relation with other dimensions	Internal energy market, Research, innovation, and competitiveness

PAM 9 Setting a national 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 NZIA (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 (NZIA) – 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	National

Relevant planning documents, legal and regulatory acts	• LTS • GEO no. 64/2011 regarding the geological storage of carbon dioxide • Communication COM Industrial Carbon Management of 06.02.2024
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions	
Status of implementation	Under implementation
• Steps taken	• Initiating the update of the existing legislation (transposition of the CCS directive) • Establishment of the inter-institutional working group on the capture, transport and geological storage of CO_2
• Steps envisaged	• Assessment of geological storage potential, including prospecting of storage sites and experimental projects at local levels with small CO_2 volumes, supported by European and national funds. • Development of a comprehensive national carbon management strategy, integrating CCUS in alignment with other strategies such as hydrogen while emphasizing geological storage potential and detailing internal storage capacity, projected injection volumes up to 2030/2050, transport infrastructure, and financing mechanisms. • Establishing an appropriate regulatory framework and new legislation in line with European and national targets including the implementation of the EUNZIA Regulation, declaring CCUS projects as strategic, and implementing a simplified authorization process. • Development of financing and co-financing feasibility studies, focusing on onshore storage and potential industrial hubs for CCUS projects. • Presentation of available funding sources for CCS, ensuring quick access to European funds and utilizing EU ETS revenues for advancing CCS in Romania. • Enhancing institutional capacity for CCUS development, including funding attraction, project monitoring, and participation in knowledge exchange at European and international levels by 2025. • Development of a program for public involvement to raise awareness about the necessity of CCUS technologies, their benefits for CO_2 reduction, and their economic advantages while considering cross-border dimensions. • Opening financing opportunities through the Modernization Fund for CO_2 capture, transport, use, and storage projects until 2025. • Ensuring necessary insurance for CO_2 transport infrastructure advancement and co-financing at least three CCUS projects by 2027. • Alignment with the requirements of NZIA Regulation

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020 – 2021	2025	2030
Progress – Mandatory target defined	/	/	√
Emissions reduction (Gg CO_2-eq)		n/a	

Finance	Budget	M€
	Source of finance	MF, IF, Private sources, Commercial loans
Implementing entity		• ME • MMAP • ANRMPSG • Private investors
Monitoring entity		ME, MMAP, ANPM
Relation with other dimensions		Internal energy market, Research, innovation, and competitiveness

PAM 10 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 2020.

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

Relevant planning documents, legal and regulatory acts	• LTS • GEO 163/2022 for the completion of the legal framework for the promotion of the use of energy from renewable sources, as well as for the modification and completion of some normative acts
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 – Nutrition and feeding practices introduced			√
Emissions reduction (Gg CO_2-eq)			1450

Finance – Budget	M€
Source of finance	State budget, Private sources
Implementing entity	• ANSVSA
Monitoring entity	ANSVSA
Relation with other dimensions	Research, innovation, and competitiveness

PAM 11 Improving 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 collect and direct agricultural residues and potentially use crop stubble as an energy source (sustainable biomass) 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 N_2O.

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	• Strategic Plan for Common Agricultural Policy (PS PAC 2023-2027) • LTS
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	• Development of the secondary legislation necessary for the implementation of RED II and a national certification scheme for sustainability and GHG reduction - until the end of 2024 • Development of a biomass use strategy - until the end of 2024, in alignment with the other plans and strategies developed at national level (STL, Circular Economy Strategy, Carbon Management Strategy, etc.

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020 – 2021	2025	2030
Progress – Documents adopted		• Secondary legislation necessary for the implementation of RED II and a national certification scheme for sustainability and GHG reduction • Biomass use strategy	
Emissions reduction (Gg CO_2-eq), methane recover			n/a

Finance – Budget	M€
Source of finance	PAC 2023-2027, Agency for Funding Rural Investments – AFIR, Private sources
Implementing entity	• MADR • ME • MMAP • IGSU
Monitoring entity	MADR, MMAP, ANPM, ME, IGSU, ANRE
Relation with other dimensions	Energy efficiency, Research, innovation, and competitiveness

PAM 12 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	• PS PAC 2023-2027 • LTS • PNRR		
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: Capturing and using the methane technology introduced		√	√
Emissions reduction (Gg CO_2-eq)		34	74
Finance: Budget	M€		
Source of finance	PAC 2023-2027, Private sources		
Implementing entity	• MADR • MMAP • ANSVSA		
Monitoring entity	MADR, MMAP, ANSVSA		
Relation with other dimensions	Energy efficiency, Research, innovation, and competitiveness		

PAM 13 Increasing the agrisolar production

Main objective: Increase in the share of solar energy for agricultural (including food) purposes.
Description: This measure brings together farming and producing clean energy. To achieve this goal, solar panels are installed on agriculture lands or the constructions that serve for agricultural activities, enabling both energy generation and profitable agricultural activities. 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/ operators in the food industry by giving them more ways to grow financially and it helps make farms and rural areas stronger on 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		• PS PAC 2023-2027 • LTS • PNRR • LAW 220/2008 on establishing the system for promoting 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.
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	MF, Regional Programs - PR, PAC 2023-2027, Private sources
Implementing entity		• MADR • ME
Monitoring entity		• MADR • ME
Relation with other dimensions		Energy efficiency, Research, innovation, and competitiveness

PAM 14 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 • LTS • PNRR
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
Emissions reduction (Gg CO_2-eq)			8

Finance	Budget	/
	Source of finance	Public and private sources
Implementing entity		• MMAP • MAI • IGSU • National Environmental Guard • National Directorate of Forests - Romsilva
Monitoring entity		MMAP
Relation with other dimensions		

PAM 15 PV systems in agriculture for irrigation

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. The measure also includes floating solar power plants on irrigation canals projects.

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

Relevant planning documents, legal and regulatory acts		• LTS • PNRR
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 will access funds from the PNRR (component 16 REPowerEU) for construction of 20 MW of floating solar park on the main, already rehabilitated, irrigation canals Gălăţui – Călăraşi. It is projected that the project will be completed by the end of the fourth quarter of 2025.
• 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)		20	100
Emissions reduction (Gg CO_2-eq)			3	28
Other	Primary energy savings (ktoe)		2	24

Finance	Budget	80 M€
	Source of finance	MF, PR, PAC 2023-2027, Private sources
Implementing entity		• MADR • ME
Monitoring entity		MADR, ME
Relation with other dimensions		Energy efficiency, Research, innovation, and competitiveness

PAM 16 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		• PS PAC 2023-2027 • LTS
Methodology		Bottom up modeling using LEAP-RO model, IPCC methodology
Assumptions		
Status of implementation		Under implementation
• Steps taken		•
• Steps envisaged		• Increase the number of new agricultural machines

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

Finance	Budget	M€
	Source of finance	PAC 2023-2027, State-aid schemes AFM, Private sources
Implementing entity		• MADR • MMAP • AFM
Monitoring entity		MADR, MMAP, AFM
Relation with other dimensions		Energy efficiency

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 • LTS • PNRR • GEO no. 92/2021 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 – Waste per capita			204

Finance – Budget	M€
Source of finance	PDD, PTJ, State-aid schemes AFM
Implementing entity	• MMAP • Local authorities
Monitoring entity	• MMAP, ANPM
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 • LTS • PNRR
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	Wood		25%	30%
	Food			50%

Finance	Budget	M€
	Source of finance	PDD, PTJ, State-aid schemes AFM
Implementing entity		• MMAP • Local authorities
Monitoring entity		• MMAP • ANPM
Relation with other dimensions		

PAM 19 Optimization of incineration / co-incineration processes

Main objective: Improvement of incineration/co-incineration processes
Description: Improvement of the incineration/co-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 • LTS • GEO no. 92/2021 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 NC8), with the option of this waste being used for energy recovery in recovery facilities and/or in cement plants. • Development of the secondary legislation necessary for the implementation of RED II and a national certification scheme for sustainability and GHG reduction - until the end of 2024 • Development of a biomass use strategy - until the end of 2024, in alignment with the other plans and strategies developed at national level (STL, Circular Economy Strategy, Carbon Management Strategy, etc.
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	Volume of municipal waste incinerated (kt)			500

Finance	Budget	/
	Source of finance	PTJ, State-aid schemes AFM
Implementing entity		• MMAP • Local authorities
Monitoring entity		• MMAP • ANPM
Relation with other dimensions		Energy efficiency, Research, innovation, and competitiveness

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 • LTS
Methodology	Bottom-up modeling using LEAP-RO model, IPCC methodology
Assumptions	By 2050, 60% of the emissions from the non-recycled waste plus the historical emissions will be used for flaring in case the biogas produced cannot be collected and used for energy purposes.
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 – Methane flared (kt)			94

Finance – Budget	M€
Source of finance	Private sources
Implementing entity	• MMAP • Local authorities
Monitoring entity	• MMAP • ANPM
Relation with other dimensions	Energy efficiency

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, as well as drying and energy recovery (e.g. in cement factories) of sewage sludge that cannot be directed for use in agriculture.				
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 • LTS • PNRR • Water Law no. 107/1996			
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 2030. • 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. • Development of the secondary legislation necessary for the implementation of RED II and a national certification scheme for sustainability and GHG reduction - until the end of 2024 • Development of a biomass use strategy - until the end of 2024, in alignment with the other plans and strategies developed at national level (STL, Circular Economy Strategy, Carbon Management Strategy, etc.			
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: Connected to WWTP			5% of the rural areas	
Finance: Budget	M€			
Finance: Source of finance	PDD, PNI Anghel Saligny			
Implementing entity	• MMAP, MIPE, MDLPA. ANRSC • Local authorities			
Monitoring entity	• MMAP			
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	• LTS • PNRR • LAW 220/2008 on establishing the system for promoting energy production from renewable energy sources • GEO 163/2022 for the completion of the legal framework for the promotion of the use of energy from renewable sources, as well as for the modification and completion of some normative acts			
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: • 700 MW each year from 2023 to 2030, 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)		2400		6400
Emissions reduction (Gg CO_2-eq)		672		1793
Other — Primary energy savings (ktoe)		578		1541
Finance — Budget	3100 M€			
Source of finance	MF, PNRR, PTJ, PR, Private sources			
Implementing entity	• ME • Private investors			
Monitoring entity	ME			
Relation with other dimensions	Security of supply			

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	• LTS • PNRR • LAW 220/2008 on establishing the system for promoting energy production from renewable energy sources • GEO 163/2022 for the completion of the legal framework for the promotion of the use of energy from renewable sources, as well as for the modification and completion of some normative acts • Law no. 121/2024 on offshore wind energy, entered into force on June 7, 2024
Methodology	Bottom-up modeling and least-cost optimization using the LEAP-RO model. IPCC Methodology
Assumptions	It is envisaged that by 2050 additional capacity, onshore and offshore, of: • 750MW each year from 2025 to 2026, • 800 MW each year from 2027 to 2030, • 675 MW each year from 2031 to 2040 • 750 MW each year from 2041 to 2050 will be constructed. Additionally, the following auto wind capacities will be built (electricity production capacities from wind energy owned by entities that do not have as their main activity the production of electricity and that can use, partially or fully, the production of electricity for self-consumption): • 75 MW each year from 2023 to 2025, • 60 MW each year from 2031 to 2040, • 100 MW each year from 2041 to 2050
Status of implementation	Under implementation
• Steps taken	• Legal framework adopted
• Steps envisaged	• Construction of wind power plants (first offshore is expected in 2032)

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020-2021	2025	2030
Progress	Total installed capacity (MW)		3,700	7,300
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			

Finance	Budget	5600 M€
	Source of finance	MF, PNRR, PTJ, Private sources
Implementing entity		• ME • Private investors
Monitoring entity		ME
Relation with other dimensions		Security of supply

PAM 24 Construction/completion of hydropower facilities

Main objective: Increase of the domestic generation capacity from renewable energy sources
Description: Construction/completion of hydro power facilities 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	• LTS • LAW 220/2008 on establishing the system for promoting energy production from renewable energy sources • Water Law no. 107/1996, with subsequent modifications and additions • GEO 175/2022 for the establishment of measures regarding the investment objectives for the realization of hydropower facilities in progress, as well as other projects of major public interest that use renewable energy, as well as for the modification and completion of some normative acts • GEO 163/2022 for the completion of the legal framework for the promotion of the use of energy from renewable sources, as well as for the modification and completion of some normative acts • Government Decision no. 148/2020 approving the method of determination and calculation of the ecological flow rate
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 2026 • 9.4 MW (AHE Pascani Sirt) starting from 2026 • 40.5 MW (AHE Cornetu – Avrig (Caineni and Lotrioara)) starting from 2029 • 55 MW (AHE Surduc Siriu) starting from 2026 • 38 MW (AHE Siret Cosmesti - Movileni) starting from 2026 • 35 MW (AHE Rastolita) starting from 2026 • 15 MW (AHE Cerna Belareca) starting from 2029 • 13 MW (AHE Cerna-Motru-Tismana second stage) starting with 2029 • 29 MW (AHE Izbiceni Dunare, Islaz) starting from 2030 will be constructed.
Status of implementation	Under implementation • Construction/completion of hydro power facilities as planned in Hypotheses • Implementation of measures to mitigate the impact on water bodies (eg ensuring ecological flow, ensuring the passability of fish fauna, sediment management, etc.) and increasing energy efficiency
• 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)			300
Emissions reduction (Gg CO_2-eq)				80
Other	Primary energy savings (ktoe)			69

Finance	Budget	483 M€
	Source of finance	State budget
Implementing entity		• ME • Hydroelectric Power Generation Company "Hidroelectrica" SA (Hidroelectrica)
Monitoring entity		ME
Relation with other dimensions		Security of supply

PAM 25 Pump storage				
Main objective: Increase the flexibility of the system **Description:** Pumped storage is crucial for the flexibility of the electricity system. It allows for the storage of excess energy generated during periods of low demand, which can then be used during peak demand times. This ability to balance supply and demand helps to stabilize the grid and prevents blackouts. Additionally, pumped storage supports the integration of renewable energy sources, such as wind and solar, by storing energy when production is high and releasing it when production is low.				
Timeframe	Type	Sector	Gases	Scope
2022 – 2050	Technical	Energy supply	CO_2, CH_4, N_2O	National
Relevant planning documents, legal and regulatory acts	• LTS • LAW 220/2008 on establishing the system for promoting energy production from renewable energy sources, with subsequent modifications and additions • Water Law no. 107/1996 • GEO 175/2022 for the establishment of measures regarding the investment objectives for the realization of hydropower facilities in progress, as well as other projects of major public interest that use renewable energy, as well as for the modification and completion of some normative acts • GEO 163/2022 for the completion of the legal framework for the promotion of the use of energy from renewable sources, as well as for the modification and completion of some normative acts			
Methodology	Bottom-up modeling and least-cost optimization using the LEAP-RO model. IPCC Methodology			
Assumptions	800 MW			
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)				800
Finance: Budget	1800 M€			
Finance: Source of finance	MF, State budget, Private sources			
Implementing entity	• ME • Hydroelectric Power Generation Company "Hidroelectrica" SA (Hidroelectrica)			
Monitoring entity	ME			
Relation with other dimensions	Energy security			

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 statistic 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 SEN 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 PNRR and Modernization Fund financing allocated for Romania. It plays a key role in supporting 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 envisaged 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 26, through the Green house photovoltaic program (funded from the state budget), PV rooftops construction and installation 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 26 Rooftop PV

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	• SNRTL • LTS • PNRR Component C16, Repower EU

			• Law 220/2008 on establishing the system for promoting energy production from renewable energy sources • Law 372/2005 for energy performance of buildings • Law 121/2014 on Energy Efficiency • GEO 163/2022 for the completion of the legal framework for the promotion of the use of energy from renewable sources, as well as for the modification and completion of some normative acts • Just Transition Program 2021-2027 (PTJ) and Territorial Just Transition Plan (PTTJ)	
	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 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. • Scheme for awarding vouchers to accelerate the installation of renewable energy capacities within individual households (allocation EUR 610,762,268)	
	• 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 2500	At least 3500
	Emissions reduction (Gg CO_2-eq)			701	981
	Other	Primary energy savings (ktoe)		843	602
	Finance	Budget	2000 M€		
		Source of finance	MF, PNRR, PTJ, PR, Social Climate Fund (SCF), Private sources		
	Implementing entity		• AFM • ME • MMAP • Private investors	
	Monitoring entity		ME	
	Relation with other dimensions		Energy efficiency, Energy security	

PAM 27 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	• LTS • SNRTL • Law 220/2008 on establishing the system for promoting energy production from renewable energy sources • Law 372/2005 for energy performance of buildings • Law 121/2014 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
Emissions reduction (Gg CO_2-eq)		43	130
Other: Primary energy savings (ktoe)		60	95

Finance: Budget	2300 M€
Source of finance	MF, PTJ, PR, SCF, Private sources
Implementing entity	• ME • End-users
Monitoring entity	ME
Relation with other dimensions	Energy efficiency, Energy security

PAM 28 Facilitate the establishment of energy communities

Main objective: Enable the establishment of energy communities
Description: The aim of this measures it to address the required specific amendments of the legislative framework that would accelerate the establishment of energy communities and self-sufficient villages

Timeframe	Type	Sector	Gases	Scope
2024 – 2050	Legal	Energy	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• RED III • GEO 163/2022 • Law 123/2012
Methodology	Collaborative Policy Development
Assumptions	• The specific required amendments of the primary and secondary legislation will be identify based on the barriers/challenges encounter by the already established energy communities in Romania
Status of implementation	Under implementation
• Steps taken	Stakeholder engagement: • The Ministry of Energy initiated a Working Group for the development of energy communities in Romania and launched the invitation to interested entities such as consumers, non-governmental organisations, local communities, industry and the public sector. • The first meeting of the group was organised by Ministry of Energy and took place on the 4th of June 2024.
• Steps envisaged	• Jointly analyse the existing legislative framework to identify barriers and challenges. • Identify good practices based on the existing energy communities in Romania, as well as within other EU Member States. • Jointly develop proposals to create/modify the specific required secondary legislation alongside with the related primary legislations to enable the establishment of energy communities. • Ensure that the proposed changes are implemented effectively and monitoring their impact over time.

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2022	2025	2030
Progress	Number of energy communities established (No.)			

Finance	Budget	/
	Source of finance	/
Implementing entity		• ME
Monitoring entity		ME, ANRE
Relation with other dimensions		

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

PAM 29 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	• LTS • Law 220/2008 on establishing the system for promoting energy production from renewable energy sources • Law 121/2014 on energy efficiency • GEO no. 53/2019 regarding the approval of the multi-annual investment financing program for the modernization, rehabilitation, re-technology and expansion or establishment of the centralized supply systems with thermal energy of localities and for the amendment and completion of the Law on community services of public utilities no. 51/2006 • Law no. 325/2006, the law on the public service of thermal energy supply • GEO 163/2022 for the completion of the legal framework for promoting the use of energy from renewable sources, as well as for the modification and completion of some normative acts
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 of the Modernization Fund
• 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)			150
Emissions reduction (Gg CO_2-eq)				42
Other	Primary energy savings (ktoe)			36

Finance	Budget	618 M€
	Source of finance	MF, PDD, Private sources
Implementing entity		• ME • Private investors
Monitoring entity		ME
Relation with other dimensions		Energy efficiency, Energy security

PAM 30 Biogas and biomethane

Main objective: Increase the share of RES and reduce the methane emission from agriculture and waste
Description: Addressing methane emissions from agriculture and waste through improved waste management practices and technologies, like anaerobic digestion, mitigates one of the most potent greenhouse gases. These combined efforts not only contribute to climate change mitigation but also promote a cleaner, more resilient energy and environmental landscape.

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

Relevant planning documents, legal and regulatory acts	• LTS • Law 220/2008 on establishing the system for promoting energy production from renewable energy sources • Law 121/2014 on energy efficiency • GEO no. 53/2019 regarding the approval of the multi-annual investment financing program for the modernization, rehabilitation, re-technology and expansion or establishment of the centralized supply systems with thermal energy of localities and for the amendment and completion of the Law on community services of public utilities no. 51/2006 • Law no. 325/2006, the law on the public service of thermal energy supply • GEO 163/2022 for the completion of the legal framework for promoting the use of energy from renewable sources, as well as for the modification and completion of some normative acts
Methodology	Bottom-up modeling and least-cost optimization using the LEAP-RO model. IPCC Methodology
Assumptions	
Status of implementation	Under implementation
• Steps taken	• EBRD study develop on biomethane potential
• Steps envisaged	•

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020-2021	2025	2030
Progress – Share of biomethane in natural gas network			5% (according to relevant legal provisions and in parts of the system where the technical conditions allow it)
Biomethane consumption (ktoe)			368

Finance	Budget	M€
	Source of finance	PAC 2023-2027, AFIR, PNRR, MF, State budget, Private sources
Implementing entity		• ME • Private investors
Monitoring entity		ME
Relation with other dimensions		Energy efficiency, Energy security

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 31 Development of the advanced biofuels market

Main objective: Increase the domestic production of advanced biofuels
Description: RES share in the transport sector will be achieved only if advanced biofuels are used. Having in mind the obligation under RED II directive of using advanced 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		• LTS • Law 220/2008 on establishing the system for promoting energy production from renewable energy sources, modified by GEO no. 163/2022 for the completion of the legal framework for the promotion of the use of energy from renewable sources, as well as for the modification and completion of some normative acts and by other legislation • Directive (EU) 2023/2413 (Directive RED III)
Methodology		Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions		At least 5,5% advanced biofuels in final energy consumption in transport by 2030
Status of implementation		Under implementation
• Steps taken		•
• Steps envisaged		• A state-aid scheme, funded from MF, will be launched, providing support for biofuels producers

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020-2021	2025	2030
Progress	Share of biofuels			5,5%
Other	Overall biofuels consumption (ktoe)			~400

Finance	Budget	M€
	Source of finance	MF, State budget, Private sources
Implementing entity		• ME • MTI • Private investors
Monitoring entity		ME
Relation with other dimensions		Energy efficiency, Energy security, Research, Innovation and Competitiveness

PAM 32 Renewable and low-carbon fuels for maritime transport and sustainable aviation fuels in aviation

Main objective: Reduce greenhouse gas emissions
Description: Although consumption in aviation and marine transport in Romania is negligible compared to road transport, biofuels and alternative fuels in these sectors provide a sustainable alternative to traditional fossil fuels, significantly helping to reduce greenhouse gas emissions.

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

Relevant planning documents, legal and regulatory acts	• LTS • Regulation (EU) 2023/2405 of the European Parliament and of the Council of 18 October 2023 on ensuring a level playing field for sustainable air transport (ReFuelEU Aviation) • Delegated Regulation (EU) 2023/1184 supplementing Directive (EU) 2018/2001 of the European Parliament and of the Council by establishing a Union methodology laying down detailed rules for the production of liquid and gaseous fuels of non-biological origin produced from renewable sources and used in transport. • Regulamentul delegat (UE) 2023/1185 de completare a Directivei (UE) 2018/2001 a Parlamentului European și a Consiliului prin stabilirea unui prag minim pentru reducerea emisiilor de gaze cu efect de seră generate de combustibilii pe bază de carbon reciclat și prin specificarea unei metodologii de evaluare a reducerilor de emisii de gaze cu efect de seră obținute de la combustibilii lichizi și gazoși de origine nebiologică produși din surse regenerabile și utilizați în transporturi și de la combustibilii pe bază de carbon reciclat. • Regulamentului (UE) 2023/1805 privind utilizarea combustibililor din surse regenerabile și cu emisii scăzute de carbon în transportul maritim.	
Methodology	Bottom-up modeling using LEAP-RO model, IPCC methodology	
Assumptions	•	
Status of implementation	Under implementation	
• Steps taken	• Implementing COM comments in the doc. SWD(2023) 930 final	
• Steps envisaged	• Additional analysis will be made on the potential for SAF domestic production • A state-aid scheme, funded from MF, will be launched, providing support for biofuels (including SAF) producers	

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020 – 2021	2025	2030
Progress	Share of sustainable aviation fuels The average annual GHG intensity generated by the energy used on board a ship during a reporting period may not exceed the limit set by the Regulation. Thus, this limit is calculated by subtracting from the reference value of 91,16 grams of CO2 equivalent per MJ the following percentage:		2%	6%
Emissions reduction (Gg CO_2-eq)				At least 14
Other	Domestic production of SAF benefiting from public support (kt)			20 (for both domestic and international air transport)

Finance	Budget	M€
	Source of finance	SCF, MF, State budget, EEEF, Private sources
Implementing entity	• MTI • ME • MMAP • Private investors	
Monitoring entity	ME, MMAP	

Relation with other dimensions	Decarbonization

PAM 33 RFNBO

Main objective: Increase share of RES in the transport sector
Description: Establishing a sub-target for advanced biofuels and renewable fuels of non-biological origin (RFNBO) in the transport sector is crucial for Romania, given their growing importance. This measure ensures compliance with the minimum RFNBO level required by 2030, particularly focusing on renewable hydrogen. Romania's current targets are ambitious but lack a solid regulatory framework and sufficient funding. To facilitate faster and easier project implementation, it's necessary to harmonize and simplify the applicable legislation, supporting the efficient collection and use of raw materials as outlined in the RED II and potentially RED III Directives.

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

Relevant planning documents, legal and regulatory acts	• LTS • Law 220/2008 on establishing the system for promoting energy production from renewable energy sources • Directive (EU) 2023/2413 (Directive RED III) • Delegated Regulation (EU) 2023/1184 supplementing Directive (EU) 2018/2001 of the European Parliament and of the Council by establishing a Union methodology laying down detailed rules for the production of liquid and gaseous fuels of non-biological origin produced from renewable sources and used in transport. • Delegated Regulation (EU) 2023/1185 supplementing Directive (EU) 2018/2001 Of the European Parliament and of the Council by setting a minimum threshold for reducing greenhouse gas emissions from recycled carbon fuels and specifying a methodology for assessing greenhouse gas emission reductions from renewable and transport-based non-biological liquid and gaseous fuels recycled carbon
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions	The combined share of advanced biofuels and biogas, as well as renewable fuels of non-biological origin, in the energy supplied to the transport sector is at least 1% in 2025 and 5.5% in 2030, of which at least one percentage point must come from renewable fuels of non-biological origin in 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	Share of RFNBO			at least 1%
Other	Consumption in WAM scenario (ktoe)			146 (2% share in final energy consumption in transport in 2030)

Finance	Budget	M€
	Source of finance	MF, State budget, Private sources
Implementing entity		• ME • MTI • Private investors
Monitoring entity		ME
Relation with other dimensions		Energy efficiency, Energy security, Research, Innovation and Competitiveness

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

PAM 34 contributes to the sustainability of biomass production.

PAM 34 Development of the use of biomass, bioliquids and biogas within the EU-ETS installations based on energy-intensive thermal processes

Main objective: Increasing the use of biomass, bioliquids and biogas within EU-ETS installations based on energy-intensive thermal processes, in order to reduce the use of fossil fuels and stimulate the decarbonisation of industrial sectors
Description: The decarbonization of industrial sectors by reducing their related combustion emissions, reducing dependence on fossil fuels is only possible by replacing these fuels with alternative energy sources (such as those from waste or residues) or with sustainable biomass. Considering the obligations established by the RED II directive regarding the use of biomass including in industrial thermal processes and the sustainability and greenhouse gas reduction criteria that must be met, there is a need for collaboration between the Romanian authorities and companies in the field to increase the use of biomass, bioliquids and biogas, especially within EU-ETS installations based on energy-intensive thermal processes.

Time interval	Type	Section	GAS	Application domain
2022 – 2050	Technical	Energy, EU-ETS industry	CO_2, CH_4, N_2O	National

Relevant planning documents, normative and regulatory acts	• STL • GEO 163/2022 for the completion of the legal framework for the promotion of the use of energy from renewable sources, as well as for the modification and completion of some normative acts • Circular economy strategy • The National Waste Management Plan • Guidance document no. 3-biomass problems in EU-ETS (GD3) of the monitoring regulation and reporting (MRR 2066/2018)
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC methodology
Hypotheses	•
Implementation stage	Under implementation
• Steps taken	•
• Expected stages	• Development of the secondary legislation necessary for the implementation of RED II and a national certification scheme for sustainability and GHG reduction - until the end of 2024 • Development of a strategy for the use of biomass, bioliquids and biogas - until the end of 2024, in line with the other plans and strategies developed at national level (STL, Circular Economy Strategy, Carbon Management Strategy, etc.) • The development of institutional capacity and the accreditation of EU-ETS verifiers for verifying the fulfillment of the criteria of sustainability and reduction of GHG emissions provided for in RED II

indicator	Value in the last reporting year	Indicative trajectory	The target value
	2020-2021	2025	2030
Progress — Secondary legislation developed		√	

funding — Budget	M€
Source of funding	MF, Private sources
The implementing entity	• MEAT • ME • Ministry of the Environment • Private investors
Monitoring entity	MMAP and ANPM
Relationship with other dimensions	Energy efficiency, Energy security, Research, Innovation and Competitiveness

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[17].

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 5, PAM 22, PAM 23, PAM 26, PAM 29, PAM 35, PAM 36, PAM 37, PAM 38, PAM 42, PAM 43, PAM 46, PAM 47, PAM 56, PM 85.

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 35 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

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

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	• SNRTL • Law 121/2014 on energy efficiency • Law no. 372/2005 on the energy performance of buildings • LTS • PNRR
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	Please see the text in measure PAM 37 Renovation of residential building
• Steps envisaged	•

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020 – 2021	2025	2030
Emissions reduction (Gg CO_2-eq)		Calculated together with measure Renovation of commercial buildings	
Other: Primary energy savings (ktoe)			

Finance – Budget	300 M€ by 2030
Finance – Source of finance	PDD, State-aid schemes AFM, PR, SCF, State budget
Implementing entity	• Central government authorities
Monitoring entity	MDLPA, SGG – Coordination Committee of SNRTL
Relation with other dimensions	Decarbonization

PAM 36 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, interventions regarding the technical systems of buildings, introduction of automation solutions and BMS (Building Management Systems), etc. As part of the measure, steps will also be taken to issue the energy performance certificates of the buildings in question.

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	• SNRTL • Law 121/2014 on energy efficiency • Law no. 372/2005 on the energy performance of buildings • LTS • PNRR
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	• Please see the text in measure PAM 37 Renovation of residential building
• Steps envisaged	•

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020 – 2021	2025	2030
Emissions reduction (Gg CO_2-eq)		Calculated together with measure Renovation of commercial buildings	
Other: Primary energy savings (ktoe)			

Finance – Budget	1.3 bill. € by 2030 (EUR 700 million from State budget / EU funds and ~ EUR 600 million from the private sector)
Source of finance	PDD, State-aid schemes AFM, PR, SCF, State budget, Local budgets
Implementing entity	• ADR • Local authorities
Monitoring entity	MDLPA, ADR, SGG – Coordination Committee of SNRTL
Relation with other dimensions	Decarbonization

PAM 37 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, interventions regarding the technical systems of buildings, introduction of automation solutions and BMS (Building Management Systems), etc. As part of the measure, steps will also be taken to issue the energy performance certificates of the buildings in question.

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

Relevant planning documents, legal and regulatory acts	• SNRTL • Law 121/2014 on energy efficiency • Law no. 372/2005 on the energy performance of buildings • GEO 18/2009 on increasing the energy efficiency of the residential blocks of flats • LTS • PNRR
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. Scenario 2 starts with almost 0.7% renovation rate in 2021 and ends in 2030 with 3.4% renovation rate.
Status of implementation	Under implementation
• Steps taken	• to accelerate measures to increase the renovation rate of the building stock, a series of reforms regarding legislative and normative changes have already been instituted at the national level, as well as financing instruments to ensure the operationalization of investments (the National Recovery Plan and Resilience, Cohesion Policy 2021-2027, national programs financing energy renovation and integrated renovation measures, etc.). • at the governmental level, Government Decision no. 10/2023 for the amendment and completion of the long-term national renovation strategy to support the renovation of residential and non-residential buildings, both public and private, and its gradual transformation into a real estate park with a high level of energy efficiency and decarbonation until 2050, approved by Government Decision no. 1034/2020. The normative act provides for the establishment of priority actions for the period 2022-2030, necessary for the implementation of the national long-term renovation strategy, by allocating resources to the energy efficiency of buildings and deepening policy/regulatory, institutional and implementation efforts, with monitoring indicators and evaluation of the achievement of the expected results, deadlines for the achievement of specific objectives, the responsible institutions and the institutions and organizations that contribute to the fulfilment of the measures.
• Steps envisaged	•

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020 – 2021	2025	2030
Emissions reduction (Gg CO_2-eq)		514	1884
Other — Final energy savings (ktoe)		210	771

Finance — Budget	10.9 bill. € by 2030 (4 billion from State budget / EU funds, ~ EUR 6.9 billion from the private sector)
Finance — Source of finance	PR, SCF, State budget, Local budgets, Private sources
Implementing entity	• Local authorities • MDLPA • ADR • Landlords and landlords' associations
Monitoring entity	MDLPA, ADR
Relation with other dimensions	Decarbonization

PAM 38 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 commercial buildings, which may involve activities such as the replacement of windows, insulation, interventions regarding the technical systems of buildings, introduction of automation solutions and BMS (Building Management Systems), etc. As part of the measure, steps will also be taken to issue the energy performance certificates of the buildings in question.

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	• SNRTL • Law 121/2014 on energy efficiency • Law no. 372/2005 on the energy performance of buildings • LTS
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions	The renovation rate, as outlined in SNRTL scenario 2, aligns with the parameters defined in the WAM scenario of the NECP. Scenario 2 starts with almost 0.7% renovation rate in 2021 and ends in 2030 with 3.4% renovation rate. In the LEAP_RO model between these two years we have linear interpolation which lead us to almost 2% average annual renovation rate. 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	• Please see the text in measure PAM 37 Renovation of residential building
• Steps envisaged	•

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020 – 2021	2025	2030
Emissions reduction (Gg CO_2-eq)		45.4	313.1
Other: Final energy savings (ktoe)		19	128

Finance – Budget	300 M€ by 2030
Finance – Source of finance	SCF, Private sources, Commercial loans
Implementing entity	• ME • Commercial building owners
Monitoring entity	ME
Relation with other dimensions	Decarbonization

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 39 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 121/2014 on energy efficiency • LTS
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: 2020 – 2021 / Indicative trajectory: 2025 / Target value: 2030
Emissions reduction (Gg CO_2-eq)		13.8 / 41.6
Other	Final energy savings (ktoe)	5.6 / 17.0
Finance	Budget	M€
	Source of finance	PR, National Programme for Local Development (PNDL), State-aid schemes AFM, Local budgets
Implementing entity		• Local authorities • MDLPA • MMAP • ADR
Monitoring entity		ADR
Relation with other dimensions		Decarbonization

PAM 40 Development of energy services/market, ESCO

Main objective: Framework enabling institutions to improve their energy efficiency
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 121/2014 on energy efficiency • LTS • PNRR			
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
Emissions reduction (Gg CO_2-eq)		184		556
Other: Primary energy savings (ktoe)		75		227
Finance: Budget	M€			
Finance: Source of finance	Private sources			
Implementing entity	• ME • MMAP • MDLPA			
Monitoring entity	ME, MDLPA			
Relation with other dimensions	Internal energy market			

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 41 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 121/2014 on energy efficiency • LTS • PNRR • Law no. 69/2016 on Green Public Procurement • Green Public Procurement Action Plan
Methodology		Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions		Increased rate of advanced energy efficiency technology and materials/products with a low carbon footprint and with a high degree of circularity due to public procurement by 7%
Status of implementation		Under implementation
• Steps taken		•
• Steps envisaged		• defining sustainability criteria which must be fulfilled within public procurement, both from the perspective of decarbonization as well as from the perspective circularity of resources

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020 – 2021	2025	2030
Progress	Sustainability criteria developed	/	√	/
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			

Finance	Budget	M€
	Source of finance	State budget, Local budgets
Implementing entity		• MEAT • MMAP • National Agency for Public Procurement • Local authorities • The National Office for Centralised Acquisition (ONAC)
Monitoring entity		National Agency for Public Procurement
Relation with other dimensions		Decarbonization, Energy security

PAM 42 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 121/2014 on energy efficiency • LTS • PNRR • Revised EU-ETS Directive
Methodology		Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions		
Status of implementation		Under implementation
• Steps taken		•
• Steps envisaged		• Updating the methodology Nation (normative) for carrying out audits energy so as to indicate the GHG reductions which results from recommended measures

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 sources
Implementing entity		• ME • MEAT
Monitoring entity		ME
Relation with other dimensions		Decarbonization, Energy security

PAM 43 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 • LTS • PNRR • GEO 163/2022 for the completion of the legal framework for promoting the use of energy from renewable sources, as well as for the modification and completion of some normative acts
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	• ME initiated discussion with INS to include heat pumps in the energy balance
• Steps envisaged	• A national plan on deploying heat pumps both for residential and commercial heating & cooling should be drafted

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020 – 2021	2025	2030
Progress	Installed capacity (MW)		Around 760 MW in the residential sector 40% share in the commercial sector	Around 1 GW in the residential sector 50% share in the commercial sector
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			

Finance	Budget	M€
	Source of finance	FM, PR, PTJ, State-aid schemes AFM, SCF, Private sources
Implementing entity		• ME • MMAP • End-users
Monitoring entity		ME
Relation with other dimensions		Decarbonization

PAM 44 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 121/2004 on Energy efficiency • Law no. 372/2005 on the energy performance of buildings • LTS • PNRR
Methodology		Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions		
Status of implementation		Under implementation
• Steps taken		• New program from 2024 (Rabla program for stoves) with support of 10,000 lei per person for the replacement of the old stove with new, more efficient stoves in rural areas
• 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	PR, State-aid schemes AFM, SCF, Private sources
Implementing entity		• ME • MDLPA • MMAP • ADR • End-users
Monitoring entity		ME
Relation with other dimensions		Decarbonization

PAM 45 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	• LTS • PNRR • NSCE
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions	
Status of implementation	Under implementation
• Steps taken	•
• Steps envisaged	• Updating and clarifying the reporting forms of energy efficiency measures definitions recovered energy (from waste and residues, from industrial processes, etc.) and RES energies used by industrial consumers, 2024 • Establishing a national biomass sustainability certification scheme and GHG reductions, 2024 • Industrial Strategy update, 2024 • Development of the Green Deal Industrial Plan, 2024 • Opening of the financing axis according to Key Program 7 of the Modernization Fund for modernization projects at BAT level • Replacing inefficient technologies and implementation of BAT technologies

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020 – 2021	2025	2030
Progress – Documents adopted		• National biomass sustainability certification scheme • Industrial Strategy update • Green Deal Industrial Plan	
Emissions reduction (Gg CO_2-eq)			
Other – Primary energy savings (ktoe)			

Finance – Budget	M€
Source of finance	MF, PDD, Private sources
Implementing entity	• MEAT • ME • MMAP • Private investors
Monitoring entity	ME
Relation with other dimensions	Decarbonisation, Research, Innovation and Competitiveness

PAM 46 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	• LTS • PNRR
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions	
Status of implementation	Under implementation
• Steps taken	•
• Steps envisaged	• Industrial Strategy update, 2024 • Development of the Green Deal Industrial Plan, 2024 • Opening of the financing axis according to Key Program 7 of the Modernization Fund for modernization projects at BAT level

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020 – 2021	2025	2030
Progress – Documents adopted		• Industrial Strategy update • Green Deal Industrial Plan	
Emissions reduction (Gg CO_2-eq)			
Other – Primary energy savings (ktoe)			

Finance – Budget	M€
Source of finance	MF, Private sources
Implementing entity	• MEAT • ME • MMAP • Private investors
Monitoring entity	MEAT, ME, MMAP
Relation with other dimensions	Decarbonisation, Research, Innovation and Competitiveness

PAM 47 Increased share of alternative fueled cars

Main objective: Increased share of alternative fuelled 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		• LTS • PNRR • 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		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		• Installation of e-charging stations
• Steps envisaged		• Increasing the number of e-charging stations as well as hydrogen station • Change of car fleet

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020-2021	2025	2030
Progress	Number of Electric and plug-in cars (thousand)		63 electric 124 plug-in	680 electric 617 plug-in
	High power electric charging points (at least 50kW) on the highway network, expressways and national roads			2,896
	High-power electric recharging points (at least 50kW) on the road network within administrative-territorial units (UATs)			13,200
	Other high power and normal power charging points			12,083
Emissions reduction (Gg CO_2-eq)				1.800 compared to 2020 level (including switch from car to buses and rail)
Other	Final energy savings (ktoe)			460 compared to 2020 level

Finance	Budget	9.3 billion € by 2030 for electric and plug-in cars
	Source of finance	State-aid schemes AFM, SCF, PNRR, CEF, FM, Private sources
Implementing entity		• MTI • AFM • ME • MMAP • Private investors
Monitoring entity		MTI and ME
Relation with other dimensions		Decarbonization

PAM 48 Increased share of alternative fueled buses

Main objective: Increased share of alternative fuelled buses
Description: There is significant need of promoting and use of alternative fuelled buses 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	• LTS • National Integrated Urban Development Strategy for Resilient, Green, Inclusive and Competitive Cities 2022-2035 (Romania's Urban Policy) • PNRR
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%
Status of implementation	Under implementation
• Steps taken	•
• Steps envisaged	• Change of bus fleet

		Value in the last reporting year	Indicative trajectory	Target value
Indicators		2020 – 2021	2025	2030
Progress	Share of alternative buses (Electric and hydrogen)			19160 hybrid 12350 electric 1280 hydrogen
Emissions reduction (Gg CO_2-eq)				Emission in 2030 are projected to be at the same level since the activity is increased as a result of switch from cars to buses
Other	Primary energy savings (ktoe)			Increase by 150 ktoe

Finance	Budget	2.4 bill.€ for hybrid, electric and hydrogen buses by 2030
	Source of finance	PR, PNNR, SCF, Local budgets
Implementing entity		• ME • MMAP • Local authorities • Private investors
Monitoring entity		ME
Relation with other dimensions		Decarbonization

PAM 49 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	• LTS • PNSS • 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 • Just Transition Program 2021-2027 (PTJ) and Territorial Just Transition Plan (PTTJ)		
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
Emissions reduction (Gg CO_2-eq)			Calculated together with PAM 49
Other: Primary energy savings (ktoe)			Calculated together with PAM 49
Finance: Budget	M€		
Source of finance	PR, PNNR, SCF, Local budgets		
Implementing entity	• MDLPA • ME • MMAP • ADR • Local authorities • Private investors		
Monitoring entity	ME, MDPLA, MMAP		
Relation with other dimensions	Decarbonization		

PAM 50 Development of the underground transport infrastructure

Main objective: Improve the public transport.
Description: Development of the underground transport network in the municipalities of Bucharest. This will lead to decarbonization of the metropolitan area.

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

Relevant planning documents, legal and regulatory acts	• LTS • PNRR • Investment Plan for the development of the national transport infrastructure over the period 2020 – 2030 • Romania's General Transport Master Plan for the period 2014-2030 (HG no. 666/2016) • MTI Order no. 1035/29.04 2022 • Law no. 121/2014 on energy efficiency with subsequent additions and amendments • Directive (EU) 2023/1791 of the European Parliament and of the Council on energy efficiency and the promotion of the end-user use of renewable energy sources
Methodology	• Bottom-up modelling using the LEAP-RO model. • IPCC Methodology
Assumptions	• The extension of the metro transport infrastructure by 1.66 km (double line), starting with November 2023 • The extension of the metro transport infrastructure in Bucharest with 14,2 km (double line) starting with 2029 Modernisation of the transport fleet
Status of implementation	Under implementation
• Steps taken	• Awarding contracts for construction of subway infrastructure on M6 line (1 Mai – Henri Coanda Otopeni International Airport)
• Steps envisaged	• Conducting necessary works to expand the metro network infrastructure by 14.2 km (dual track)

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020 – 2021	2025	2030
Progress		Expansion of the metro transport infrastructure in the city of Bucharest by 7,00 km (dual track), starting in September 2020	Extension of the metro transport network by 1.66 km (double track), starting from November 2023	Expansion of the metro transport infrastructure in the city of Bucharest by 14.2 km (double track), starting with 2029
Emissions reduction (Gg CO_2-eq)		3.8% CO_2	0.38% CO_2	4.56% CO_2
Other	Primary energy savings (ktoe)	1.16	0.83	0.98
	Energy recovered by regenerative braking (about 5% of electric traction energy (ktep)	0,39	0,50	0,58

Finance	Budget	Estimated 1,800 MEuros (VAT included)
	Source of finance	PNRR, PT, SCF, MF, State budget, Japan International Cooperation Agency (JICA), Commercial loans
Implementing entity		• Metrorex Bucharest SA
Monitoring entity		MTI
Relation with other dimensions		Decarbonization

PAM 51 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	• LTS • PNRR			
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	Indicative trajectory	Target value	
	2020 – 2021	2025	2030	
Progress – Share of alternative trucks (Electric and hydrogen) (thousand)			176 electric 123 hydrogen	
Emissions reduction (Gg CO_2-eq)			1100 compared to 2020 level (including switch from HGV to rail)	
Other – Primary energy savings (ktoe)			370 compared to 2020 level	
Finance – Budget	9.2 bill. € by 2030 for electric and hydrogen tracks			
Source of finance	State-aid schemes AFM, SCF, State budget, Private sources, Commercial loans			
Implementing entity	• ME • MTIMMAPPrivate investors			
Monitoring entity	ME, Romanian Automotive Registry (RAR), General Directorate for Driving Licenses and Vehicles Registration (DRPCIV)			
Relation with other dimensions	Decarbonization			

PAM 52 Modernization of naval transport

Main objective: Modernization of naval transport
Description: Introducing cutting-edge naval fleets, equipped with state-of-the-art propulsion, navigation, and surveillance technologies. These vessels redefine maritime engineering, prioritizing efficiency, speed, and strategic capabilities. A revolutionary advancement in naval transport, they elevate standards for security, sustainability, and adaptability, showcasing the forefront of maritime excellence

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

Relevant planning documents, legal and regulatory acts	• POIM • PT
Methodology	The calculation was made by the fuel savings resulting from removing 2 old technical ships and adding 6 new technical ships. Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions	2 old technical ships and adding 6 new technical ships
Status of implementation	Under implementation
• Steps taken	• 2020 -2022 The removal from the technical ships of old 2 and the introduction of 6 new technical ships
• Steps envisaged	• 2025 - The removal from the technical ships of old 2 and the introduction of 4 new technical ships

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020 – 2021	2025	2030
Emissions reduction (Gg CO_2-eq)	N/A		
Other – Primary energy savings (ktoe)	0.09	0.24	0.29

Finance – Budget	Approx. 70 MEUR
Finance – Source of finance	MF, State budget, Private investors, MF
Implementing entity	• Galați Lower Danube River Administration (AFDJ)
Monitoring entity	• MTI
Relation with other dimensions	Decarbonization

PAM 53 Modernization of air transport

Main objective: Modernization of air transport
Description: Transforming air transportation by integration of new aircrafts. This strategic initiative enhances operational efficiency, safety protocols, and introduces advanced avionics, propelling the aviation industry into a new era of technological sophistication.

