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Support to the update of the National Energy and Climate Plan of the Republic of North Macedonia

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National Energy and Climate Plan for the Period 2021 - 2030

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1. Overview and Process for Establishing the Plan

1.1. Summary

i. The political, economic, environmental, and social context of the plan

The Republic of North Macedonia is a small, landlocked country with a population of 1.8 million, around 40% of which is residing in rural areas. The country belongs to a group of upper-middle-income economies. It aspires to join the European Union (EU) which, along with regulatory and trade reforms, presents an opportunity for sustainable economic growth.

The country is a contracting party to the Energy Community Treaty and is thereby required to align its energy and climate legislation with EU legal framework in energy and climate. The country has also made commitments to the United Nations Framework Convention on Climate Change (UNFCCC).

The Republic of North Macedonia drafted its National Energy and Climate Plan (NECP) for the period 2021-2030 in 2020, according to the Recommendation of the Ministerial Council of the Energy Community (2018/1/MC-EnC) and the relevant Policy Guidance by the Energy Community Secretariat (PG 03/2018).

The Energy Community Secretariat provided its comments and recommendations in response to the submitted document in November 2020. These recommendations, together with the changing circumstances in the meantime (coal phase out, changes in the Energy Community acquis and a growing importance of energy security) present the key drivers for the current NECP update.

ii. Strategies that address the five dimensions of the Energy Union

As a candidate for EU membership, The Republic of North Macedonia is actively aligning its energy policies with the European Energy Union's five key pillars: energy security, internal energy market, energy efficiency, decarbonization, and research, innovation, and competitiveness. The following outlines the country's strategic efforts in each area.

1. Strengthening Energy Security

To enhance energy security, the Republic of North Macedonia is working on diversifying its energy sources, reducing dependence on coal, and expanding its renewable energy sector, including solar, wind, and hydropower. The country is also deepening regional energy cooperation through initiatives linked to the Energy Community Treaty. Efforts to expand natural gas infrastructure aim to decrease reliance on electricity for heating, while investments in energy storage technologies, such as battery systems and pumped hydro storage, are being undertaken in order to improve grid stability. Electricity interconnections exist with all neighbouring countries except Albania.

2. Advancing the Internal Energy Market

The liberalization of the electricity market is underway, aligning national regulations with EU market rules to foster competition and efficiency. In order to enhance energy trade, a new cross-border interconnection with Albania is currently under development. Transmission and distribution operations are fully unbundled, promoting greater independence for the electricity transmission system operator, MEPSO. Numerous investments in electric networks are underway, increasing not only security of supply but also enabling connections of new renewable energy facilities (primarily solar and wind). Strengthening market coupling mechanisms is also a priority to facilitate a more integrated and competitive regional energy market.

3. Improving Energy Efficiency

The Republic of North Macedonia is actively implementing national energy efficiency action plans to optimize energy use across industries, transportation, and residential areas. Stricter building performance regulations aim to enhance insulation and heating efficiency. Meanwhile, public-sector initiatives are promoting energy-efficient solutions, such as improved municipal lighting systems. The government is also providing financial incentives to encourage businesses and households to adopt energy-saving technologies.

4. Commitment to Decarbonization and Climate Goals

The country is gradually transitioning away from coal, with a focus on closing outdated coal-fired power plants and replacing them with cleaner energy alternatives. Investments in renewable energy expansion, particularly solar and wind projects, are expected to play a crucial role in reaching long-term sustainability targets. The Republic of North Macedonia is also preparing for the introduction of a carbon pricing system, in alignment with the EU's Emissions Trading System (ETS). Additional efforts include the promotion of electric vehicles and sustainable transport solutions, contributing to a greener mobility sector.

5. Driving Research, Innovation, and Competitiveness

To remain competitive in the evolving energy landscape, the Republic of North Macedonia is supporting research and development in renewable energy and smart grids. Participation in EU research programs, such as Horizon Europe, strengthens cooperation on innovative energy solutions. Efforts are also underway to digitalize the energy system, with the introduction of smart metering and automation technologies. Encouraging private-sector investment in energy innovation and fostering a startup-friendly environment are key components of the country's long-term strategy.

iii. Overview tables with key objectives, policies and measures of the plan

Table 1 shows the targets for greenhouse gas emissions reductions in 2030.

Table 1 Targets for greenhouse gas emissions

	2030	1990
GHG emissions	7.21 $MtCO_{2eq}$ (-42.2%)	12.48 $MtCO_{2eq}$
GHG emissions and removals	5.26 $MtCO_{2eq}$ (-51.9%)	10.93 $MtCO_{2eq}$

Table 2 contains targets for key NECP indicators – share of RES in gross final consumption and energy efficiency goals, stated as primary energy consumption and final energy consumption.