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

Relevant planning documents, legal and regulatory acts	• The restructuring plan of the TAROM company •
Methodology	• The calculation was made based on the fuel savings resulting from the replacement of old aircraft with new ones
Assumptions	
Status of implementation	Under implementation
• Steps taken	• New fleet: 2020 - The removal from the TAROM fleet of 7 old ATR 42-500 type aircraft and the introduction of 4 new ATR 72-600 type aircraft
• Steps envisaged	• New fleet: 2025 - The removal from the TAROM fleet of 4 old BOEING 737 type aircraft and the introduction of 4 new BOEING 737 type aircraft

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020 – 2021	2025	2030
Progress	New aircrafts	4	4	
Emissions reduction (Gg CO_2-eq)		N/A		
Other	Primary energy savings (ktoe)	0.859* - 2,914*	5,514*	5,514*

Finance	Budget	Aircraft are operated under financial or operational leasing contracts Approx. 72 MEUR
	Source of finance	State budget, Private sources, Commercial loans
Implementing entity		• TAROM •
Monitoring entity		MTI
Relation with other dimensions		Decarbonization

** Currently, there is no data available on the energy savings resulting from the introduction of the new BOEING 737 aircraft into the TAROM fleet. If necessary, the data will be updated with information on private capital airlines.*

PAM 54 Modernization and renewal of railway transport

Main objective: Modernization and renewal of railway transport
Description: Advancing railway technology, new operational infrastructure and electric trains are shaping the future of rail transport. Upgraded tracks, electrification of railway lines and advanced signalling enhance operational efficiency, while the introduction of electric trains underscores a commitment to sustainability. This dual approach signifies a transformative leap towards a modernized and environmentally conscious railway system

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 2021 - 2030 • MPGT • LTS • PNRR
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions	1185 km of railway in 2026
Status of implementation	Under implementation
• Steps taken	• For the modernization and renewal of the railway infrastructure projects there are financed contracts signed under POIM, CEF and PNRR
• Steps envisaged	• For the next periods, financing applications under MF, CEF and PT programs are under preparation

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020 – 2021	2025	2030
Progress km	107.8	158	1210
Emissions reduction (Gg CO_2-eq)			
Other: Primary energy savings (ktoe)			

Finance – Budget	Approx. 10,781 M€
Finance – Source of finance	MF, PT, PNRR, SCF, CEF, State budget
Implementing entity	• MTI • CFR SA • Railway Reform Authority (ARF)
Monitoring entity	CFR SA, ARF
Relation with other dimensions	Decarbonization

PAM 55 Railway rolling stock

Main objective: New electric rolling stock in operation
Description: The deployment of new electric railway rolling stock signifies a technical breakthrough in rail transportation. Utilizing cutting-edge electric traction and advanced propulsion, these trains prioritize efficiency and sustainability, reducing carbon emissions for a greener future in rail operations.

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	• Investment Plan for the development of the national transport infrastructure over the period 2020 - 2030 • MPGY • LTS • PNRR
Methodology	Bottom-up modeling using the LEAP-RO model. IPCC Methodology
Assumptions	37 long distance Electric Multiple Unit (EMU) – POIM and PT 62 short distance EMU - PT 12 Hydrogen trains - PNRR 20 long distance EMU - PNRR
Status of implementation	Under implementation
• Steps taken	• Purchase completed and contract signed for the 37 EMUs • Purchase completed for the 62 short distance EMUs • Purchase in progress for the 12 Hydrogen and 20 long distance EMUs
• Steps envisaged	• Continuing the purchase process for sustainable passenger trains

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020 – 2021	2025	2030
Progress km		133,790,623	265,865,253
Emissions reduction (Gg CO_2-eq)		57,877	115,012
Other Primary energy savings (ktoe)		11,505	11,505

Finance Budget	1,3 M€
Source of finance	MF, PT, PNRR, SCF, State budget, Private sources
Implementing entity	• MTI • Railway Reform Authority (ARF)
Monitoring entity	• ARF
Relation with other dimensions	Decarbonization

PAM 56 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	• LTS • PNRR • 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)				Calculated together with the measure PAM 48 Increased share of alternative fueled cars
Other	Primary energy savings (ktoe)			Calculated together with the measure PAM 48 Increased share of alternative fueled cars

Finance	Budget	M€
	Source of finance	PR, PNI Anghel Saligny, State-aid schemes AFM, SCF, MF, Local budgets
Implementing entity		• MDLPA (bicycle lanes only, not any other complementary investments) • ME • MMAP • ADR • Local authorities • Private investors
Monitoring entity		MDLPA, MMAP
Relation with other dimensions		Decarbonization

PAM 57 Increasing the energy efficiency for the buildings in the transport sector

Main objective: Reducing the energy consumption in buildings that are part from transport infrastructure
Description: By implementing energy-saving and energy producing from renewable sources technologies and practices, these buildings can significantly decrease their carbon footprint, contributing to broader environmental goals. This approach supports sustainability and enhances the resilience and long-term viability of transport networks.

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

Relevant planning documents, legal and regulatory acts	• LTS • PNRR • 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 • The investment plan for the Development of Transport Infrastructure in Romania in the period 2020 – 2030 • GEO no. 60/2022 regarding the establishment of the institutional and financial framework for the implementation and management of the funds allocated to Romania through the Modernization Fund • SNRTL
Methodology	Modernization of the air transport infrastructure - The calculation took into account the impact of some investments made at the level of airports and ROMATSA on energy savings.
Assumptions	
Status of implementation	Under implementation
• Steps taken	• Modernization of air transport infrastructure: modernization of airport infrastructure and terminals and ROMATSA infrastructure (including photovoltaic panels)
• Steps envisaged	• Modernization of air transport infrastructure: modernization of airport infrastructure and ROMATSA infrastructure (including photovoltaic panels

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020 – 2021	2025	2030
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)	0.003 - 0.01	0.53	5.269

Finance	Budget	Approx. 38 M€
	Source of finance	State-aid schemes AFM, SCF, MF, State budget
Implementing entity		• MTI • ME • Local authorities • Romanian airports administration • ROMATSA
Monitoring entity		MDLPA, MTI, ME, SGG – Coordination Committee of SNRTL
Relation with other dimensions		Decarbonization

PAM 58 Modernization of road transport infrastructure

Main objective: Expansion and modernization of the road infrastructure related to national roads, in accordance with the TEN-T priorities
Description: Energy savings can result from the expansion or modernization of road infrastructure. It is clear that a vehicle will emit more greenhouse gases on a detour than on a direct route, a point consistently emphasized in all European documents related to the TEN-T network under the Fit for 55 legislative package

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

Relevant planning documents, legal and regulatory acts	• LTS • PNRR • 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 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	Connected to WWTP			
Emissions reduction (Gg CO_2-eq)				
Other	Primary energy savings (ktoe)			

Finance	Budget	M€
	Source of finance	PT, PNI Anghel Saligny, PNRR, PR, State budget, Local budgets
Implementing entity		• MTI • ADR • Local authorities
Monitoring entity		MTI, ADR, MMAP
Relation with other dimensions		Decarbonization

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 59 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 measure allows the integration of new energy production sources from RES to their full potential, as well as the integration of new consumers/consumptions generated by the rapid electrification of many industrial branches, including electromobility. Also, 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	• GEO 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 • PNRR			
Methodology	• Bottom-up modeling using the LEAP-RO model. IPCC Methodology			
Assumptions	Energy saving of about 131 GWh			
Status of implementation				
• Steps taken	• Elaboration of 2022 – 2031 RET 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€)	1,850 mill. EUR			
Source of finance	MF, PDD, State budget, Private sources			
Implementing entity	• ME • Electricity distribution companies			
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** during June 2019 – January 2020.The ENSMOV project seeked to provide support to Member States and stakeholders for the implementation of energy efficiency policies. It was 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[18].

At the same time, ANRE was also part of the following projects:

The LABEL2020 project – New Label driving supply and demand of energy efficient products - ANRE was part, as a beneficiary, between June 2019 and January 2020, of the LABEL2020 project carried out within Horizon 2020. In 2019, within the project, the following activities were deployed: the evaluation of the general framework for running national campaigns took place, informing and involving of the key stake-holders, the evaluation of existing instruments and the possibility of developing new ones and the development of a first plan regarding the actions to be unrolled.

CA EED 2 project - Joint actions for the energy efficiency directive (EED - 2012/27/EU), including the revision of the EED - ANRE was part, as a beneficiary, between April 2017 and January 2020, together with 27 other member states, of the CAEED 2 Project, in the context of the revision of the Energy Efficiency Directive 2012/27/EU for the fulfillment of the European objectives related to the Europe 2030 Strategy and the Energy Union.

The ODYSEE MURE project - Monitoring EU energy efficiency first principle and policy implementation - ANRE was part, as a beneficiary, between June 2019 and January 2020, of the Odyssee Mure project carried out within Horizon 2020 together with 31 other EU and non-EU states. The project pursued the development of the necessary support tools for monitoring and evaluating the impact of energy efficiency measures implemented at EU level, but also at the level of each member state (through the national energy efficiency action plans), by updating and modernizing the ODYSSEE and MURE databases regarding energy efficiency measures.

In the context of the provisions of art. XVI of GEO 1/2020 regarding some fiscal-budgetary measures and for the modification and completion of some normative acts, at the beginning of 2020, ANRE withdrew from the 4 projects financed through Horizon 2020 presented above.

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 60 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 GW & 462 MW (3.26 GW) 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	• LTS			
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 2031 • U4 (CANDU) – 700 MW in 2032 • SMR - 462 MW in 2030			

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

			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	1862
	Emissions reduction (Gg CO_2-eq)				
	Other	Primary energy savings (ktoe)			
	Finance	Budget	11,900 MEUR (SMR 4,900 MEUR, CANDU 7,000 MEUR)		
		Source of finance	MF, State budget, Private, sources, Public private partnership		
	Implementing entity		• ME • MMAP • MEAT • SNN • Private investors		
	Monitoring entity		• ME		
	Relation with other dimensions		Decarbonisation, Energy efficiency, Internal energy market, Research, Innovation and Competitiveness		

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, 2 and 3)[19] and the development of the Southern Gas transmission corridor – which is intended to enable the transport of the natural gas from the Black Sea (Black Sea – Podisor).

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.[20]

Romania is also part of the high – level dialogue established within **the Central and South-Eastern Europe Connection Initiative (CESEC)** which aims to increase the cooperation between Austria, Bulgaria, Croatia, Greece, Hungary, Italy, Romania, Slovakia and Slovenia. Moreover, Romania partakes in planning future natural gas infrastructure projects within the framework of **the "Vertical Corridor" initiative**, alongside Bulgaria, Hungary and Greece[21].

[19] 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)

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

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

Romania promotes the Project to increase the daily extraction capacity of the Bilciuresti deposit. The purpose of the project is to ensure the security of the gas supply during the winter and the security of the operation of the national gas system. The project is co-financed by the EU through the CEF Energy mechanism.

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 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 61 Black Sea Corridor (ENTSO-E 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		• 2022 – 2031 RET Development Plan • 4th PCI List • 2022 ENTSO–E TYNDP
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 (OHL 400 kV Smârdan – Gutinaș), **Invest. ID** 273 (OHL 400 kV Cernavodă – Gura Ialomitei – Stâlpu), **Invest. ID** 715 (400/110kV Stâlpu substation) and **Invest. ID** 800 (OHL 400 kV Varna - Burgas)). All Under implementation
• Steps taken		• ID 275, ID 273 and ID 715: Under construction; • ID 800: Completed;
• Steps envisaged		• ID 275, ID 273 and ID 715: To be commissioned in 2027;

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020-2021	2025	2030
Progress – Project commissioned	/	/	All lines and substation
Emissions reduction (Gg CO_2-eq)	/	/	/
Other – Primary energy savings (ktoe)	/	/	/

Finance	Budget (M€)	• Total project costs: CAPEX – 204.38, OPEX – 1.61 ○ ID 275 - CAPEX – 76.04, OPEX – 0.41/per year ○ ID 273 - CAPEX – 50.32, OPEX – 0.25/per year; ○ ID 715 - CAPEX – 15.02, OPEX – 0.15/per year; ○ ID 800 - CAPEX – 63, OPEX – 0.8/per year;
	Source of finance	MF, CEF Energy, State budget
Implementing entity		• Transelectrica • ME
Monitoring entity		• ENTSO-E
Relation with other dimensions		Decarbonization, Energy security

PAM 62 Mid-Continental East corridor (ENTSO-E 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 – 2030	Technical	Energy	/	Transnational

Relevant planning documents, legal and regulatory acts	• 2022 – 2031 RET Development Plan • 4th PCI List • 2022 ENTSO–E TYNDP
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 (OHL 400 kV Resita – Pancevo), **Invest. ID** 269 (OHL 400 kV Portile de Fier - Reșita), **Invest. ID** 270 (OHL 400 kV Reșița – Săcălaz and OHL 400 kV Reșița - Timisoara), **Invest. ID** 701 (400 kV Reșita substation), **Invest. ID** 705 (400 kV Timișoara substation) and **Invest. ID** 1827 (OHL 400 kV Timișoara – Arad and OHL 400 kV Săcălaz – Arad), ID according to ENTSO-E).
• Steps taken	• ID 238 and ID 269: Under construction; • ID 270: In permitting; • ID 701: Under construction; • ID 705: Under construction; • ID 1827: In permitting;
• Steps envisaged	• ID 238 and ID 269: To be commissioned in 2024; • ID 270 and ID 705: To be commissioned in 2027; • ID 701: To be commissioned in 2025; • ID 1827: To be commissioned in 2029;

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020-2021	2025	2030
Progress	Project commissioned	/	ID 238, ID 269 and ID 701	ID 270, ID 705 and ID 1827
Emissions reduction (Gg CO_2-eq)		/	/	/
Other	Primary energy savings (ktoe)	/	/	/

Finance	Budget (M€)	• Total project costs - CAPEX – 213.65, OPEX – 1.39 ○ ID 238 - CAPEX – 47, OPEX – 0.23/per year ; ○ ID 269 - CAPEX – 28.05, OPEX – 0.14/per year ○ ID 270 - CAPEX – 46.93, OPEX – 0.23/per year ○ ID 701 - CAPEX – 23.26, OPEX – 0.23/per year; ○ ID 705 - CAPEX – 18.02, OPEX – 0.18; ○ ID 1827 - CAPEX – 50.39, OPEX – 0.38
	Source of finance	MF, CEF Energy, State budget
Implementing entity		• Transelectrica • ME
Monitoring entity		• ENTSO - E
Relation with other dimensions		Decarbonization, Energy security

PAM 63 HU-RO (ENTSO-E 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 – 2030	Technical	Energy	/	Transnational

Relevant planning documents, legal and regulatory acts	• 2022 – 2031 RET Development Plan • 2022 ENTSO–E TYNDP
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	Seven separate investments clustered within project (**Invest. ID:** 1205 (OHL 400 kV Oradea Sud - Debrecen), **Invest. ID** 1832 (AT1 400 MVA, 400/220 kV Roșiori substation), **Invest. ID** 1833 (Reconductoring of the 220 kV Urechești – Târgu Jiu Nord power line), **Invest. ID** 1834 (Reconductoring of the 220 kV LEA Târgu Jiu Nord – Paroșeni), **Invest. ID** 1835 (Reconductoring of the 220 kV LEA Paroșeni – Baru Mare) and **Invest. ID** 1836 (Reconductoring of the LEA 220 kV Baru Mare - Hășdat) and **Invest ID** 1865 (400 kV Nădab – Bekescsaba circ. 2), ID according to ENTSO-E).
• Steps taken	• All projects: Planned, but not yet permitting;
• Steps envisaged	• ID 1832 and ID 1865: To be commissioned in Q_4 2027; • ID 1833, ID 1834, ID 1835 and ID 1836: To be commissioned in Q_4 2028; ID 1205: To be commissioned in Q_4 2030;

Indicators	Value in the last reporting year	Indicative trajectory	Target value
	2020-2021	2025	2030
Progress	/	/	All lines and substations
Emissions reduction (Gg CO_2-eq)	/	/	/
Other – Primary energy savings (ktoe)	/	/	/

Finance – Budget (M€)	• Total project costs - CAPEX – 124.37, OPEX – 1.244 ○ ID 1205 - CAPEX – 110, OPEX – 1.1/per year; ○ ID 1832 - CAPEX – 5.18, OPEX – 0.052/per year; ○ ID 1833 - CAPEX – 1.38, OPEX – 0.014/per year ; ○ ID 1834 - CAPEX – 2.91, OPEX – 0.029/per year ; ○ ID 1835 - CAPEX – 1.53, OPEX – 0.015/per year ; ○ ID 1836 - CAPEX – 3.37, OPEX – 0.034/per year ;
Source of finance	MF, CEF Energy, State budget
Implementing entity	• Transelectrica • ME
Monitoring entity	• ENTSO - E
Relation with other dimensions	Decarbonization, Energy security

PAM 64 North CSE Corridor (ENTSO-E 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 – 2030	Technical	Energy	/	Transnational

Relevant planning documents, legal and regulatory acts	• 2022 – 2031 RET Development Plan • 2022 ENTSO–E TYNDP
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	Four separate investments clustered within project (**Invest. ID:** 1536 (OHL 400 kV Portile de Fier – Djerdap circ. 2), **Invest. ID** 1537 (400/110 kV substation Belgrade 50), **Invest. ID** 1538 (OHL 400 kV WPP Cibuk - SS Belgrade 50), **Invest. ID** 1864 (Reconductoring of the 220 kV OHL Portile de Fier – Reșita circ. 1 and circ. 2) ID according to ENTSO-E).
• Steps taken	• All projects: Planned, but not yet permitting;
• Steps envisaged	• ID 1537 and ID 1538: To be commissioned in Q3 2028; • ID 1864: To be commissioned in Q4 2028; • ID 1536: To be commissioned in Q4 2029;

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020-2021	2025	2030
Progress	Project commissioned	/	/	All lines and substations
Emissions reduction (Gg CO_2-eq)		/	/	/
Other	Primary energy savings (ktoe)	/	/	/

Finance	Budget (M€)	• Total project costs - CAPEX – 84, OPEX – 0.84 ○ ID 1536 - CAPEX – 4, OPEX – 0.04/per year; ○ ID 1537 - CAPEX – 45, OPEX – 0.45/per year; ○ ID 1538 - CAPEX – 35, OPEX – 0.35/per year;
	Source of finance	MF, CEF Energy, State budget
Implementing entity		• Transelectrica • ME
Monitoring entity		• ENTSO - E
Relation with other dimensions		Decarbonization, Energy security

PAM 65 Georgia-Romania Black Sea interconnection cable project (ENTSO-E 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		• 2022 – 2031 RET Development Plan • 2022 ENTSO–E TYNDP
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 (Black Sea HVDC submarine interconnection project), ID according to ENTSO-E).
• Steps taken		• Under consideration;
• Steps envisaged		• To be commissioned in Q_4 2029;

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2020-2021	2025	2030
Progress	Project commissioned	/	/	Start with operation
Emissions reduction (Gg CO_2-eq)		/	/	/
Other	Primary energy savings (ktoe)	/	/	/

Finance	Budget (M€)	• Total project costs - CAPEX – 2118.85, OPEX – 9.42/per year;
	Source of finance	MF, CEF Energy, State budget
Implementing entity		• Transelectrica • ME
Monitoring entity		• ENTSO - E
Relation with other dimensions		Decarbonization, Energy security

PAM 66 Increasing the interconnectivity between the Eastern regions of Romania and the rest of SEN

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	• 2022 – 2031 RET Development Plan
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 2022 – 2031 RET Development Plan
• Steps envisaged	• The foreseen individual projects within the 2022 – 2031 RET Development Plan, 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 2022 – 2031 RET Development Plan

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

Finance – Budget (M€)	
Finance – Source of finance	MF, CEF Energy, State budget
Implementing entity	• Transelectrica • ME
Monitoring entity	• Transelectrica
Relation with other dimensions	Decarbonization, Energy security

PAM 67 Integrating the output generated by powerplants in the South and the South-West of Romania

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	• 2022 – 2031 RET Development Plan
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 2022 – 2031 RET Development Plan • The foreseen individual projects within the 2022 – 2031 RET Development Plan 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 2022 – 2031 RET Development Plan
• 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	MF, CEF Energy, State budget
Implementing entity	• Transelectrica • ME
Monitoring entity	• Transelectrica
Relation with other dimensions	Decarbonization, Energy security

PAM 68 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	• 2022 – 2031 RET Development Plan •			
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 2022 – 2031 RET Development Plan •			
• 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€)				
Source of finance	MF, CEF Energy, State budget			
Implementing entity	• Transelectrica • ME			
Monitoring entity	• Transelectrica			
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.

On 11.12.2023, the "Memorandum of Understanding between the Government of Romania and the Government of the Republic of Moldova regarding the realization of the projects necessary to interconnect the natural gas and electricity networks in Romania and the Republic of Moldova" was approved. In the field of electricity, the main investment objectives set out in the memorandum are: the second interconnection line between Romania and the Republic of Moldova OHL 400 kV Suceava – Balti and the third interconnection line between Romania and the Republic of Moldova, ending with 330/110 kV Strășeni substation in the Republic of Moldova.

Romania is part of **the Black Sea corridor project** (TYNDP ID: 138 of ENTSO-E) 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)).[22]

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

Romania is also part of **the Mid-Continental East Corridor interconnectivity project** (TYNDP ID: 144 of ENTSO-E), 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.[23]

Romania's interconnectivity with Serbia is also supported under **the North CSE Corridor project** (TYNDP ID: 341 of ENTSO-E). 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 capacity across the mentioned border. The investments under this project will also advance further the development of the East – to – West corridor. [24]

In addition to the forementioned initiatives and projects, Romania is also part of **the HU – RO project (**TYNDP ID: 259 of ENTSO-E). 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.[25]

Also, Romania has been part of **the Georgia-Romania Black Sea interconnection cable project** (TYNDP ID: 1105 of ENTSO-E), 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 [26].

Finally, Romania is part of the submarine cable project that connects the south-eastern region of Romania (Black Sea area with offshore and onshore wind power plants) with Hungary (ID 1.216 from draft TYNDP 2024 of ENTSO-E). The project also ensures continuity of the Green Energy Corridor between the European Union and the countries of the Caspian Sea, establishing a corridor between Azerbaijan, Georgia, Romania and Hungary. In this context, the project will massively increase the green energy tax in the European UnionTO.

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

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

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

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

[26] 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 69 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		• 2022 – 2031 RET Development Plan
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 2022–2031 RET Development Plan
• Steps envisaged		• The foreseen individual projects within the 2022–2031 RET Development Plan, which are aimed at the modernization and/or building of new substations need to be implemented within the foreseen period – as stated in the 2022–2031 RET Development Plan
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	MF, PDD, State budget, Private sources	
Implementing entity	• Transelectrica • ME	
Monitoring entity	Transelectrica	
Relation with other dimensions	Decarbonization, Energy security	

PAM 70 Refurbishment and development of the underground natural gas storage depot Depomureș - Târgu Mureș

Main objective: The aim of the measure is to upgrade and develop the Târgu-Mureş underground natural gas storage facility in order to improve the technical storage conditions in the Târgu-Mureş warehouse and implicitly increase the degree of flexibility of the services provided, especially in the context of the current dynamics of the gas market.
Description: Modernization and expansion of an existing 300 million cubic meters (mcm) natural gas storage facility at Târgu Mureș, located in central Romania, to a facility with a storage capacity of 400 mcm in the first stage and a storage capacity expected total of 600 mcm in the second stage.

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

Relevant planning documents, legal and regulatory acts		• EU List of projects of PCI (fifth list) → Project belongs to Cluster 6.20 (Project ID in PCI: 6.20.4); • PDSNT 2024-2033
Methodology		-
Assumptions		The main objectives of this project are: • increasing the flexibility of the deposit on the one hand by increasing the gas delivery pressure from the deposit at the interface with the SNT up to approx. 35 bar, and on the other hand by increasing the daily injection and extraction capacity from a current average of approx. 1,6 million cubic meters/day at approx. 3.5 million m3/day after the implementation of phase 1 of the project, respectively at approx. 5 million cubic meters/day, after the implementation of the second phase of development, respectively • increasing the useful volume of the deposit to 400 million cubic meters in a first stage (Phase 1), respectively to 600 million cubic meters in a later stage (Phase 2).
Status of implementation		
• Steps taken		• Feasibility study – completed • FEED study – completed • First phase – In progress • 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€)	87 mill. EUR
	Source of finance	CEF Energy, State budget, Own funds
Implementing entity		• Depomureș SA • ME
Monitoring entity		ACER, ENTSOG, ANRE
Relation with other dimensions		Energy security

PAM 71 Increasing the daily extraction capacity in the underground gas storage system (SISG) Bilciurești

Main objective: Increasing the security of supply by modernizing the infrastructure of the [Underground] Natural Gas storage system in Bilciurești and increasing the daily withdrawal capacity.
Description: The objective of the project is to enhance the daily gas delivery capability from the Bilciurești warehouse, increasing it from 14 million cubic meters/day to 20 million cubic meters/day. This expansion is coupled with an increase in storage capacity to 108 million cubic meters/cycle. To ensure heightened operational safety and to maximize the existing gas infrastructure's capacity, the creation of new surface facilities is imperative. These new facilities will handle the additional flow, alongside the modernization and completion of the current infrastructure.

From a technical perspective, the project encompasses drilling new wells, upgrading existing wells, and enhancing surface infrastructure to comply with European safety and control standards. Furthermore, it involves expanding, modernizing, and optimizing existing separation and tax measurement facilities. The construction of a new collector between the Bilciurești Warehouse and the Butimanu Gas Compression Station is part of the initiative, as well as the modernization of the cooling system of the M3 module in the Butimanu Gas Compression Station.

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 from 2021 (fifth list) → The project belongs to Cluster 6.20 (project ID in PIC: 6.20.7); • PDSNT 2024-2033 • ENTSOG TYNDP 2024 - UGS-F-311 • Regulation (EU) 2022/1032 of the European Parliament and of the Council of 29 June 2022 amending Regulations (EU) 2017/1938 and (EC) no. 715/2009 regarding gas storage
Methodology		-
Assumptions		• Ensuring an additional daily delivery capacity, in correlation with the daily consumption peak
Status of implementation		
	• Steps taken	• Feasibility study – completed • Design - completed • The grant contract signed for non-refundable financing in the amount of EUR 37,962,111.95. • Building Authorization obtained • Obtaining financing through the CEF Energy mechanism
	• Steps envisaged	• December 2023 – May 2024 Tender for the execution of the works • June 2024 Start of works • June 2027 completion of the works

Indicators:		Value in the last reporting year	Indicative trajectory	Target value
		2020-2021	/	12/2026
Progress	Increasing the daily delivery capacity (mcm);	14 million mcm/day		20 million mcm/day
Emissions reduction (Gg CO_2-eq)		/		
Other	Primary energy savings (ktoe)	/		

Finance	Budget (M€)	156M€
	Source of finance	CEF Energy, State budget, Own funds
Implementing entity		• SNGN ROMGAZ SA – Natural Gas Storage Branch DEPOGAZ PLOIESTI SRL
Monitoring entity		• CINEA • ME, ANRE, ENTSOG
Relation with other dimensions		Energy security

PAM 72 Modernization of the natural gas storage system infrastructure - Bălăceanca

Main objective: Employing the Bălăceanca deposit within a multi-cycle regime, and increasing the daily gas delivery capability from the Bălăceanca deposit to a maximum of 1.6 million mc/d.
Description: The initiative involves the drilling of new wells, enhancing the infrastructure of existing wells, and upgrading surface facilities to comply with European safety and control standards. Additionally, it includes the expansion, modernization, and optimization of current compression, separation, and tax measure facilities.

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

Relevant planning documents, legal and regulatory acts		• PDSNT 2024-2033 • ENTSO-G TYNDP 2024 - UGS-N-606 • Regulation (EU) 2022/1032 of the European Parliament and of the Council of 29 June 2022 amending Regulations (EU) 2017/1938 and (EC) no. 715/2009 regarding gas storage
Methodology		-
Assumptions		• Increasing the daily gas delivery capacity from the Bălăceanca warehouse up to 1.6 million cubic meters/day.
Status of implementation		
• Steps taken		• Feasibility study – completed
• Steps envisaged		• Elaboration of technical project • Realization of works
Indicators:		Value in the last reporting year: 2020-2021 / Indicative trajectory: / / Target value: 12/2026
Progress	Increasing the daily delivery capacity (mcm);	
Emissions reduction (Gg CO_2-eq)		/
Other	Primary energy savings (ktoe)	/
Finance	Budget (M€)	• Estimated €50 M
	Source of finance	CEF Energy, State budget, Own funds
Implementing entity		• SNGN ROMGAZ SA – Natural Gas Storage Branch DEPOGAZ PLOIESTI SRL
Monitoring entity		• ME, ANRE, ENTSO-G
Relation with other dimensions		Energy security

PAM 73 Increasing the underground natural gas storage capacity of the Ghercești deposit

Main objective: Enhancing security of supply by developing and diversifying natural gas sources in South-Eastern Europe and ensuring the operational capacity of the deposit at 600 million cubic meters per cycle.
Description: Executing the project in conjunction with the SNTGN Transgaz SA initiative, the "Ghercești-Jitaru natural gas transport pipeline," will result in a increase in injection capacity by 3 million m3/day, reaching a total of 5 million m3/day. Simultaneously, the extraction capacity will increase by 3 million mc/day, totaling 5 million mc/day.

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

Relevant planning documents, legal and regulatory acts		• PDSNT 2024-2033 • ENTSO-G TYNDP 2024 - UGS-F-398 • Regulation (EU) 2022/1032 of the European Parliament and of the Council of 29 June 2022 amending Regulations (EU) 2017/1938 and (EC) no. 715/2009 regarding gas storage
Methodology		-
Assumptions		• Ensuring an additional natural gas storage capacity, in correlation with the annual consumption
Status of implementation		
• Steps taken		• Feasibility study – completed • Technical project – Completed
• Steps envisaged		• Obtaining the construction permit 2024 • Auction of works 2024 • Execution of works 2025-2028 • Completion of works 2028
Indicators:		Value in the last reporting year: 2020-2021 / Indicative trajectory: / / Target value: 12/2026
Progress	Increasing Storage Capacity (mcm);	250 thousand mcm / 600 thousand mcm
Emissions reduction (Gg CO_2-eq)		/
Other	Primary energy savings (ktoe)	/
Finance	Budget (M€)	Estimated €125 M
	Source of finance	CEF Energy, State budget, Own funds
Implementing entity		• SNGN ROMGAZ SA – Natural Gas Storage Branch DEPOGAZ PLOIESTI SRL
Monitoring entity		• ME, ANRE, ENTSO-G
Relation with other dimensions		Energy security

PAM 74 Increasing the underground natural gas storage capacity at the Sărmasel deposit (Transylvania)

Main objective: Enhancing security of supply involves developing and diversifying natural gas sources in South-Eastern Europe to achieve greater energy independence. This strategy aims to mitigate the risks of interruptions in natural gas flows during peak consumption periods, considering various scenarios.
Description: The project's objective is to expand the Sărmășel underground storage facility from a capacity of 900 million cubic meters per cycle to 1550 million cubic meters per cycle, representing a substantial increase of 650 million cubic meters per cycle. This expansion includes raising the injection capacity to 10 million cubic meters per day (a 4 million cubic meters per day increase) and elevating the extraction capacity to 12 million cubic meters per day (a 4 million cubic meters per day increase). These enhancements involve augmenting compression capacity, drilling new wells, and establishing new surface infrastructure.

From a technical standpoint, the project entails drilling new wells, constructing a contemporary surface infrastructure that adheres to European safety and control standards, expanding gas compression facilities, and modernizing and optimizing existing separation and tax measure facilities. The injection/extraction system is meticulously designed to facilitate the circulation of gas flows for injection/extraction through dedicated collector pipes for each specific objective.

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

Relevant planning documents, legal and regulatory acts		• PDSNT 2024-2033 • ENTSO-G TYNDP 2024 - UGS-N-371 • Regulation (EU) 2022/1032 of the European Parliament and of the Council of 29 June 2022 amending Regulations (EU) 2017/1938 and (EC) no. 715/2009 regarding gas storage
Methodology		-
Assumptions		• Ensuring an additional natural gas storage capacity, in correlation with the annual consumption
Status of implementation		
	• Steps taken	• Phase I of the project is ongoing, namely the execution works for the modernization of 12 wells and the technical project (PT) for the drilling of 6 new wells, was completed; • So far, investment applications have been submitted for this project (in 2020 when the project was PIC) - without success
	• Steps envisaged	• Phase II of the project: expansion of storage facilities;

Indicators:		Value in the last reporting year	Indicative trajectory	Target value
		2020-2021	/	12/2026
Progress	Additional installed capacity (mil m3)	900 mil mc/cycle		1,550 mil mc/cycle
Emissions reduction (Gg CO_2-eq)		/		
Other	Primary energy savings (ktoe)	/		

Finance	Budget (M€)	Estimated €185 M
	Source of finance	CEF Energy, State budget, Own funds
Implementing entity		• SNGN ROMGAZ SA – Natural Gas Storage Branch DEPOGAZ PLOIESTI SRL
Monitoring entity		• ME, ANRE, ENTSO-G
Relation with other dimensions		Energy security

PAM 75 New underground natural gas storage facility Fălticeni (Moldova)

Main objective: Increasing security in natural gas supply for Romania and the SE region of Europe. Deploying a pilot project in the Fălticeni storage facility regarding the possibility of storing either the H2–CH4 mix or only H2.
Description: The project is designed to establish a new underground storage facility in the northeastern part of Romania, specifically in the Moldova region. The anticipated technical specifications include a storage capacity of around 200 million m3 per cycle, an injection capacity of roughly 1.4 million m3 per day, and an extraction capacity of approximately 2 million cubic meters per day.

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

Relevant planning documents, legal and regulatory acts	• PDSNT 2024-2033 • ENTSOG TYNDP 2022 - UGS-N-399 • Regulation (EU) 2022/1032 of the European Parliament and of the Council of 29 June 2022 amending Regulations (EU) 2017/1938 and (EC) no. 715/2009 regarding gas storage • GD no. 170/2024 for the approval of the Memorandum of Understanding between the Government of Romania and the Government of the Republic of Moldova regarding the implementation of the projects necessary to interconnect the natural gas and electricity networks in Romania and the Republic of Moldova, signed in Chisinau on December 11, 2023.
Methodology	• Currently, DEPOGAZ is partnering in an RDI project with the University of Oil&Gas (UPG) Ploiesti for determining, in laboratory environmental conditions, the optimal hydrogen concentration required to obtain a homogeneous CH4–H2 mixture and the developing a numerical model for the underground storage of H2 and of the H2-CH4 mixture. • By carrying out the pilot-project, the aim will be to obtain the optimal H2 concentration for the transportation of a homogeneous H2-CH4 mixture.
Assumptions	• Increasing the security of supply of natural gas for Romania and the SE region of Europe, by ensuring a larger volume of stored gas. • The need for natural gas supply to the NE area of Romania as well as the Republic of Moldova, in the context of EU Regulation 2022/1032.
Status of implementation	• Discussions were initiated on obtaining the oil concession agreement for storage.
• Steps taken	• A study was developed on the possibility of transforming a depleted deposit in the Fălticeni area into a natural gas storage facility. From DEPOGAZ's internal analysis, it emerged that the structure in the Fălticeni area is suitable for being turned in a natural gas storage facility.
• Steps envisaged	• FID – Estimated completion date: 2026 • Design – Estimated completion date: 2026 • Technical documentation for obtaining building permits and obtaining the Building Permit – Estimated date of completion: 2028 • Tender and procurement documentation - Estimated completion date: 2028 • Construction - Estimated completion date: 2032 • Commissioning/start of operation - Estimated date of completion: 2032

Indicators:		Value in the last reporting year	Indicative trajectory	Target value
		2020-2021	/	12/2026
Progress	**Additional storage capacity (TWh)**	/		2.12
Emissions reduction (Gg CO_2-eq)		/		
Other	Primary energy savings (ktoe)	/		

Finance	Budget (M€)	Estimated €160 M
	Source of finance	CEF Energy, FI, FM, State budget, Own funds
Implementing entity		• SNGN ROMGAZ SA – Natural Gas Storage Branch DEPOGAZ PLOIESTI SRL
Monitoring entity		• ME, ANRMPSG, ANRE, ENTSO-G
Relation with other dimensions		Energy security

PAM 76 Modernization of natural gas infrastructure for enabling the transport of hydrogen

The main objective: Rehabilitation of natural gas transport infrastructure to enable hydrogen transport
Description: The measure involves the conversion and modernization of the following natural gas transport pipelines to enable transport of hydrogen: Coroi - Mediești Aurit (300 km), Giurgiu - Nădlac (DN800 between the RO/HU border - Jupa-Podișor, new H2 compression stations, measuring station at the border RO/HU), Isaccea – Jupa (550 km), Onești – Ungheni (183 km), interconnection Romania – Serbia (85 km), Vadu – T1 (25 km), Black Sea – Podișor (308 km), Negru Vodă – Isaccea (185 km).

Timeframe	Type	Section	Gases	Scope
2022 – 2030	Technical	Energy	/	Transnational

Relevant planning documents, legal and regulatory documents	• ENTSOG TYNDP 2024
Methodology	-
Hypotheses	The integration of Hydrogen from renewable sources and with low carbon emissions into the natural gas transport system, in order to align with the European Directives, Strategies and Agreements in force.
Implementation stage	The projects in the PAM are under analysis, in the conceptual stage.
• Steps taken	Deposit studies
• Steps envisaged	• Going through the design stages • support the realization of studies, analyzes and pilot projects for all relevant processes and components, in order to evaluate the compatibility of the current natural gas infrastructure with the decarbonization objectives and the implementation of new technologies related to these objectives. • continue the compatibility assessment approach to finance the effective conversion of current networks to hydrogen ready networks and the development of new "hydrogen ready" networks, based on a cost-benefit analysis, with priority for customers with special decarbonization specifications , large individual and industrial ones.

Indicator	Value in the last reporting year	Indicative trajectory	Target value
		/	2035-2042
Progress	/		
Reduction of emissions (Gg CO_2 equivalent)	/		
Other: Primary energy savings (ktep)	/		

Finance – Budget	Estimated 3,337M€ (+/- 30%, 2021 preliminary estimation)
Source of funding	MF, CEF Energy, State budget, Own funds
Implementing entity	• SNTGN Transgaz SA • ME
The monitoring entity	SNTGN Transgaz SA, ME, ANRE
Relationship with other dimensions	Decarbonisation, Energy security

PAM 77 Creation of new infrastructure for the transport of hydrogen

The main objective: Development of dedicated colors for hydrogen transport
Description: The measure involves the construction of the following hydrogen transport corridors: Giurgiu-Podișor-Bibești-Jupa-Horia-Nădlac, Black Sea-Podișor and Cluj–Târgu Mureș–Sighișoara–Sibiu–Sebeș.

Timeframe	Type	Section	Gases	Scope
2022 – 2030	Technical	Energy	/	Transnational

Relevant planning documents, legal and regulatory documents		• ENTSOG TYNDP 2024 • Directive (EU) 2024/1788 of the European Parliament and of the Council of 13 June 2024 on common rules for the internal markets for renewable gas, natural gas and hydrogen, amending Directive (EU) 2023/1791 and repealing Directive 2009/73/EC (recast)
Methodology		-
Hypotheses		· The integration of Hydrogen from renewable sources and with low carbon emissions into the natural gas transport system, in order to align with the European Directives, Strategies and Agreements in force.
Implementation stage		· The projects within the Measure are under analysis, in the conceptual stage
	• Steps taken	· Preliminary analyses
	• Steps envisaged	· Going through the design stages

Indicator		Value in the last reporting year	Indicative trajectory	Target value
		2020-2021	2025	2030
Progress		/		
Reduction of emissions (Gg CO_2 equivalent)		/		
Other	Primary energy savings (ktep)	/		

Finance	Budget	Estimated €3,337 M(+/- 30%, preliminary estimate at the level of 2021)
	Source of funding	MF, CEF Energy, State budget, Own funds
Implementing entity		• SNTGN Transgaz SA • ME
The monitoring entity		SNTGN Transgaz SA, ME, ANRE
Relationship with other dimensions		Decarbonisation, Energy security

PAM 78 Increasing the transmission capacity of SNT and security in natural gas supply

Main objective: Development and increasing the transport capacity of the SNT and security in natural gas supply in Romania in order to strengthen the country's energy infrastructure by expanding and modernizing the SNT, ensuring a reliable and secure supply to storage facilities, power plants, and diverse consumers.
Description: The measure involves the construction of the following new gas transport pipelines: Gherceşti – Jitaru pipeline (to ensure the supply of natural gas to the Gherceşti storage depot), increasing the transport capacity of the SNT and the security of natural gas supply for the CCGT Turceni and CCGT Iṣalniţa plants , Jupa - Băile Herculane - Orṣova – Prunişor pipeline, Mihai Bravu - Siliştea pipeline and its transformation into a godavilable pipeline, a pipeline for supplying CET Mintia, Tetila - Horezu - Râmnicu Vâlcea.

Timeframe	Type	Section	Gases	Scope
2022 – 2030	Technical	Energy	/	National

Relevant planning documents, legal and regulatory documents	• PDSNT 2024-2033 • GD no. 1589/2022 - declaration of a project of national importance • GD. no. 549/2023 and HG no. 551/2023 - declaration of projects of national importance • GD. no. 616/2020 – declaration of a project of national importance. • GD. no. 550/2023 – declaration of a project of national importance. • GD. no. 129/2023 - declaration of a project of national importance • GD. no. 1590/2022 – declaration of a project of national importance.
Methodology	-
Hypotheses	1. Natural gas supply to the Gherceşti storage warehouse and to domestic and industrial consumers; 2. The supply of natural gas to the Iṣalniţa Electrocentrale Branch and the Turceni Electrocentrale Branch to ensure a sustainable transition towards electricity production with low carbon emissions by replacing lignite-based electricity production with electricity produced from natural gas and renewable sources. 3. Natural gas supply to domestic and industrial consumers 4. The transformation of the pipeline into a godable pipeline in order to inspect with PIG Inteligent and ensure the supply of natural gas to domestic and industrial consumers and ensure an additional capacity to take over natural gas from the Black Sea 5. Supplying CET Mintia with natural gas at required parameters (covering other industrial and household consumers as well) to ensure a sustainable transition to low-carbon electricity production by replacing lignite-based electricity production with electricity produced from natural gas and renewable sources
Implementation stage	
• Steps taken	• The projects within the PAM are in different design stages
• Steps envisaged	• Finalization of design and execution

indicator	Value in the last reporting year	Indicative trajectory	Target value
	2020 – 2021	/	2025-2027
Progress	/		
Reduction of emissions (tCO_2/year)	0	0	883,172
Other: Primary energy savings (ktep)	0	0	186,508

Finance – Budget	€389,071,086.33 (without VAT)
Source of funding	MF, CEF Energy, PNI Anghel Saligny, State budget, Own funds
Implementing entity	• SNTGN Transgaz SA • ME
The monitoring entity	SNTGN Transgaz SA, ME, ANRE
Relationship with other dimensions	Decarbonisation, Energy security

PAM 79 Increasing the transport capacity and ensuring the security of natural gas supply throughout the region.

Main objective: Connecting natural gas transmission systems in Slovakia, Hungary, Romania and Bulgaria to gain access to natural gas reserves in the Caspian region and the Middle East.
Description: The EASTRING project, promoted by EUSTREAM, is a two-way pipeline for Central and South-Eastern Europe that aims to connect the natural gas transmission systems of Slovakia, Hungary, Romania and Bulgaria to gain access to natural gas reserves in the region Caspian and Middle East.
According to the feasibility study, the implementation of the project will be carried out in two phases, as follows:

- Phase 1 – Maximum capacity of 20 billion cubic meters/year;
- Phase 2 – Maximum capacity of 40 billion cubic meters/year.

Time interval	Type	Section	GAS	Aplication domain
2028 – 2032	Technical	Energy	CH_4	Transnational

Relevant planning documents, normative and regulatory acts		• PDSNT 2024-2033 • ENTSOG TYNDP 2024	
Methodology			
Hypotheses		• EASTRING will provide the most cost-effective, direct transport route between gas platforms in the western European Union and the Balkan Region/Western Turkey – an area with very high potential to provide gas from various sources. • By being able to diversify transport routes as well as sources of supply, security of supply will be ensured throughout the region, mainly in the countries of South-Eastern Europe.	
Implementation stage			
	• Steps taken	• Feasibility study - completed	
	• Expected stages	• Going through the design stages	
Indicators :		Value in the last reporting year	Indicative trajectory / The target value
		2020-2021	2025 / 2033
Progress	Additional storage capacity (TWh)		
Reduction of emissions (Gg CO2-eq)		/	
Other	Primary energy savings (ktep)	/	
funding	Budget (M€)	▪ Phase 1 - 1,297 million Euros for Romania (2,600 million Euros – total); ▪ Phase 2 - 357 million Euros for Romania (739 million Euros – total).	
	Source of funding	MF, CEF Energy, State budget, Own funds	
The implementing entity		• SNTGN Transgaz SA • ME	
Monitoring entity		SNTGN Transgaz SA, ME, ANRE	
Relationship with other dimensions		Decarbonization, Energy security	

PAM 80 LNG terminal located on the shores of the Black Sea, interconnection of the SNT to the LNG terminal and the development of the natural gas transport pipeline on Romanian territory for taking over natural gas from the Black Sea shore

Main objective: Increasing the transport capacity of the national natural gas transport system on the shores of the Black Sea
Description: The measure involves the construction of a terminal located on the shores of the Black Sea, the construction of a telescopic natural gas transmission pipeline Tuzla-Amzaccea-Podișor (308 km) and the interconnection of the SNT to the LNG terminal through the construction of a natural gas transmission pipeline, approx. 25 km long.

Timeframe	Type	Section	Gases	Scope
2022 – 2030	Technical	Energy	/	Transnational

Relevant planning documents, legal and regulatory documents	• European Union list of projects of common interest from 2021 (fifth list) → The project belongs to Cluster 6.24. (Project ID in PIC: 6.24.4-2); • PDSNT 2024-2033 • ENSTO-G TYNDP 2024
Methodology	-
Hypotheses	The implementation of the Project results in the diversification of natural gas supply resources through the construction of an LNG terminal located on the shore of the Black Sea
Implementation stage	
• Steps taken	• The projects within the PAM are in early stages.
• Steps envisaged	• Going through the next stages of design • Project implementation.

Indicator		Value in the last reporting year	Indicative trajectory	Target value
Progress		2020 – 2021	/	2028
Reduction of emissions (Gg CO_2 equivalent)		/		
Other	Primary energy savings (ktep)	/		

Finance	Budget	Estimated 874 M€
	Source of funding	CEF Energy, State budget, Own funds
Implementing entity		• SNTGN Transgaz SA • ME
The monitoring entity		SNTGN Transgaz SA, ACER, ENTSOG, ME, ANRE
Relationship with other dimensions		Energy security

PAM 81 Development on the Romanian territory of SNT on the Bulgaria-Romania-Hungary-Austria Corridor (BRUA) – Phase II and Phase III

Main objective: Implementation of Phases II (increasing gas flow to Hungary through the Horia–Csanadpalota interconnector) and III of the cross-border BRUA project (expansion of the two-way natural gas transmission corridor Bulgaria–Romania–Hungary–Austria

Description: BRUA Phase II consists in achieving the following objectives: Recaş-Horia pipeline 32" x 63 bar in length of approximately 50 km; the expansion of the three compression stations (SC Podişor, SC Bibeşti and SC Jupa) by installing an additional compressor in each station; the expansion of the existing gas measuring station SMG Horia. BRUA Phase III consists in the rehabilitation of existing pipelines belonging to the SNT, the replacement of existing pipelines belonging to the SNT with new pipelines or the construction of new pipelines installed in parallel with the existing pipelines, the development of 4 or 5 new compression stations with a total installed capacity of approx. 66-82.5 MW, increasing natural gas transmission capacity to Hungary by 4.4 billion cubic meters/year

Timeframe	Type	Section	Gases	Scope
2022 – 2030	Technical	Energy	/	Transnational

Relevant planning documents, legal and regulatory documents	• European Union list of projects of common interest from 2021 (fifth list) → The project belongs to Cluster 6.24. (Project ID in PIC: 6.24.4) for BRUA phase II; • PDSNT 2024-2033 • ENSTOG TYNDP 2024
Methodology	-
Hypotheses	The implementation of the BRUA-Phase II Project results in ensuring the physical possibility of permanent bidirectional flow between the interconnections with Bulgaria and Hungary, ensuring the following natural gas transport capacities: transport capacity to Hungary of 4.4 billion cubic meters/year, respectively of 1.5 billion cubic meters/year to Bulgaria. Phase III: In the hypothesis that the transport capacities required for the utilization of natural gas from the Black Sea on the Central-West European markets exceed the transport potential of the BRUA Phase II corridor, TRANSGAZ has planned the development of the central corridor on the Oneşti-Coroi-Haţeg-Nădlac corridor (BRUA – Phase III)
Implementation stage	
• Steps taken	Phase II: Technical project and technical documentation for obtaining building permits - completed. Phase III: Pre-feasibility study completed
• Steps envisaged	Phase II: Building Authorization; Purchase of materials and equipment and purchase of execution works Phase III: Going through the next stages of design, Project implementation.

indicator	Value in the last reporting year	Indicative trajectory	Target value
	2020 – 2021	/	2029
Progress	/		
Reduction of emissions (Gg CO_2 equivalent)	/		
Other: Primary energy savings (ktep)	/		

Finance – Budget	Estimated 1005 M€
Source of funding	CEF Energy, State budget, Own funds
Implementing entity	• SNTGN Transgaz SA • ME
The monitoring entity	SNTGN Transgaz SA, ME, ANRE
Relationship with other dimensions	Energy security

PAM 82 Development/Modernization of the natural gas transmission infrastructure and interconnections

Main objective: Modernization of the national natural gas transmission system and interconnections with Serbia and Bulgaria
Description: The measure consists in the construction of natural gas transmission pipelines and related facilities on the routes Horia–Mediești Aurit, Sărmășel–Mediești Aurit, Huedin-Aleșd, Recaș–Mokrin (interconnection with Serbia, approx. 97 km long, out of which approx. 85 km on the territory of Romania and 12 km on the territory of Serbia), a natural gas compression station at Mediești Aurit, a new SMG on the territory of Romania, near the border with Serbia (on the Recaș-Mokrin route) and, depending on the needs, the construction of a new natural gas transmission pipeline and related facilities between Romania and Bulgaria, at Giurgiu (including the construction of a new undercrossing of the Danube and the expansion of SMG Giurgiu)

Timeframe	Type	Section	Gases	Scope
2022 – 2030	Technical	Energy	/	Transnational

Relevant planning documents, legal and regulatory documents	▪ PDSNT 2024-2033 ▪ ENSTOG TYNDP 2024
Methodology	-
Hypotheses	In the context of the provisions of the European Energy Strategy and the actions to implement the objectives of this strategy (competitiveness, sustainability, and security of energy supply), Romania pays particular attention to ensuring the dimension of energy security, the development of the energy infrastructure by diversifying energy transport sources and routes, strengthening solidarity between member states and ensuring the efficient functioning of the energy market
Implementation stage	
• Steps taken	▪ Projects within the PAM are in early stages
• Steps envisaged	• Going through the next stages of design • Project implementation

indicator	Value in the last reporting year	Indicative trajectory	Target value
	2020 – 2021	/	2028
Progress	/		
Reduction of emissions (Gg CO_2 equivalent)	/		
Other: Primary energy savings (ktep)	/		

Finance: Budget	Estimated 544 M€
Source of funding	MF, CEF Energy, PNI Anghel Saligny, State budget, Own funds
Implementing entity	• SNTGN Transgaz SA • ME
The monitoring entity	SNTGN Transgaz SA, ME, ANRE
Relationship with other dimensions	Energy security

PAM 83 Development of SMG in order to achieve bidirectional flow on the T2 and T3 pipelines

Main objective: Development of SMGs on transit pipelines T2 and T3
Description: The measure consists in the modernization of SMG Isaccea 2, SMG Negru Vodă 2, SMG Isaccea 3 and SMG Negru Vodă 3. The modernized Metering Stations will be equipped with separation/filtering facilities and measuring facilities

Timeframe	Type	Section	Gases	Scope
2022 – 2030	Technical	Energy	/	Transnational

Relevant planning documents, legal and regulatory documents	• PDSNT 2024-2033 • ENSTOG TYNDP 2024
Methodology	-
Hypotheses	The implementation of the Project results in the provision of bidirectional flow on the border with Ukraine and Bulgaria on the T2 and T3 transit pipeline, part of the Trans-Balkan corridor
Implementation stage	
• Steps taken	• Projects within the PAM are in early stages
• Steps envisaged	• Going through the next stages of design • Project implementation

indicator	Value in the last reporting year	Indicative trajectory	Target value
	2020 – 2021		2028
Progress	/		
Reduction of emissions (Gg CO_2 equivalent)	/		
Other: Primary energy savings (ktep)	/		

Finance – Budget	Estimated 53.3 M€
Finance – Source of funding	PNI Anghel Saligny, State budget, Own funds
Implementing entity	• SNTGN Transgaz SA • ME
The monitoring entity	SNTGN Transgaz SA, ME, ANRE
Relationship with other dimensions	Energy security

PAM 84 Rehabilitation, modernization and expansion of SNT				
Main objective: Rehabilitation, modernization and expansion of the natural gas transmission infrastructure, ensuring increased durability and safety in the operation of transmission pipelines, based on acquired data, as well as ensuring simplicity of operation for a complex pipeline protection system with low maintenance costs. **Description:** The measure consists in creating a monitoring, control and data acquisition system (SCADA) for the cathodic protection stations related to the SNT, the expansion of the SNT, where necessary, in order to ensure the conditions for supplying future industrial consumers or future distribution networks, the rehabilitation/modernization of the natural gas transport infrastructure (pipelines, technological nodes, compression stations, measurement regulation stations) there where necessary, so that the national natural gas transmission system is modernized and able to support a development of distribution networks				
Timeframe	Type	Section	Gases	Scope
2028 – 2032	Technical	Energy	CH_4	Transactional
Relevant planning documents, normative and regulatory acts	• PDSNT 2024-2033			
Methodology				
Hypotheses	• The implementation of the Measure results in ensuring increased durability and safety in the operation of natural gas transport pipelines • SNT will be improved and the network will be further developed and modernized. • The expansion of the infrastructure of the national natural gas transport system will contribute to GHG emissions reduction in the targeted areas by replacing coal and fuel oil for heating with natural gas			
Implementation stage	•			
• Steps taken	• Feasibility study completed for the SCADA system • The inclusion of individual projects in the PDSNT 2022 – 2031			
• Steps envisaged	• Going through the design stages for the individual projects included, • Implementation of individual projects included. • The inclusion of individual projects, depending on the need, in the future editions of the Development Plan for the National Natural Gas Transport System			
Indicators:	Value in the last reporting year	Indicative trajectory	The target value	
	2020-2021	2025	2027	
Progress: Additional storage capacity (TWh)				
Reduction of emissions (Gg CO_2-eq)	/			
Other: Primary energy savings (ktep)	/			
funding: Budget (M€)	Estimated 24 M€			
Source of funding	MF, CEF Energy, PNI Anghel Saligny, State budget, Own funds			
The implementing entity	• SNTGN Transgaz SA • ME			
Monitoring entity	SNTGN Transgaz SA, ME, ANRE			
Relationship with other dimensions	Energy security, Decarbonization			

II. Regional cooperation in this area

Romania actively engages in regional cooperation with neighboring countries in the field of natural gas infrastructure. 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 85 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		• PNRR
Methodology		
Assumptions		• Achieving a minimum total electricity storage capacity of 240 MW (equivalent to 480 MWh) by June 30, 2026 will be carried out through a project selection process with criteria designed to align with the technical guidelines for (2021 / C58 / 01) • A target for 2030 is an additional storage capacity of 760 MW (1520 MWh) compared to 2025.
Status of implementation		
• Steps taken		• PNRR call relaunched
• Steps envisaged		• Construction of the storage capacities

Indicators:		Value in the last reporting year	Indicative trajectory	Target value
		2020-2021	2025	2030
Progress	Battery storage capacities (MW)		200	1200
Emissions reduction (Gg CO_2-eq)		/		
Other	Primary energy savings (ktoe)	/		

Finance	Budget (M€)	~600 M€
	Source of finance	PNRR, MF, State budget, Private sources
Implementing entity		• Transelectrica • ME • Private investors and developers
Monitoring entity		ME
Relation with other dimensions		Decarbonization, Energy security

PAM 86 Creating an enabling environment for production and trading of green gases.

Main objective: Decarbonisation of the gas sector by promoting the use of various types of gas from renewable sources, gases with low carbon emissions and hydrogen (green gases) and their integration in the natural gas market, thus keeping the development pace anticipated at EU level.
Description: By Decision no. 62/2022 regarding the proposal for a Directive of the European Parliament and of the Council on common rules for the internal markets of gases from renewable sources, natural gases and hydrogen - COM(2021) 803 final, the Romanian Senate establishes that gaseous forms of energy will retain a significant share of the national energy mix by 2050 and also underlines the need to decarbonise the gas sector with a forward-looking approach. According to the cited Decision, the use of renewable and low carbon emission gases will increase, in parallel with the efforts to integrate the natural gas markets. Green gas uptake will take place at different rates across the EU.

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

Relevant planning documents, legal and regulatory acts		• Decision No. 62/2022
Methodology		
Assumptions		•
Status of implementation		
	• Steps taken	• By Decision no. 62/2022, the Senate of Romania recognizes the validity of the principles of the European Parliament and the Council regarding the common rules for internal markets of gases from renewable sources.
	• Steps envisaged	• Following the adoption of the proposed Directive on common rules for the internal markets in renewable and natural gases and in hydrogen by the European Parliament and the Council (expected to be adopted soon), to transpose it in the national legislation; • To take other legal, administrative and promotional measures to ensure the green gases are integrated and compete on the gas market in Romania, as well as to facilitate their cross-border trading; • Introduce and implement guarantees of origin for the green gases.

Indicators:	Value in the last reporting year	Indicative trajectory	Target value
	2020-2021	2025	2030
Progress – Documents adopted		• Transposition of the EU Common Rules into the national legislation • Green gases integrated on the market	
Emissions reduction (Gg CO_2-eq)	/		
Other – Primary energy savings (ktoe)	/		

Finance	Budget (M€)	
	Source of finance	
Implementing entity		• ME • Private investors and developers
Monitoring entity		ME
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

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.

Also, the introduction of SMI allows the existence of dynamic (time-of-use) and binomial network tariffs.

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[27,28].

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)[29]. The project was concluded in June 2022, with the successful go-live on the 8th of June[30].

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[31,32].

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,

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

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

[29] www.jao.eu/sites/default/files/2022-06/Core%20FB%20MC%20Successful%20Go-live.pdf

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

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

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

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)[33]. 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[34].

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 2025[35,36].

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[37,38].

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[39,40].

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

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

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

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

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

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

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

[40] 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 87 Development and use of a fully-fledged national social assistance IT system

Main objective: Fair and efficient granting of energy subsidies
Description: The IT 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 IT system	
Methodology		
Assumptions		
Status of implementation		
• Steps taken	•	
• Steps envisaged	•	
Indicators	Value in the last reporting year	Indicative trajectory
	2020 – 2021	2025
Progress: Additional installed capacity (MW)		
Emissions reduction (Gg CO_2-eq)		
Other: Primary energy savings (ktoe)		
Finance: Budget	€	
Finance: Source of finance	State budget	
Implementing entity	• MMSS	
Monitoring entity	MMSS	
Relation with other dimensions		

PAM 88 Ensuring the implementation of the just transition process

Main objective: Reducing the negative socio-economic impact of the coal energy industry closure
Description: The implementation of this measure will target the mono-industrial regions, such as Valea Jiului, but also other regions dependent on the coal industry or on other energy intensive sectors. The fossil fuels 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	• GEO on the decarbonization of the energy sector no. 108/2022 and approved with modifications by Law no. 334/2022 PTJ • PTTJ
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	State budget, PTJ, PTTJ
Implementing entity	• ME • MMSS • ADR • MEAT • Local public authorities
Monitoring entity	ME, MEAT, MMSS
Relation with other dimensions	

PAM 89 Ensure the access of energy consumers to diversified, sustainable and accessible sources of energy for lighting, heating and cooling

Main objective: This measure aims to enhance energy accessibility and sustainability by finalizing national electrification, developing decentralized renewable energy systems, and implementing low carbon emission heating and cooling projects in both rural and urban areas.
Description: Facilitate access to electricity through electrification programs, finalize national electrification, develop transmission and distribution systems, create micro-grids, and increase the RES-E and RES-H&C share with a focus on decentralized solutions. Implement low carbon emission heating and cooling projects, especially in rural areas by replacing inefficient wood-burning stoves with sustainable biomass, heat pumps, and other efficient systems, and decarbonize the centralized heating system in urban areas.

Timeframe	Type	Sector	Gases	Scope
2024 – 2026	Technical	Households	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Law 226/2021 • Law 123/2012 • Directive (EU) 2023/1791 of the European Parliament and of the council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (recast)
Methodology	
Assumptions	•
Status of implementation	Under implementation
• Steps taken	• Our of a total budget of around EUR 611 mil., in May 2024, MIPE lunched in public consultation process a grant scheme in the form of vouchers to accelerate the use of energy from renewable sources by households with a total budget of EUR 300 mil. • Out of a total budget of around EUR 560 mil., in May 2024, MIPE lunched in public consultation process a scheme of grants in the form of vouchers for improving the energy efficiency of households with a total budget approximately EUR 300 mil.
• Steps envisaged	• During 2024, MIPE will open the call that was lunched in public consultation and will organise a subsequent call to allocated the rest of the budget envisaged within the PNRR for RES generation and BESS installation • During 2024, MIPE will open the call that was lunched in public consultation and will organise a subsequent call to allocated the rest of the budget envisaged within the PNRR which aims to renovate residential buildings to increase energy efficiency and install photovoltaic panel systems.

Indicators	Value in the last reporting year	Target value		Target value
	2022	2025	2026	2030
Progress Inability to keep home adequately warm (%)	15.2%			9.8%
Vouchers paid for solar PVs and/or BESS (no. of vouchers)		122,000		
Completion of energy renovation of homes (no. of homes)			33,000	

Finance – Budget	~€1.2 bn.
Finance – Source of finance	PNRR – REPowerEU chapter
Implementing entity	• ME, MDLPA
Monitoring entity	ME, MDLPA
Relation with other dimensions	• Decarbonisation, Energy Efficiency

PAM 90 Develop one stop shops

Main objective: this measure aims to establish targeted measures to decrease the energy poverty level and protect the vulnerable consumers

Description: The one stop shops will help energy consumers and energy communities access information on investment programmes, and throughout the one stop shops authorities can identify energy-poor which will be further targeted in future financing programmes.

Timeframe	Type	Sector	Gases	Scope
2024 – 2030	Technical	Households	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• GEO 92/2024 • GEO 163/2022 • Law 226/2021 • Law 123/2012 • Directive (EU) 2023/1791 of the European Parliament and of the council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (recast)
Methodology	
Assumptions	•
Status of implementation	Under implementation
• Steps taken	• Throughout GEO 92/2024, MDLPA established the required regulatory framework to implement the 42 one stop shops envisaged in the PNRR
• Steps envisaged	• Develop 42 one stop shops at local public administrations level and at county level. • The established one stop shops will conduct analysis to identify energy-poor households

Indicators	Value in the last reporting year	Target value	Target value
	2022	2024	2030
Progress – Established one stop shops (no. of operational one stop shops)		42	

Finance – Budget	M€
Source of finance	PNRR – REPowerEU chapter
Implementing entity	• MDLPA
Monitoring entity	MDLPA, MIPE
Relation with other dimensions	• Decarbonisation, Energy Efficiency

PAM 91 Coordinated interministerial committee regarding protecting vulnerable consumers and addressing energy poverty

Main objective: Consolidate an energy poverty governance system to measure, monitor and update the energy poverty objectives periodically
Description: Setting-up an interministerial committee for the protection of vulnerable consumers and the reduction of energy poverty, which will include representatives of the Government and academia

Timeframe	Type	Sector	Gases	Scope
2024 – 2030	Legal	Households	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Law 226/2021 • Law 123/2012 • Directive (EU) 2023/1791 of the European Parliament and of the council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (recast) • Regulation (EU) 2023/955 of the European Parliament and of the Council of 10 May 2023 establishing a Social Climate Fund
Methodology	Collaborative policy development
Assumptions	•
Status of implementation	Planned
• Steps taken	• Elaboration of the memorandum regarding the implementation of coordinated interministerial committee regarding protecting vulnerable consumers and addressing energy poverty
• Steps envisaged	• A methodology/guideline that will enable Romanian authorities to measure the energy poverty and identify the related barriers to tackle energy poverty in Romania will be developed by 2025.

Indicators		Value in the last reporting year	Indicative trajectory	Target value
		2022	2025	2030
Progress	Inability to keep home adequately warm (%)	15.2%		9.8%

Finance	Budget	/
	Source of finance	/
Implementing entity		• ME, MMSS, MIPE, MDLPA, ANAF, ANPIS, INS, CNSP, SGG, Presidential Administration
Monitoring entity		ME, MMSS, MIPE, MDLPA, ANRE, ANAF, ANPIS, INS, CNSP, SGG, Presidential Administration
Relation with other dimensions		• Energy Efficiency

3.5 Dimension research, innovation and competitiveness

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

Romania has made limited progress in research and innovation in recent years. In 2021, the country's gross domestic expenditure on research and development (GERD) was 0.47%% of GDP, the same level as in 2016 and well below the EU average of 2.27% of GDP. At the same time, the number of researchers per 1,000 inhabitants also increased, from 1.3 in 2016 to 1.5 in 2021. The number of patent applications increased to 2,300 patent applications in 2021, compared to 1,700 in 20.[41]

Romania's slight improvement research and innovation performance helped boost its competitiveness. In the 2022 Global Competitiveness Index, Romania ranked 48th out of 140 countries, up from 53rd in 2016.[42]

The Romanian government is committed to further investing in research and innovation. SNCISI 2022-2027 sets a target of increasing GERD to 2% of GDP by 2030. Out of this, public investment in research and development should be increased from 0,17% of GDP in 2018 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 Romania's Executive Agency for Higher Education, Research, Development and Innovation Funding (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 significant funding within Horizon Europe. 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 PCIDIF program (Smart Growth, Digitalisation and Financial Instruments Programme), and at the regional level through 8 regional programs. SNCISI (National Strategy for Research, Innovation and Smart Specialization) and the 8 RIS3 (Research and Innovation Strategies for Smart Specialization) 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 (National Research, Development and Innovation Plan 2022-2027 (PNCDI IV), PNRR, Education and Employment Program 2022-2027 (PEO 2022-2027), PTJ (2021-2027) and international programs (Horizon Europe Program, Interregional and Cross-border Cooperation Programs, Erasmus+, Invest EU, Innovation Fund, 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[43]:

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

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

of **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**.
- **UEFISCDI**, the **Romanian Space Agency (ROSA)** and the **Institute of Atomic Physics (IFA)** coordinate (administratively) some specific programmes and subprogrammes within PNCDI IV.
- **Other ministries** play a role in the Romanian R&I system. MEAT is responsible for designing and implementing entrepreneurship policies. MADR, the **Ministry of Health**, ME, and the **Ministry of National Defence** manage their own R&D Plans. MIPE coordinates the programming and implementation of EU funds in Romania. The Ministry of European Investments and Projects (MIPE) plays a crucial role in coordinating and implementing the programs funded by the ESIF (European Structural and Investment Funds) and EU Funds.
- At the regional level, the **Regional Development Agencies (ADR)** are responsible for the elaboration of the regional smart specialisation strategies and the the executive bodies that implement R&I policy.

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 on Research, Innovation and Smart Specialization 2022-2027 (SNCISI 2022-2027) prepared by MCID[44].

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 (SNDDR 2030)[45]**

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 Research, Development and Innovation Plan 2022-2027 (PNCDI IV)[46]**

This plan outlines the specific actions that will be taken to implement SNCISI 2022-2027. PNCDI IV 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 (PCIDIF)**[47]

PCIDIF is one of programme during 2021-2027 programming period. It is financed by the European Regional Development Fund (ERDF) and has a total budget of EUR 2.201 billion. This program aims to support national level measures in the following areas::

[44] 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

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

[46] https://www.mcid.gov.ro/transparenta-decizionala/planul-national-de-cercetare-dezvoltare-si-inovare-2022-2027/

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

- Research and innovation
- Digitalization in central public administration, education and culture
- SMEs and entrepreneurship
-

The PCIDIF is expected to contribute to the achievement of Romania's national strategic objectives, such as research, development and innovation, digitization and entrepreneurship in compliance with the targets of Sustainable Development Goals and in correlation and complementary with the funded measures within PNRR. It is also expected to create jobs and boost economic growth. Some of the key priorities of the PCIDIF are:

- Research and innovation: The PCIDIF will support research and innovation projects in a wide range of areas, including new technologies, digitalization, and environmental protection. This will be in line with the priorities identified by the National Strategy for Research, Innovation and Smart Specialization.
- Digitalization: The PCIDIF will support the digitalization of businesses, public administration, and education.
- SMEs and entrepreneurship: The PCIDIF will support the development of SMEs and entrepreneurship, including the creation of start-ups,etc.
- Environmental protection: The interventions financed by PCIDIF will contribute to environmental protection, including the development of green infrastructure and the improvement of energy efficiency.

- **Sustainable Development Program 2022-2027** (PDD)[48]

PDD has 4 priorities:

- Priority P1 - Development of water and wastewater infrastructure and the transition to a circular economy
- Priority P2 - Environmental protection by conserving biodiversity, ensuring air quality and remediating contaminated sites
- P Priority P3 - Promoting climate change adaptation and risk management
- Priority P4 - Promoting energy efficiency, smart energy systems and networks and reducing greenhouse gas emissions

Through all 4 priorities, the PDD contributes to the implementation of policies and measures necessary for the transition to climate neutrality, supporting the transformation of the Romanian economy into a modern, competitive and efficient economy, decoupled from the use of resources, in line with the objectives of the European Green Deal and the EU Zero Pollution Action Plan.

- **Just Transition Programme** (PTJ)[49]

Romania's Just Transition Programme is a €2.14 billion plan that will help the country to transition to a climate-neutral economy. The PTJ will focus on six regions that are most affected by the transition: Dolj, Galaţi, Gorj, Hunedoara, Mureş, and Prahova. These regions are all heavily reliant on coal mining or other carbon-intensive industries. The PTJ is expected to create around 11,000 jobs, in the entities that will benefit from the support and by 2030, to reduce the GHG emissions by 10 million tCO_2 as a result of the implementation of the measures within PTJ and other funding sources. 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 PTJ 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 PTJ:

[48] https://mfe.gov.ro/wp-content/uploads/2022/11/ccd9ae994ca747e93c52ec9c97fc4c39.pdf
[49] https://mfe.gov.ro/wp-content/uploads/2022/12/21e46881d6b62fc6f6941423d889a14e.pdf

- Renewable energy: The PTJ 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 PTJ 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 PTJ 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 PTJ 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 PTJ will implement social programs to support residents of areas where the transition from intensively polluting industries will take place.

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 collaborates 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 can access calls for projects within Horizon Europe, this funding can be used to carry out research-innovation projects in areas such as renewable energy, digitalization and healthcare.
- Romania can also access project calls from the Innovation Fund, thus financing its research-innovation projects producing state-of-the-art technologies in the field of reducing GHG emissions and increasing energy efficiency.
- Romania accesses funding from ESIF, mainly through PCIDIF and PTJ, to carry out research-innovation projects that contribute to the development of new technologies, to the creation of jobs and to the improvement of skills in the field of green energy and to the stimulation of growth economic.
- 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, ESIF, Innovation Fund, and EIC, as well as national funding programs, such as PNCDI IV. 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.
- ESIF: They are implemented in Romania through several programs, among which PCIDIF, PR and PTJ provide funds for the development of research-innovation projects.
- 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.
- 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.
- 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.
- 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.

The most important national sources of funding and tax incentives are presented below:

- PNCDI IV 2022-2027: This program is financed from the state budget and supports research and development projects in all areas of smart specialization in SNCISI 2022-2027.
- Tax incentives for research and development:
    - Additional deduction of 50% of expenses incurred for research and development activities
    - Use of accelerated depreciation method in the case of apparatus and equipment used for research and development activities
    - Income tax exemption for employees working in research and development projects
    - Profit tax exemption for legal entities deploying only research-development activities in the first 10 years of their activity (currently not applicable due to absence of state aid measures).

At the end, it is up to Romanian universities, R&D institutes and all the entities in the national R&D ecosystem to attract as much as possible EU and national public funding for deploying R&D projects contributing to the green transition.

Recommendations on improvement of the R&D of Romania

To foster long-term economic growth and enhance Romania's global competitiveness, it is essential to implement strategic measures aimed at increasing the number of researchers with focus on PhD students as leading researchers. According to latest available data for 2021-2022, in Romania there were cca. 22.400 PhD Students[50]. We can note a slight decrease from academic year 2020-2021 when the number of PhD students was cca. 22,730 students. Romania has some funding initiatives and educational reforms aimed at making doctoral studies more accessible and attractive. For instance, the Ministry of Education in Romania funds a set number of PhD places annually, and these positions are highly competitive. We can suggest having specific quote for energy related PhD scholarship. To attract more PhD students and researchers a financial incentive is only one piece of the puzzle. The private sector needs to be incentivized as well to promote and support enrollment in PhD Studies. Therefore – industrial doctoral studies, especially in the energy and climate changes area should be priority for Romanian government in the period up to 2030.

The following steps and measures align in the direction to achieve these goals:

Title of the measure	Objective / Rationale	Budget / potential sources	Key elements for implementation
Scholarship Programs for PhD Students	Increase the number of PhD students by providing financial support.	Budget €15 million i.e covering at least 1,000 100% scholarships for foreign students and 1,000 50% scholarships for foreign students and at least 2,000 100% scholarships for domestic students and 2,000 50% scholarships for domestic students. Based on the averages annual PhD costs stated below. Funding Sources: European Union Structural Funds, National Research and Development Fund (NRDF)	Establish competitive scholarships for domestic and international students in key research areas such as technology, health, and environmental sciences. The scholarship should be envisioned as a grant, covering 50-100% of the PhD cost which according to web research is averaging EUR 5,000 per year[i] for foreign students and averaging EUR 2,500 for domestic students.[51] Low living cost is another important incentive to attract international PhD students (300 – 600 EUR per month)[52].
Post-Doctoral Fellowships & Secure Job placements	Retaining skilled researchers post-graduation ensures that the investment in education translates into tangible research outcomes. Countries with strong research ecosystems, such as the UK and the Netherlands, invest heavily in post-doctoral support.	Budget can be related within the same program for PhD scholarship Correlating to the scholarship program, PhD researchers that have used the scholarship will be contracted to stay in Romania for 3-5 years (based on amount of scholarship received) and contribute to the countries R&D growth. This needs to be communicated with the private sector in order to ensure open positions for each candidate after	This investment will help maintain a pipeline of high-quality research talent, fostering innovation and scientific advancements.

[50] https://www.statista.com/statistics/1252551/romania-number-of-phd-students/

[51] https://www.findaphd.com/guides/phd-study-in-romania ; https://www.phdportal.com/countries/33/romania.html; https://www.studyinginromania.com/tuition-fees-and-live-cost.html

[52] https://www.phdportal.com/countries/33/romania.html

		graduation if not already employed.	
Research Grants and Awards	To support all types of innovative ideas (as a start-ups or as a SMEs), especially in the field of energy. Recognizing and rewarding exceptional research will drive higher levels of innovation and attract leading researchers to Romania.	Budget: €20 million i.e. Grants in sizes EUR 20.000 – 200.000 Grants can be divided in 2-3 categories, e.g. for start-ups, for technology advanced solutions, etc.	Competitive grants and awards incentivize high-impact research. Countries with thriving research environments, such as the USA and Japan, offer substantial grants to encourage innovative projects.[53]
Tax Incentives for R&D Investment	Simplifying, increasing the level promoting the package of tax exemptions for research-development-innovation activities will lead to more substantial investments in the field, stimulating economic growth	Budget: /	Tax incentives have proven effective in stimulating private sector R&D investment. For instance, Ireland and Israel offer generous tax benefits to R&D-intensive companies, leading to increased innovation[54]. Netherlands have a benefit called 30% ruling where 30% of the tax that the company needs to pay is deducted for each employee that is enrolled on PhD Studies[55]

In order for R&D in Romania to improve, there is a need to set clear national targets for clean technology research and innovation, establish a direct correlation between energy sector priorities and funding sources, and outline specific short- and long-term objectives. Additionally, a detailed strategy to train and attract a skilled workforce is needed, address gaps in the sector, and ensure the development and resilience of value chains for clean technology components and equipment.

Some of the recommendations related to above mentioned shortages are:

Inadequate Addressing of R&I Dimension	To develop specific national targets for R&I**:** Short-term (2025): **Increase R&D investment in clean technologies by 10%.** Long-term (2030): **Achieve a 50% increase in patents related to clean technologies compared to 2022 levels.**	Detailed actions and objectives**:** Short-term objectives: • **Establish at least 2 new research centers focused on clean energy technologies by 2025.** • **Increase the number of research projects funded by EU programs by 15%.** Long-term Objectives: • **Develop a national network of green technology incubators by 2030.** • **Facilitate the commercialization of at least 5 clean technology innovations by 2030.**
Correlation Between Energy Sector Priorities	Funding Allocation**:** • EU Funds (e.g., Horizon Europe, Cohesion Funds)**:** For large-scale R&I	Possible Breakdown**:**

[53] https://www.nsf.gov/ ; https://www.jsps.go.jp/english/e-pd/ ; https://www.mext.go.jp/en/

[54] https://kpmg.com/ie/en/home/services/tax/rd-tax-credits.html#:~:text=The%20R%26D%20tax%20credit%20is,to%20certain%20conditions%20being%20met).

[55] https://www.orangetax.com/tax-blog/tax-news/2017-12-12-30-ruling-phd-graduates/

and Funding Sources	projects and cross-border collaborations. • National Funds**:** For smaller, localized projects and startups.	• Development of Renewable Energy Technologies**:** €50-100 million from Horizon Europe for research on advanced solar and wind technologies. • Energy Efficiency Improvements**:** €50 million from the National Fund for retrofitting buildings and improving industrial processes.
Problems with Skill Gaps in the Energy Sector	Specific Training Programs**:** • Renewable Energy Technician Training**:** Develop a curriculum and certification program in partnership with technical universities and industry leaders. • Digital Skills for Energy Management**:** Launch online courses and workshops focused on smart grid technologies, energy storage, and digital energy management.	Investments in Education and Training**:** • Annual Budget**:** Allocate €30 million annually for vocational training programs and €20 million for university partnerships. • Funding Sources**:** EU Social Fund, National Training Fund.

SECTION B: ANALYTICAL BASIS

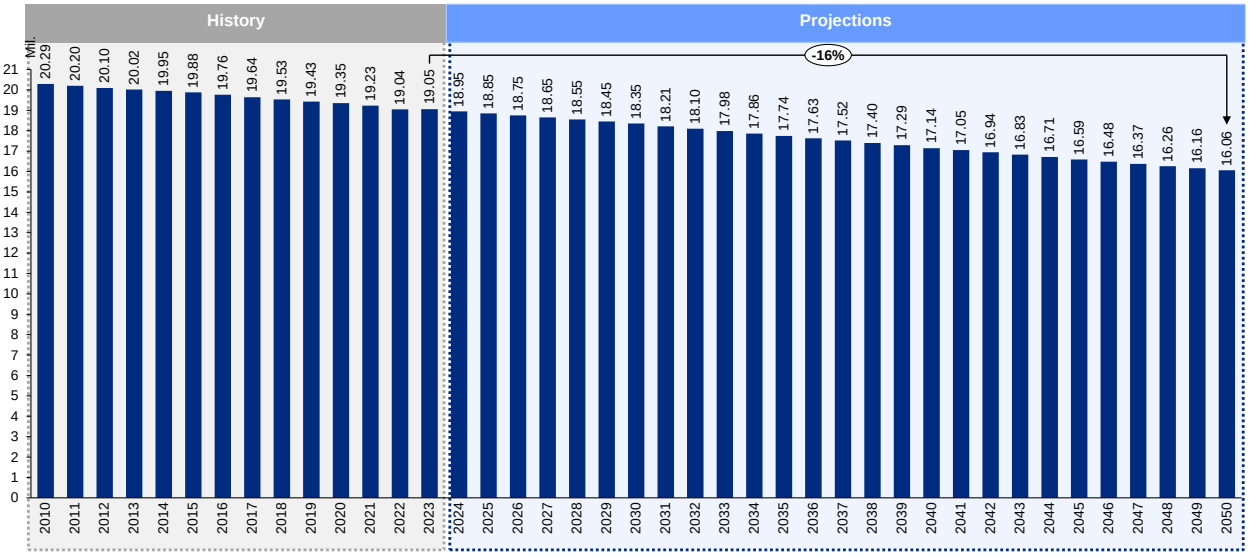
4. CURRENT SITUATION AND PROJECTIONS WITH EXISTING POLICIES AND MEASURES

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

I. Macroeconomic forecasts (Population and GDP growth)

Population and GDP are crucial input parameters for energy modeling as they directly influence the calculation of energy demand. Together, these factors help predict future energy needs and guide effective energy planning. Historically, the population in Romania showed a gradual decline from 20.3 million in 2010 to 19.0 million in 2023 (Figure 45). Projections indicate a continued decrease in population, with the figure expected to drop steadily to 16.06 million by 2050, 16% lower that 2023 (data from National Commission for Strategy and Prognosis of Romania are used). This trend suggests a decrease population, reflecting demographic changes and possibly indicating challenges related to aging and migration.

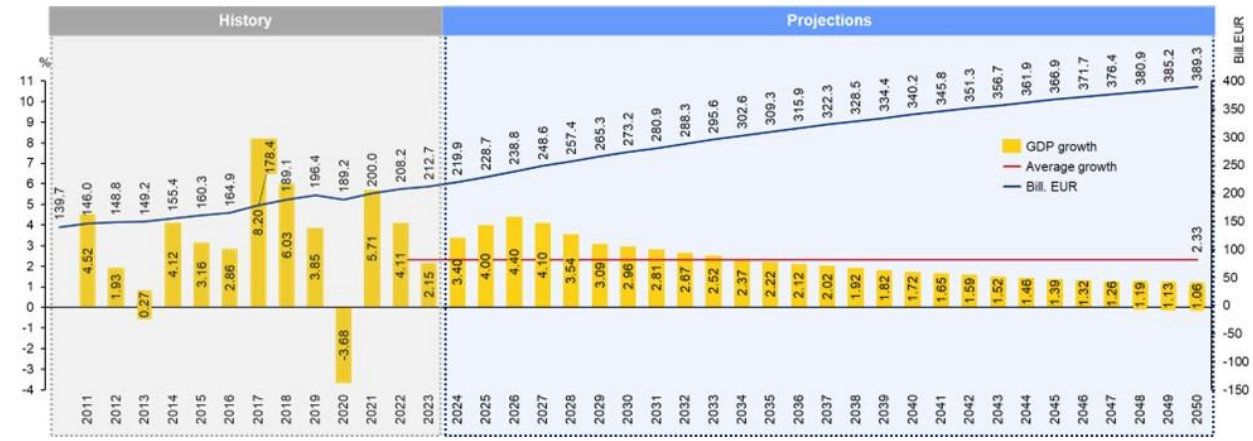
Figure 45. Population in Romania – historical and projected values



Source: 2011-2020 National Institute of Statistics, 2021-2040 The National Commission for Strategy and Prognosis, 2041-2050 working group decision based on NCSP

The other main assumptions used for energy demand and GHG emission projections used in both scenarios is the GDP growth. Figure 45 outlines GDP growth, average GDP growth, and GDP in billion euros from 2010 to 2050, with 2010-2023 as historical data and 2024-2050 as projections. Historically, GDP growth showed fluctuations, with a peak of 8.3% in 2017, followed by a significant decline in 2020 (due to global disruptions), then a recovery in 2021. The projections indicate a gradual slowdown in GDP growth, averaging around 2.33% annually from 2024 onwards. GDP in euros is expected to rise steadily from €212.7 billion in 2023 to €389.3 billion by 2050, suggesting ongoing economic growth. For the projections of the GDP, the data from the National Commission for Strategy and Prognosis of Romania for the period by 2024-2040 are used, while for the period 2040 extrapolations is done.

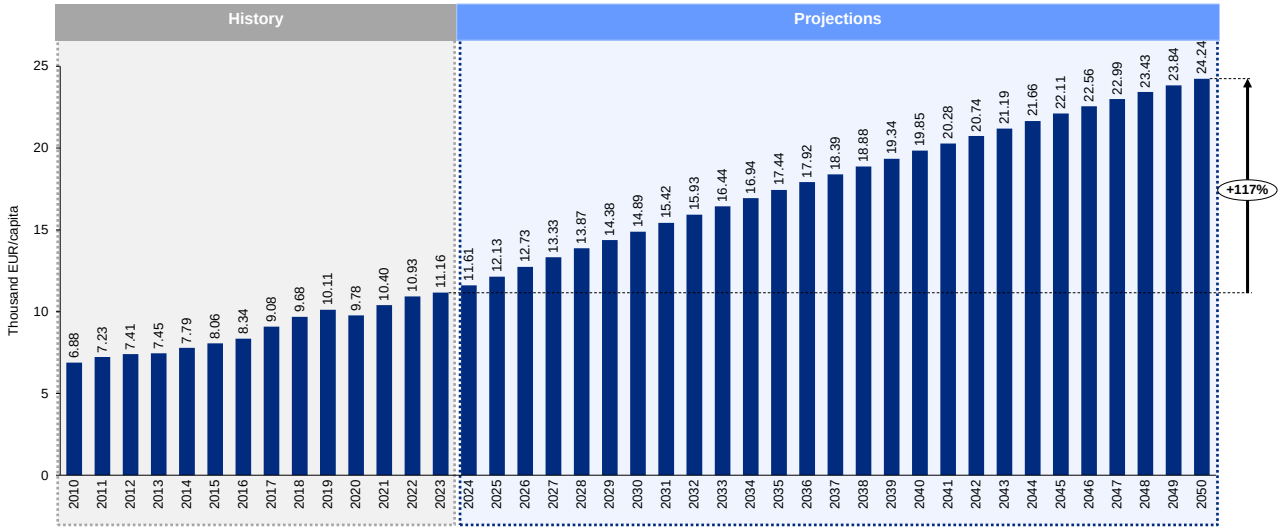
Figure 46. GDP - historical and projected values up to 2050



Source: 2011-2020 National Institute of Statistics, 2021-2040 The National Commission for Strategy and Prognosis, 2041-2050 working group decision

The GDP per capita in Romania has shown a consistent upward trend from 2010 to 2023, increasing from €6.88 thousand in 2010 to €11.16 thousand EUR in 2023 (Figure 47). Projections indicate that this growth will continue, with GDP per capita expected to reach €24.24 thousand by 2050. This steady rise reflects Romania's ongoing economic development and improving living standards over the coming decades.

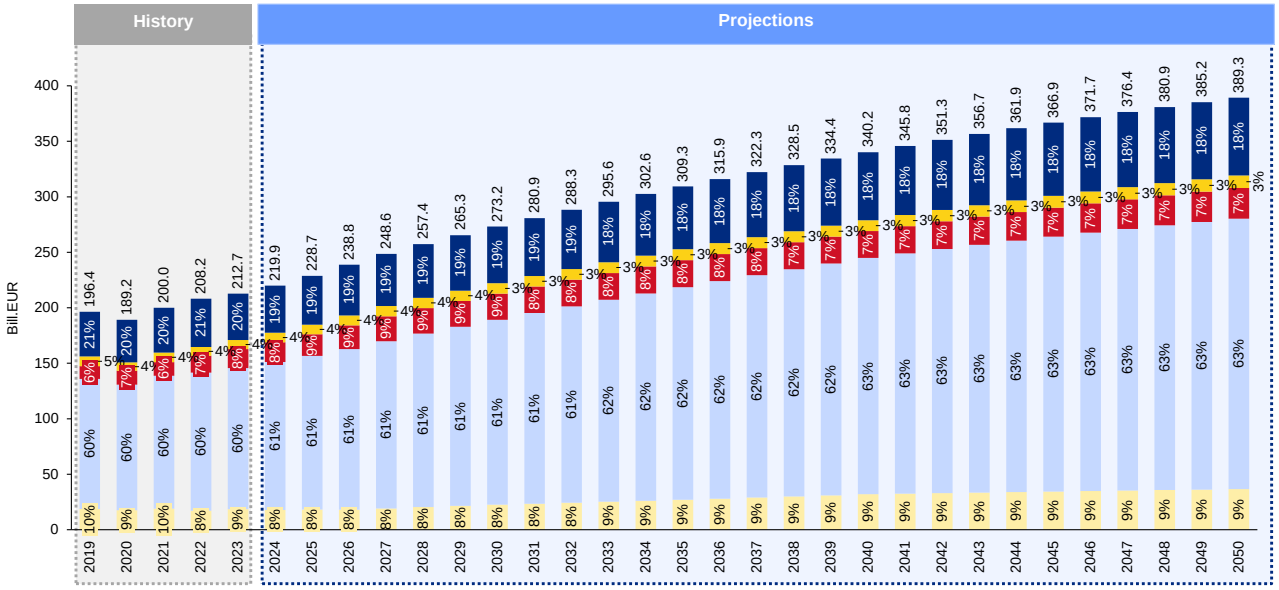
Figure 47. GDP per capita- historical and projected values up to 2050



Source: GDP in EUR from Figure 46 is divided with population from Figure 45.

Regarding the value added by sectors, the data shows that the services sector has the highest share throughout the period (more than 60%), starting at EUR 127.2 billion in 2023 and growing steadily to 243.7 by 2050 (Figure 48), highlighting its dominant role in the economy. Industry, the second-largest sector, is also projected to experience consistent growth, increasing from EUR 41.7 billion in 2023 to EUR 70.1 billion by 2050, reflecting ongoing industrial development. In contrast, agriculture, with the lowest share, is expected to slowly increase, from EUR 8.3 billion in 2023 to EUR 11.3 billion by 2050, indicating a smaller but stable contribution to the economy. The construction sector is set to show notable growth, starting from EUR 18.5 billion in 2023 and rising to EUR 27.6 billion by 2050, reflecting a significant expansion.

Figure 48. Sectoral gross value added - historical and projected values up to 2050



Source: Calculated based on the data provided by The National Commission for Strategy and Prognosis by 2040, and by 2050 the same data for 2040 are used.

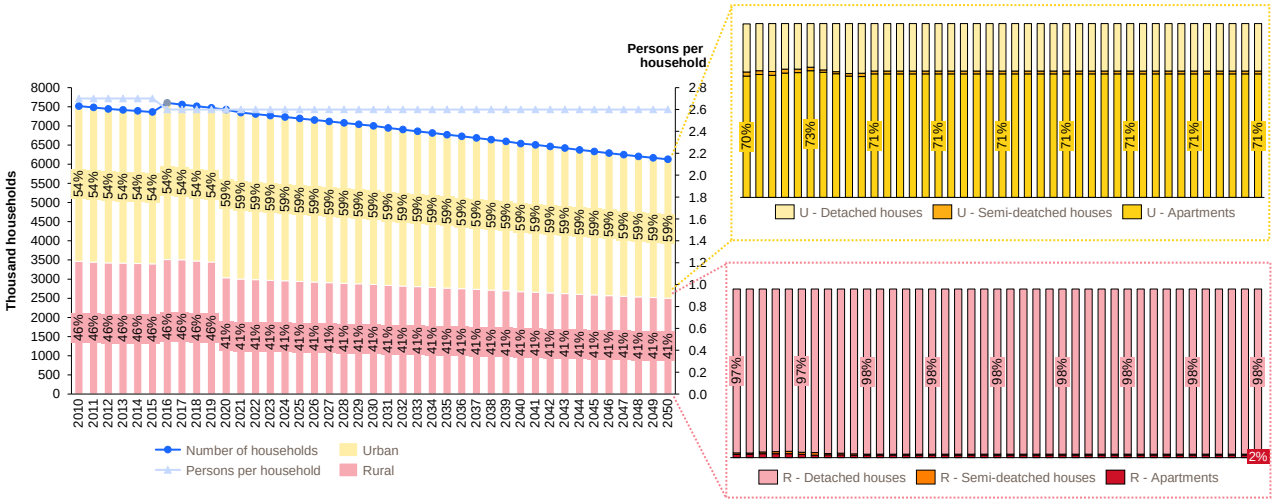
II. Sectoral changes expected to impact the energy system and GHG emissions

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 49). 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 49, the households are divided into urban and rural, and for each of them there are three groups: detached, semi-detached houses and apartments.