Table 2 Targets for renewable energy share and energy efficiency

	Goal for 2030
Share of RES in gross final energy consumption	31.6 %
Energy efficiency	
Primary energy consumption[1]	100.5 PJ
Final energy consumption	78.3 PJ

[1] Primary energy consumption, according to EUROSTAT guidelines, is defined as total energy consumption less non-energy consumption.

Measures relevant to individual dimensions of the Energy Union are shown in Table 3. For each measure, its title and dimension have been shown, as well as one or more dimensions. Energy Union dimensions are: decarbonization (DEC) – containing greenhouse gases emissions and renewable energy sources, energy efficiency (EE), energy security (ES), internal energy market (IEM) and research, innovation and competitiveness (RIC).

Table 3 Overview of measures and interactions

PM	Title	DEC	EE	ES	IEM	RIC
D1	Strengthening institutional and governance framework for effective NECP implementation		√	√	√	√
D2	Introduction of MRVA and national carbon pricing mechanism in the period 2025 - 2029 as a preparatory work for full-fledged implementation of EU ETS in 2030				√	
D3	Improved manure management on small dairy cows and swine farms and reduction of the N2O emissions and N-loss in line with the Nitrate Directive					
D4	Improved manure management, increased use of organic fertilisers and waste to biogas/energy production on the big farms in the Republic of North Macedonia					
D5	Sustainable Forest Management					
D6	Forest Fire Prevention and Early Warning Systems					
D7	Large scale afforestation projects, financial instruments and urban forests					
D8	Sustainable Land Management on Sloped Agricultural Terrains					
D9	Mechanical and biological treatment (MBT) in new landfills with composting					
D10	Enhanced circularity practices at industrial facilities					
D11	Reduced generation of municipal solid waste					
D12	Improved landfill management					
D13	Sludge to energy development (STE) and improved energy management for waste water treatment plants					
D14	Implementation of the Just transition roadmap, establishment of structures and implementation of JT measures				√	
D15	Generation Portfolio Decarbonization: Sequential Coal Closure & Low-Carbon Build-out			√		√
D16	Transpose and implement the Taxonomy Regulation 2020/852/EU and its implementing and delegated acts					
D17	Carbon Capture and Utilization in the cement and the steel industry					√
D18	Green hydrogen production facilities for industrial applications focusing on steel, cement and petrochemical production			√		√
D19	Identification and use of the proper location for new energy facilities, in particular, solar, wind power plants and energy storage facilities			√		

D20	Photovoltaic Irrigation					
D21	Implementation of the system of guarantees of origin for energy from renewable energy sources		√		√	
D22	Contracts for Difference			√	√	
D23	Simplification of permitting procedures and introduction of one-stop shops facilitating deployment of RE			√		
D24	Promotion of energy communities			√		√
D25	Market-Based Support Incentives and promotion of long-term PPAs			√		
D26	Developing a low-carbon fuel market			√	√	√
EE1	Energy efficiency obligation schemes	√		√		
EE2	Retrofitting of residential buildings	√		√		
EE3	Retrofitting of central government buildings	√		√		
EE4	Retrofitting of local self-government buildings	√		√		
EE5	Retrofitting of commercial buildings	√		√		
EE6	Minimal energy performance standards and energy certificates for new and refurbished buildings	√		√		
EE7	Improvement of street lighting in the municipalities	√		√		
EE8	Green procurement	√		√		
EE9	Eco-design requirements for energy-using equipment and labelling of electric appliances and equipment	√		√		
EE10	Increased use of heat pumps	√		√		
EE11	Public awareness campaigns and network of energy efficiency info centres	√		√		
EE12	Energy management in manufacturing industries	√		√		
EE13	Improvement of processes in manufacturing industries	√		√		
EE14	Enabling regulatory framework for development of new DHS, connection to existing DHS and individual metering and billing of heat consumption	√		√		
EE15	Development of energy-efficient rail transport	√		√		
EE16	Regulatory instruments to promote a cleaner transport system	√		√		
EE17	Advanced mobility	√		√		√
EE18	Construction of the eastern section of the railway Corridor VIII	√		√		
EE19	Increasing the number of alternative fuel vehicles and the development of alternative fuel infrastructure in road transport	√		√		√
EE20	Reduction of network losses				√	
ES1	Developing capacities for hydrogen production, transport, storage and use	√			√	
ES2	Increasing energy system flexibility	√			√	