Figure 49. Number of households, person per households and split of households by type

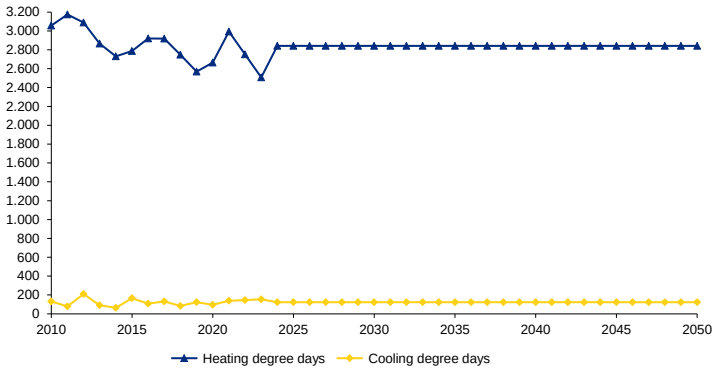


Source: Eurostat – Average number of persons per household, INS - Search results - Usually resident population by age group and ages, sex, urban/ rural area, macroregions, development regions and counties at January 1st. TEMPO ONLINE [TEMPO_POP105A], The structure of households by the dwelling's tenure status, urban/ rural area - TEMPO OnLINE [TEMPO_CAV101O] 1998 - 2018 INSTITUTUL NATIONAL DE STATISTICA

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 2023, while the average number of degree days in that period is utilized for the years after 2023 (Figure 50).

Figure 50. Heating and cooling degree days

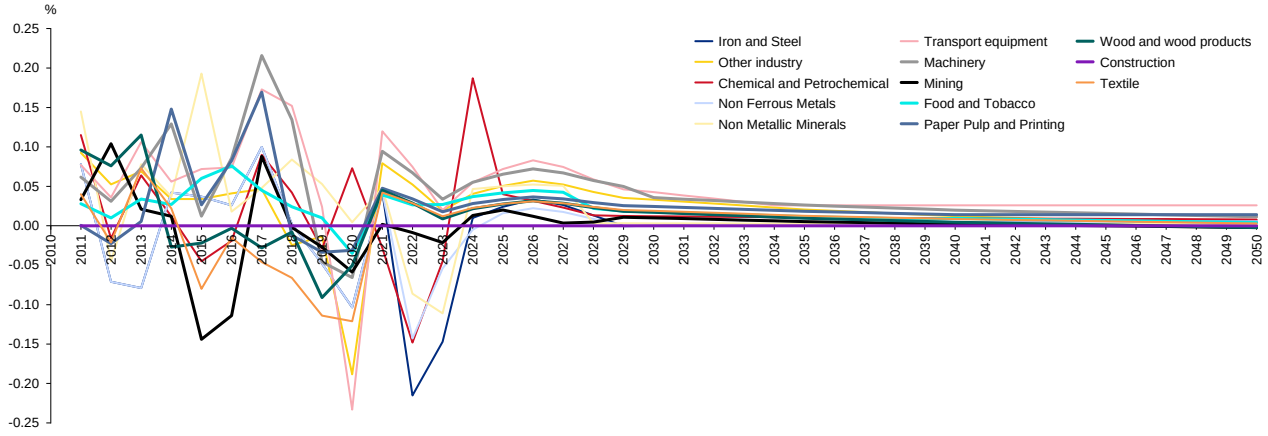


Source: EUROSTAT (2010-2023), LEAP Romania (2021-2050)

Industry and Industrial Processes and Product Use

For the Industry sector, the most important parameter is the production index growth per industry type (Figure 51). 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 51. Industry production index growth



Source: 2010-2020, EUROSTAT 2021-2050 team analyses using NCSP projections

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.

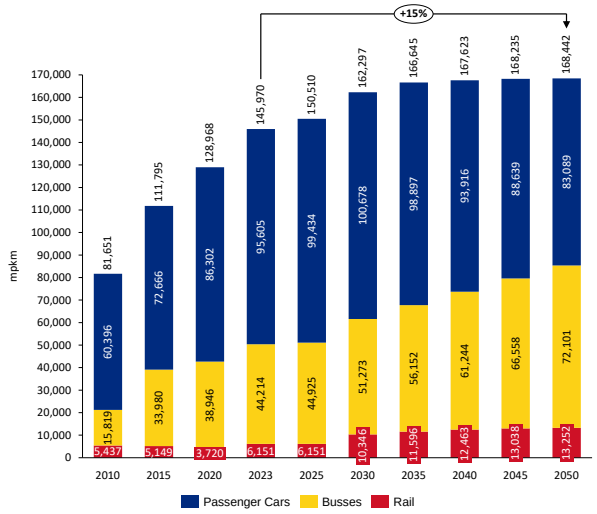
Transport

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 passenger kilometers in Romania is projected to increase by 15% in the period 2023-2050 and show varying trends across different modes of transport. Passenger cars in the see significant growth until 2030, reaching 100 billion kilometers, but then decline gradually to 83 billion kilometers by 2050, mainly as a result of mode switch measures in the WAM scenario (switch from car to bus and train). In contrast, buses and rail experience continuous growth, with bus passenger kilometers rising from about 44 billion km in 2023 to 72,101 million in 2050, and rail increasing from around 6 billion in 2023 to 13.2 billion in 2050, reflecting a shift towards more public and sustainable transportation options over time.

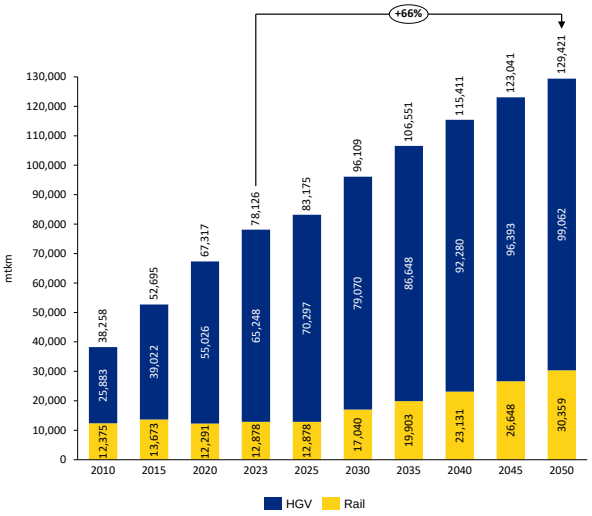
Tonne kilometers in Romania is projected to increase by 66% in the period 2023-2050. Heavy Goods Vehicles (HGV) show strong growth from 66 billion tkm in 2023 to 99 billion by 2050, reflecting increased road freight activity. Rail freight also expands significantly, rising from 12 billion tonne-kilometers in 2023 to 30 billion by 2050. This indicates a growing reliance on both road and rail transport, with rail gaining more prominence over time in the WAM scenario.

Figure 52. Number of passenger-kilometres split between road (cars and buses separated) and rail (WEM)



Source: Road transport it is calculated based on the number of vehicles, activity and passengers per vehicles. For the road the TEMPO data are used for the period 2010-2023. The period 2024-2050 is modelled in LEAP

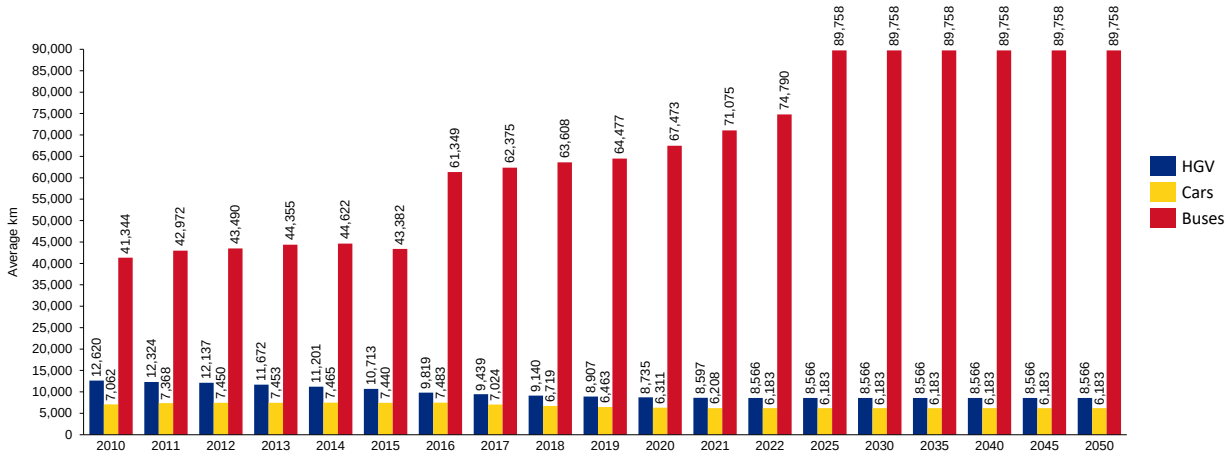
Figure 53. Freight transport tonnes-kilometres split between road (HGV) and rail (WEM)



Source: Road and rail transport is based on TEMPO data for the period 2010-2023. The period 2024-2050 is modelled in LEAP

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 54. Here it can be noticed that the average passenger kilometres of the buses 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 54. 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 10 presents the average number of passengers for the buses, motorcycles, cars and the average tonnes of goods per HDV. The data for the buses 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 10. 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 11 are based on the 2010-2021 historical data for Livestock in the BR 4 and on the sectoral investment plans.

Table 11. Livestock population projections

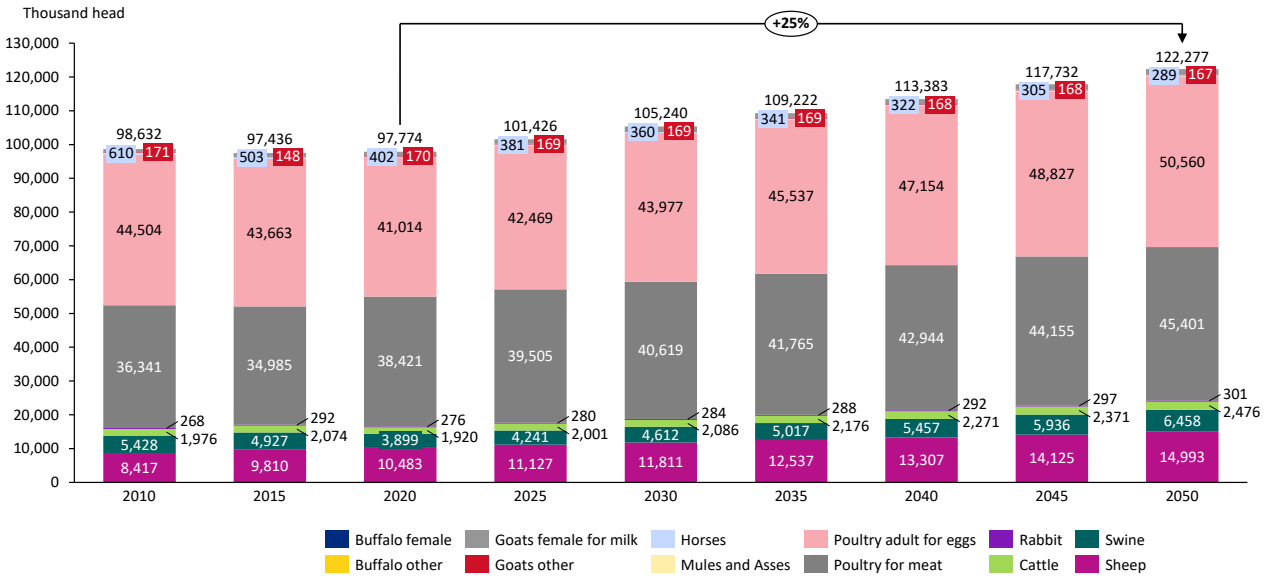
Buffalo	Female	- 0.5%
	Other types of buffalo	- 0.5%
Goats	Dairy goats	+ 1.1%
	Other types of goats	+ 0.4%
Horses	Horses	- 1.1%
Mules and Asses	Mules and Donkeys	+ 0.2%
Poultry	Adult for eggs	+ 0.7%
	For meat	+ 0.7%
Rabbit	Rabbit	+ 0.5%
Cattle	Slaughter calves younger than 1 year	+ 1.1%
	Breeding cattle 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

Based on data presented in Table 11, the number of various animals in Romania is projected to increase steadily. The cattle population is expected to grow from 1.9 million in 2020 to 2.5 million by 2050, while the number of swine rises from 3.9 million to 6.5 million over the same period. Sheep populations are also anticipated to see significant growth, increasing from 10.5 million in 2022 to almost 15 million by 2050, indicating a strong upward trend in livestock numbers across these key categories. Most dominate are poultry over the whole period.

Figure 55. Livestock population projections



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.

- 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[56]
- 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[57]) 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 with the GHG Emission Factors Review – ESA[58].
- 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 in cases where biogas cannot be collected and used for energy. 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.
- 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.

[56] 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

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

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

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 as well as ENTSO-E Ten Year Network Development Plan. 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 56). However, concurrently, the price of CO_2 emissions is expected to rise to approximately 170 EUR/t (Figure 57).

Figure 56. 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 57. CO_2 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

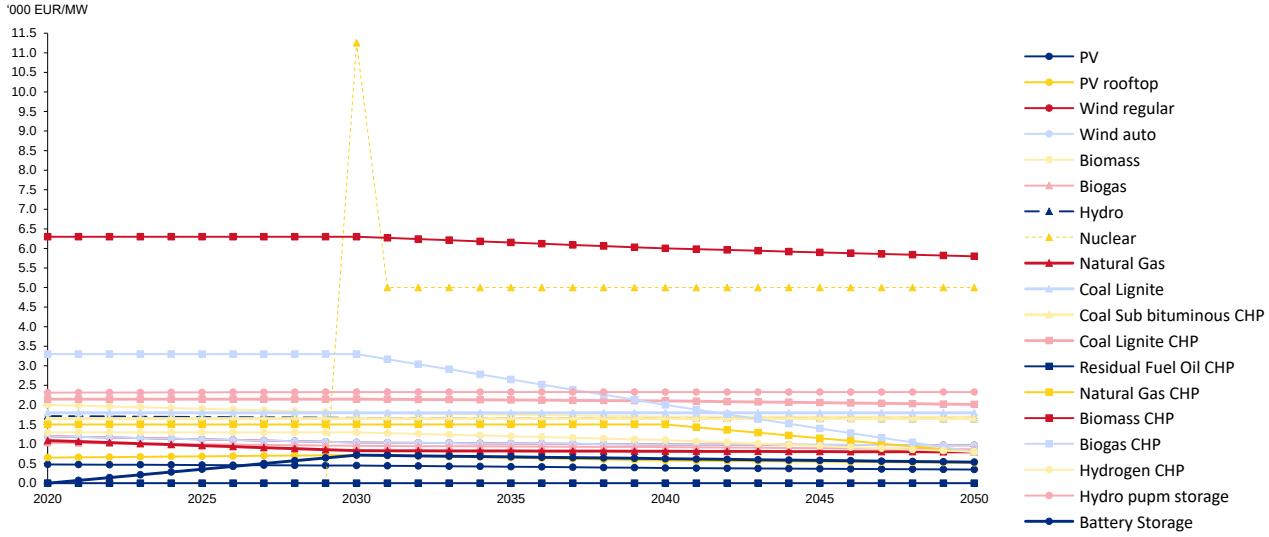
Source : World Energy Outlook 2022

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

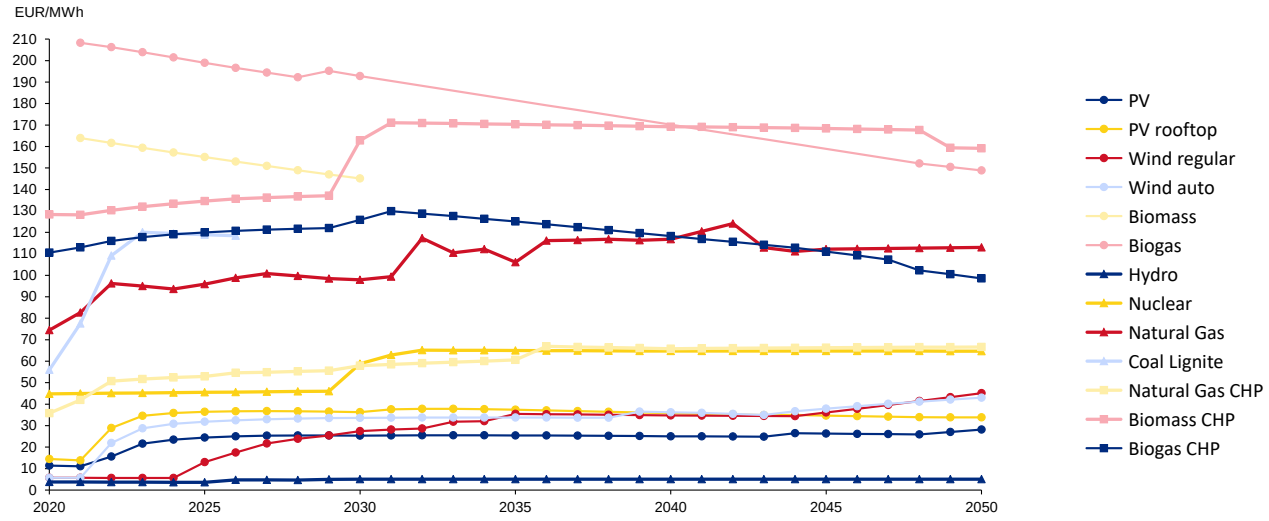
presented on Figure 58. The most expensive technology in this regard is nuclear power plants, whereas PV has the lowest investment expenses. However, the production costs of certain technologies depend more on national factors than only investment costs, such as wind and solar irradiation, local natural gas and lignite supply, biogas output, and biomass potential. Figure 59 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 PV, whilst biomass CHP will be the costliest in 2050. The highest drop in the production cost is for the PV rooftop.

Figure 58. Investment costs per technology ('000 EUR/MW)



Source: LEAP-RO model

Figure 59. Production cost per technology (EUR/MWh)



Source: LEAP-RO model

4.2 Dimension Decarbonisation

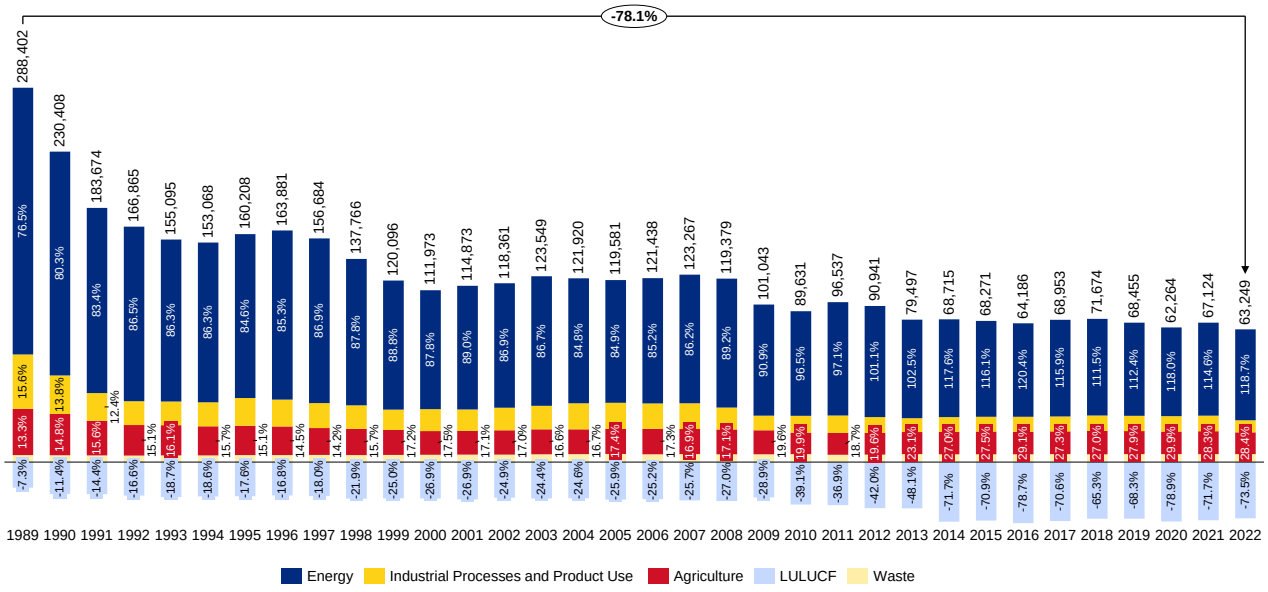
4.2.1. GHG emissions and removals

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

The 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 2024, the total GHG emissions and removals (net emissions, including the LULUCF sector) amounted to 63.25 Mt CO_2-eq in 2022 (as depicted in Figure 60). Notably, this signifies a substantial reduction of 78% compared to the emission levels documented in 1989.

Figure 60. GHG emissions and removals (net-emissions) by sector (in kt CO_2-eq), 1989-2022



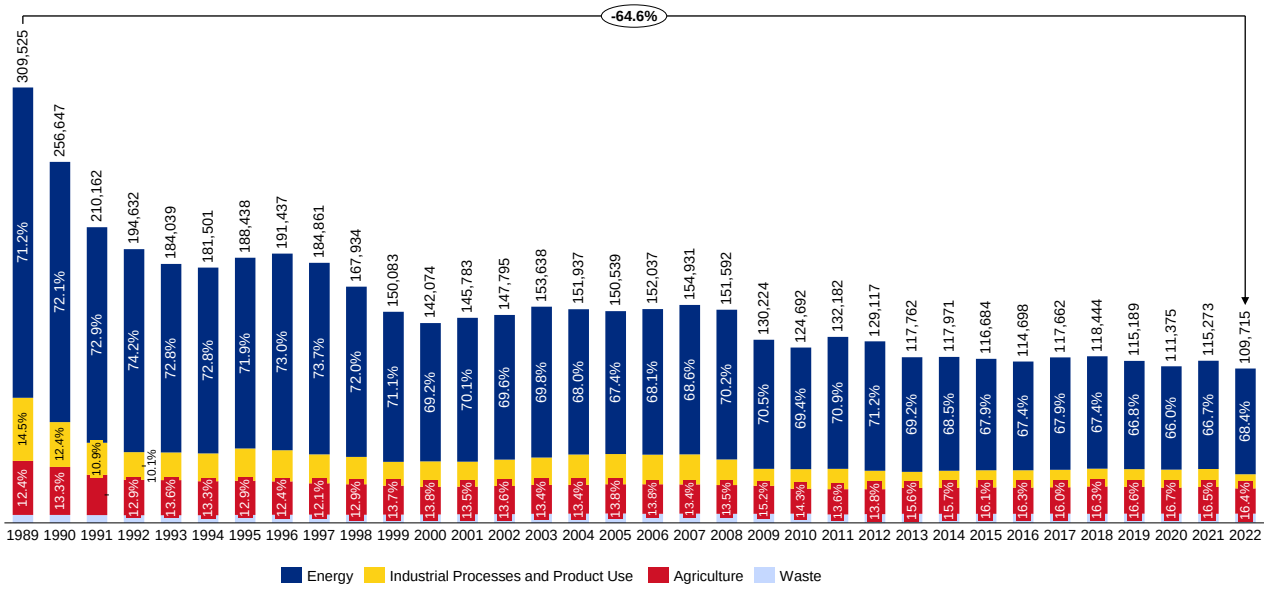
Source: Romania's Greenhouse Gas Inventory 1989 – 2022 (National Inventory Report - NIR and Common Reporting Format – CRF tables, submitted in March 2024)

If the removals from the LULUCF sector are not accounted for, then the aggregate greenhouse gas (GHG) emissions in 2022 were 109.72 Mt CO_2-eq indicating a substantial reduction of 65% compared to 1989 levels (as illustrated in Figure 61). The largest share of emissions originated from the Energy sector (throughout the period 1989-2022), accounting for around 68.4% of the total emissions in 2022, followed by Agriculture, with 16.4%, while the Industrial Processes and Product Use (IPPU) sector and the Waste sector contributed around 9.2% and 6%, respectively (as depicted in Figure 61).

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.

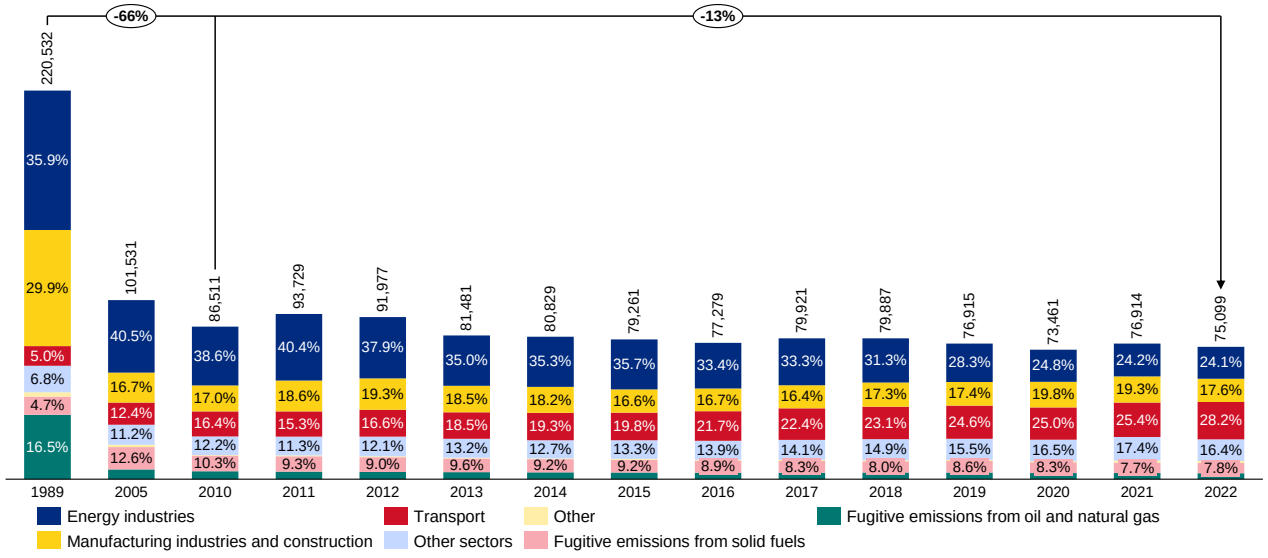
In the Energy sector, the primary sources of emissions are the energy industries (electricity and/or heat production plants) and transport, contributing around 24% and 28%, respectively, to the total emissions in 2022 (as depicted in *Figure 62*). For comparison, in 1989, the manufacturing and construction 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 around 5% in 1989 to 28% in 2022. Meanwhile, between 2010 and 2022, the energy sector's GHG emissions recorded a reduction of approximately 13%.

Figure 61. GHG emissions by sector (in kt CO_2-eq), 1989-2022



Source: Romania's Greenhouse Gas Inventory 1989 – 2022 (National Inventory Report - NIR and Common Reporting Format – CRF tables, submitted in March 2024)

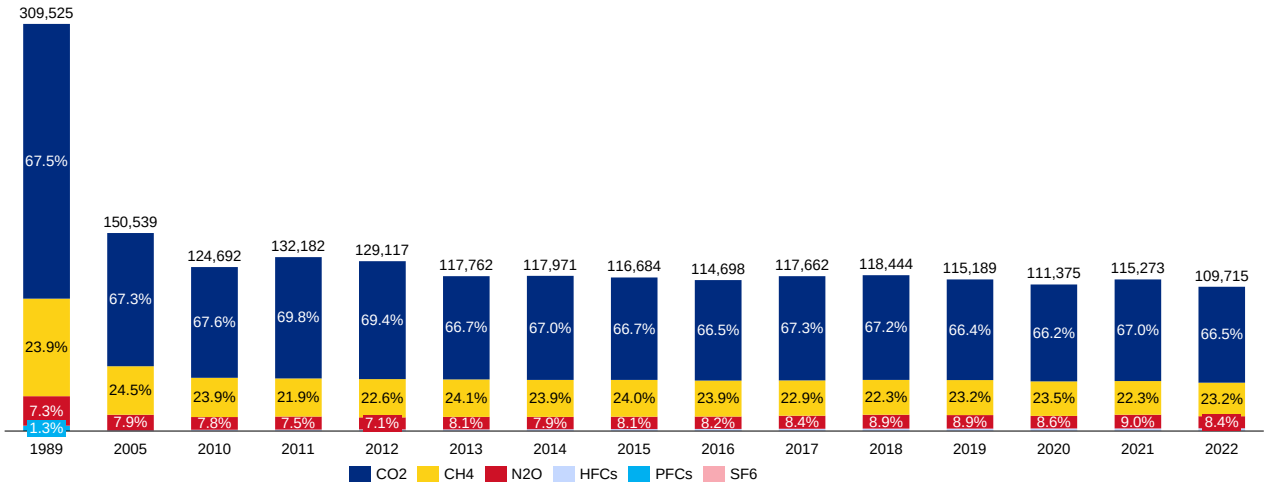
Figure 62. GHG emissions in Energy sector, by category (in kt CO_2-eq)



Source: Romania's Greenhouse Gas Inventory 1989 – 2022 (National Inventory Report - NIR and Common Reporting Format – CRF tables, submitted in March 2024)

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 2022, succeeded by CH_4 emissions with 23% and N_2O emissions with roughly 8%. The remaining greenhouse gases (HFCs, PFCs, SF6) collectively contributed to around 2% of the total greenhouse gas emissions (Figure 63).

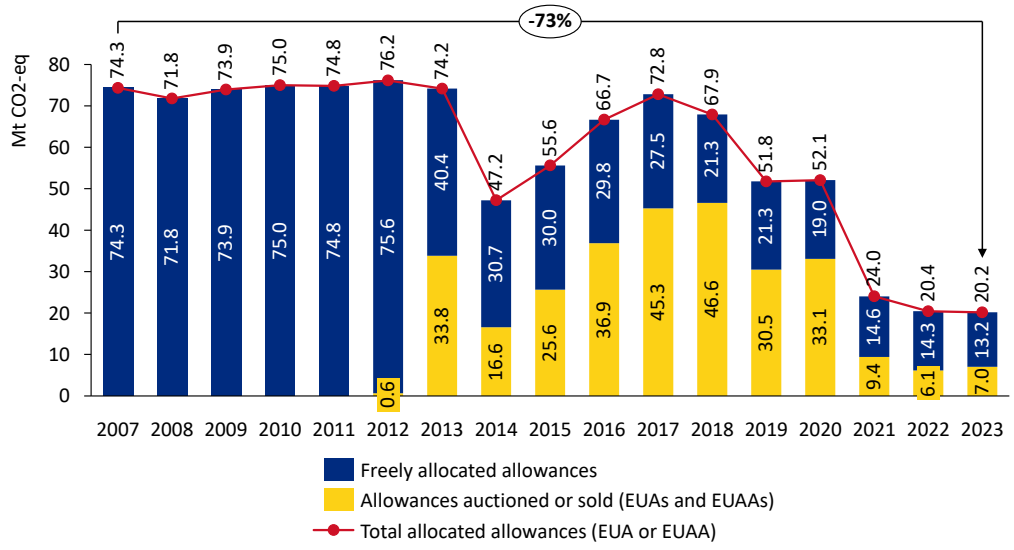
Figure 63. GHG emissions by gas (% share in total)



Source: Romania's Greenhouse Gas Inventory 1989 – 2022 (National Inventory Report - NIR and Common Reporting Format – CRF tables, submitted in March 2024)

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 20.2 million t CO_2-eq in 2023 (Figure 64). The freely allocated allowances have declined, ranging from 74.3 million t CO_2-eq in 2007 to 13.2 million t CO_2-eq in 2023. Additionally, allowances that were auctioned or sold varied, with the lowest value being 0.6 million t CO_2-eq in 2012 and the highest value reaching 46.6 million t CO_2-eq in 2018. In 2023, the auctioned/sold allowances amounted to 7 million t CO_2-eq.

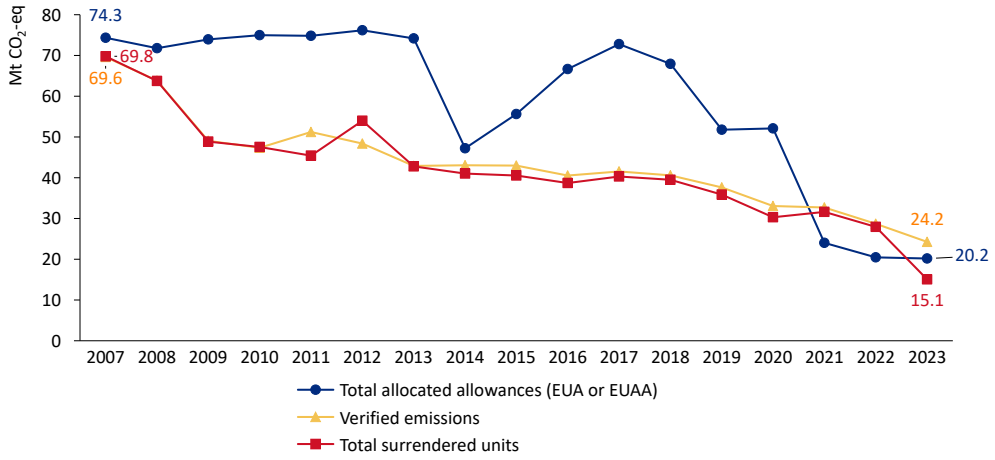
Figure 64. Allocation of the emission reduction allowances (Mt CO_2-eq)



Source: EEA, European Union Emissions Trading System (EU ETS) data from European Union Transaction Log (EUTL), (database from April, 2024)

Analyzing the verified emissions reported on the EUTL between 2007 and 2023 reveals a 65% reduction (Figure 65). Emissions decreased from 69.6 million t CO_2-eq in 2007 to 24.2 million t CO_2-eq in 2023. The total surrendered units exhibit a similar trend, dropping from 69.8 million t CO_2-eq in 2007 to 15.1 million t CO_2-eq in 2023, representing a decrease of approximately 78%.

Figure 65. EU-ETS data for Romania (Mt CO_2-eq)

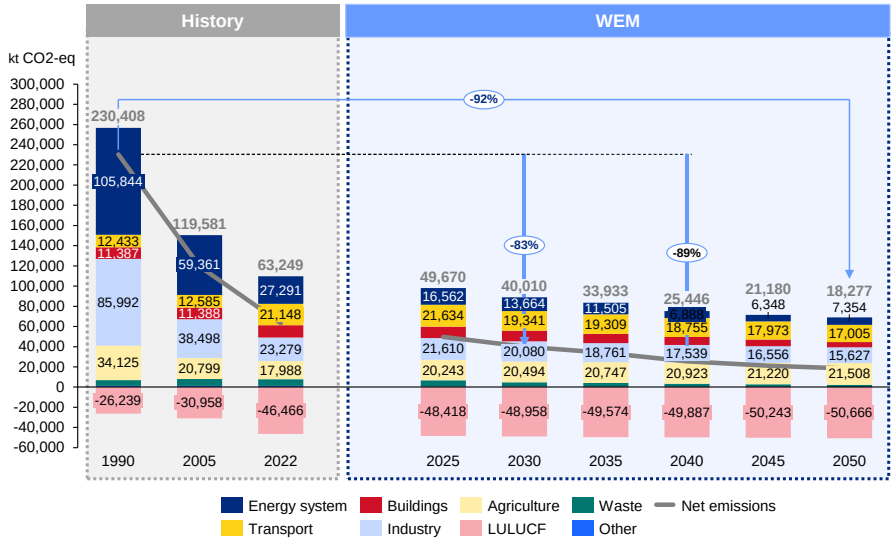


Source: EEA, European Union Emissions Trading System (EU ETS) data from European Union Transaction Log (EUTL), (database from April 2024)

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

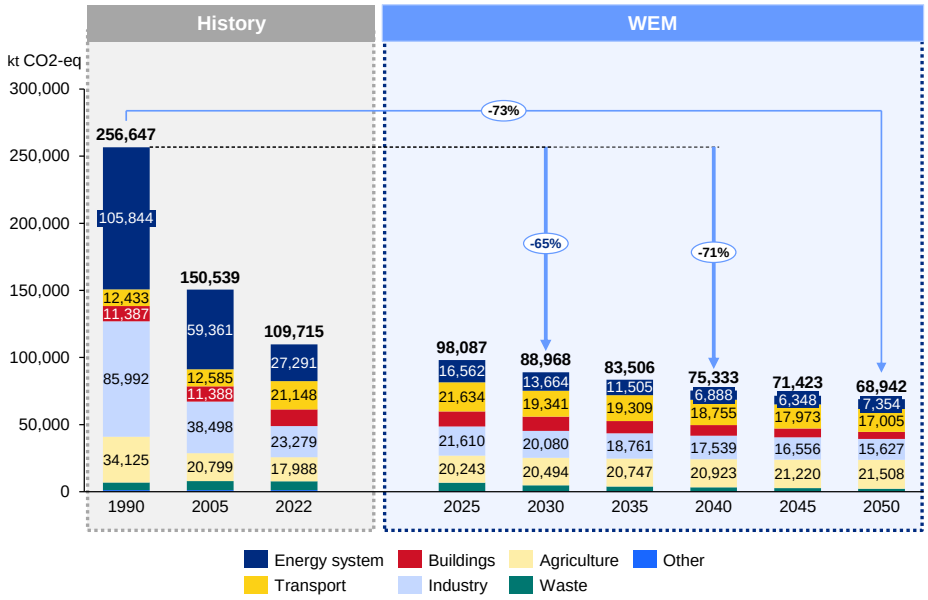
Based on the current measures in place, Romania is projected to achieve a substantial reduction in its net emissions, with a decrease of 83% by the year 2030, compared to the levels recorded in 1990 (as illustrated in Figure 66). Specifically, its emissions, excluding Land Use, Land Use Change, and Forestry (LULUCF) considerations, are anticipated to drop by 65% (Figure 67). Most of these emission reductions are expected to materialize between 2030 and 2040, a period during which net emissions are forecasted to decline by 89% relative to the 1990 levels or by 71% solely in terms of emissions (excluding LULUCF effects). Looking ahead to 2050, the envisaged reduction from the existing measures will reach 92% for net emissions and 73% 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 66. Decarbonization pathways until 2050 by sectors (WEM)



Source: 1990, 2005, 2022 Greenhouse Gas Inventory (March 2024), 2025-2050 LEAP-RO model

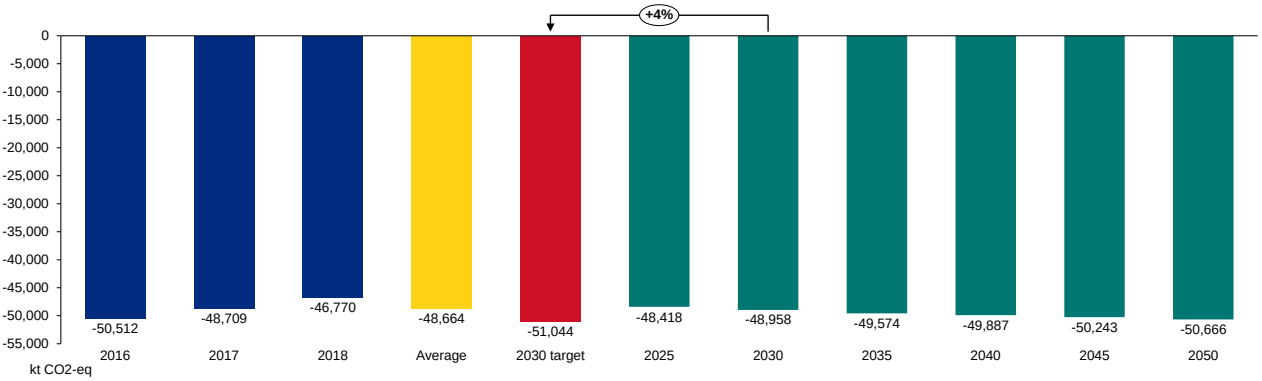
Figure 67. Decarbonization pathways until 2050 without LULUCF by sectors (WEM)



Source: 1990, 2005, 2022 Greenhouse Gas Inventory (March 2024), 2025-2050 LEAP-RO model

By 2030, the projections are that the sink in LULUCF sector will reach 48,664 kt CO2, which is nearly the same as the 2016-2018 average, while by 2050 it is 50.666 kt CO2. As in the case of WAM scenario, the 2030 target is not achieved, actually the sinks are 4% below the target (Figure 88).

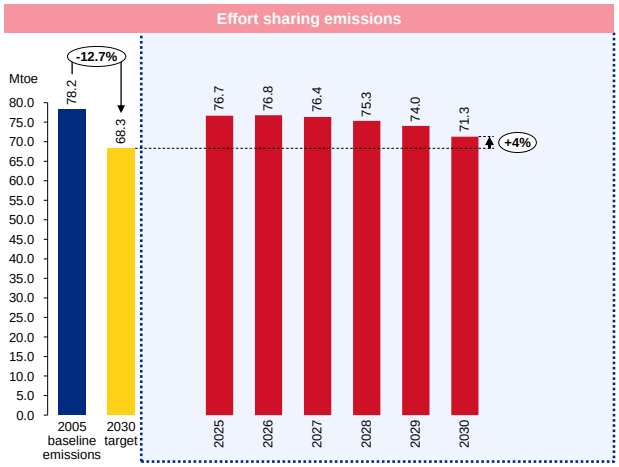
Figure 68 GHG trajectory for LULUCF GHG emissions (with updated inventory) (WEM)



Source: 2016, 2017, 2018 Greenhouse Gas Inventory (March 2024), 2025-2050 LEAP-RO model

The emissions under the effort sharing are projected to decrease gradually each year, reaching 71.3 Mtoe by 2030, which is above the target of 68.3 Mtoe.

Figure 69. Effort sharing emissions (WEM)

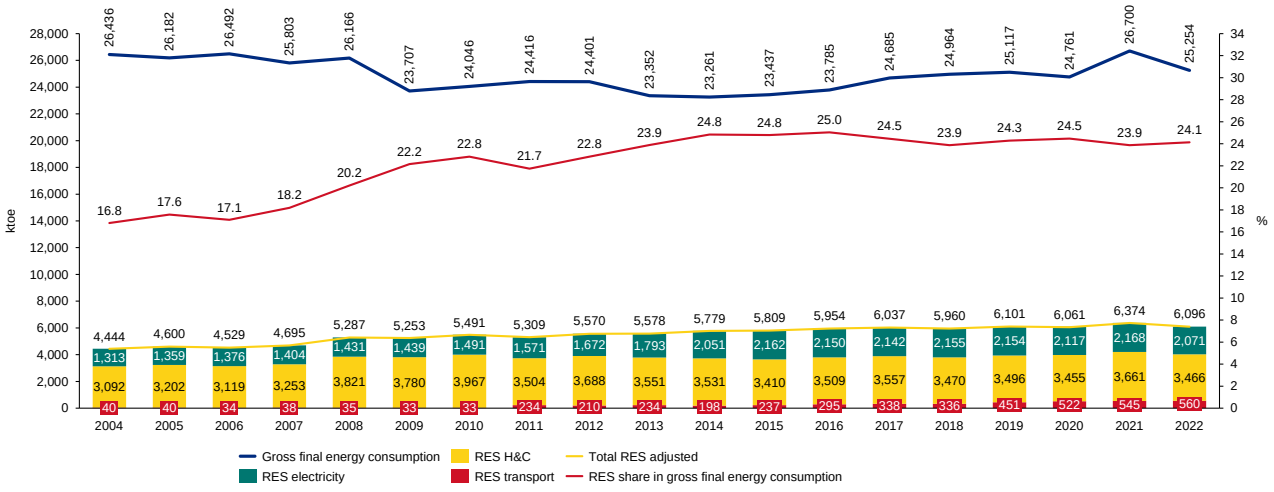


4.2.2. Renewable energy

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 2004-2022 is constantly increasing, with exclusion of 2022,so that in 2021 it is more than 40% increased when compared to the 2004 level, but there is a slight decrease in the last reporting year compared to 2021, (as presented in Figure 70). 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 and then slightly lower values for 2022. 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 70. RES share in gross final energy consumption, 2004-2022

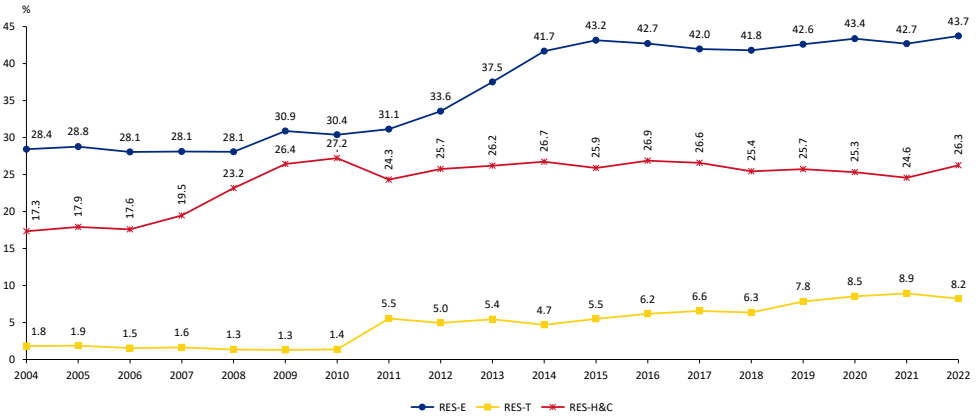


Source: 2004-2022 SHARE tool EUROSTAT

When analyzing the RES share in the gross final energy consumption by sectors, the highest percentage is in the electricity sector (Figure 71) in which the RES consumption has increased by around 66% in the period 2004-2022. This is a result of the increased electricity production mainly from wind, but also solar and other RES, as presented in Figure 72. At the same time there is also an increase in the final energy consumption

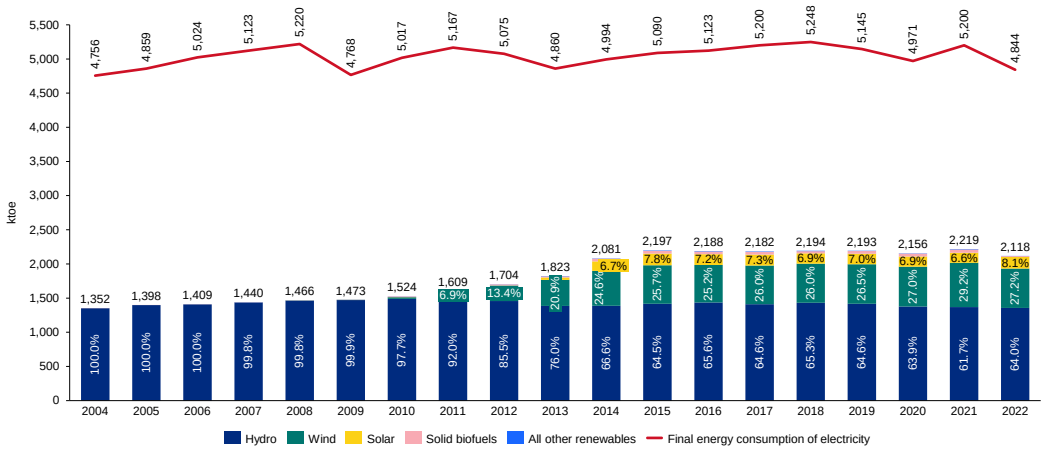
of electricity, which contributes the RES share in the gross final energy consumption of electricity to reach 43.7% in 2022, while in 2004 it was 28.4%.

Figure 71. Share of RES in gross final energy consumption of electricity and final energy consumption of Heating and cooling and transport sector, 2004-2022



Source: 2004-2022 SHARE tool EUROSTAT

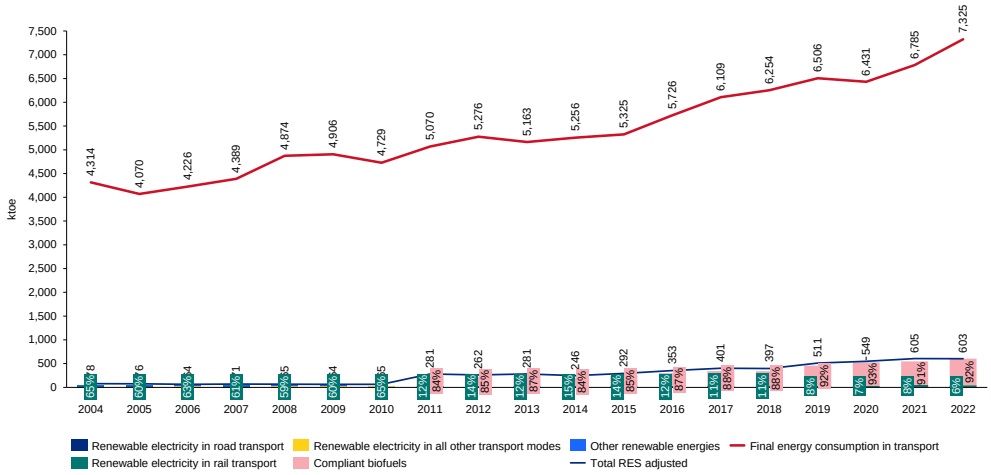
Figure 72. Share by technology in RES consumption of electricity and gross final electricity consumption, 2004-2022



Source: 2004-2022 SHARE tool EUROSTAT

In the transport sector, there is a drastic increase of the final energy consumption by around 59% in the period 2004-2022 (Figure 73). Due to the EU regulations, starting from 2011 the compliant biofuels have a significant role in the RES consumption in the transport sector reaching 92% in 2022. All of these contributes the RES share in the gross final energy consumption in the transport sector to reach 7.8% in 2021 and 6.2% in 2022 from 1.8% in 2004. Even though the final energy consumption in this sector increases , the RES share in transport in 2022 is lower because the RES consumption in transport remains almost the same as 2021).

Figure 73. Share by technology in RES consumption of transport and final consumption in the transport sector, 2004-2022

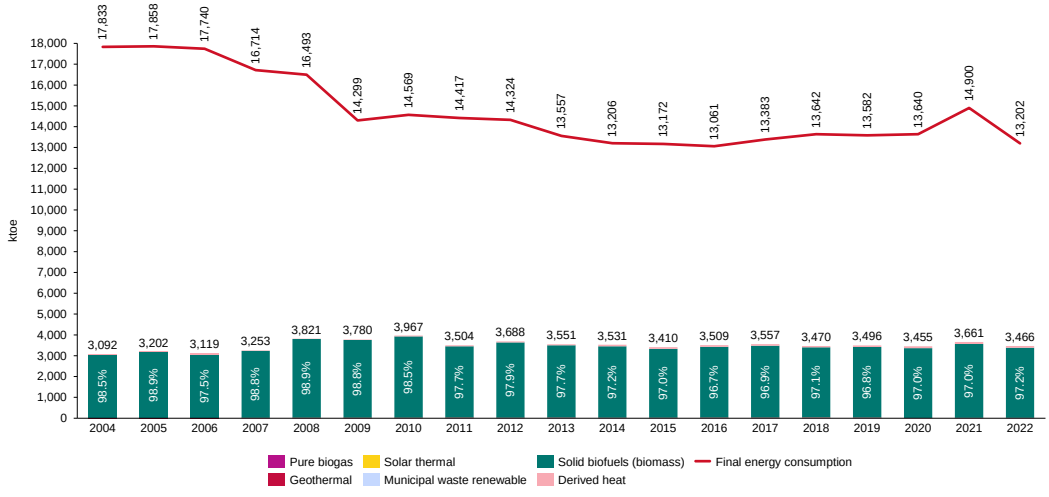


Source: 2004-2022 SHARE tool EUROSTAT

In the heating and cooling sector, the major contributor to the RES consumption is the biomass (Figure 74).

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 and then slight decrease in 2022. 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 74. Share by technology in RES consumption of heating and cooling and final energy consumption of Heating and cooling, 2004-2022



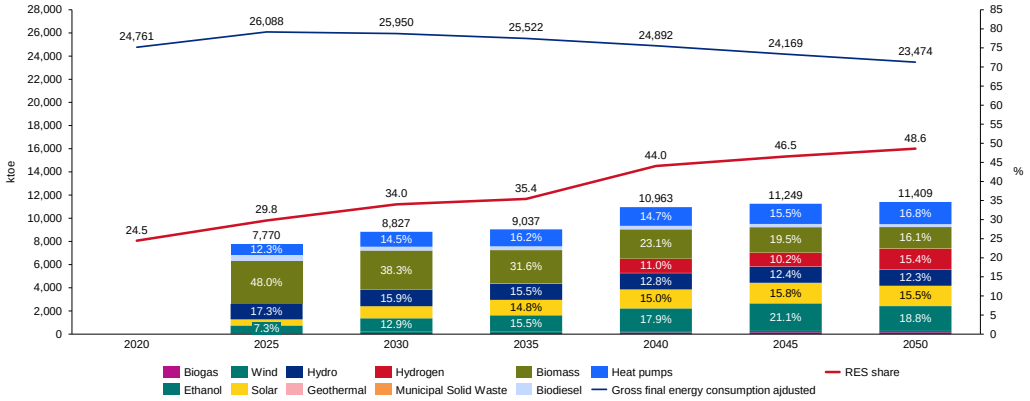
Source: 2004-2022 SHARE tool EUROSTAT

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 48.6% in 2050 (Figure 75). 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 5.2% 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. By 2050, biomass, wind, heat pumps, and hydrogen will each contribute nearly equally to the final energy consumption from renewable energy sources, with each accounting for approximately 16% to 19%.

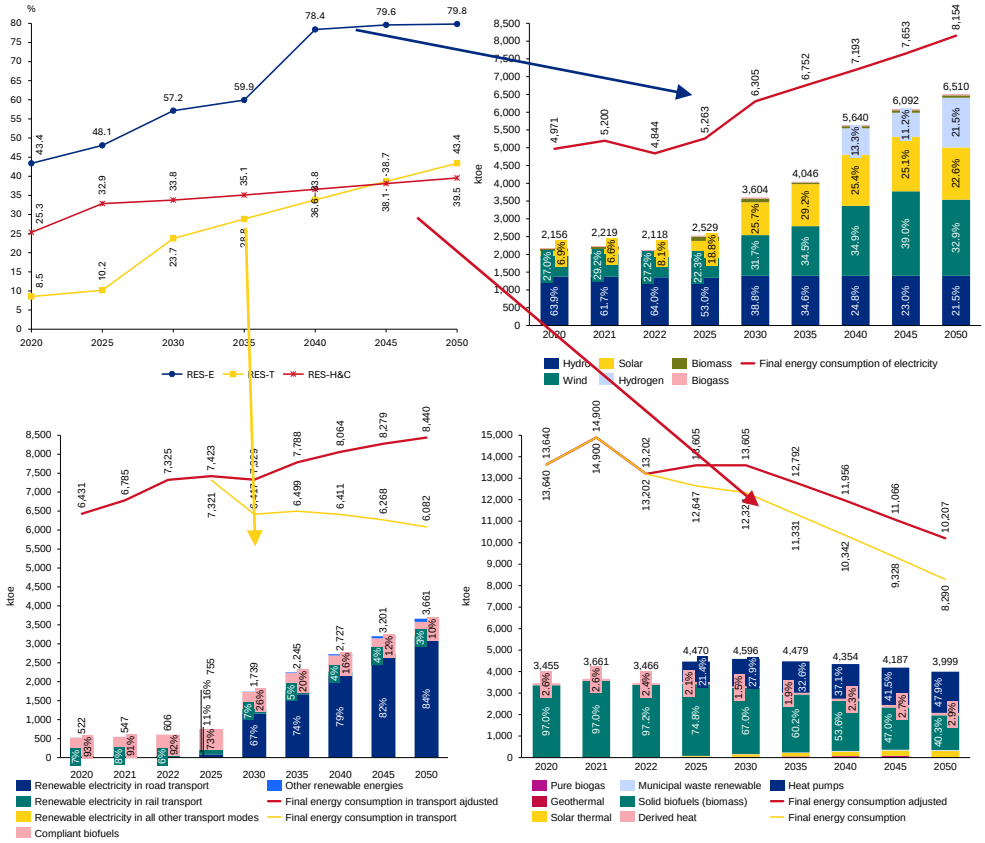
Figure 75. Indicative projections of RES share in gross final energy consumption up to 2050 (WEM)



Source: 2022 SHARE tool EUROSTAT, 2025-2050 LEAP-RO model

When analyzing by sectors, the RES share in the electricity will reach 57.2% in 2030 and almost 80% in 2050 (Figure 76). 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 23.7% in 2030 and 43.4% 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 33.8% in 2030 and 39.5% 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 76. 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



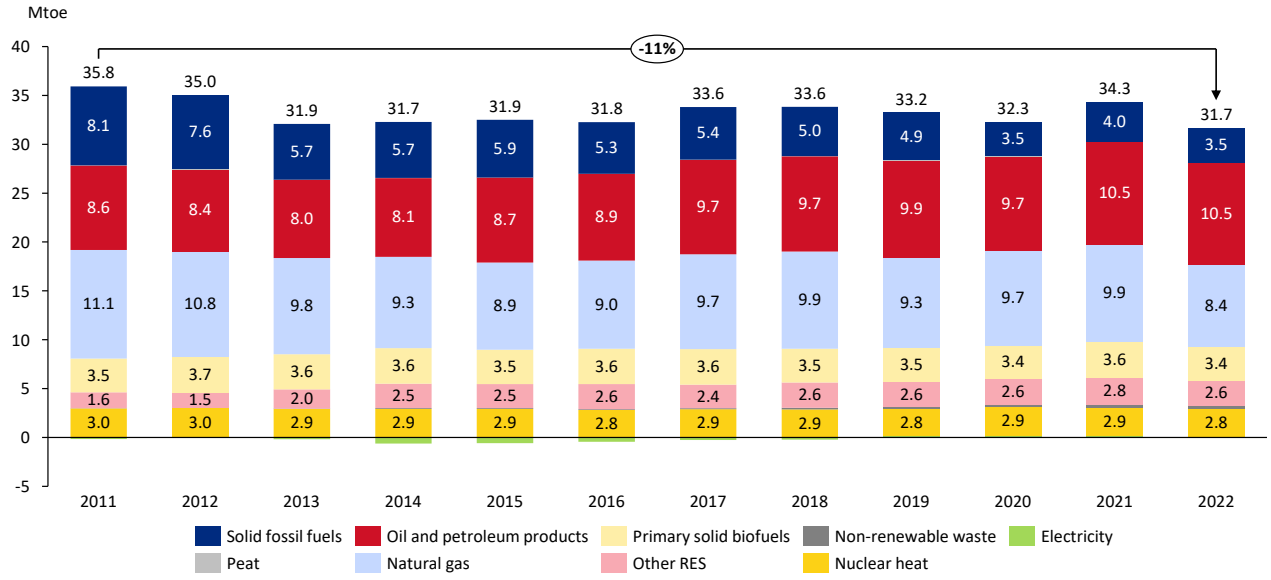
Source: 2020 - 2022 SHARE tool EUROSTAT, 2025-2050 LEAP-RO model

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 2011-2022 reveals several trends, although the total primary consumption has been quite stable (Figure 77). First, the primary consumption of solid fossil fuels (mainly coal) has decreased by 57%, and the consumption of natural gas has decreased by 25%. On the other hand, the primary consumption of other RES (except biomass – primary solid biofuels) has increased by 61% 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 22%.

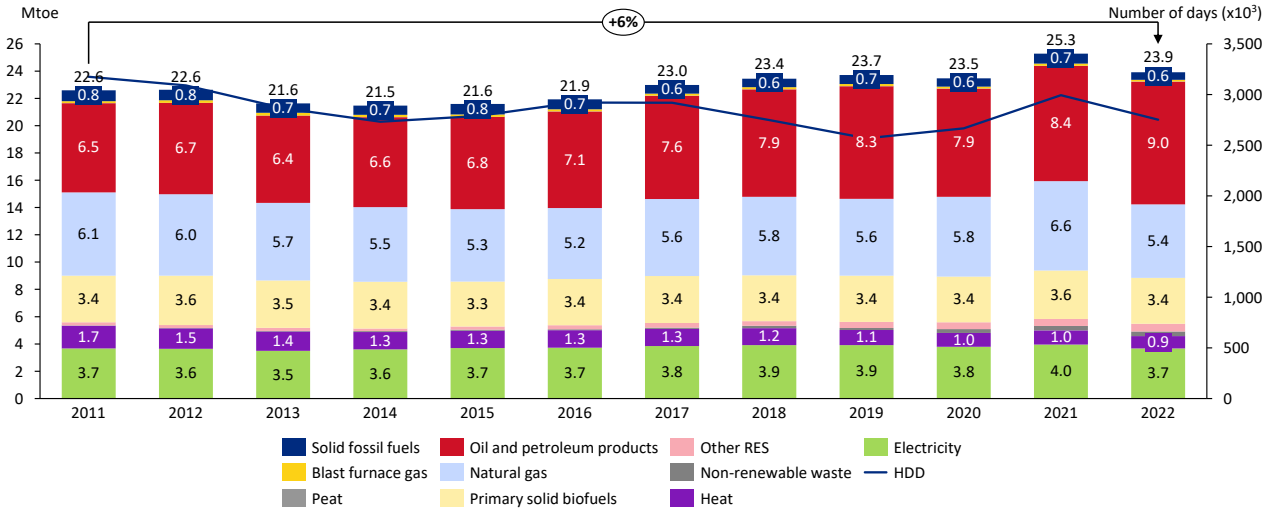
Figure 77. Primary energy consumption by fuels, 2011-2022



Source: 2011-2022 Energy balance EUROSTAT

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 6% in the same period (Figure 78). This shows that the efficiency in the energy sector has increased from around 63% in 2011 to 75% in 2022. 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 150% in the period 2011-2022 and for the oil and other oil products for around 38%.

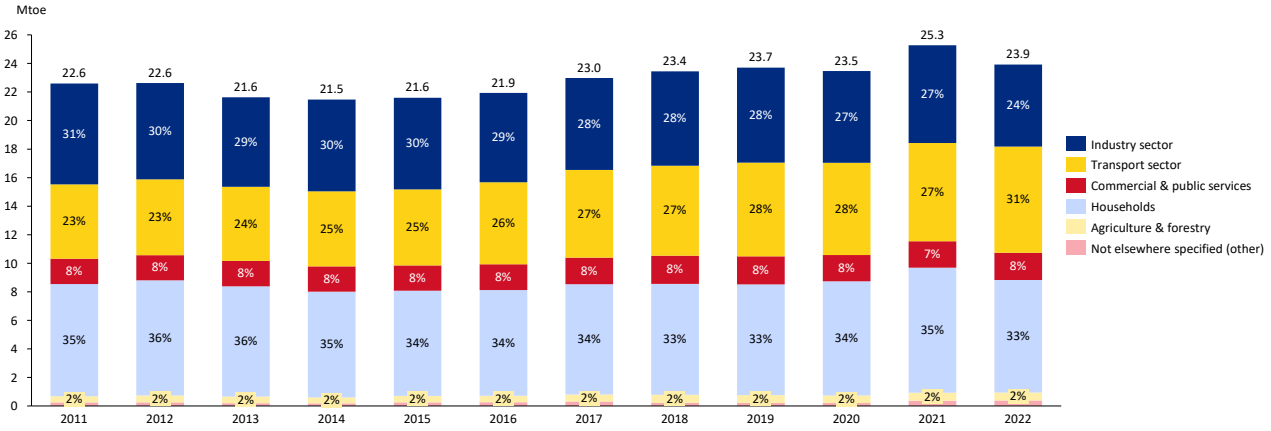
Figure 78. Final energy consumption by fuels, 2011-2022



Source: 2011-2022 Energy balance EUROSTAT

The previous conclusion about the transport sector, can be confirmed from Figure 79. Namely, the final energy consumption in the transport sector has increased by 43%, so its share has increased from 23% in 2011 to 31% in 2022. The share of the industry sector has decreased from 31% in 2011 to 24% in 2022. 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 slight increase in the absolute values for the last two years of the analyzed period, mainly due to the higher heating demand.

Figure 79. Final energy consumption by sectors, 2011-2022



Source: 2011-2022 Energy balance EUROSTAT

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 9% in 2030 compared to 2022 (Figure 80). At the same time, the final energy consumption will remain at almost the same level (Figure 81). In the long-term plan, primary energy consumption should be decreased by 33% 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 40% and 30% in 2050, respectively.

Figure 80 Projections of primary energy consumption – WEM

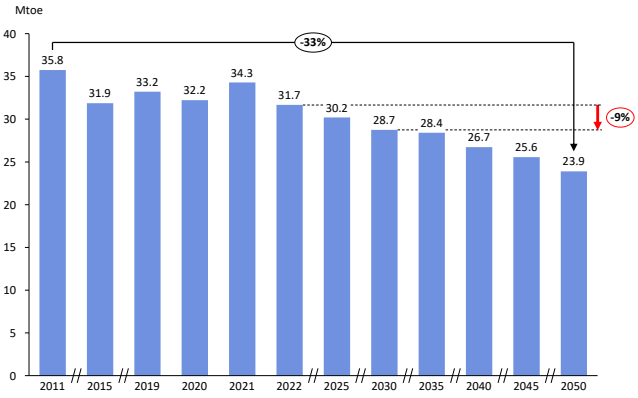
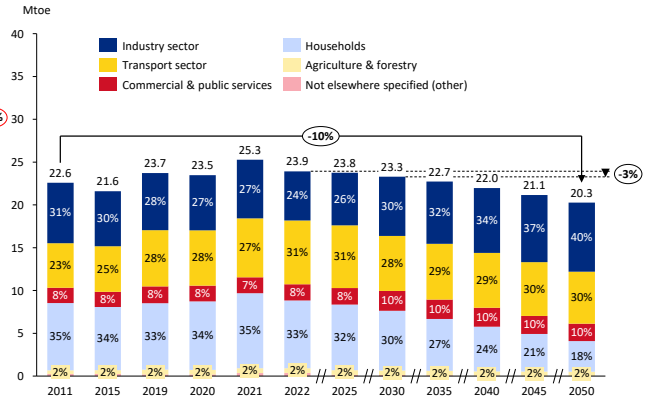


Figure 81. Projections of final energy consumption by sectors – WEM

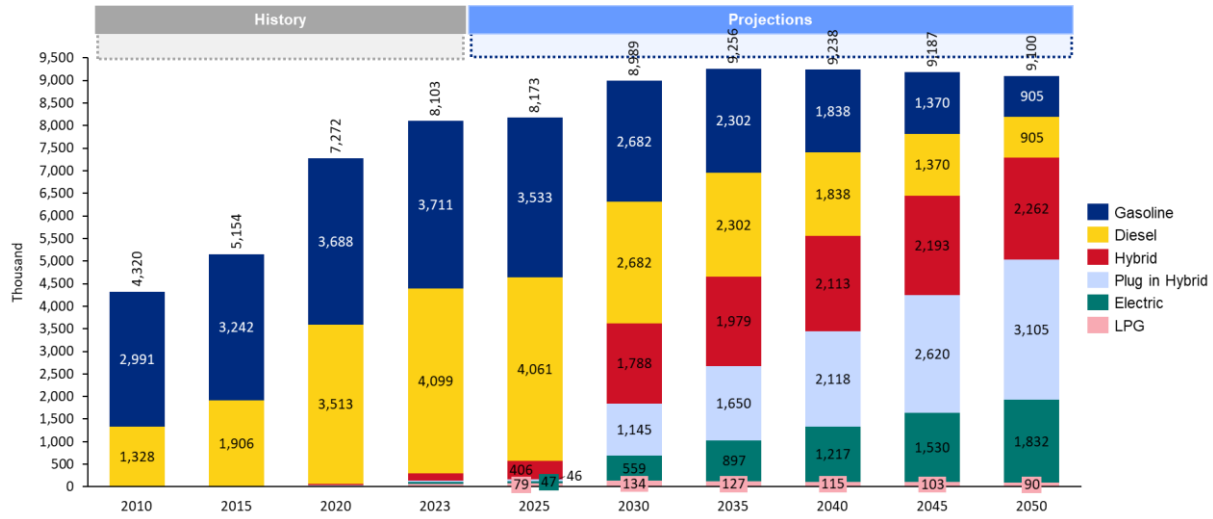


Source: 2011, 2015,2019-2022 Energy balance EUROSTAT, 2025-2050 LEAP-RO model

To enhance transparency, as much results as possible are presented, allowing for a clear and comprehensive understanding of the analysis done as part of the NECP. This approach ensures that all stakeholders can fully evaluate the basis of the conclusions and the reliability of the results. As a results of this, in the text bellow more detailed presentation of the transport and household sectors is given.

To decrease the final energy and primary energy consumption the technologies on the demand side are one of the most important drivers. In the transport sector the evolution of the number of registered cars during 2010-2050 is presented in Figure 82 . The total number of cars in Romania in the WEM scenario is projected to peak at 9.2 million in 2035 before slightly declining to 9.1 million by 2050. Gasoline and diesel vehicles, which dominate the market in 2023 with 3.7 and 4.1 million respectively, are expected to decline steadily, reaching just 905 thousand each by 2050. In contrast, hybrid, plug-in hybrid, and electric vehicles show strong growth; hybrids rise to 2.3 million by 2050, while plug-in hybrids and electric vehicles see even more dramatic increases, with plug-in hybrids growing to 3.1 million and electric vehicles to 1.8 million by 2050. This trend indicates a significant shift towards more environmentally friendly and sustainable car technologies, with traditional fuel vehicles gradually being phased out.

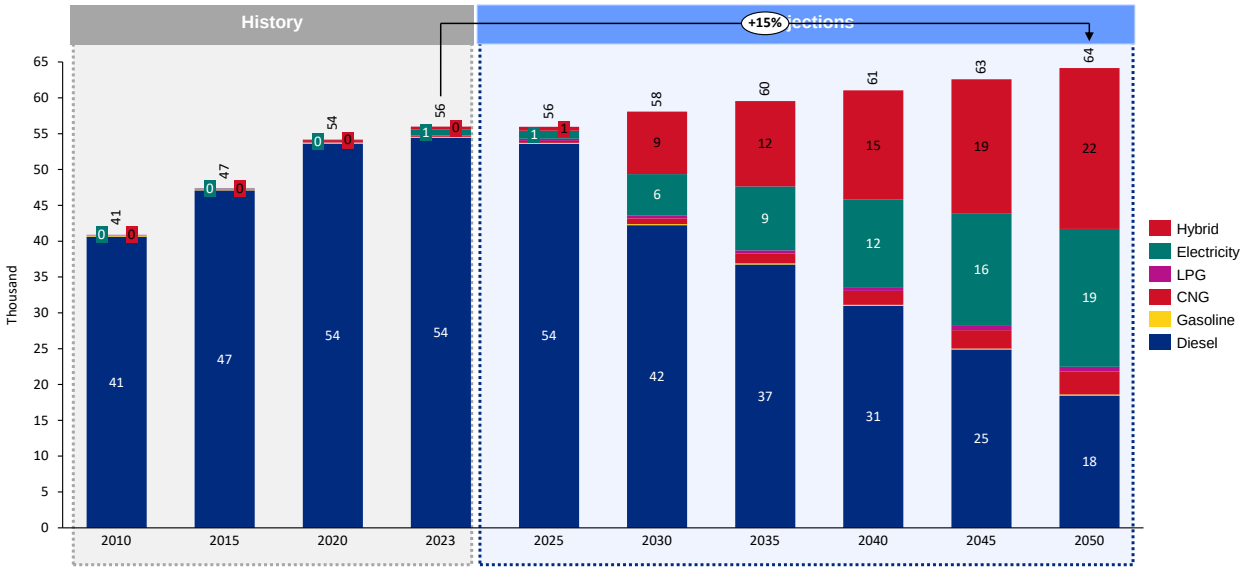
Figure 82. Number of passenger cars - historical and projected values up to 2050 (WEM)



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

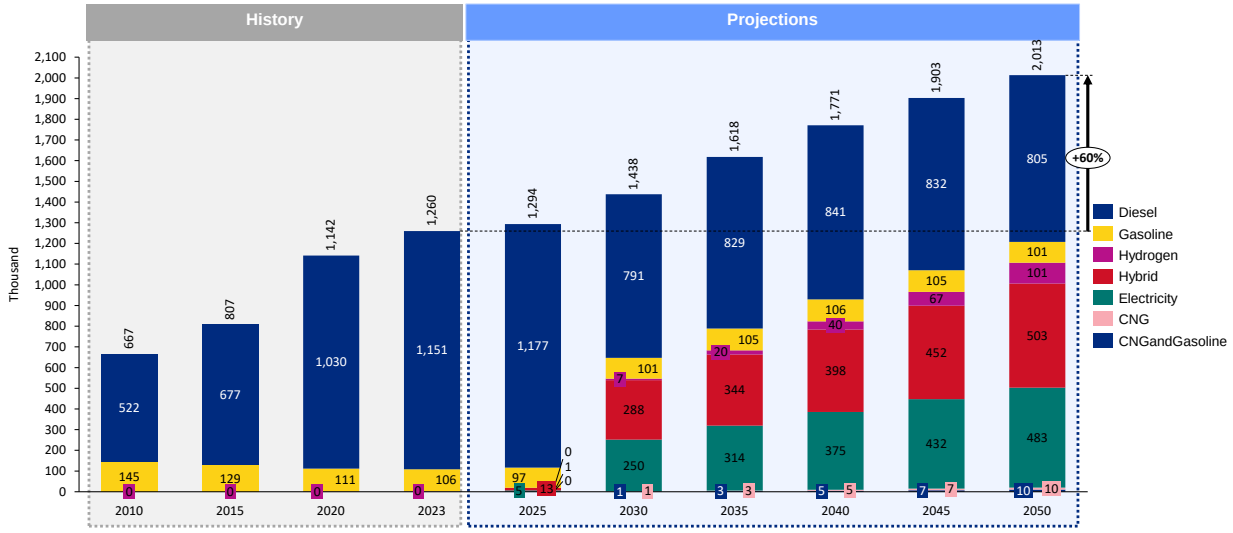
Additionally, for the road transport, the number of buses and the number of heavy goods vehicles are also used in the model. Figure 83 and Figure 84 show the modelling output per fuel type and the real data from INS. The number of both types of vehicles is increasing, the number of HGV is increased by 60% in the period 2023-2050, while the growth of buses is by 15% in the same period. In both cases the electric and hybrid technologies aim to change the traditional technologies, although in the HGV case the diesel is still dominant in 2050 in the WEM scenario.

Figure 83. Number of buses - historical and projected values up to 2050 (WEM)



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

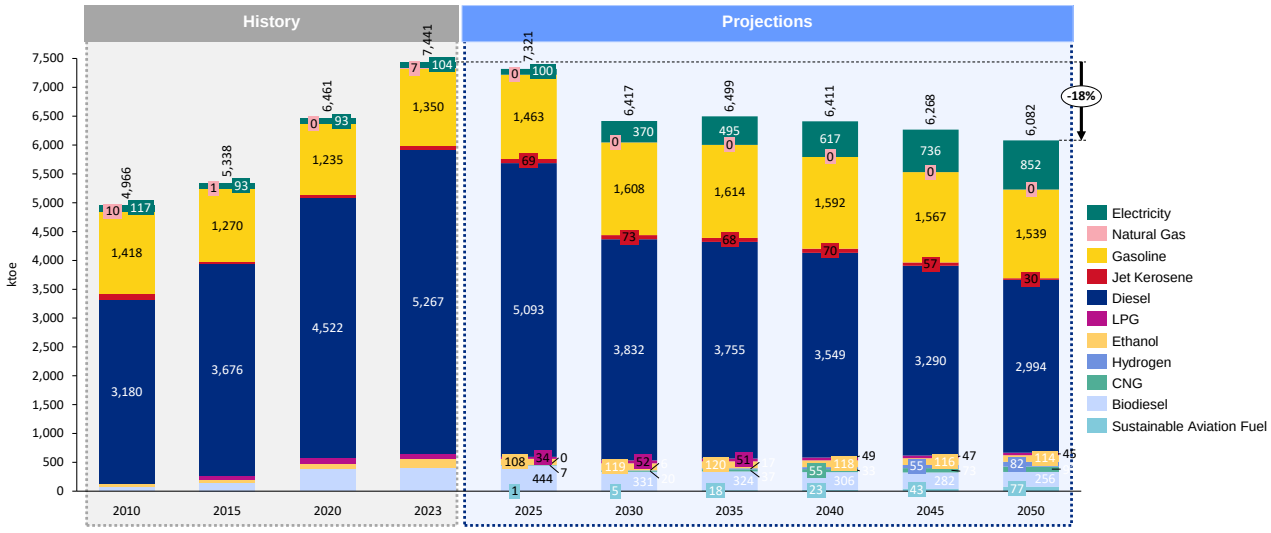
Figure 84. Number of Heavy Goods Vehicles (HGV) - historical and projected values up to 2050 (WEM)



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

The technologies mentioned above in the transport sector result in an 18% reduction in final energy consumption between 2022 and 2050. The total fuel consumption in Romania is projected to peak at 7,441 ktoe in 2022, followed by a decline to 6,082 ktoe by 2050. Diesel remains the most significant fuel source through 2030, although its consumption drops from 5,267 ktoe in 2022 to 3,832 ktoe by 2030. Gasoline also sees a slight increase until 2025, reaching 1,463 ktoe before stabilizing around 1,608 million units in 2030. In contrast, electricity sees substantial growth, rising from 104 ktoe in 2022 to 370 ktoe by 2030, reflecting the increasing adoption of electric vehicles and renewable energy sources.

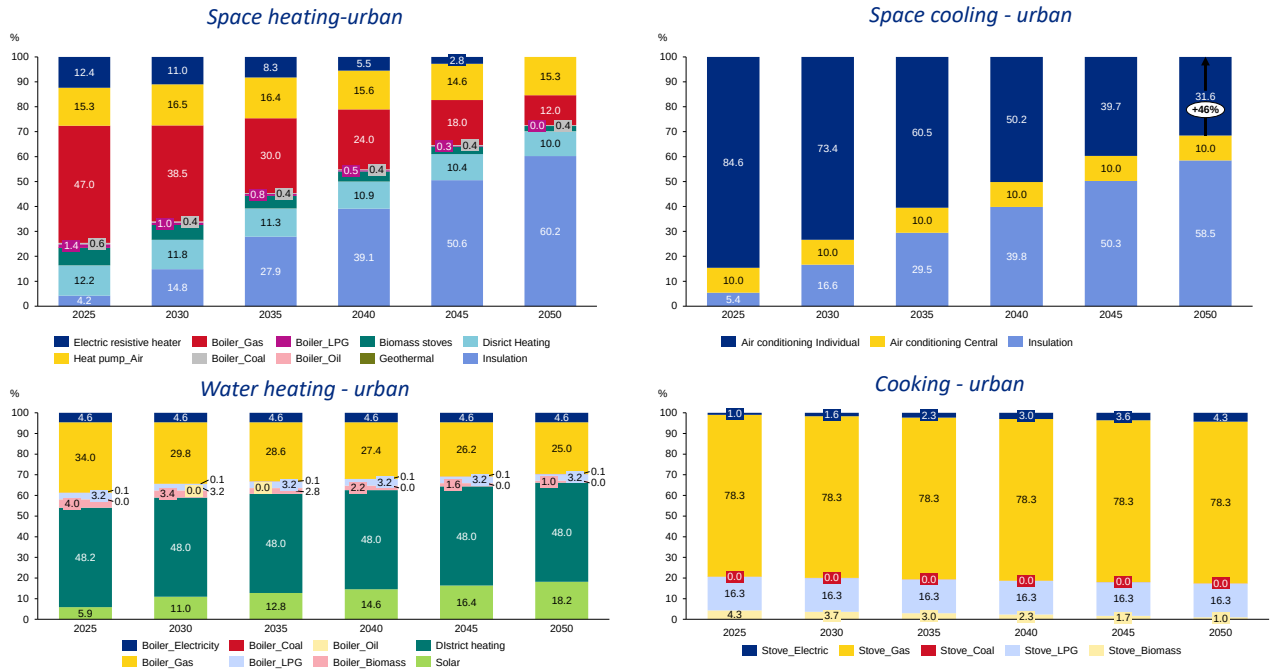
Figure 85. Final energy consumption in transport sector by fuels - historical and projected values up to 2050 (WEM)



Source: EUROSTAT 2010-2022, projections LEAP-RO mode, team analysis

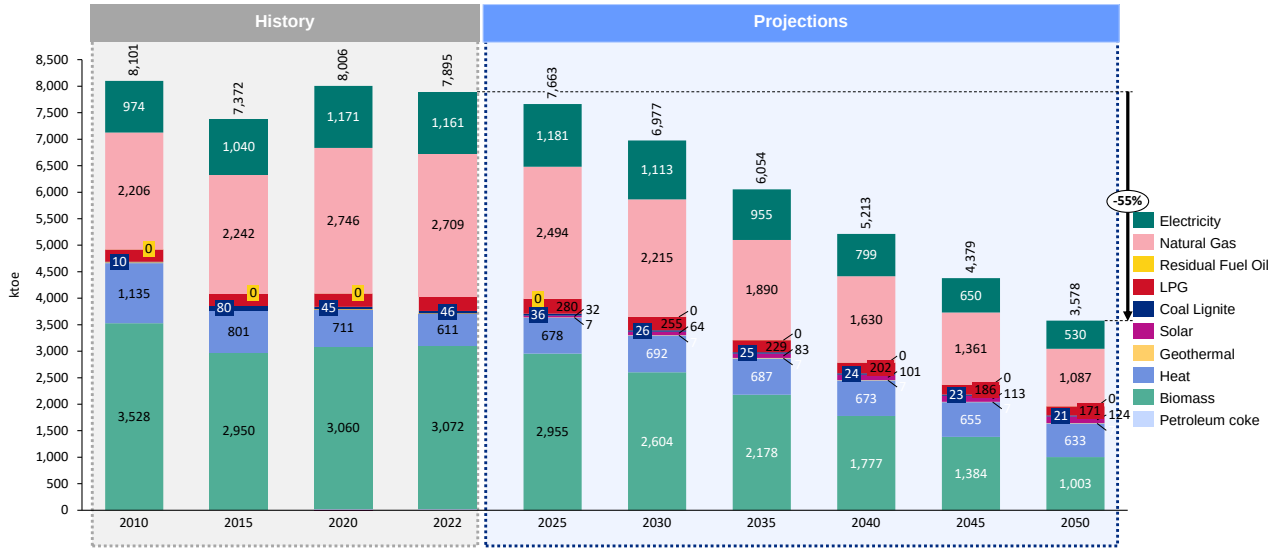
Figure 86 illustrates the share of various technologies in meeting different energy needs within the residential sector. In the heating and cooling sector, moderate and deep energy renovation plays a crucial role in improving energy efficiency. There is a noticeable shift from traditional technologies to more modern, less polluting alternatives.

Figure 86. Share of different technologies in residential sector (urban) up to 2050 (WEM)



The implementation of the technologies in the residential sector lead to significant changes between 2022 and 2050 decreasing the energy consumption by 55%. Natural gas and biomass, which are currently major energy sources, are expected to see a steady decline, with natural gas consumption dropping from 2.7 Mtoe in 2022 to 1.1 Mtoe by 2050 and biomass decreasing from 3.1 Mtoe to 1 Mtoe in the same period. Conversely, solar energy is expected to rise gradually, increasing to 0.12 Mtoe by 2050, reflecting a shift towards renewable energy sources in the residential sector.

Figure 87. Final energy consumption in residential sector by fuels - historical and projected values up to 2050 (WEM)



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

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 based on statistical sampling. The

selection considered the most common architectural characteristics, types and climatic zones in Romania. The analysis under the Long-Term Renovation Strategy is 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.

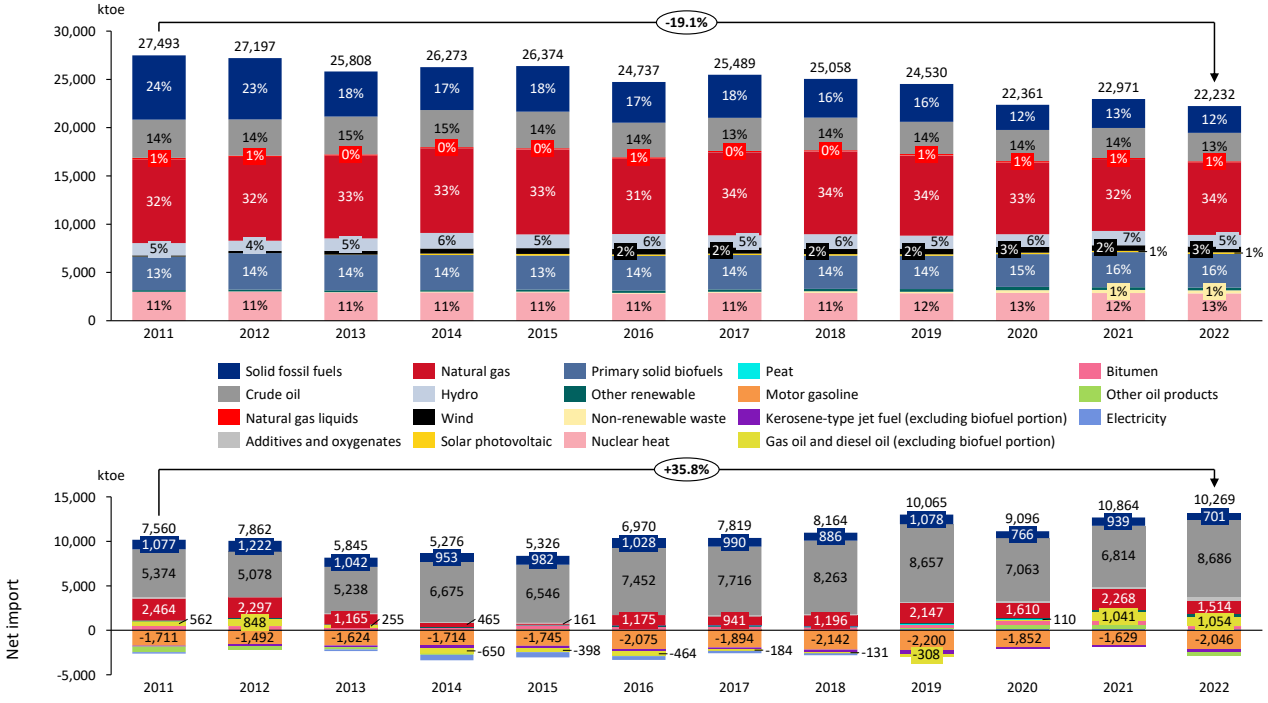
4.4 Dimension energy security

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%–34%) of the total (Figure 88). Solid fossil fuels, crude oil, primary solid biofuels, and nuclear heat all have about similar shares in 2022, 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 2022 compared to 2011. Additionally, throughout the studied time, there was about 26% and 13% 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 period, their overall shares of the energy mix are 3% and 1% in 2022, respectively. All these factors together caused the total primary production to decrease by more than 19% between 2011 and 2022.

In parallel to the decrease in domestic primary production, there is an increase in the net import of around 36% in the period 2011-2022. This import is dominantly based on the quantity of crude oil import, which accounts for around 85% of the net import in 2022. The highest share of export of fuels has the motor gasoline which is maintained at a similar level throughout the entire period.

Figure 88. Current energy mix by domestic resources and imports, 2011-2022

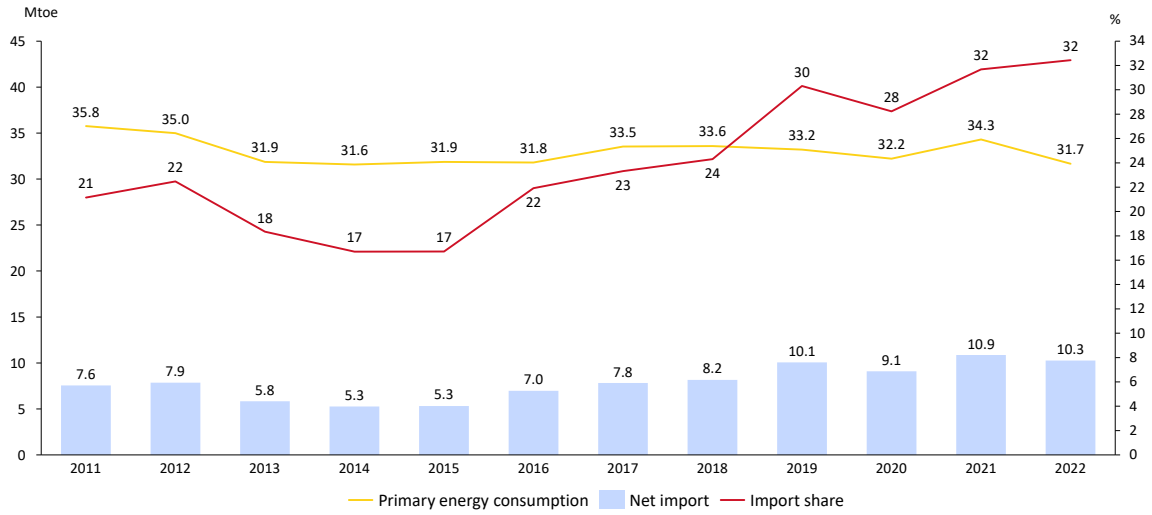


Source: EUROSTAT energy balances, project team analysis

In the last three years of the studied period, the overall import dependency has increased, reaching 32% in 2022, while in 2011 this percentage was 21% (Figure 89). As previously mentioned, this import is mainly

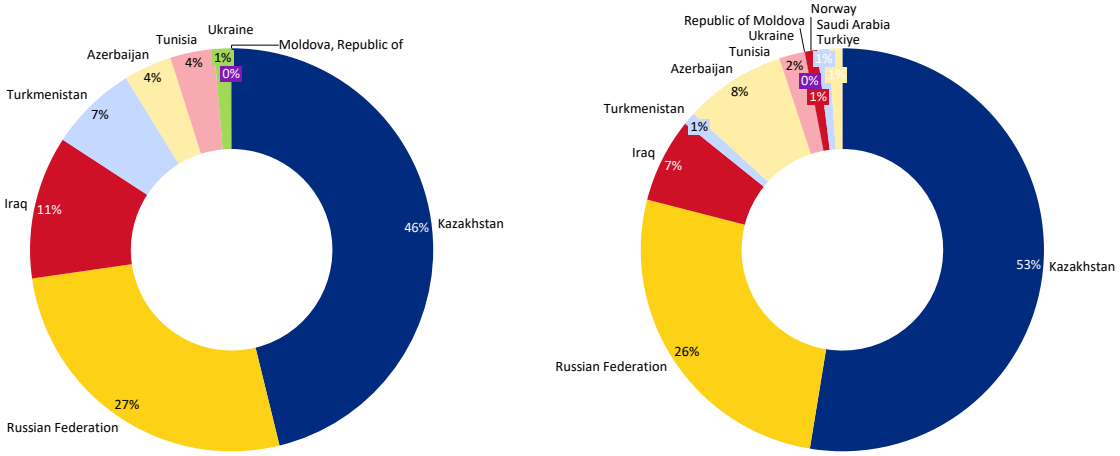
increased due to the import of crude oil. Additional study of the countries from where the import is made is considered in order to evaluate the risk associated with this import. In 2022, around 53% of the crude oil is imported in Romania from Kazakhstan, 26% from Russian Federation and 7% from Iraq (Figure 90). Regarding the import of natural gas, around 71% is from Bulgaria and around 15% from Hungary (Figure 91).

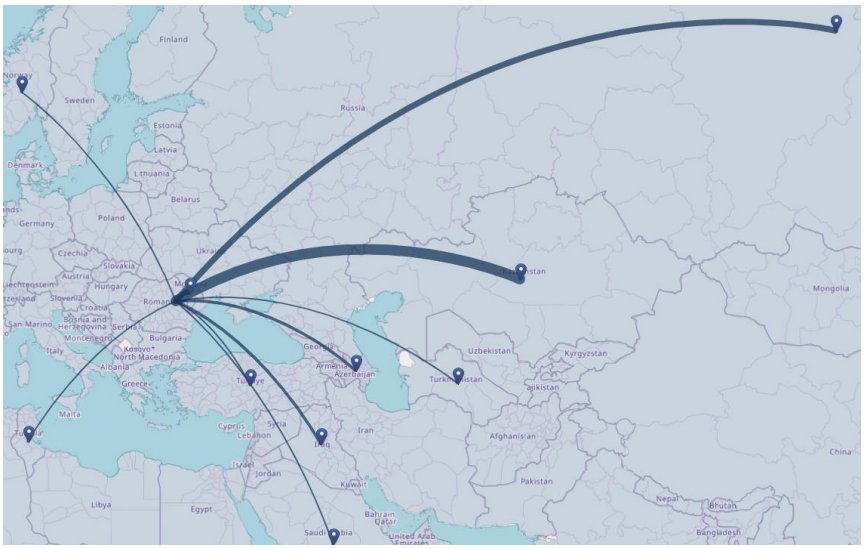
Figure 89. Import dependence, 2011-2022



Source: EUROSTAT energy balances, project team analysis

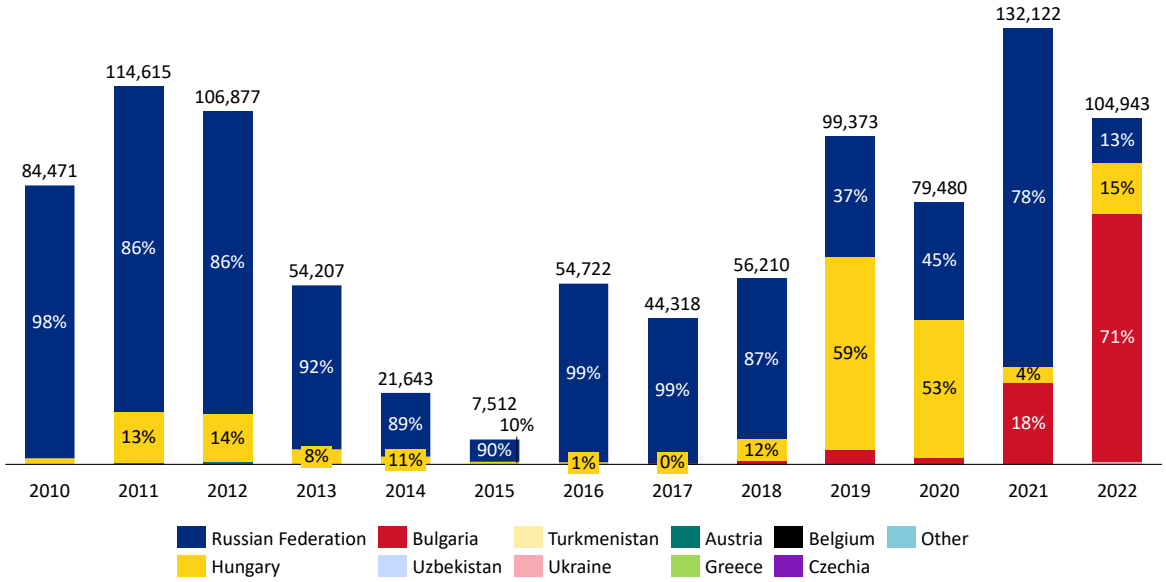
Figure 90. Countries from which crude oil is imported in Romania – 2021 and 2022 (kt)

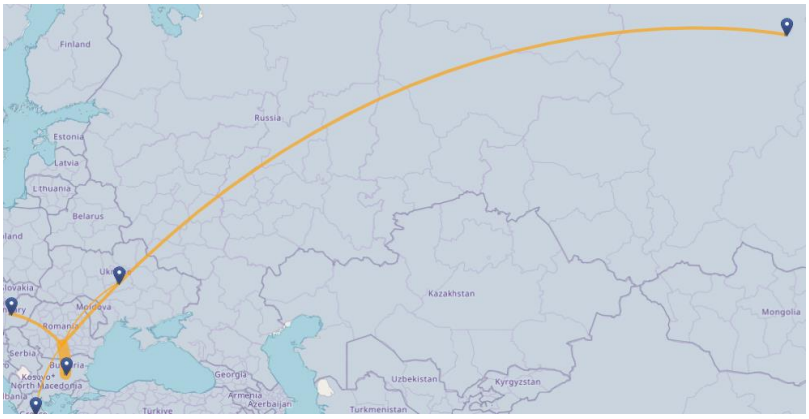




Source: EUROSTAT energy balances, project team analysis

Figure 91. Countries from which natural gas is imported in Romania – 2010 – 2022 (TJ)

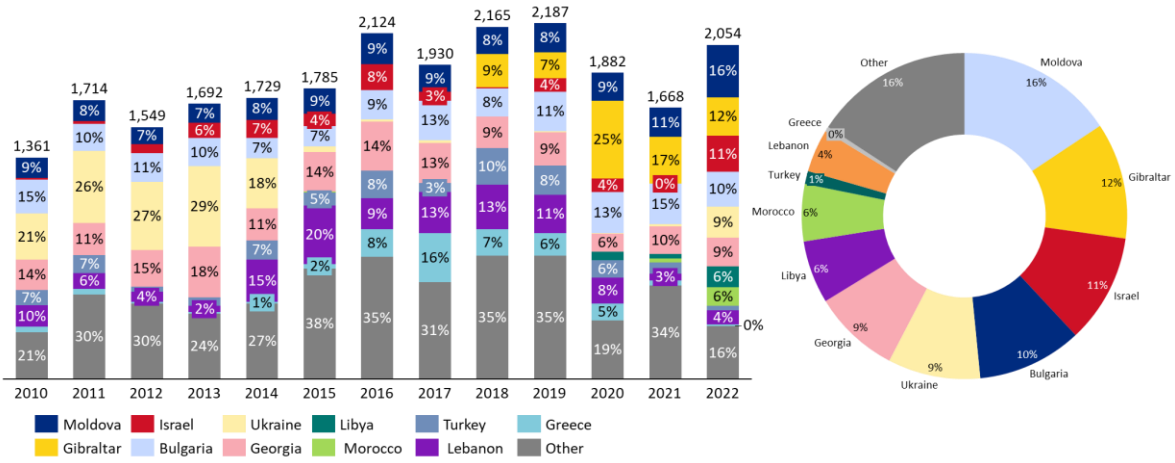


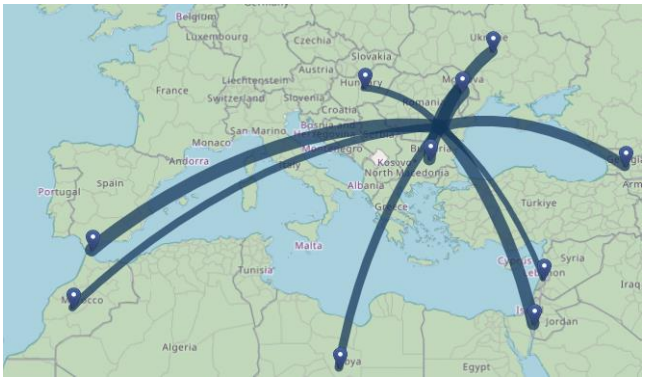


Source: EUROSTAT energy balances, project team analysis

As motor gasoline has the highest share of the export of fuels, Figure 92 shows the countries to which Romania exports motor gasoline in 2022. It can be noted that the export is very diverse and includes many countries, such as Moldova with 16% share, Gibraltar with 12%, Israel – 11%, Bulgaria – 10%, Ukraine and Georgia with 9% each.

Figure 92. Countries to which motor gasoline is exported from Romania – 2010 – 2022 and detailed for 2022 (kt)





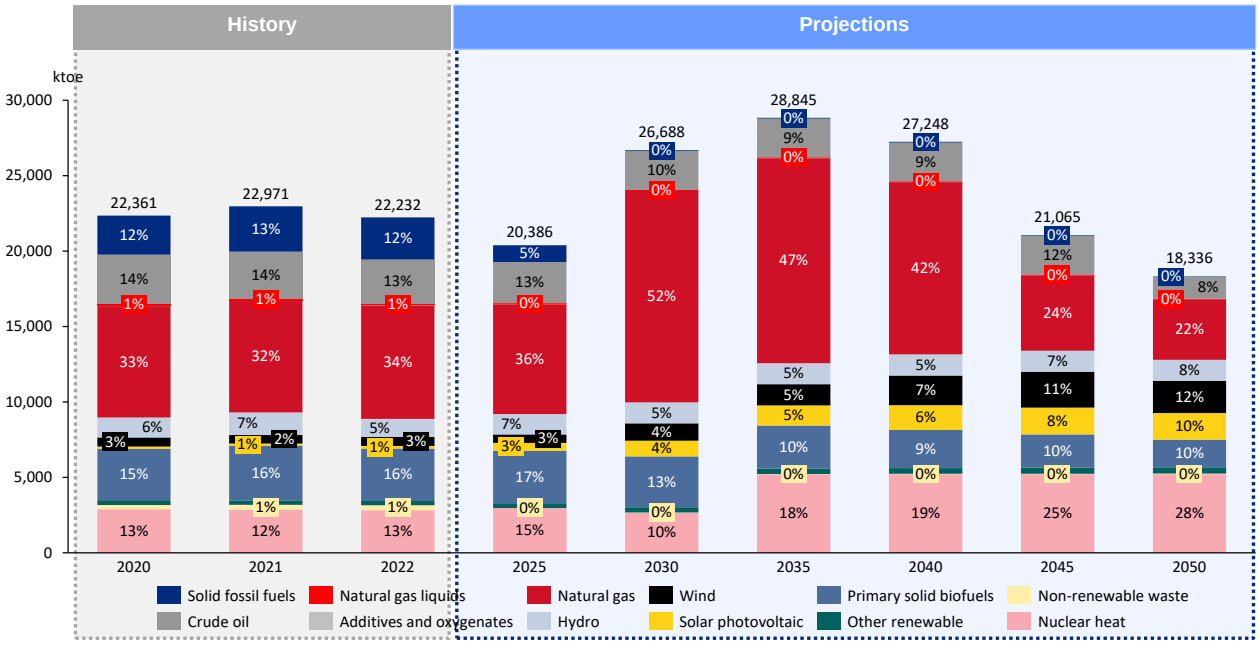
Source INS energy balances, project team analysis

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

Figure 80 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.

Figure 93 and Figure 95 present long-term projections related to energy sourcing and import reliance. Figure 93 illustrates the projected energy mix by domestic resources from 2020 to 2050, providing insights into the future composition of locally sourced energy. Natural gas and nuclear hear are fuels with highest share in the period after 2030 participating each with 47% and 18% in 2040.

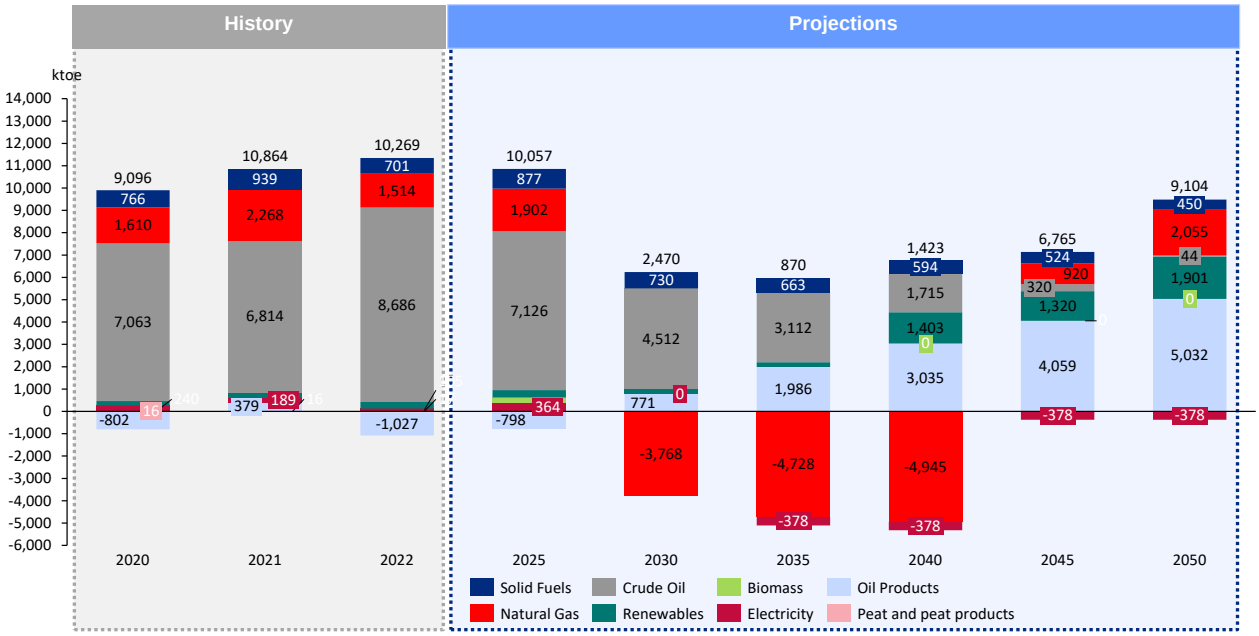
Figure 93 Energy mix by domestic resources - historical and projected values up to 2050 (WEM)



Source: EUROSTAT energy balances (2020-2022), LEAP-RO (2025-2050)

Romania's net imports show a significant fluctuation from 2022 to 2050, with a notable decline after 2030. The total net import value sees a drastic reduction, dropping from 10,269 ktoe in 2022 to just 869.8 ktoe by 2035, before rising again to 9,103.9 ktoe by 2050, indicating a complex transition in energy dependencies. By 2030, the net import of natural gas turns negative, reaching -3,768 ktoe, indicating a shift from import reliance to self-sufficiency or exports as a result of Netun deep project. Crude oil imports also decrease sharply, from 8,685.6 ktoe in 2022 to 7,126 ktoe in 2025 and continue to drop to just 44 ktoe by 2050. Meanwhile, renewable energy imports (part of hydrogen projected to be used in Romania) gradually rise, peaking significantly at 1,403 ktoe by 2040, reflecting an increasing focus on sustainable energy sources.

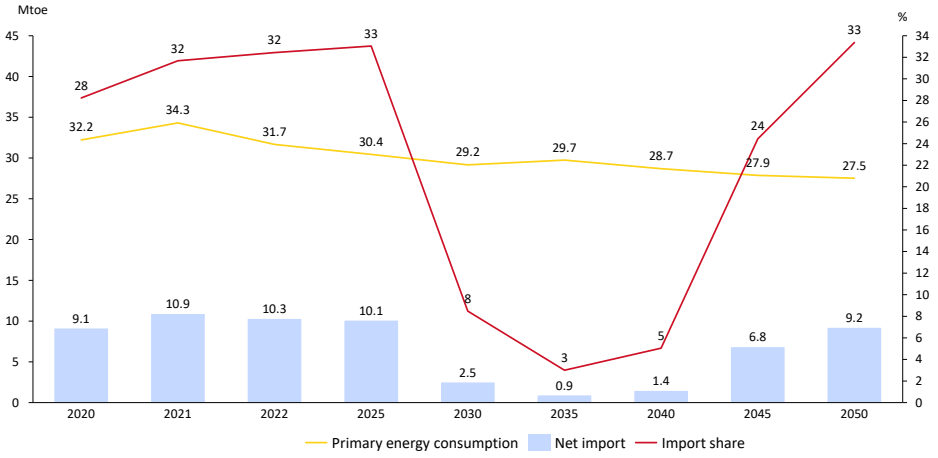
Figure 94 Net import - historical and projected values up to 2050 (WEM)



Source: EUROSTAT energy balances (2020-2022), LEAP-RO (2025-2050)

Figure 95 shows the projected import dependence over the same period, emphasizing that the import dependence will be reduced to around 3% mainly as a result of the Neptun deep project.

Figure 95. Import dependence - historical and projected values up to 2050 (WEM)

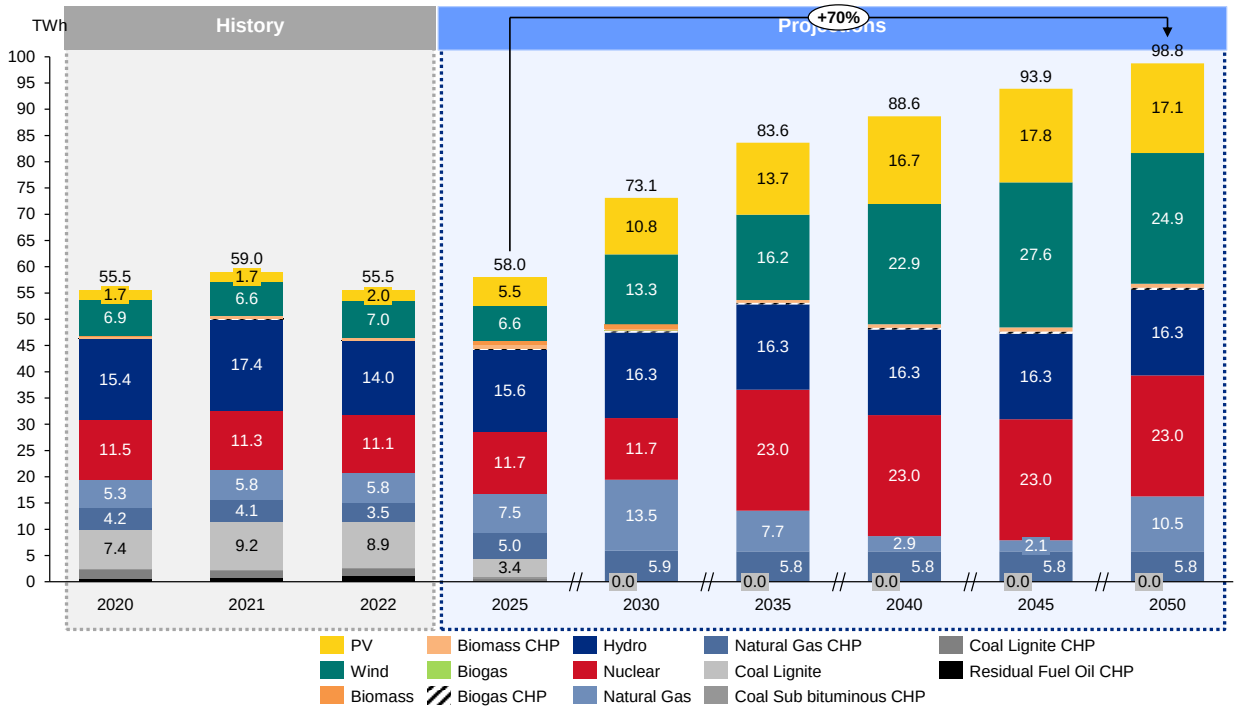


Source: EUROSTAT energy balances (2020-2022), LEAP-RO (2025-2050)

As electricity is the dominant energy source and plays a crucial role in energy security, special attention is focused on electricity generation in the next part of this chapter. In the WEM scenario for Romania, electricity consumption is projected to increase steadily from 55.5 TWh in 2022 to 98.8 TWh by 2050 (Figure 96). PV and wind are expected to see substantial growth, with PV rising from 2.0 TWh in 2022 to 10.8 TWh by 2030, and wind energy growing from 7.0 TWh to 13.3 TWh in the same period. Nuclear power remains a significant

contributor, especially after 2035, with its output doubling from 11.7 TWh in 2030 to 23 TWh by 2050, reflecting its vital role in Romania's energy mix.

Figure 96. Gross electricity generation by technologies - historical and projected values up to 2050 (WEM)

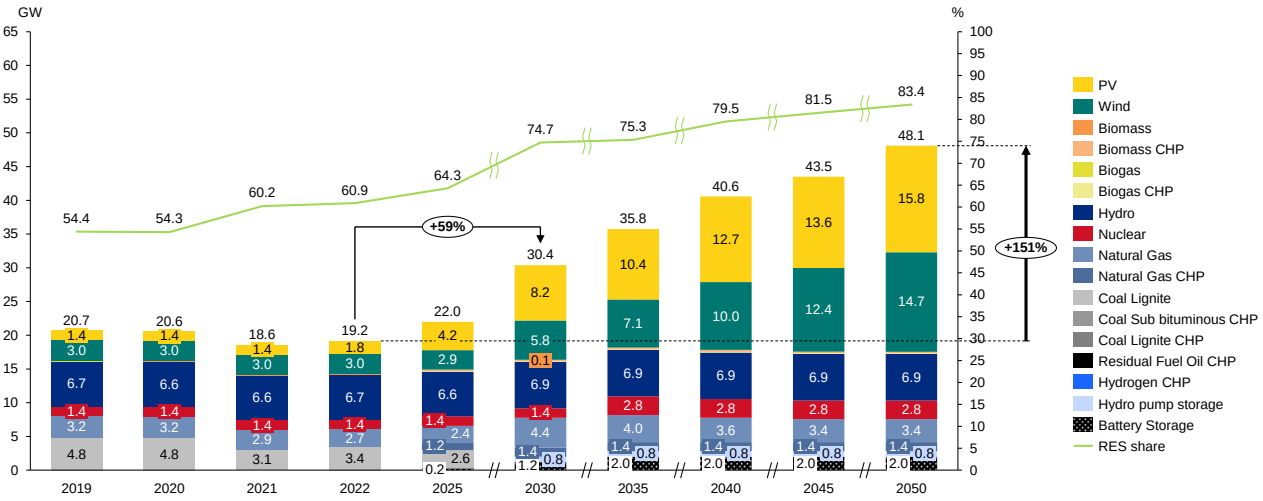


Source: EUROSTAT energy balances (2020-2022), LEAP-RO (2025-2050)

Note: Starting from 2036, all natural gas plants will switch to use at least 50% of renewable and/or low-carbon gaseous fuels (including green gases) which will lead to additional "RES" capacities and GHG emission level reduction. In the above graphs, after 2035, by natural gas one means natural gas, biomethane and renewable hydrogen.

The electricity generation capacity is projected to shift significantly towards renewable energy sources between 2022 and 2050. By 2030, PV capacity is expected to increase substantially from 1.8 GW in 2022 to 8.2 GW, and wind capacity is projected to nearly double from 3 GW to 5.8 GW, highlighting a strong focus on expanding renewable energy. During this period, coal-based generation will be phased out, while nuclear and natural gas capacities will play important roles, with nuclear capacity rising to 2.8 GW by 2035 and natural gas CCGT peaking at 4.4 GW by 2030.

Figure 97. Electricity generation capacity by technologies - historical and projected values up to 2050 (WEM)



Source: EUROSTAT (2019-2022), LEAP-RO (2025-2050)
Note: In WEM scenario, no SMRs are considered for nuclear energy.

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 12). 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 12. 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.

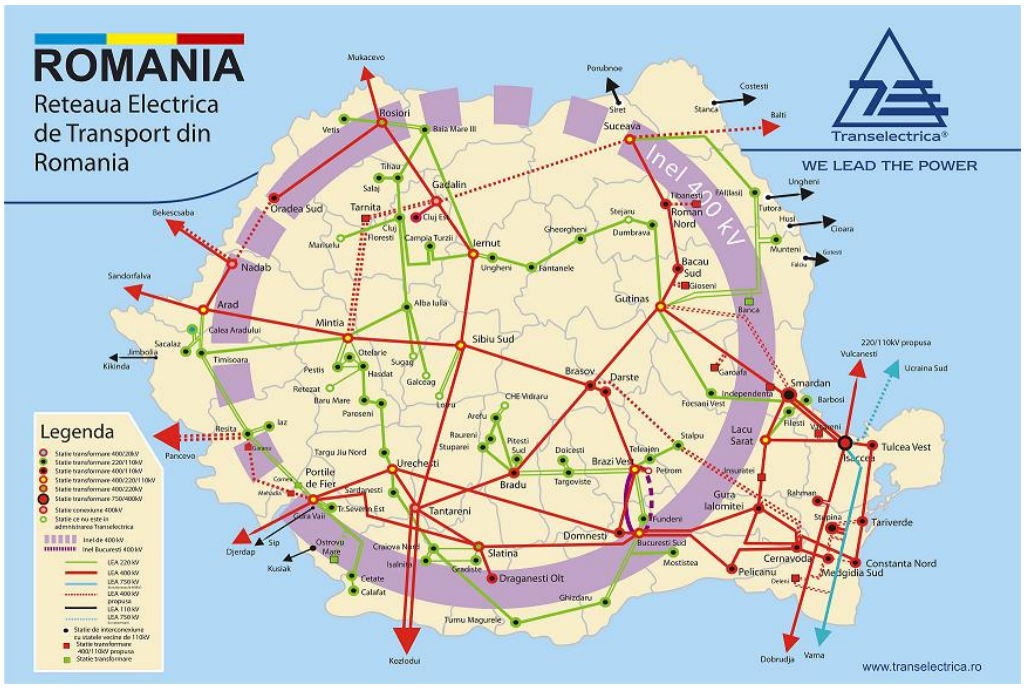
According to the RET Development Plan for the period 2022-2031 the total length of the electricity interconnection lines sums up to 489.04 km in the total grid. The current interconnections are listed in Table 13 and presented on Figure 98.

Table 13. 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 98. Current situation of the electricity transmission grid in Romania



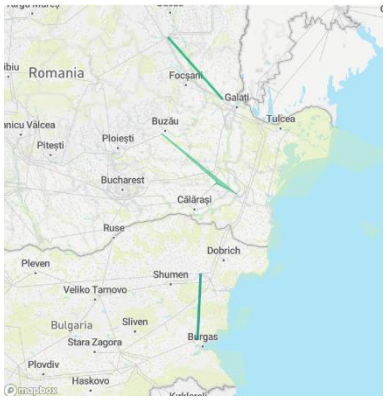
Source: Transelectrica, Transport-detalii - Transelectrica

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)

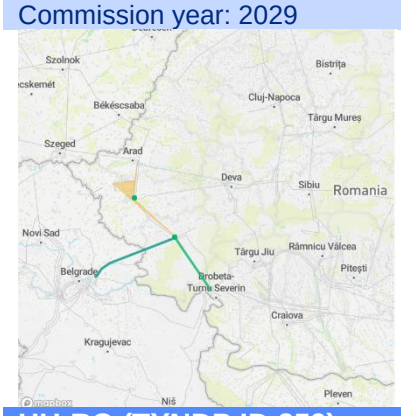
Commission year: 2024



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)

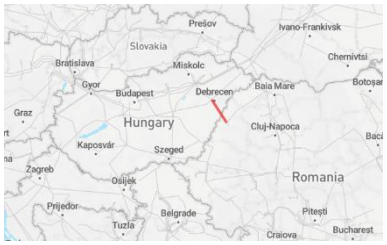
Commission year: 2029



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

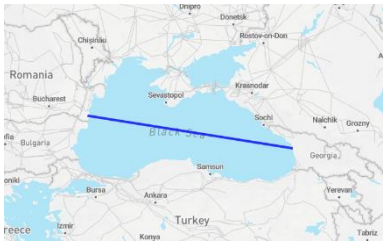
North CSE Corridor (TYNDP ID 341)

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

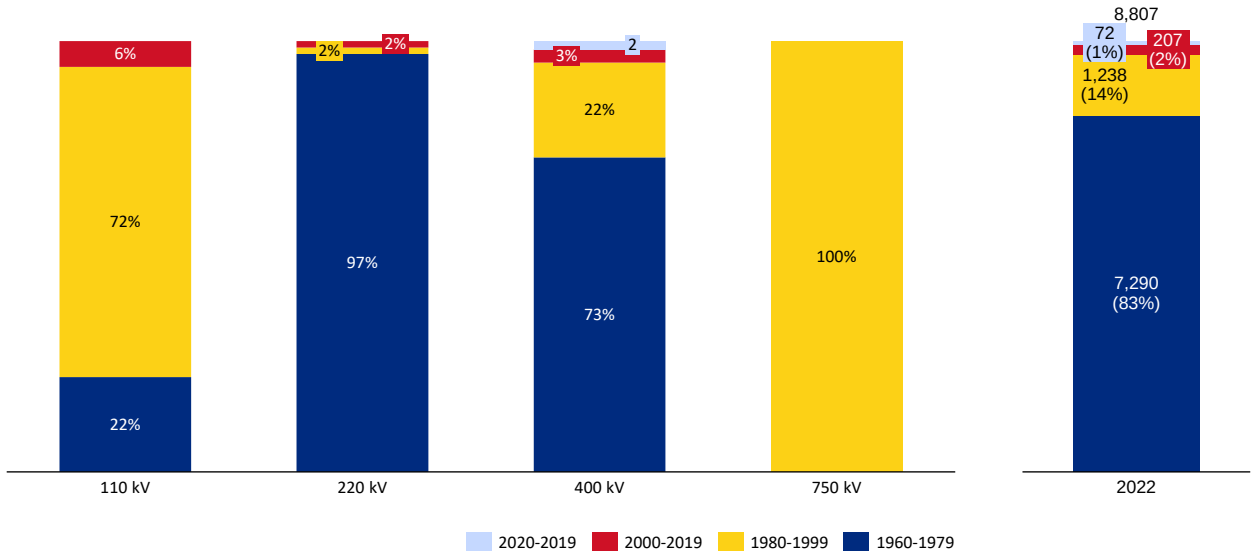
I. Key characteristics of the existing transmission infrastructure for electricity and gas

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 99). Only 3% of the OPL are commissioned 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.

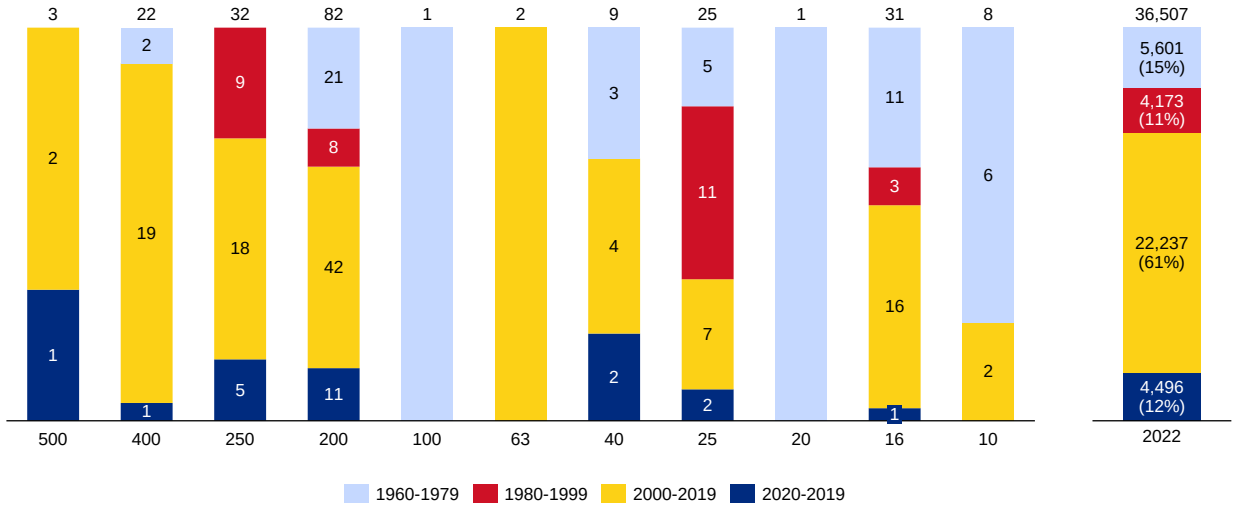
Figure 99. The LEA distribution by voltage levels, length and commissioning periods



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 100). 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 100. The number and installed power in substations (MVA)



Source: ANRE annual report 2022

Natural gas transmission infrastructure

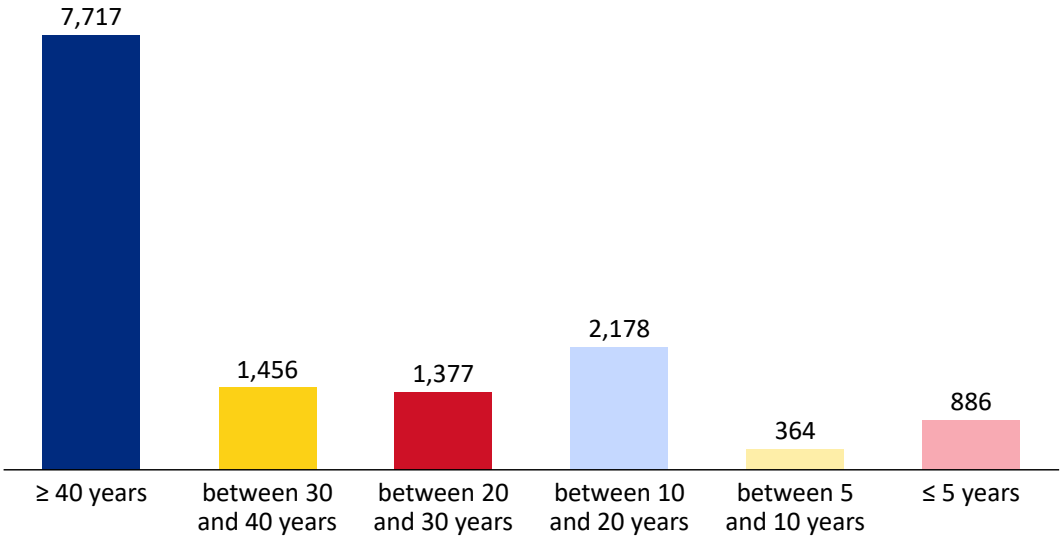
According to the latest version of ANRE annual report (2022), natural gas transmission system is accomplished via main pipelines and supply connections, spanning a total length of 13,978 km. These pipelines have diameters ranging from 25 mm to 1200 mm. Moreover, the associated facilities, equipment, 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 101). The situation with the other components of the transmission network is much better and they are between 10 and 20 years old (Table 14).

Figure 101. Length of the transmission network by year of commission



Source: ANRE annual report 2022

Table 14. 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

Source: ANRE annual report 2022

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 is provided in 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, while in the second half of 2023 the price was 33 lower compared to EU average, similar to the period prior to 2020 (Figure 102). In the same way, the electricity prices for non-household consumers also surpass the EU average in 2022, while in 2023 again become 13% lower than the EU average, as shown in (Figure 103).

Figure 102. Trend in electricity prices for household consumers - bi-annual data Consumption from 2 500 kWh to 4 999 kWh - band DC

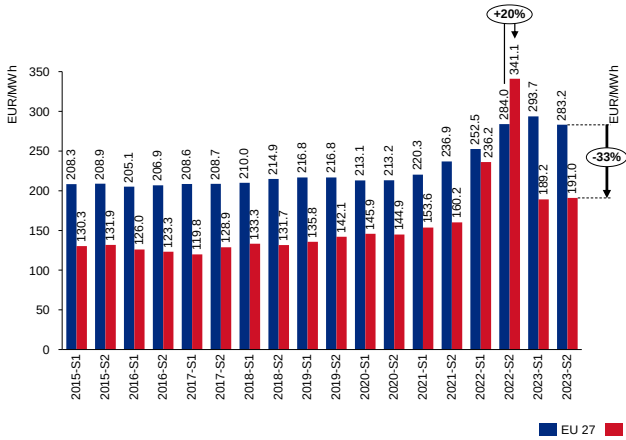
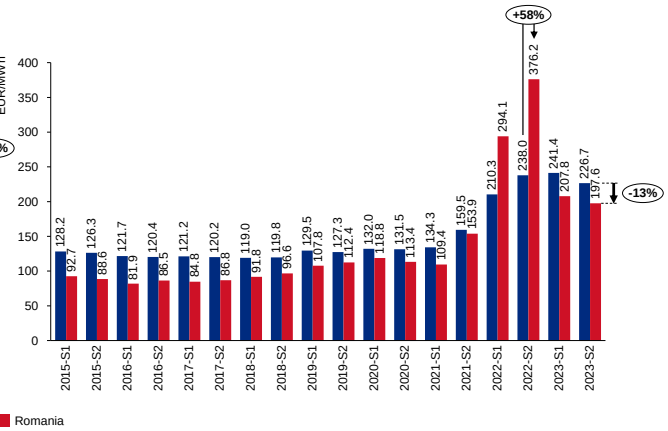


Figure 103. Trend in electricity prices for non-household consumers - bi-annual data Consumption from 2 000 MWh to 19 999 MWh - band ID



Source: EUROSTAT

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 104 and Figure 105). Considering the situation in 2022, as well as in 2023 determined by the price increase on the international electricity and natural gas markets, as well as the effects caused by these increases, it was 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, the Ordinance 27/2022 established: 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.

Figure 104. Trend in natural gas prices for household consumers - bi-annual data 20 GJ to 199 GJ - band D2

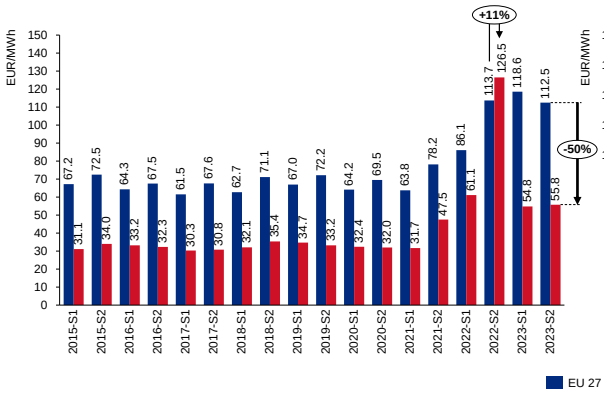
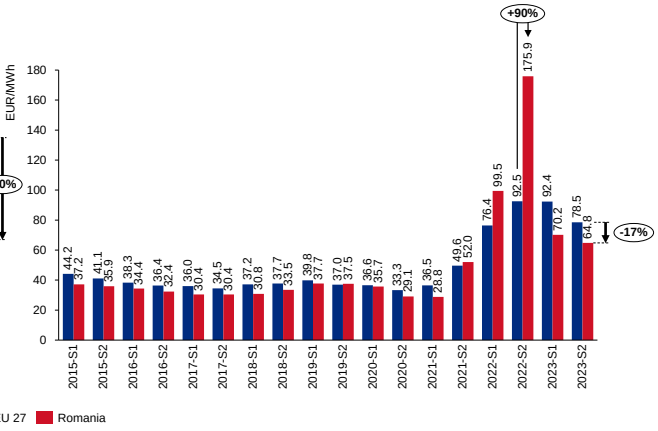


Figure 105. Trend in natural gas prices for non-household consumers - bi-annual data Consumption from 10 000 GJ to 99 999 GJ - band I3



Source: EUROSTAT

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.

To reestablish market-based principles regarding the formation of electricity prices, thus enabling liquidity, transparency and predictability for the electricity market participants, ANRE should periodically evaluate (for example, annually) the process of the phased return to the competitive market that will start on April 1, 2025, the deadline for the application of GEO no. 27/2022 which stipulates capping of final prices on the electricity and natural gas market..

In addition, it is recommended to continue reviewing and revising Article 11 on mandatory quota of gas in stocks from the GEO 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 amended. The main reason for this is to increase liquidity of the gas suppliers. This could be implemented via several measures:

- The Government should periodically (e.g. annually) assess the needs and volumes of gas reserves and based on the results of the assessment to take appropriate measures;

- On one hand, to decrease the percentage of gas reserves imposed to all gas suppliers and on the other hand, to mandate the National Administration for State Reserves and Special Issues to keep certain volumes of gas for the purpose of safeguarding the security of gas supply in the case of an emergency;

- To establish a fair mechanism for sharing the burden of maintaining gas reserves among gas suppliers, public authorities and customers, including financial incentives for compensation to market participants, to meet the filling targets; and

- To consider resuming the Gas Release Program (GRP), which is temporarily suspended, as an instrument to counterbalance the monopoly position of incumbents in the energy sector and to ensure further opening of wholesale markets to competition.

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.[59,60]
- 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 deal involving turbines supply with DTEK Renewable International Moldova Eolian for the Ruginoasa wind project with 600 MW installed.[61]
- Hydropower: Romania has a large 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.[62]
- 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 in 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.
- Carbon capture, transport, use and storage technologies: Due to the history of oil and gas extraction, Romania has a high theoretical potential for carbon storage, and the development of these technologies, together with those of capture, transport and use, are deeply innovative processes that will lead to the creation of new industries.

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 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

[59] Photon Energy connects two new solar power plants to the Romanian grid | Romania Insider (romania-insider.com)
[60] 20 Biggest Solar Projects in Romania - SolarFeeds Magazine
[61] Romania Wind Energy Market Trends (mordorintelligence.com)
[62] https://www.statista.com/statistics/864411/total-hydropower-capacity-in-romania/

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. As for the number of researchers, according to the 2021 Romanian R&D Scorecard[63], 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 several 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.
- 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.

[63]ec.europa.eu/research-and-innovation/sites/default/files/rio/report/PSF_background_report_final_23Nov_2021.pdf

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 ANRE, 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.

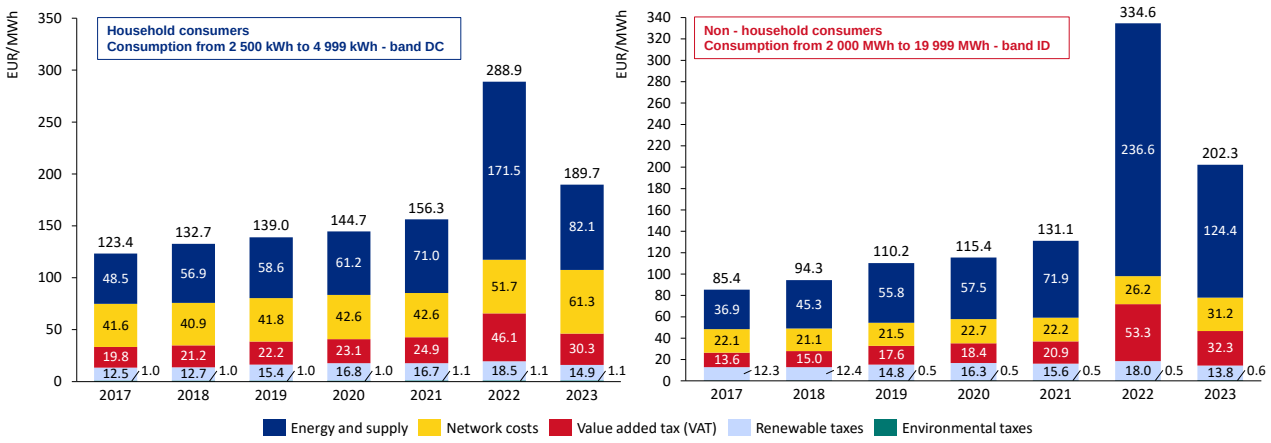
The government is also working to improve the efficiency of the electricity transmission and distribution networks, which will help to reduce the cost of electricity for consumers.

Electricity

Figure 106 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.

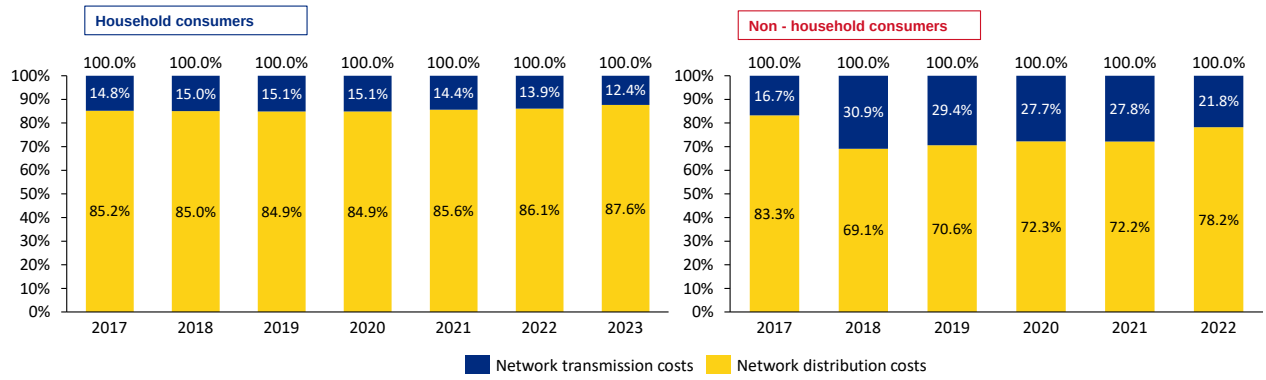
Figure 106. Breakdown electricity prices by components for household and non-household consumers



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 88%, are allocated to the distribution network, as depicted in Figure 108. The remaining 12% to 15% pertain to the transmission network. In the case of non-household consumers, the proportion of transmission network costs increased from around 17% in 2017 to roughly 28% to 31% within the 2018-2021 timeframe and reducing to 22% in 2022. Simultaneously, the share of distribution network costs decreased from 83% in 2017 to about 69% to 72% between 2018 and 2021 and increasing to 78% in 2022.

Figure 107. Share of transmission and distribution in the network costs for electricity



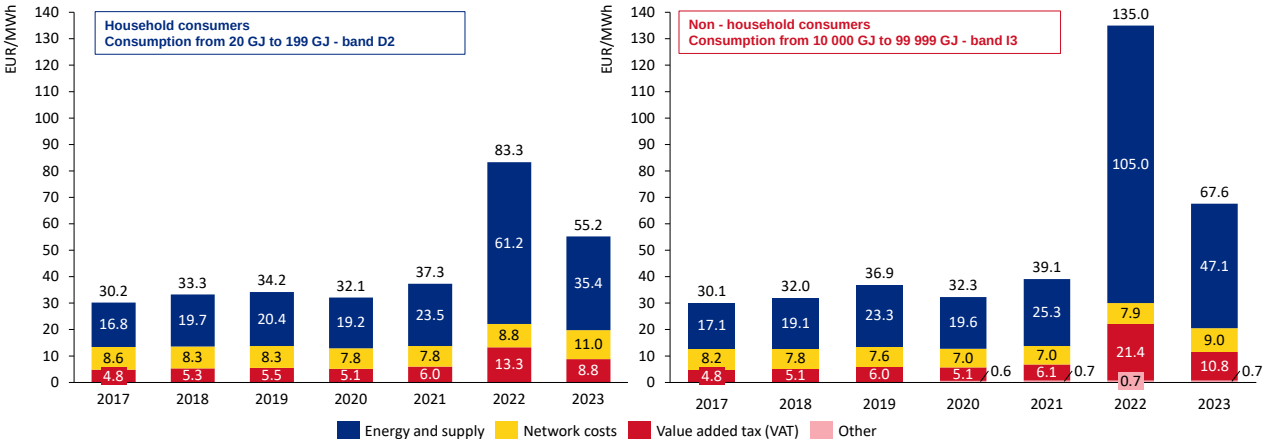
Source: Eurostat (Annual data on electricity prices components for household and non-household consumers)

Note: Data for 2023 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 108) for the period 2017 and 2023. 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.

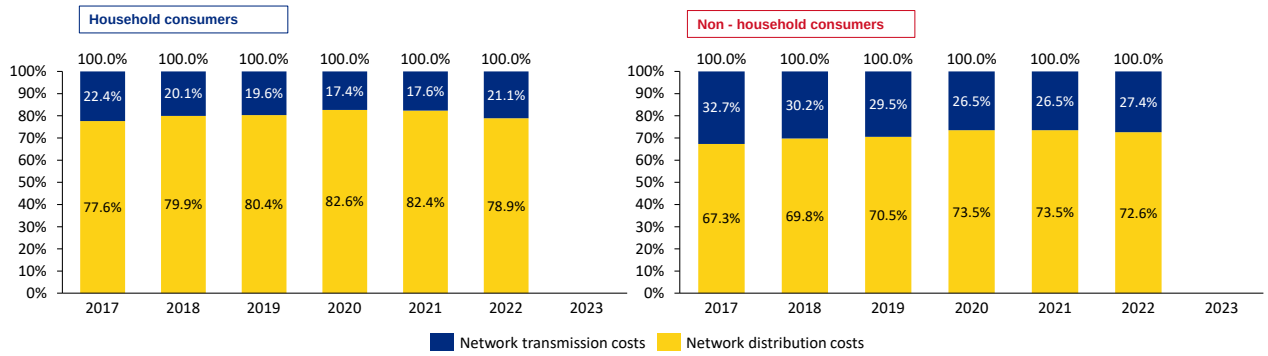
Figure 108. Breakdown of gas prices by components for household and non-household consumers



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 and increased to 21% in 2022, while the distribution network costs varies between 78% and 83%, as illustrated in Figure 109. A comparable trend is evident among non-household consumers, with the share of network transmission costs declining from nearly 33% in 2017 to 26.5% in 2021 and around 27% in 2022, while the share of network distribution costs increased from approximately 67% to 73.5% in the period from 2017 to 2022.

Figure 109. Share of transmission and distribution in the network costs for natural gas



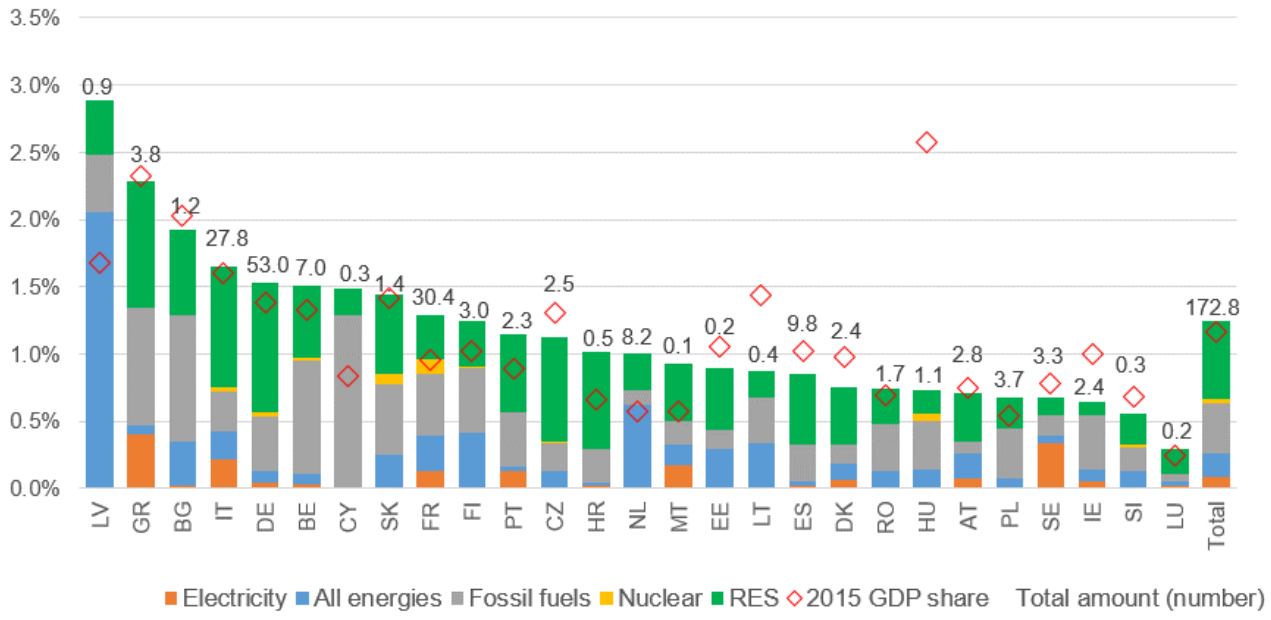
Source: Eurostat (Annual data on electricity prices components for household and non-household consumers)

Note: Data for 2023 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 is for RES.

Figure 110. 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[64]

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;

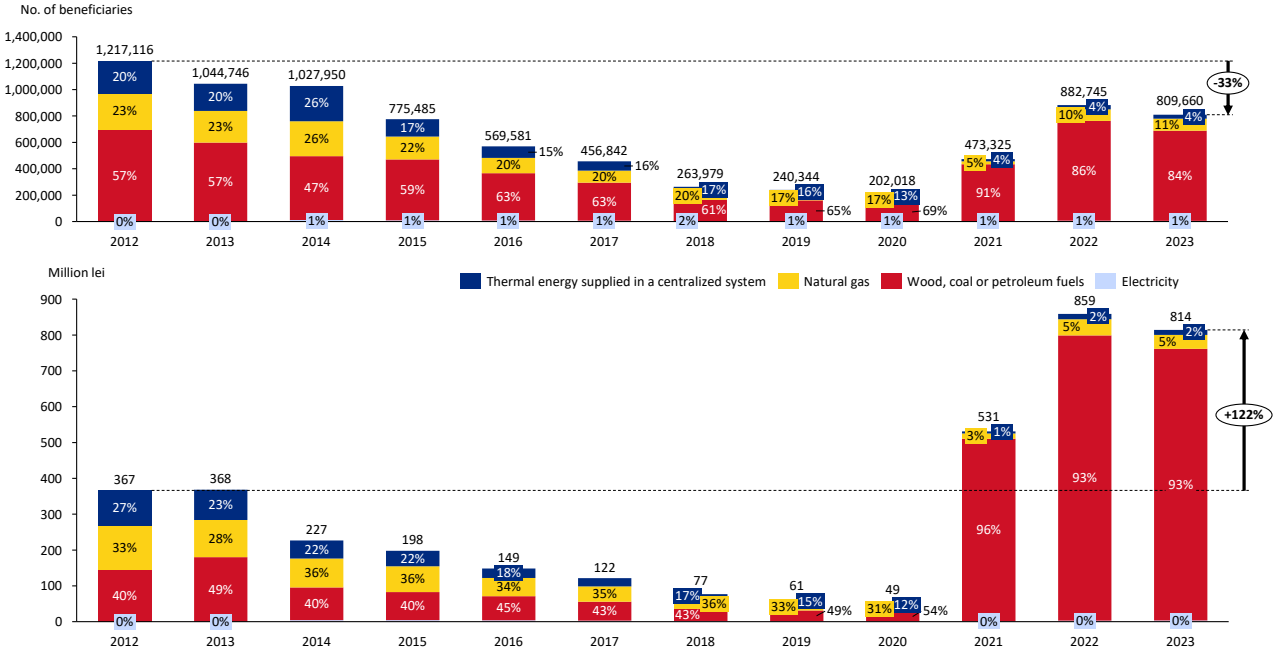
64 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022DC0642#:~:text=Energy%20subsidies%20as%20a%20percentage,most%20Member%20States%20as%20well

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 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 111. 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 111. Number of beneficiaries and funds received as home heating aid



Source: Ministry of Labor and Social Solidarity, Statistical bulletin on Social Assistance

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 14% (Figure 112). However, by implementing additional measures the difference between the scenarios is more than 100% after 2045. 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 6% in 2030 and 41% in 2050.

Figure 112. Difference between net GHG emissions in WEM and WAM scenario (including LULUCF)

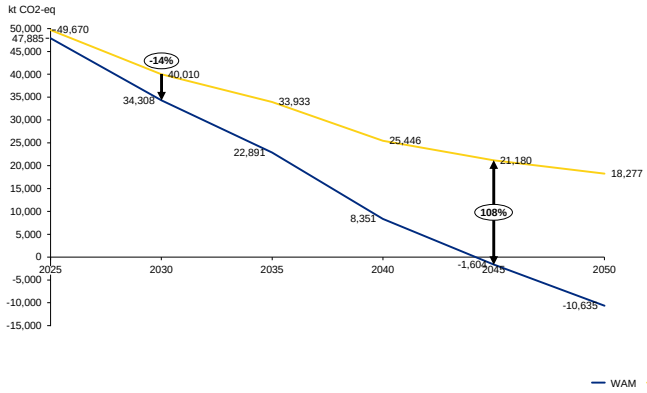
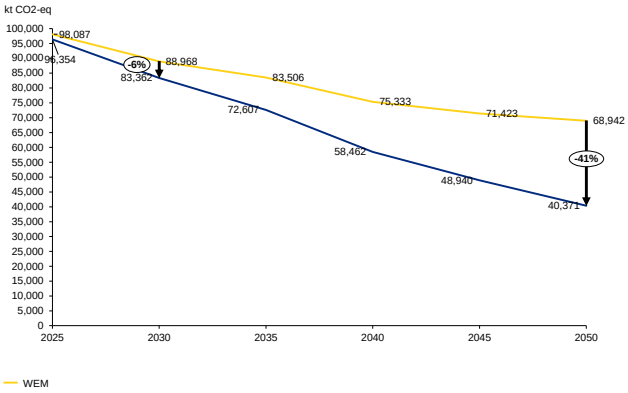


Figure 113. Difference between GHG emissions in WEM and WAM scenario (excluding LULUCF)

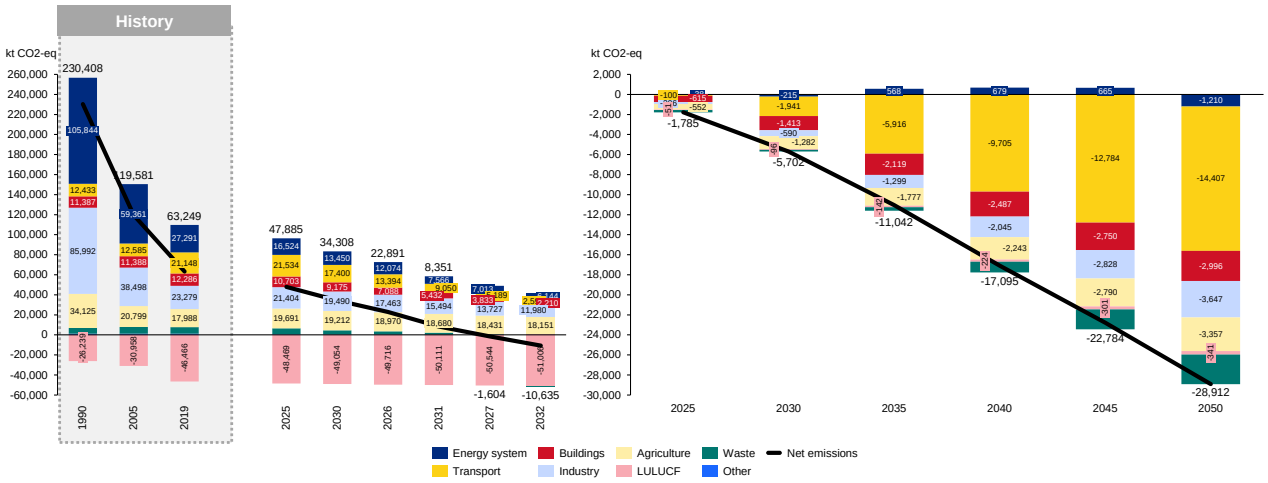


Source: LEAP-RO model

Additional measures in the Transport sector must be implemented in order to achieve this more ambitious goal, as defined in the WAM scenario (Figure 127 and Figure 128). Furthermore, the Industry sector has also a significant role in the additional emission mitigation, followed by measures implemented in the Agriculture, Buildings and Waste.

Figure 114. GHG emissions and removals (and net-emissions) by sectors in WAM

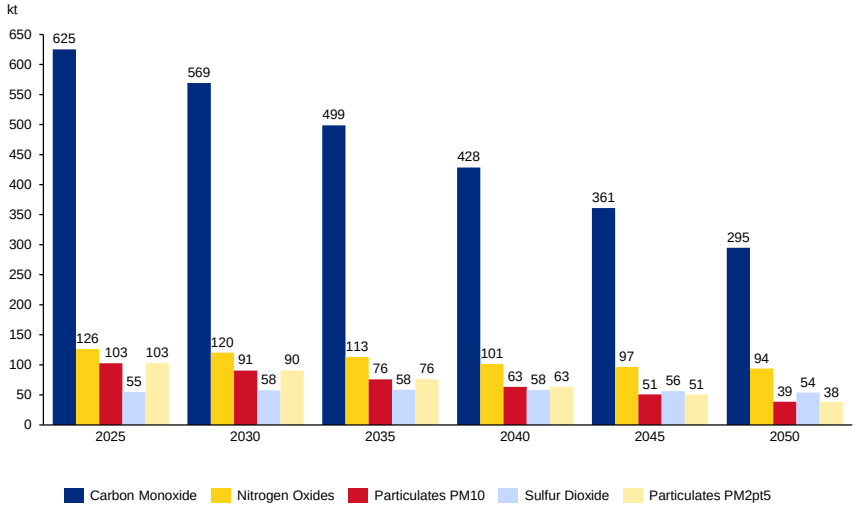
Figure 115. Difference between GHG emissions in WEM and WAM scenario by sectors



Source: 1990, 2005 and 2022 GHG Inventory (March 2024), 2025-2050 LEAP-RO model

Figure 116 illustrates the projected levels of local pollution by various gases from 2025 to 2050. In 2030, the levels of key pollutants such as carbon monoxide and nitrogen oxides are expected to be reduced to 569 kt and 120 kt respectively, indicating a downward trend. By 2050, the levels continue to decline with carbon monoxide projected to decrease to 295 kt and nitrogen oxides to 94 kt, highlighting a sustained reduction in pollution over the 25-year period.

Figure 116. Local pollution by gasses in WAM



Source: LEAP-RO

If the LULUCF sector is taken into account, the GHG intensity varies by 14% in 2030 and 157% 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 117). Similarly, the difference in the GHG intensity in both scenarios is 6% in 2030 and 41% in 2050 if the LULUCF sector is not included (Figure 118).

Figure 117. Difference between the GHG intensity in WEM and WAM scenario (including LULUCF)

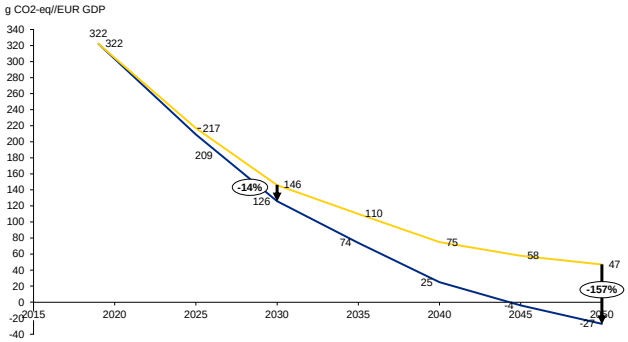
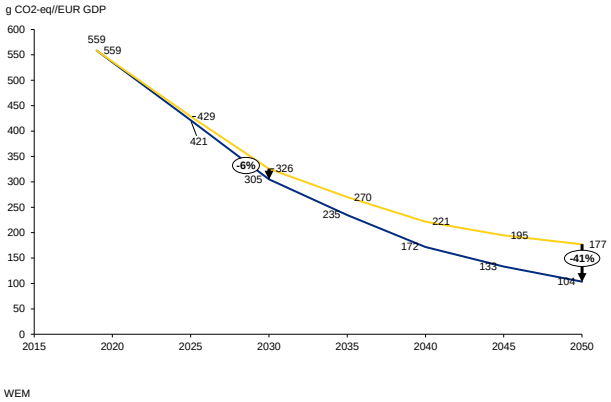


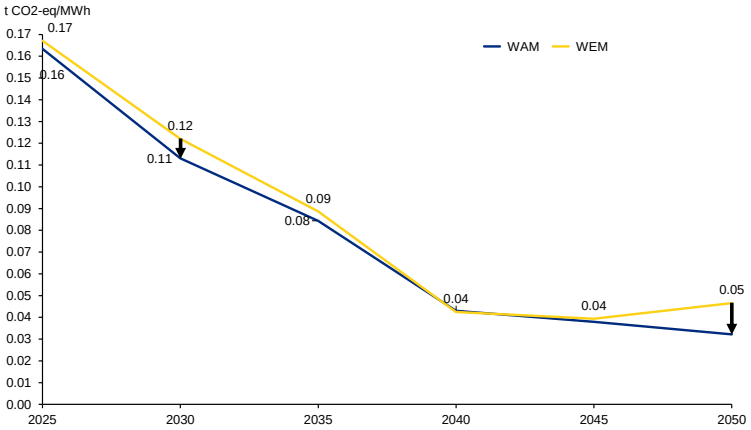
Figure 118. Difference between the GHG intensity in WEM and WAM scenario (excluding LULUCF)



Source: 2022 GHG Inventory (March 2024), 2025-2050 LEAP-RO model

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 119). However, these differences are minimal in 2030, as well as in 2050, when this sector is close to be decarbonized in both scenarios.

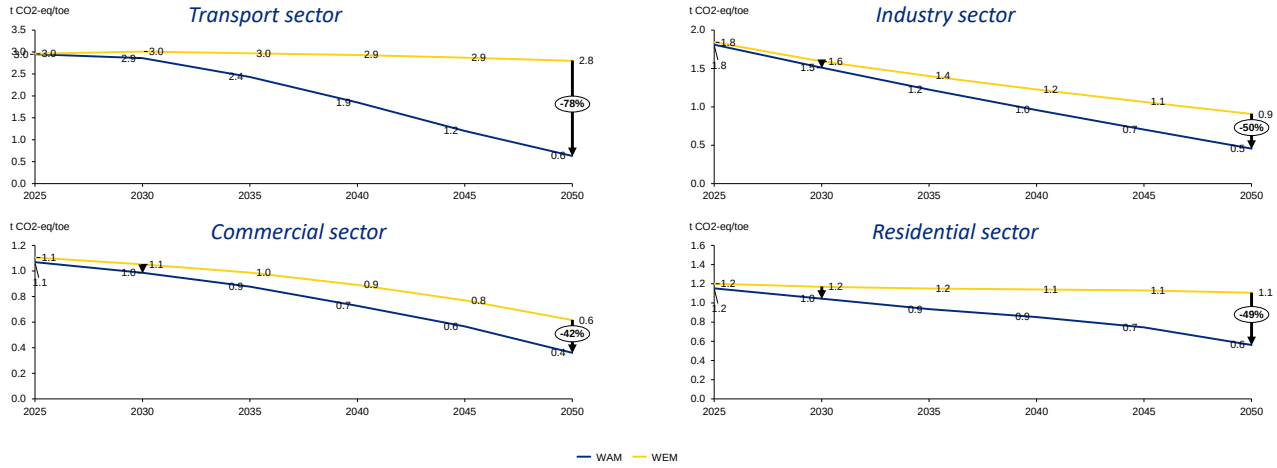
Figure 119. Difference between GHG intensity of domestic power and heat generation



Source: 2025-2050 LEAP-RO model

In line with the previous discussion, the Transport sector has the biggest difference in terms of GHG intensity, with an increase of 78% in 2050, which means that much more drastic measures are implemented in the WAM scenario in order to decarbonize this sector (Figure 120). Following behind are the sectors: industry, with a difference of 50% in 2050; residential, with a difference of 49%; and commercial, with a difference of 42%. However, it should be emphasized once more that the differences in 2030 are minimal for all of the sectors.

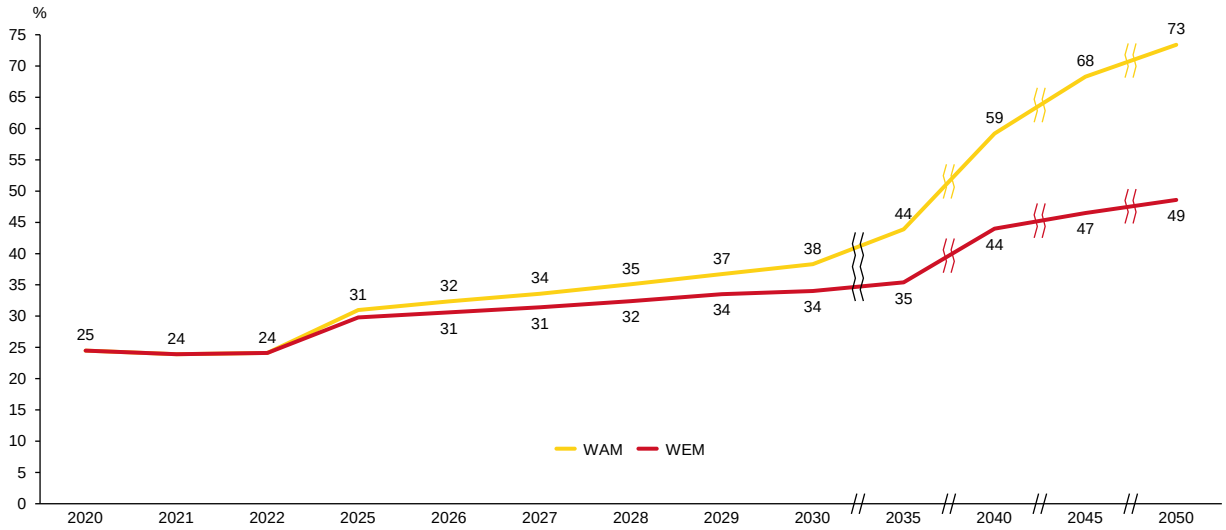
Figure 120. Difference between GHG intensity by sectors



Source: 2025-2050 LEAP-RO model

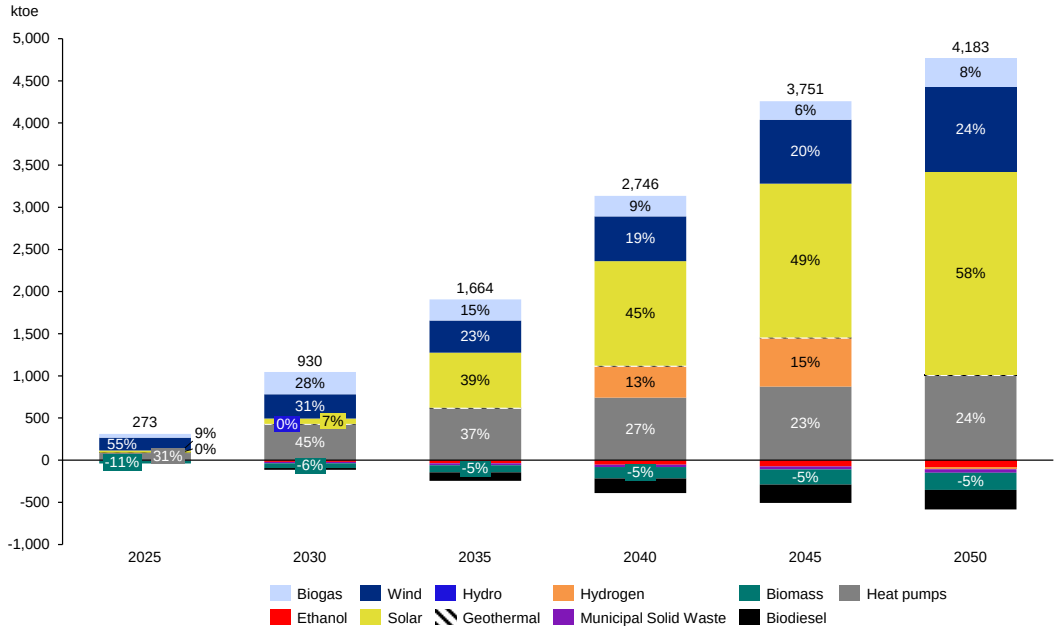
Regarding the RES share in the gross final energy consumption, the WEM and WAM scenarios differ slightly in 2030, varying from 34% in WEM scenarios to 38% in WAM scenario (Figure 121). However, the difference in 2050 is much higher. In the scenario with existing measures, the RES share will reach 49% in 2050, while with additional measures it will reach 73%. Generally, this difference, as show in Figure 122, 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 121. RES share in gross final energy consumption – Comparison between WAM and WEM scenarios



Source: 2022 SHARE tool EUROSTAT, 2025-2050 LEAP-RO model
Note: In the above graph, one considers that, starting from 2036, all natural gas plants will switch to use at least 50% of renewable and/or low-carbon gaseous fuels (including green gases) which will lead to additional "RES" capacities and GHG emission level reduction (starting from 2036, by natural gas one means natural gas, biomethane and renewable hydrogen). If the share of renewable and/or low-carbon gaseous fuels (including green gases) is increased to 100% starting from 2036, the share of RES in the gross final energy consumption, in WAM scenario, will be almost 82% in 2050.

Figure 122. RES energy consumption – difference between WAM and WEM scenarios



Source: LEAP-RO model

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 for electricity generation.

Figure 123 RES share in gross final electricity consumption – Comparison between WAM and WEM scenarios

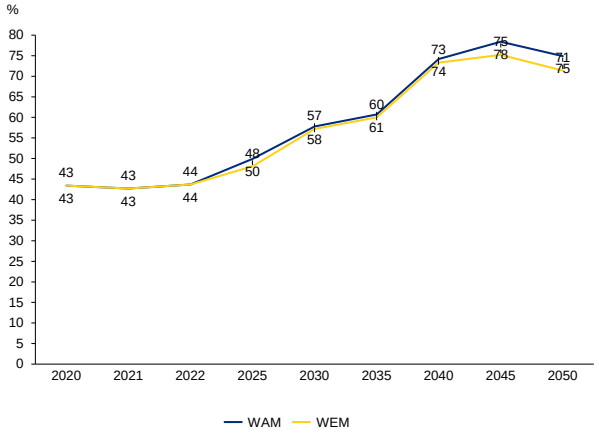
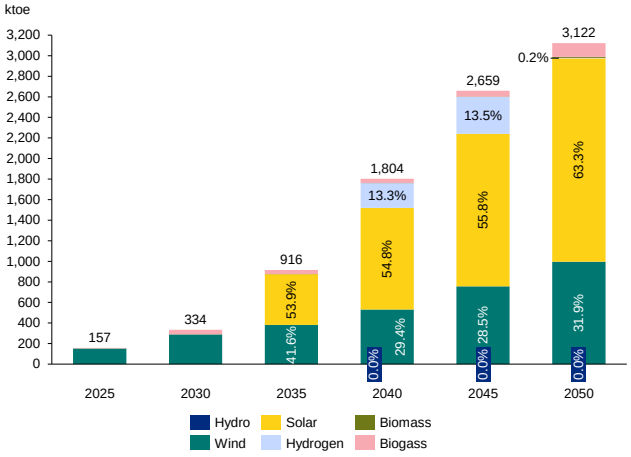


Figure 124. RES electricity – difference between WAM and WEM scenarios



Source: LEAP-RO model

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 125 and Figure 126). 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. It is projected that the hydrogen will be utilized in the industry sector and it will be produced by RES electricity in Romania. By implementing these additional measures, the RES share in this sector can be increased from 34% to 41% in 2030, or from 46% to 78% in 2050.

Figure 125. RES share in gross final consumption in H&C sector – Comparison between WAM and WEM scenarios

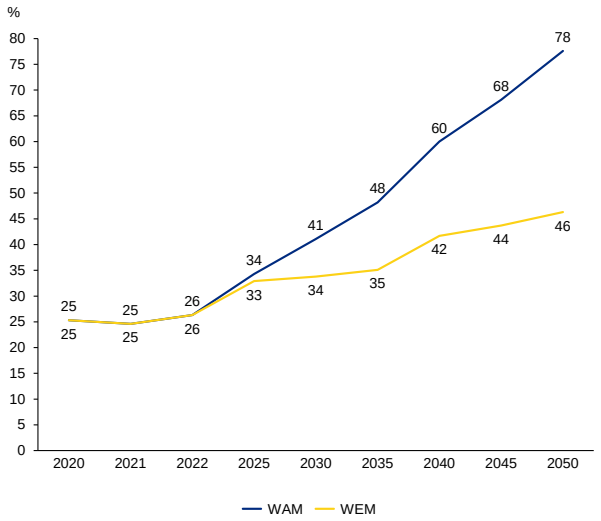
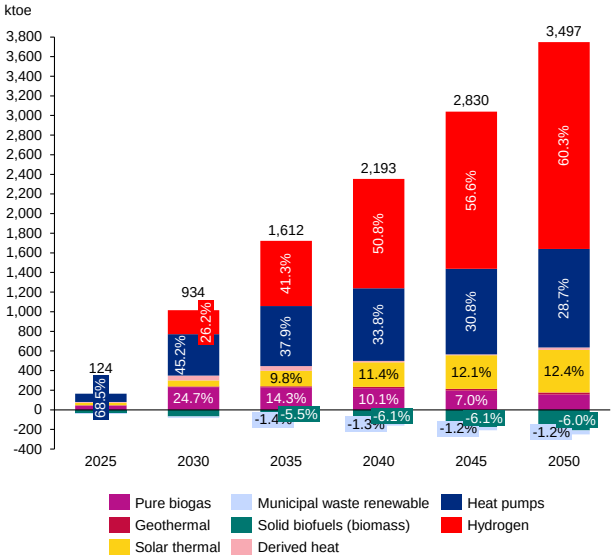


Figure 126. RES energy consumption in H&C sector – difference between WAM and WEM scenarios



Source: LEAP-RO model

The situation for the RES share in the transport sector for 2030 is similar in both scenarios. i.e., it is 24% in the WEM scenario and 29% in the WAM scenario (Figure 127 and Figure 128). 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 92% in 2050 in the WAM scenario.

Figure 127. RES share in final consumption in transport sector – Comparison between WAM and WEM scenarios

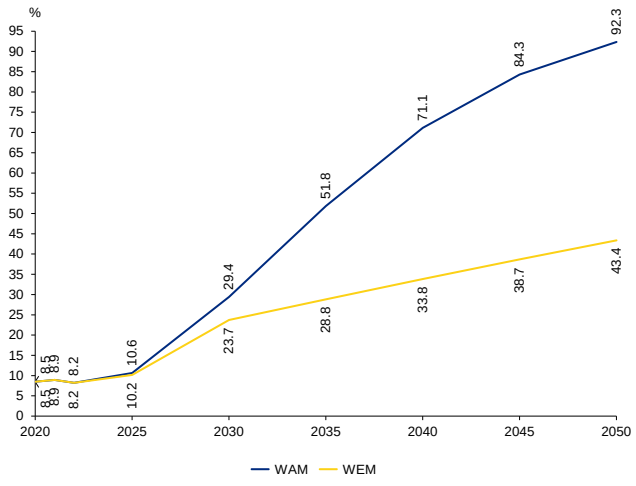
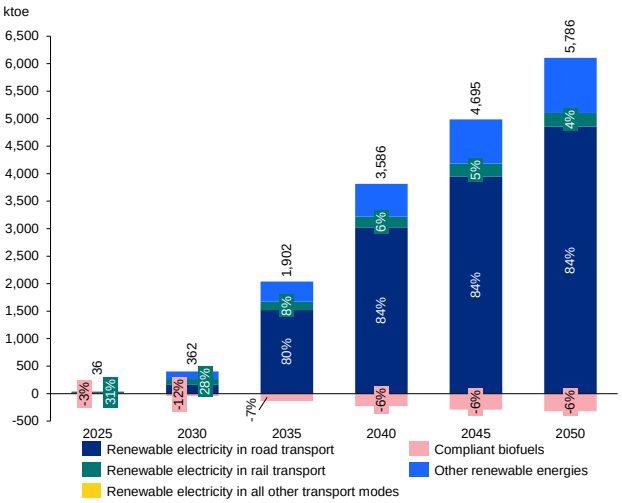


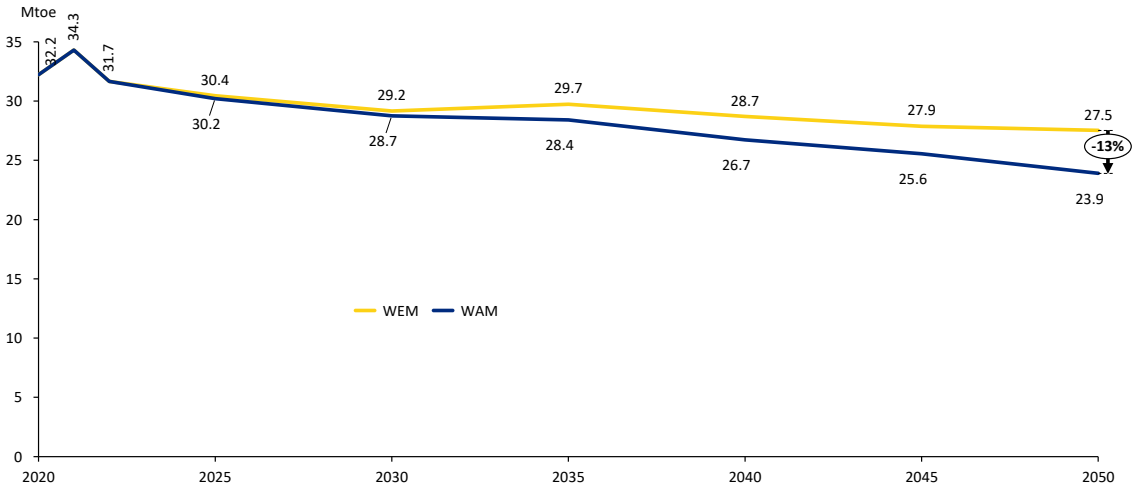
Figure 128. RES energy consumption in transport sector – difference between WAM and WEM scenarios



Source: LEAP-RO model

There is a difference of 13% in the primary energy consumption between both scenarios, as the consumption by fuels is very different (Figure 129, Figure 130 and Figure 131). 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 129. Primary Energy Consumption – Comparison between WEM and WAM scenarios



Source: 2010, 2015 and 2020 Energy balance EUROSTAT, 2025-2050 LEAP-RO model

Figure 130. Primary energy consumption by fuels – WAM scenario

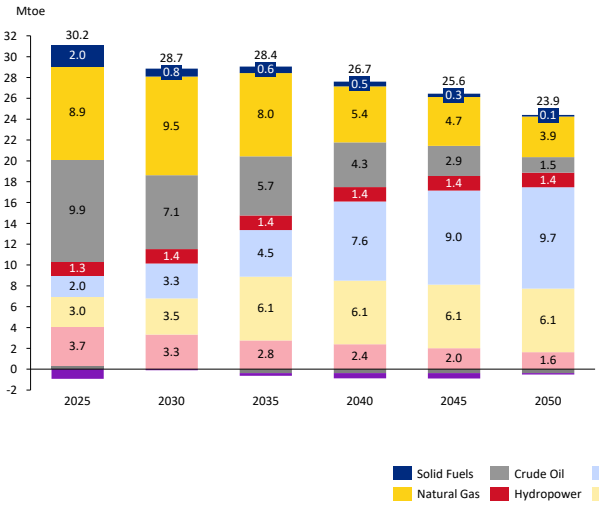
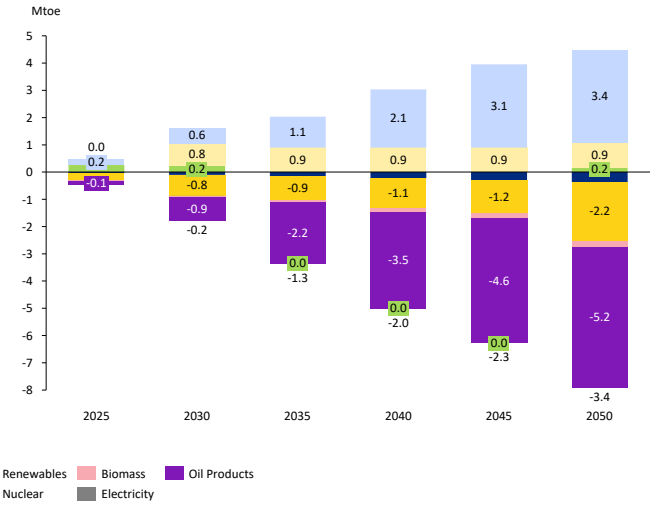


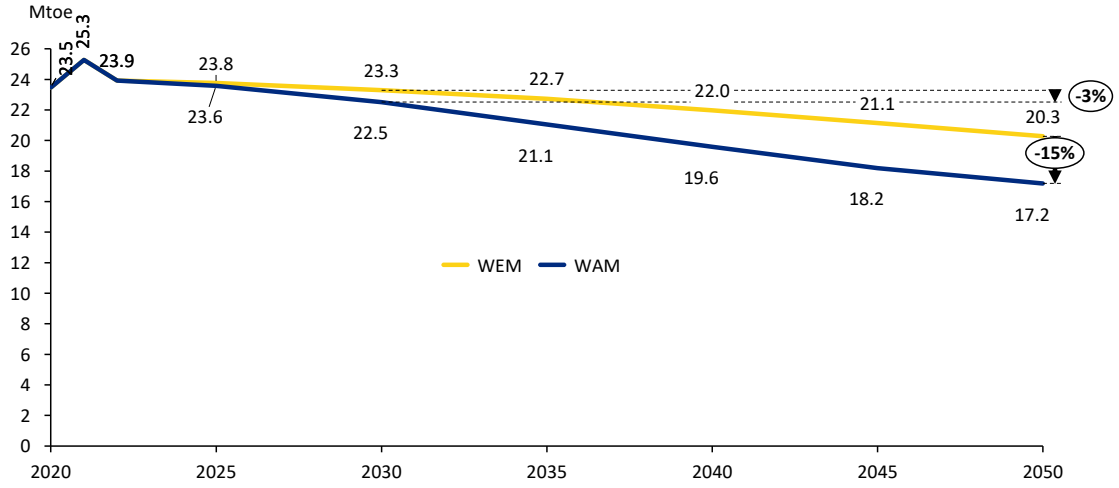
Figure 131. Difference in Primary energy consumption by fuels –between WEM and WAM scenarios



Source: LEAP-RO model

The total difference in the final energy consumption in both scenarios reaches 15% in 2050, while in 2030 it is only 3% (Figure 132). 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 133 and Figure 134).

Figure 132. Final Energy Consumption – Comparison between WEM and WAM scenarios



Source: 2010, 2015 and 2020 Energy balance EUROSTAT, 2025-2050 LEAP-RO model

Figure 133. Final energy consumption by fuels –WAM scenario

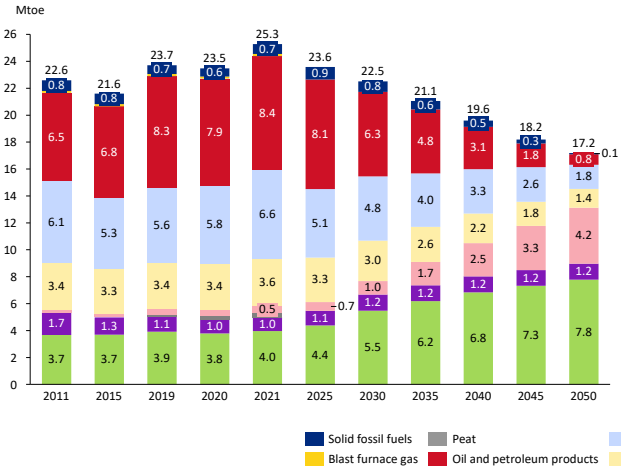
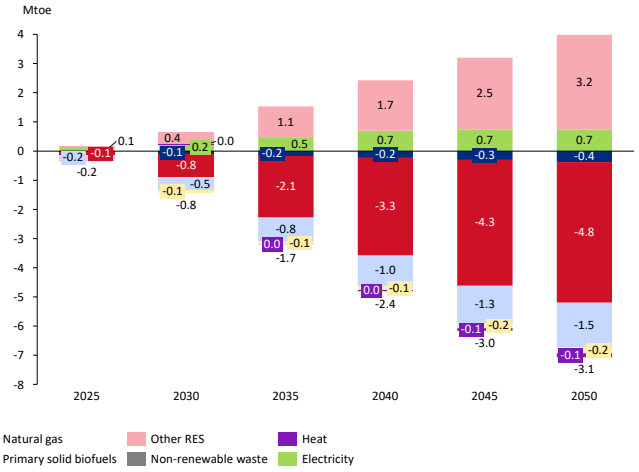


Figure 134. Difference in Final energy consumption by fuels –between WEM and WAM scenarios

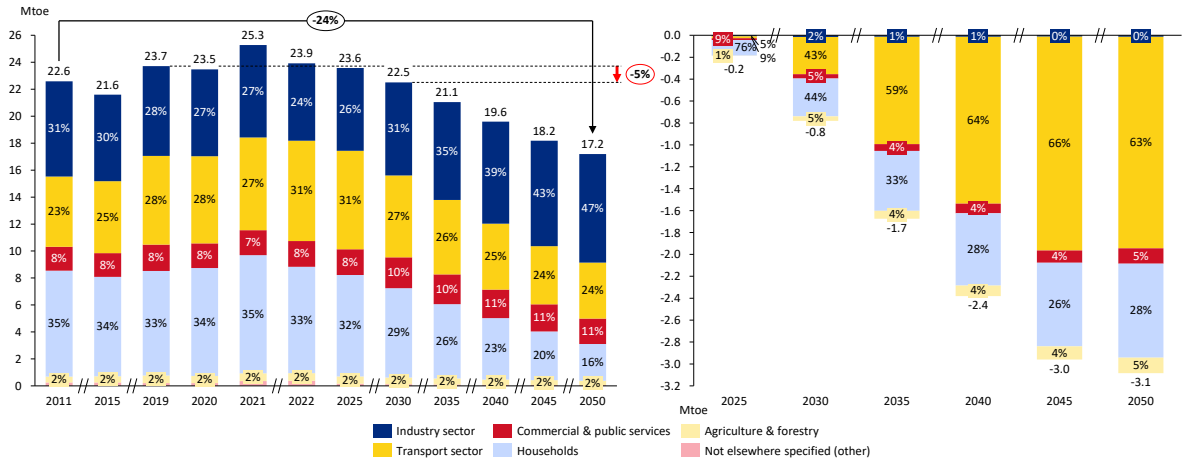


Source: 2011, 2015, 2019 - 2021 Energy balance EUROSTAT, 2025-2050 LEAP-RO model

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 135 and Figure 136). 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 28%. The difference in the other sectors is not so high, which means that in both scenarios the most efficient technologies are assumed.

Figure 135. Final energy consumption by sectors – WAM scenario

Figure 136. Difference in Final energy consumption by sectors–between WEM and WAM scenarios

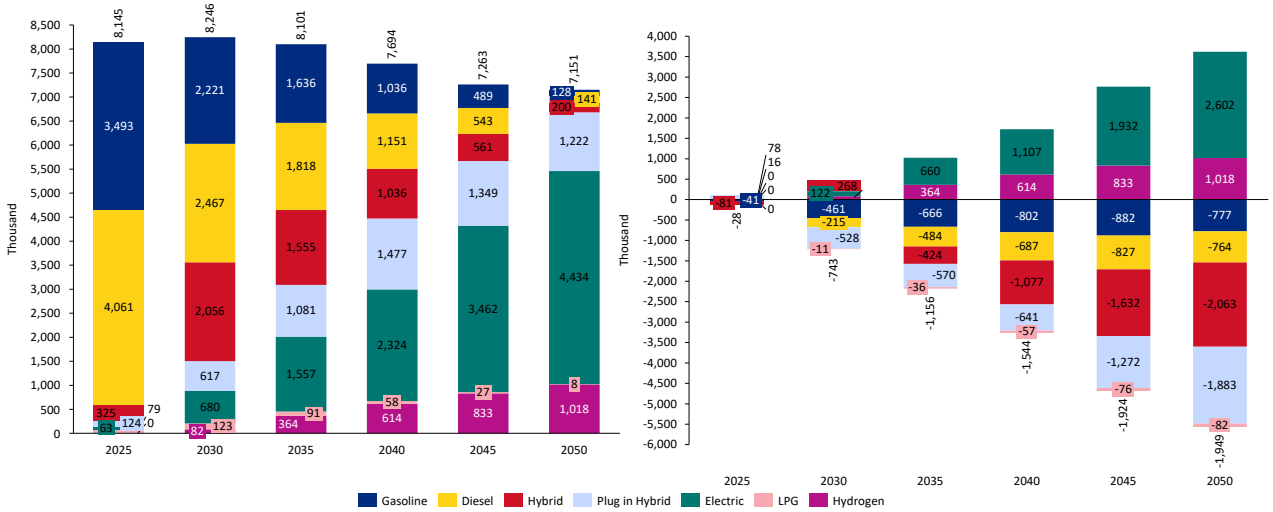


Source: 2011, 2015, 2019 - 2022 Energy balance EUROSTAT, 2025-2050 LEAP-RO model

The reduction in final energy consumption, particularly in the transport and residential sectors, is due to transport electrification and increased use of heat pumps in homes. In the WAM scenario, the number of passenger cars is expected to decrease by 2050 compared to 2023 levels (Figure 137), largely due to a shift from cars to buses and rail. Compared to the WEM scenario, Figure 138 shows a significant decline in gasoline and diesel use by 2050, each dropping by nearly 780 thousand units. Meanwhile, electric vehicles are projected to increase by over 2.6 million units, and hydrogen vehicles by more than 1 million units by 2050. Hybrid vehicles initially rise until 2030, then sharply decline, while plug-in hybrids steadily decrease after 2025.

Figure 137. Number of passenger cars–WAM scenario

Figure 138. Difference in number of passenger cars – between WEM and WAM scenarios



The situation is similar for HGVs. Compared to the WEM scenarios, the key point from Figure 139 and Figure 140 is the significant decline in diesel and gasoline use, with diesel dropping by over 781 thousand units and gasoline by 97 thousand units by 2050. In contrast, hydrogen and electricity use rise significantly, indicating a major shift toward cleaner energy sources in the coming decades.

Figure 139. Number of HGV–WAM scenario

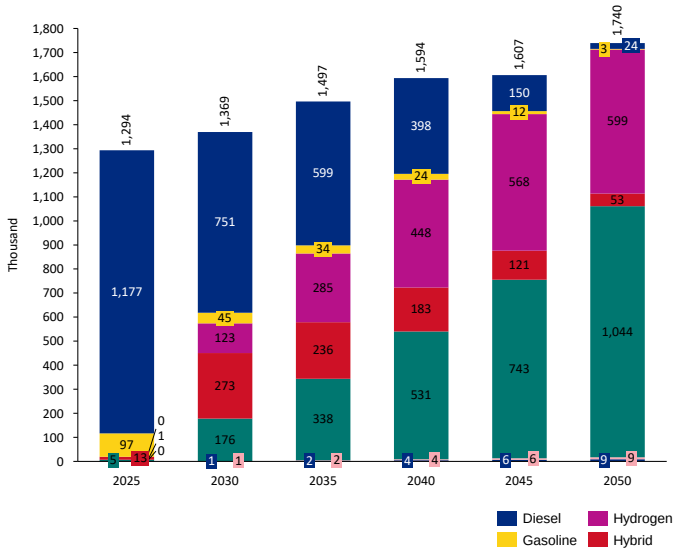
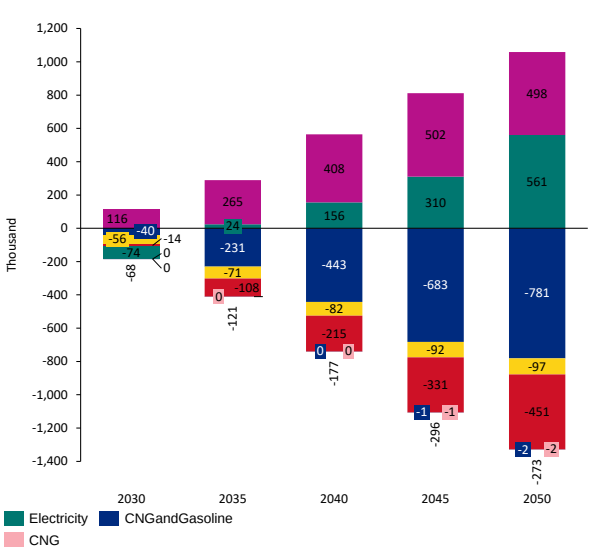
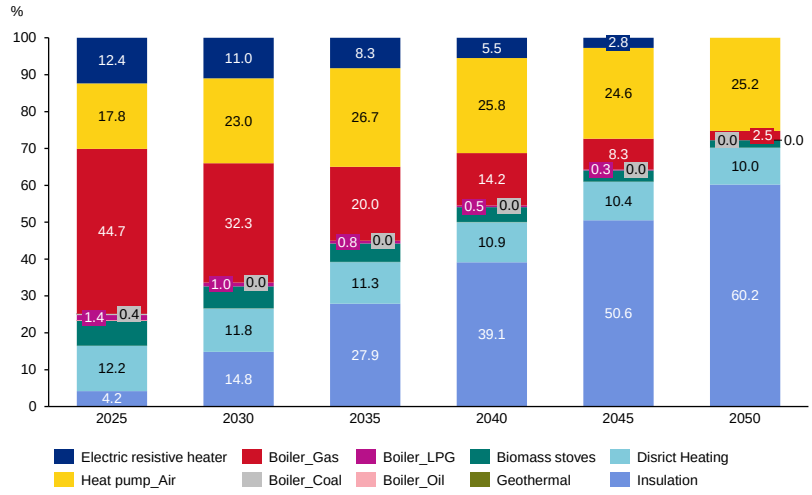


Figure 140. Difference in number of HGV –between WEM and WAM scenario



In the residential sector by 2050, traditional gas boilers in residential heating are projected to decline significantly from 45% to just 2.5%, while electric resistive heaters will phase out completely. Air heat pumps are expected to become a dominant technology, maintaining a high level of adoption at around 25% (Figure 141).

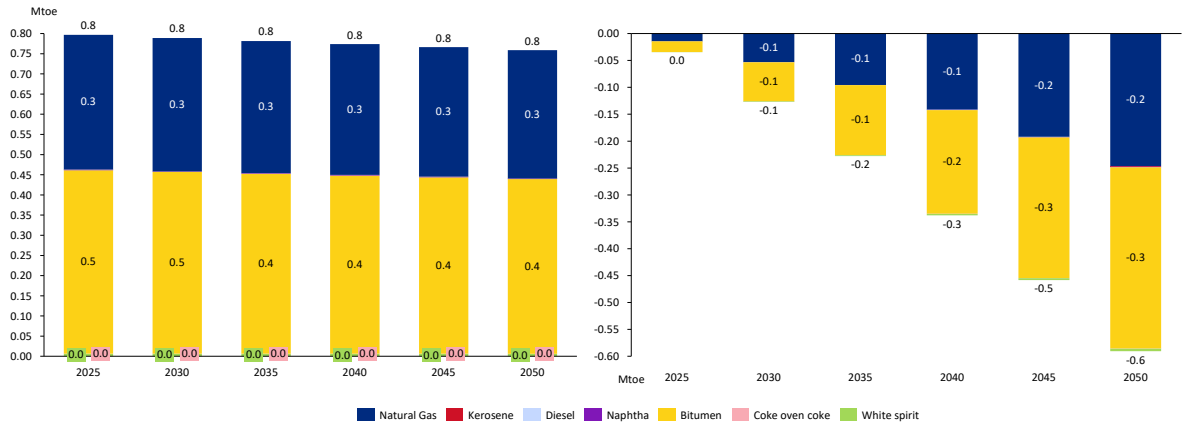
Figure 141. Share of space heating technologies in residential sector (urban) up to 2050



The highest share in the final non-energy consumption in both scenarios have the bitumen and the natural gas (Figure 142 and Figure 143). However, their consumption in the WEM scenario is more than double, when compared to the WAM scenario.

Figure 142. Final non-energy consumption by fuels – WAM scenario

Figure 143. Difference in Final non-energy consumption by fuels – between WEM and WAM scenarios

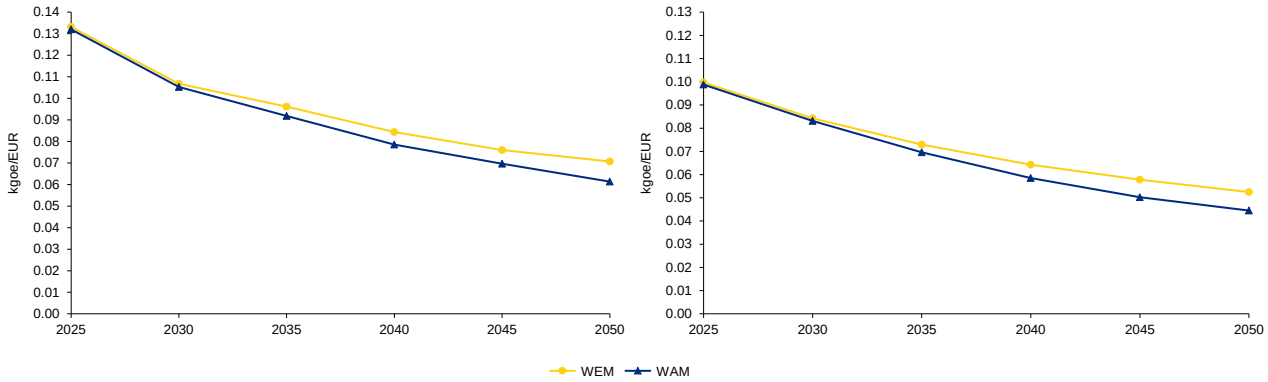


Source: LEAP-RO model

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 144 and Figure 145).

Figure 144: **Primary energy intensity of the overall economy**

Figure 145. **Final energy intensity of the overall economy**



Source: LEAP-RO model

As a results of the measures in WAM scenario, between 2025 and 2050, Romania's domestic fuel production is expected to see significant changes, particularly in the shift from fossil fuels to renewable energy sources. Solid fossil fuels are projected to be phased out entirely by 2050, while crude oil production is expected to decrease from 2.7 Mtoe in 2025 to 1.5 Mtoe by 2050 (Figure 146). In contrast, renewable energy sources like wind, solar photovoltaic, and nuclear heat are set to increase substantially, with solar photovoltaic rising from 0.5 Mtoe in 2025 to 4.2 Mtoe by 2050, and nuclear heat maintaining a steady production of 6.1 Mtoe from 2035 onwards. Busting renewables in WAM scenario will increase the domestic production by around 4 Mtoe in 2050 compared to WEM scenario (Figure 147).

Figure 146: **Domestic production by fuels – WAM scenario**

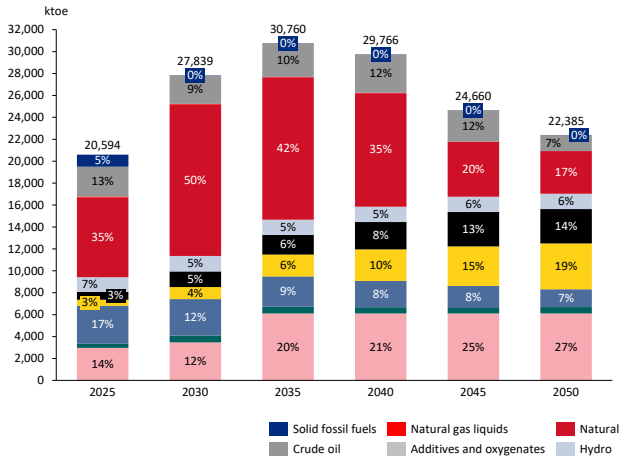
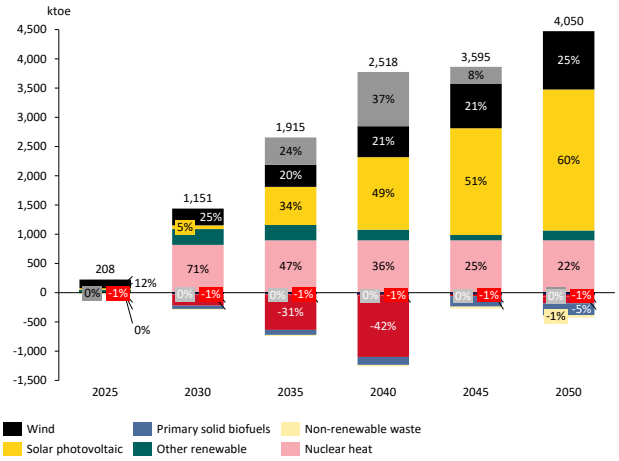


Figure 147. **Difference in domestic production by fuels – between WEM and WAM scenarios**



In WAM scenario, Romania's net energy import is projected to change significantly between 2022 and 2050, with the total imports decreasing drastically from 10,269 ktoe in 2022 to a negative value of -3,064.4 ktoe by 2040. As in the case of WEM scenario, natural gas imports are expected to turn negative by 2030, while crude oil imports will also see a sharp decline, dropping to just 22 million units by 2045 (Figure 148). Compare to WEM scenario net import in WAM scenario is projected to 7.6 Mtoe lower import (Figure 149).

Figure 148: **Net import by fuels – WAM scenario**

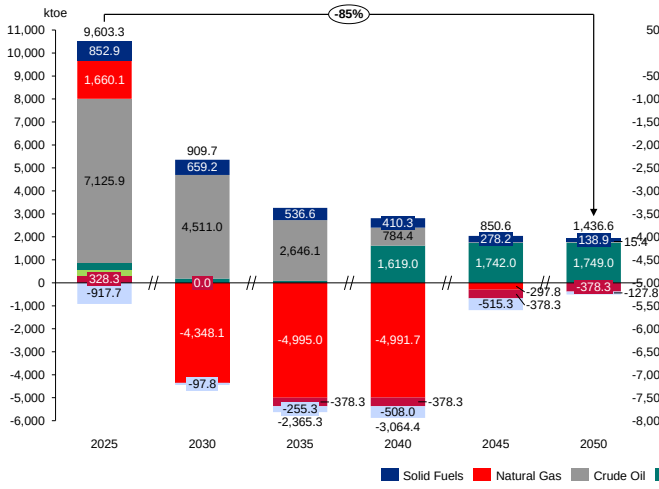
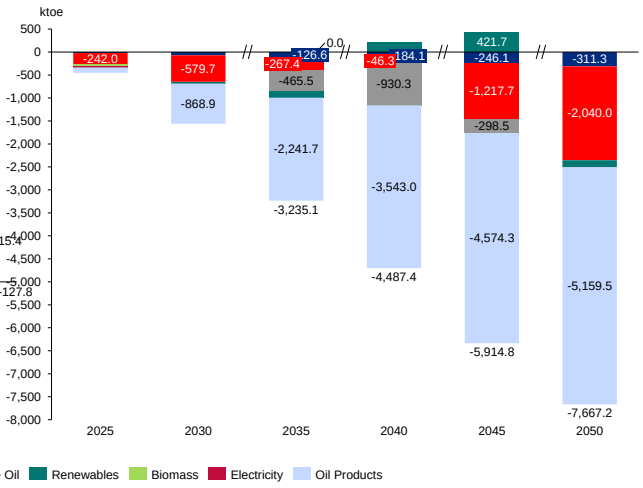


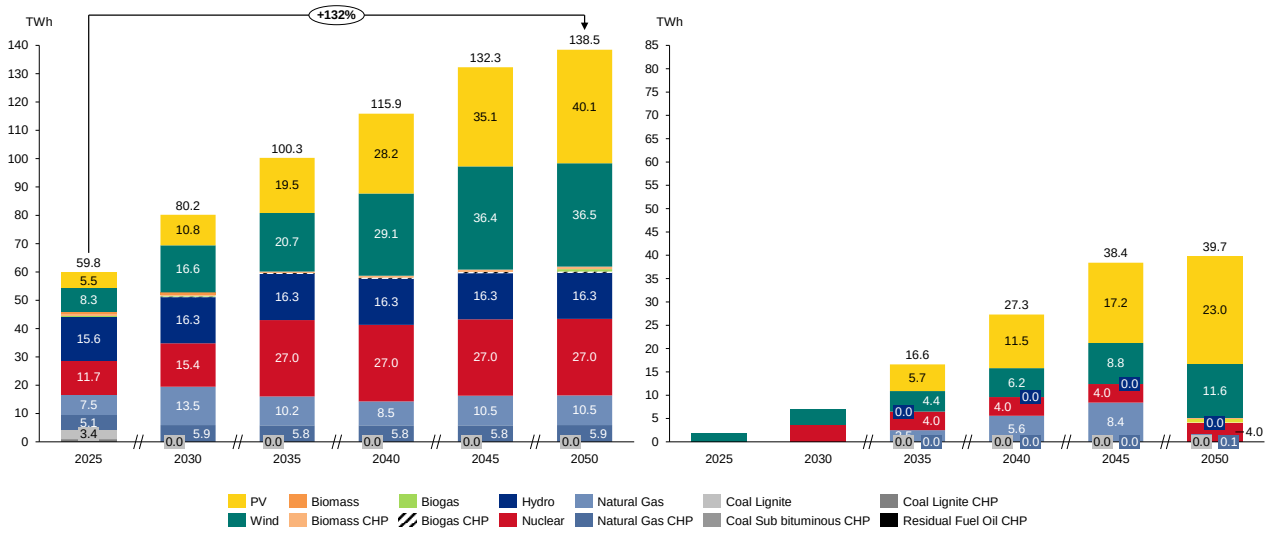
Figure 149. **Difference in net import by fuels – between WEM and WAM scenarios**



As also discussed previously, the higher rate of electrification of all sectors in the WAM scenario, contributes to increased electricity generation (Figure 150 and Figure 151). This additional electricity in the WAM scenario is mainly produced from renewable sources (PV and wind), but additional support from nuclear power plants, is also needed in order to reach the required level of electrification. (Figure 152 and Figure 153). 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 150: **Electricity generation by technology – WAM scenario**

Figure 151. Difference in **Electricity generation by technology – between WEM and WAM scenarios**

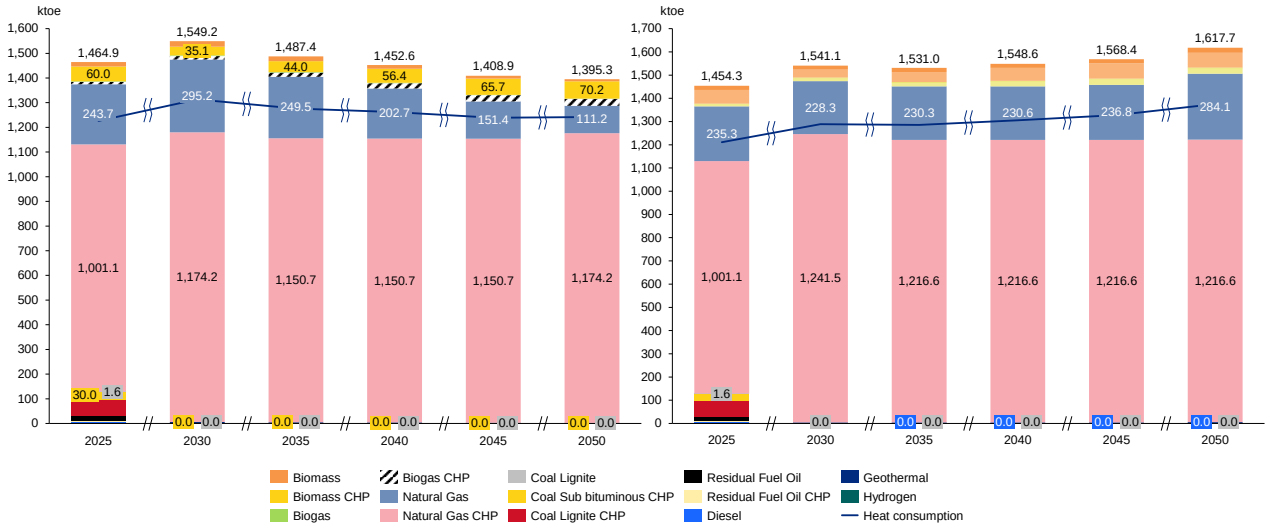


Source: LEAP_RO model

Note: Starting from 2036, all natural gas plants will switch to use at least 50% of renewable and/or low-carbon gaseous fuels (including green gases) which will lead to additional "RES" capacities and GHG emission level reduction. In the above graphs, after 2035, by natural gas one means natural gas, biomethane and renewable hydrogen.

Figure 152: **Heat generation by technology and consumption – WAM scenario**

Figure 153. **Heat generation by technology and consumption – WEM scenario**



Source: LEAP-RO model

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 132 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 15 provides an overview of how each policy or measure contributes to the various dimensions.

Table 15. Interactions between the policies and measures

	Decarbonizatio	Efficiency	Security	Internal	R&I&C
PAM 1 Phasing out coal TPP	√				
PAM 2 Introduction of renewable hydrogen into the energy system	√				√
PAM 3 Hydrogen production	√				√
PAM 4 Development of new CCGT capacities	√		√		
PAM 5 Promotion of high-efficiency cogeneration capacities	√		√		
PAM 6 Employing carbon capture, utilization and storage (CCUS) technologies	√			√	√
PAM 7 Implementation of the Kigali amendment in the Product uses as substitutes of ODS	√				√
PAM 8 Improvement and efficiency in the industrial processes	√			√	√
PAM 9 Setting a national obligation for CO2 injecting and storing for the oil & gas industry	√			√	√
PAM 10 Reduction of emissions from enteric fermentation	√				√
PAM 11 Improving agricultural residues management	√	√			√
PAM 12 Reduction of methane emission level from manure management and biogas production	√	√			√
PAM 13 Increasing the agrisolar production	√	√			√
PAM 14 Establishing integrated management of forest fires	√				
PAM 15 PV systems in agriculture for irrigation	√	√			√
PAM 16 Renewal of the agricultural machinery and equipment	√	√			
PAM 17 Reduction of municipal waste per capita	√				
PAM 18 Increased recycling and biodegradable waste selection for composting	√				
PAM 19 Optimization of incineration / co-incineration processes	√	√			√
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 Construction/completion of hydropower facilities	√		√		
PAM 25 Pump storage	√		√		
PAM 26 Rooftop PV	√	√	√		
PAM 27 Installation of solar thermal collectors in the residential sector	√	√	√		
PAM 28 Facilitate the establishment of energy communities					
PAM 29 Increase of the domestic generation capacity from biomass and biogas CHP and PP	√	√	√		
PAM 30 Biogas and biomethane	√	√	√		
PAM 31 Development of the advanced biofuels market	√	√	√		√

PAM 32 Biofuels in aviation and marine transport	√	√			
PAM 33 RFNBO	√	√	√		√
PAM 34 Development of the use of biomass, bioliquids and biogas within the EU-ETS installations based on energy-intensive thermal processes	√	√	√		√
PAM 35 Improve energy performance of public buildings at central level	√	√			
PAM 36 Improve energy performance of public buildings at local level	√	√			
PAM 37 Renovation of residential buildings	√	√			
PAM 38 Renovation of commercial buildings	√	√			
PAM 39 Rehabilitation of public lighting	√	√			
PAM 40 Development of energy services/market, ESCO		√		√	
PAM 41 Green procurement	√	√		√	
PAM 42 Energy audit and energy management	√	√		√	
PAM 43 Increased share of heat pumps	√	√			
PAM 44 Increased use of efficient technologies in the residential sector	√	√			
PAM 45 Replacement of conventional fuels with RES in manufacturing industries	√	√			√
PAM 46 Increase technology efficiency in the industrial sector	√	√			√
PAM 47 Increased share of alternative fueled cars	√	√			
PAM 48 Increased share of alternative fueled buses	√	√			
PAM 49 Modernization of urban public transport	√	√			
PAM 50 Development of the underground transport infrastructure	√	√			
PAM 51 Increased share of alternative fueled trucks	√	√			
PAM 52 Modernization of naval transport	√	√			
PAM 53 Modernization of air transport	√	√			
PAM 54 Modernization and renewal of railway transport	√	√			
PAM 55 Railway rolling stock	√	√			
PAM 56 Alternative mobility	√	√			
PAM 57 Increasing the energy efficiency for the buildings in the transport sector	√	√			
PAM 58 Modernization of road transport infrastructure	√	√			
PAM 59 Support for the expansion and modernization of the electricity distribution network	√	√	√		
PAM 60 Increased use of nuclear energy	√	√	√	√	√
PAM 61 Black Sea Corridor (ENTSO-E TYNDP ID 138)	√		√	√	
PAM 62 Mid-Continental East corridor (ENTSO-E TYNDP ID 144)	√		√	√	
PAM 63 HU-RO (ENTSO-E TYNDP ID 259)	√		√	√	
PAM 64 North CSE Corridor (ENTSO-E TYNDP ID 341)	√		√	√	
PAM 65 Georgia-Romania Black Sea interconnection cable project (ENTSO-E TYNDP ID 1105)	√		√	√	
PAM 66 Increasing the interconnectivity between the Eastern regions of Romania and the rest of SEN	√		√	√	
PAM 67 Integrating the output generated by powerplants in the South and the South-West of Romania	√		√	√	
PAM 68 400kV OHL Suceava-Bălți	√		√	√	
PAM 69 Refurbishment and modernization of the existing substations	√		√	√	
PAM 70 Refurbishment and development of the underground natural gas storage depot Depomureș - Târgu Mureș			√	√	
PAM 71 Increasing the daily extraction capacity in the underground gas storage system (SISG) Bilciurești			√	√	

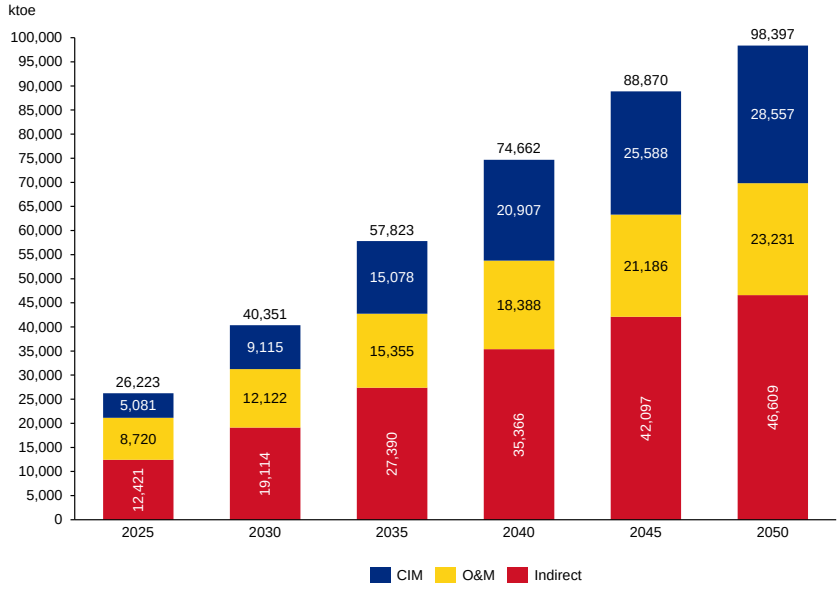
PAM 72 Modernization of the natural gas storage system infrastructure - Bălăceanca			√	√	
PAM 73 Increasing the underground natural gas storage capacity of the Ghercești deposit			√	√	
PAM 74 Increasing the underground natural gas storage capacity at the Sărmasel deposit (Transylvania)			√	√	
PAM 75 New underground natural gas storage facility Fălticeni (Moldova)			√	√	
PAM 76 Modernization of natural gas infrastructure for enabling the transport of hydrogen	√		√	√	
PAM 77 Creation of new infrastructure for the transport of hydrogen	√		√	√	
PAM 78 Increasing the transmission capacity of SNT and security in natural gas supply	√		√	√	
PAM 79 Increasing the transport capacity of SNT and ensuring the security of natural gas supply throughout the region.	√		√	√	
PAM 80 LNG terminal located on the shores of the Black Sea, interconnection of the SNT to the LNG terminal and the development of the natural gas transport pipeline on Romanian territory for taking over natural gas from the Black Sea shore			√	√	
PAM 81 Development on the Romanian territory of SNT on the Bulgaria-Romania-Hungary-Austria Corridor (BRUA) – Phase II and Phase III			√	√	
PAM 82 Development/Modernization of the natural gas transmission infrastructure and interconnections			√	√	
PAM 83 Development of SMG in order to achieve bidirectional flow on the T2 and T3 pipelines			√	√	
PAM 84 Rehabilitation, modernization and expansion of SNT	√		√	√	
PAM 85 Electric energy storage capacities	√		√	√	
PAM 86 Creating an enabling environment for production and trading of green gases.	√		√	√	
PAM 87 Development and use of a fully-fledged national social assistance IT system				√	
PAM 88 Ensuring the implementation of the just transition process				√	
PAM 89 Ensure the access of energy consumers to diversified, sustainable and accessible sources of energy for lighting, heating and cooling	√	√			
PAM 90 Develop one stop shops	√	√			
PAM 91 Coordinated interministerial committee regarding protecting vulnerable consumers and addressing energy poverty	√	√			

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, almost 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 154). 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 154. Number of green jobs



Source: Project team analysis

Figure 155 illustrate the social cost associated with primary energy consumption, while Figure 156 highlights the differences in these costs between the WEM and WAM scenarios, emphasizing the potential benefits of implementing further energy policies.

Figure 155: **Social cost primary energy**

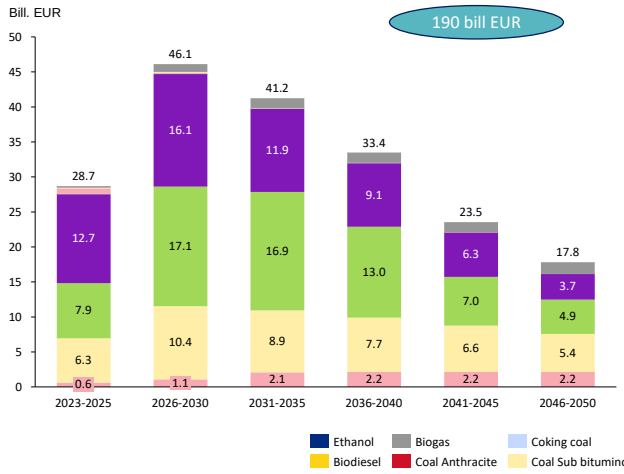
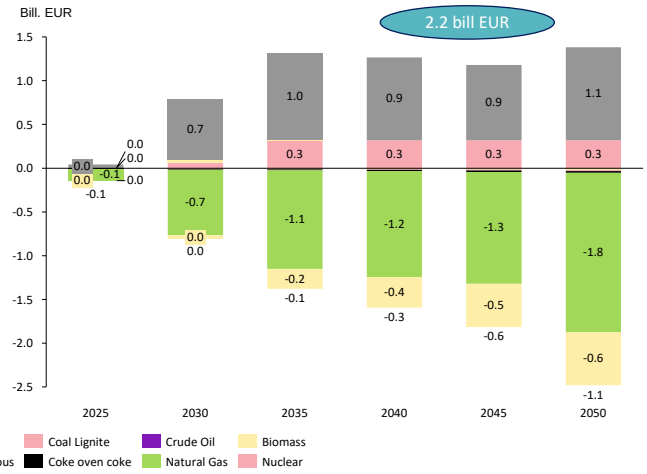


Figure 156. **Difference in social costs primary energy – WEM and WAM scenarios**

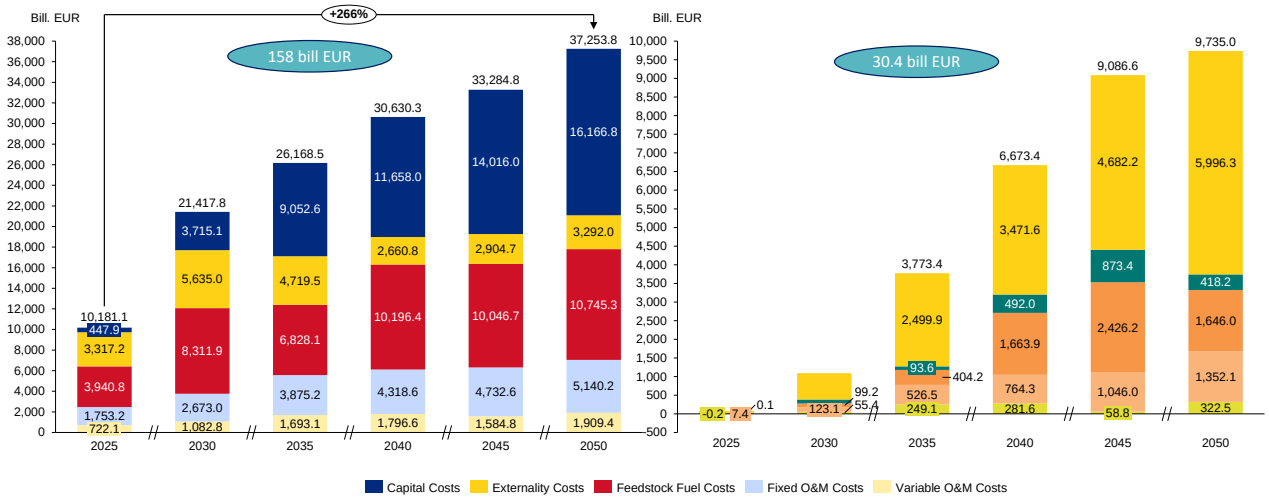


Source: LEAP-RO

Figure 157and Figure 158 provide a detailed breakdown of electricity production costs. Figure 157 focuses specifically on the WAM scenario, while Figure 158 compares the disaggregated costs between the WEM and WAM scenarios, highlighting the financial impact of implementing additional energy measures.

Figure 157: Electricity production costs disaggregate -WAM

Figure 158. Electricity production costs disaggregate – WEM and WAM scenarios



Source: LEAP-RO

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 4,133 billion euros (Figure 159, Figure 160). Among these investments, a substantial portion is for the industry sector, as well for a comprehensive overhaul of the transport 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. It is projected that, by 2035, 2,000 MW batteries will be installed and, by 2040, 4,500 MW of installed battery capacity will be required to meet future demands and PV and wind production. The investment level depicted in Figure 159 cover only the first 2,000 MW to be installed by 2035. However, by 2040, the investment in batteries should double compared to the one by 2035.

Figure 159. Investments needed in the electricity generation

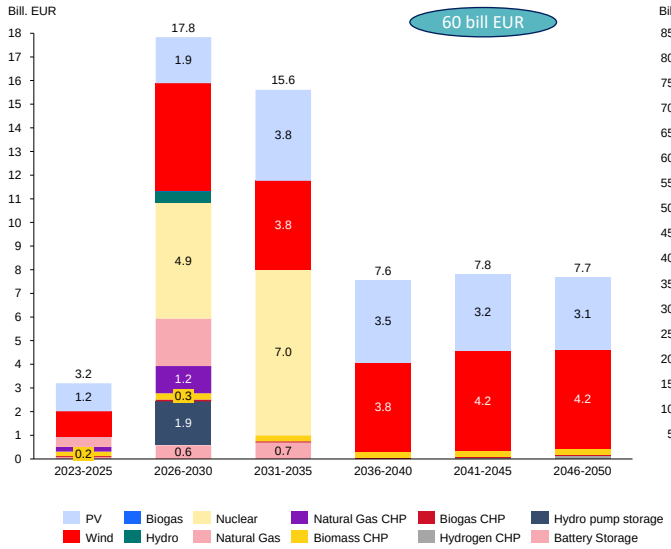
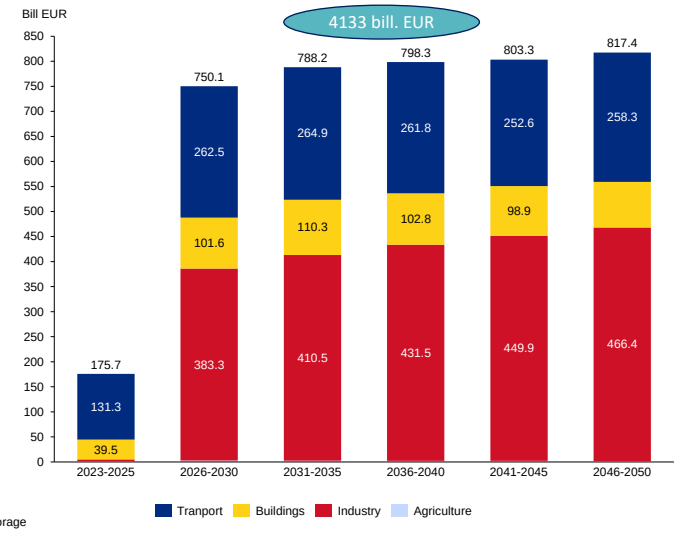


Figure 160. Investments needed in the energy demand sector



Source: LEAP-RO

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

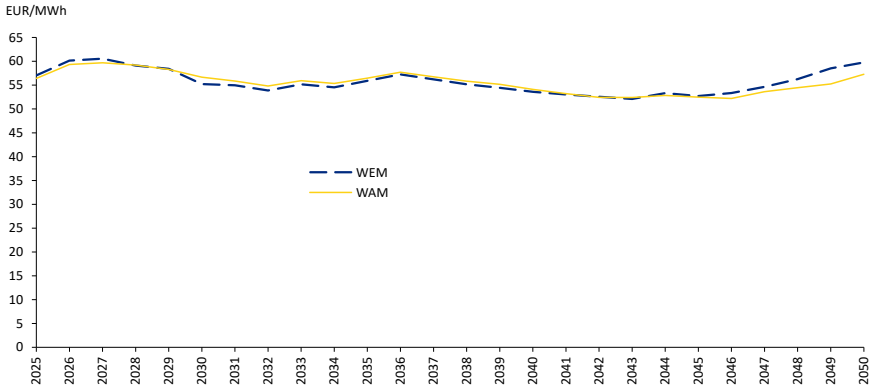
I. Impacts on the energy system in neighbouring and other Member States in the region to the extent possible

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

Considering the modeling characteristics of the WAM scenario, which include higher rate of electrification 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 1 EUR/MWh after 2030 (Figure *161*).

Figure 161. Difference in electricity production price between WAM and WEM scenario



Source: LEAP-RO

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 EU 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 16. 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 approving 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 foreseen 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 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	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	The draft version of the National Energy Strategy for 2022 - 2030 period, with the perspective of 2050	The document will be adopted
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 approving the General Transport Master Plan (MPGT)	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	The Program updates the GTMP implementation strategy and specifies

		Program for the Development of Transport Infrastructure for the period 2021-2030	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	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)
36	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
37	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
38	Decarbonisation: GHG emissions and removals	GD no. 217/2012 establishing the requirements for the identification 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

39	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 labelling and energy efficiency of certain consumer goods (household dishwashers/washing machines, household refrigerating appliances, TV sets, air conditioning installations)
40	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.
41	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
42	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
43	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 building 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 building 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.
44	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)
45	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)
46	Decarbonisation: GHG emissions and removals	Modernization of the agricultural sector	Support schemes to promote the use of renewable energy sources (solar panels, heat pumps).
47	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.
48	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.
49	Decarbonisation: GHG emissions and removals	The Amendment 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.
50	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.
51	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.
52	Decarbonisation: GHG emissions and removals	Water Law no. 107/1996, with subsequent modifications and additions	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.
53	Decarbonisation: GHG emissions and removals	The National Water Management Strategy 2023-2035 (in the final phase of interministerial approval)	The strategy contains among the strategic objectives the achievement of an integrated management of water resources to ensure the sustainable use of water resources, in correlation with the energy and waste sectors, as well as the management and protection of water resources in order to achieve and preserve the good status of surface and groundwater and prevent its deterioration.
54	Decarbonisation: GHG emissions and removals	National Rural Development Programme 2014-2020 (PNDR 2014-2020), including transition 2021-2022	PNDR 2014-2020, including transition 2021-2022, addresses 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	Established the institutional framework for the direct implementation of

		the Regulation (EC) no. 2003/2003 relating to fertilisers	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	With the Order no. 269/2020 of the Ministry of the Environment, Waters and Forests were approved 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

		guidelines for different fields and categories of projects were approved	for the intensive breading of farm animals, including meat poultry, egg-laying poultry, pigs and sows.
64	Decarbonisation: GHG emissions and removals	COM(2020) 663 final - Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on an EU strategy to reduce methane emissions COM(2021) 805 final - Proposal for a Regulation of the European Parliament and of the Council on methane emissions reduction in the energy sector and amending Regulation (EU) 2019/942	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 improve 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 2014-2020 (PNDR 2014-2020), including transition 2021-2022	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 through 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 1064/2013 on the organisation, management and use of permanent pastureland 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	Government Decision no. 933/2022 for the approval of the National Strategy on 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	Government Decision no. 1227/2022 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	GO 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, with subsequent modifications and additions	"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 equivalent inhabitants), respectively by December 31st 2018 (agglomerations with less than 10,000 equivalent 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 equivalent 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 the Energy sector, Manufacturing and Construction in the WEM	Reduction of GHG emissions in Energy Industry and Manufacturing and Construction Industry sectors

		scenario (with existing measures)	
91	Decarbonisation: GHG emissions and removals; Energy efficiency	Transport in WEM scenario (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 in WEM scenario (with existing measures)	Reduction of GHG emissions in LULUCF sector
96	Decarbonisation: GHG emissions and removals; Energy efficiency	Waste in WEM scenario (with existing measures)	Reduction of GHG emissions in Waste sector
97	Energy efficiency; Decarbonisation: GHG emissions and removals	Combustion in Energy sector, Manufacturing and Construction in WAM scenario (with additional measures)	Reduction of GHG emissions in Energy Industry and Manufacturing and Construction Industry sectors
98	Decarbonisation: GHG emissions and removals	Transport in WAM scenario (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
102	Decarbonisation: GHG emissions and removals; Research, innovation and competitiveness	LULUCF in WAM scenario (with additional measures)	Reduction of GHG emissions in LULUCF sector
103	Decarbonisation: GHG emissions and removals	Waste in WAM scenario (with additional measures)	Reduction of GHG emissions in Waste sector
104	Decarbonisation: GHG emissions and removals	GD 1215/2023 for the approval of the Long-Term Strategy of Romania	The Long-Term Strategy for Reducing Greenhouse Gas Emissions and Enhancing Renewable Energy and Energy Efficiency, Romania Neutral in 2050, presents three scenarios to achieve its goals. It highlights sector-specific decarbonization targets, required investments, and anticipated socioeconomic impacts. The chosen scenario, "Romania – Neutral in 2050," is aligned with EU climate policies, ensuring Romania's effective contribution to the EU's climate neutrality objectives.

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 (CO_2) 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 CO_2 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 CO_2 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 CO_2 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 CO_2 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 CO_2 geological storage sites issued by National Regulatory Authority in the Mining, Petroleum and Geological Storage of Carbon Dioxide (ANRMPSG) as competent authority both for CO_2 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 CO_2 geological storage**, issued in 2015 by ANRMPSG as a competent authority for CCS operations, set up a dedicated service for CO_2 geological storage in 2013, which coordinates the elaboration of procedures for granting exploration and storage permits. According to this Procedure operators may ask for ANRMPSG an opportunity analysis for underground CO_2 storage in a selected perimeter. In case the analysis is favourable, ANRMPSG 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 ANRMPSG, with the most favorable bidder further negotiating for supplemental exploration works and a plan for environmental restoration. Once the final documents are agreed upon, ANRMPSG issues the exploration permit and puts it up for 30 days for public consultations. The final exploration permit is issued by ANRMPSG 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 CO_2 geological storage permit** issued through Decision 16/2017 of the ANRMPSG 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 CO_2 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, ANRMPSG can grant storage permits competitively, by means of a bidding process. This process is detailed in ANRMPSG Procedure 16/2017, but no bidding process has taken place or been published to date. ANRMPSG 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. ANRMPSG 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, ANRMPSG may include public proposals in the draft storage permit.

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 ANRMPSG 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 CO_2 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 CO_2.

- **ANRMPSG** is under the direct coordination of the Romanian Government. Given the similarities and notable experience in standardizing the oil and gas extraction activities, ANRMPSG stands as the main implementing authority for capture and geological storage of CO_2, 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, ANRMPSG also coordinates the assessment of the storage sites and the available storage capacity. According to the reasoning document for GEO 64/2011,

ANRMPSG's attributions and competencies shall be enlarged. However, to this date the CO_2 geological service is still underdeveloped, with no more than two people running the office.

- **ANRE** is mandated to issue transport licences for CO_2 while ensuring transparent and non-discriminatory access to the CO_2 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.
- **MEAT** promoted, in 2010, GETICA CCS pilot project, but, according to GEO 64/2011 on the geological storage of carbon dioxide, with subsequent amendments and additions, has no attributions in the field.

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 CO_2 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, ANRMPSG 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 ANRMPSG will take any necessary measures following these investigations. The division of responsibilities between the National Environmental Guard and the ANRMPSG 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 CO_2 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 CO_2 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 ANRMPSG 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 ANRMPSG.

According to GEO 64/2011, the development works of CO_2 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.

Eventually, the implementation of the proposed NZIA Regulation - with injection/storage targets, as well as the LTS that provides for the capture, transport, use and storage of carbon is essential for the decarbonisation of certain industries and the achievement of the targets of the chosen scenario - "neutral Romania".

ANNEX III

In the process of developing the National Strategy for Adaptation to Climate Change for the period 2024-2030 (SNASC), a collection of studies has been conducted on the categories of products and services specific to different sectors, including sector-specific climate indicators to improve ecosystem services and prioritize adaptation measures. The strategic objectives of SNASC were formulated based on the latest climate data and projections from the RO-Adapt project and stakeholder consultations. Table 17 illustrates the links between these strategic objectives and the five dimensions of the EU Regulation 2018/1999 on the governance of the Energy Union.

Table 17. Association between SNASC strategic objectives and the five dimensions of the NECP

Strategic Objectives	Energy Security	Internal Energy Market	Energy efficiency	Decarboni-zation	Research, Innovation, Competitiveness
- Water resources:					
OS.1.1 Reducing the risk of scarcity regarding water resources	X	X	X	X	
OS.1.2 Flood risk reduction	X	X			
OS.1.3. Increasing the degree of safety of dams and dykes	X	X	X	X	
OS.1.4. Adaptation of water treatment and sewage systems to climate change by rehabilitating and streamlining water treatment and purification infrastructures/stations	X	X	X	X	
- Forests:					
OS.2.1 Adaptation of forests and the forest sector to the impact of climate change, including through sustainable management of forest resources, control of disasters and other emergency situations generated by specific risk factors and increasing forest resilience				X	
OS.2.2 Expansion of forested areas				X	
OS.2.3 Stimulating the forest bioeconomy within the limits of sustainability, promoting wood products with a long lifespan				X	X
OS.2.4 Adaptation of forest regeneration/restoration practices to climate change				X	X
OS.2.5 Developing knowledge on the impact of climate change on the forest and ways to prevent and adapt the sector to the effects of climate change				X	X
- Biodiversity and ecosystem services:					
OS.3.1 Improving and disseminating knowledge in the field of biodiversity and ecosystem services and promoting the role and contribution of biodiversity in adaptation to climate change					X
OS.3.2 Support the conservation, restoration and strengthening of the continuity and connectivity of habitats and ecological networks, relying on green-blue infrastructure and agro-ecological infrastructures				X	X
OS.3.3 Support/promote the use of best practices in sustainable and climate-smart agriculture, aquaculture and forest management				X	X
OS.3.4 Support the development of a coherent, connected and representative network of protected areas and strictly protected areas implementing adaptive management					X

OS.3.5 Integrating ecosystem resilience issues into all relevant public policies and sectoral patterns of economic activities				X	X
- Population, public health and air quality:					
OS.4.1 The establishment of the National Observatory for Climate and Health within the Ro-ADAPT platform for the inventory, monitoring and quantification of climate risks on public health, the selection of adaptation solutions and the evaluation of the impact of their implementation.					X
OS.4.2 Creating a framework harmonized with the European and international framework, which ensures resilience to cross-border climate risks that can affect the population, the health system and air quality	X			X	X
OS.4.3. Protecting citizens' health against the impacts of calamities, by strengthening the national emergency management system and connecting it with the Climate and Health Observatory within Ro-ADAPT and other relevant platforms.	X			X	X
- Education and awareness:					
OS.5.1 Increasing the level of information and awareness of the population regarding the impact of climate change and adaptation to it	X	X	X	X	X
OS.5.2 Improving the level of education of citizens regarding adaptation to climate change			X	X	X
OS.5.3 Active involvement of citizens in the process of adaptation to climate change, including relevant decision-making				X	X
OS.5.4 Promoting research, scientific innovation and digitization related to adaptation to climate change				X	X
- Cultural heritage:					
OS.6.1 Detailed, systematic and relevant climate monitoring of cultural heritage			X	X	X
OS.6.2 Protecting cultural heritage from the combined impact of climate change, associated risks and pollution at local level			X	X	X
OS.6.3 Development of a national integrated management plan for cultural heritage in relation to the impact of climate change			X	X	X
- Cities:					
OS.7.1 Improving the climate resilience of localities by developing local action plans for adaptation to climate change	X	X	X	X	X
OS.7.2 Improving existing design codes and technical regulations in the field of construction or other codes or norms relevant to the field, to increase resilience to the effects of extreme climatic events	X	X	X	X	X
OS.7.3 Adaptation of risk analysis and coverage plans and defense plans in case of emergency situations specific to climate change	X	X	X	X	X
OS.7.4 Development/implementation of education, research, information and awareness programs for the population	X		X	X	X
- Agriculture and rural development:					
OS.8.1 Development of an adaptation strategy in agriculture				X	X
OS.8.2 Realization of an efficient management of agricultural lands				X	X
OS.8.3 Improving the level of knowledge of the agricultural field and the link with climate change				X	X

OS.8.4 Increasing risk management awareness and access to risk management tools				X	X
- Energy:					
OS.9.1 Increasing the resilience of the energy sector	X	X	X	X	X
OS.9.2 Increasing the resilience of the heating and cooling sector	X	X	X	X	X
OS.9.3 Development of education, information and awareness programs in order to increase energy efficiency	X		X	X	X
OS.9.4 Establishing critical infrastructure in energy systems and implementing measures to cope with the impacts of extreme events	X	X	X	X	X
- Transports:					
OS.10.1 Consolidation of land infrastructure (road, urban, railway)				X	X
OS.10.2 Consolidation of air transport infrastructure				X	X
OS.10.3 Assessment of the vulnerability of the transport sector				X	X
OS.10.4 Integrating climate change considerations into planning and decision-making processes				X	X
- Tourism and recreational activities:					
OS.11.1 Protection and expansion of natural recreational areas in cities and their surroundings				X	X
OS.11.2 Development of tourist destinations less dependent on climate change				X	X
OS.11.3 Long-term planning for green mountain destinations				X	X
OS.11.4 Adaptation and protection of coastal tourism infrastructure to climate change				X	X
OS.11.5 Long-term policies, planning and education to adapt the sector to climate change				X	X
OS.11.6 Adaptation of tourism service providers to climate change				X	X
OS.11.7 Changes in management or behavior by tourism staff and tourists				X	X
- Industry:					
OS.12.1 Awareness of climate risks for industry and the formulation of adaptation elements for different industrial sectors	X		X	X	X
OS.12.2 Policies and long-term planning for adaptation to climate change	X	X	X	X	X
OS.12.3 Reducing risks in the supply and distribution chain in support of the circular economy	X	X	X	X	X
- Insurance:					
OS.13.1 Increasing the use and access to insurance products against extreme events associated with climate change	X	X	X	X	
OS.13.2 Increasing the institutional capacity of the insurance sector in order to develop insurance products designed to adapt to climate changes specific to all sectors of activity	X	X	X	X	