ES3	Increasing energy system resilience				√	
IEM1	Build or upgrade power transmission network in the Republic of North Macedonia including interconnectivity to Albania's transmission network			√		
IEM2	Develop natural gas cross-border infrastructure to diversify supply routes and increase market competitiveness			√		
IEM3	Build main gas pipeline sections: Gostivar-Kichevo, Sveti Nikole-Veles, Branch to Gevgelija, Branch to TPP Negotino, Branches to TIDZ, Kichevo-Ohrid, and Ohrid-Bitola			√		
IEM4	Develop gas distribution network					
IEM5	Improvement and Upgrade of Skopje District Heating Network	√		√		
IEM6	Align with electricity integration package to enable electricity market coupling of the EU and the Republic of North Macedonia	√		√		
IEM7	Smart grid technology for power system management, digital and green substations			√		
IEM8	Ensuring the national electricity system stability and adequacy			√		
IEM9	System control, SCADA/EMS and cyber/OT topics			√		
IEM10	Price signal demand response			√		
IEM11	Addressing energy poverty while ensuring further market liberalization	√		√		
RIC1	Aligning S3 and Energy union priorities	√	√			

1.2. Overview of the current policy situation

i. National circumstances and energy system

The Republic of North Macedonia is a small, landlocked country in the Western Balkans with a population of approximately 1.8 million people. Its energy system and national circumstances are shaped by its geography, economic structure, and historical development. Below is an overview of the country's energy system, key challenges, and opportunities for transformation.

Geography and Climate

The Republic of North Macedonia is characterized by a diverse landscape, including mountains, valleys, and rivers, which provide significant potential for hydropower and renewable energy. The climate is predominantly continental, with hot summers and cold winters, leading to seasonal variations in energy demand for heating and cooling.

Economic Structure

In 2024, the Republic of North Macedonia GDP reached approximately $15.86 billion, with projections indicating a rise to $17.09 billion in 2025. This translates to a GDP per capita of around $9,440. The country experienced a real GDP growth rate of 3.6% in 2024. The economy is diversified, with key sectors including manufacturing, agriculture, mining, and services. However, industrial activities, particularly in energy-intensive sectors like steel and chemicals, contribute significantly to energy consumption and emissions.

Energy Poverty

Based on the EU-SILC indicator, the energy poverty affects at least one-third of the population in the Republic of North Macedonia . Unlike general poverty, energy poverty is a more complex issue and if the energy poverty is assessed more

broadly, the share of those impacted is significantly higher. It stems from a combination of low income, poor energy efficiency in housing, high energy costs, and a lack of systematic support to address these challenges.

The situation on the ground doesn't go in favour to the commitment of the Government of RN for gradual reduction of public intervention in the determination of electricity supply prices. This is a commitment under the Reform Agenda for North Macedonia, which should be implemented in parallel with definition of Measures to address the energy poverty. The new Law on Energy, to be supplemented with a Methodology for energy poverty and vulnerable consumers, has been adopted in May 2025.

EU Accession Process

As a candidate for EU membership, the Republic of North Macedonia is aligning its energy and climate policies with the European Green Deal and the Energy Community Treaty. This includes commitments to reduce greenhouse gas (GHG) emissions, increase renewable energy, and improve energy efficiency.

Energy Mix

The Republic of North Macedonia's energy mix is dominated by fossil fuels, particularly coal, which accounts for a significant share of electricity generation and primary energy consumption. Bitola and Oslomej coal-fired power plants are the backbone of the country's electricity generation.

Hydropower is the second-largest source of electricity, accounting for about 30% of generation. The country has significant untapped potential for small and medium-sized hydropower projects.

The Republic of North Macedonia relies heavily on imported oil and natural gas for transportation, heating, and industrial use. There are no domestic oil or gas reserves, making the country vulnerable to price fluctuations and supply disruptions.

The table below shows the Republic of North Macedonia capacity mix in terms of electricity in 2022. Thermal power plants dominate with 54% of the total capacity, followed by hydropower plants at 42%, and other renewables at 4%. Within the thermal capacity, lignite power plants constitute approximately 57%, gas power plants account for 32%, and the oil-powered TPP Negotino makes up the remaining 10%. In the hydro sector, reservoir power plants represent the majority with 72%, while run-of-river plants account for 28%.

Table 4 Installed capacities per technology type in the Republic of North Macedonia in 2024[2]

Technology type	Capacity (MW)
Thermal power plants	1,034.00
CHP	287.41
Hydroelectric power plants	615.92
Small hydro	104.10
Wind	82,40
Solar	847.65
Other RES	12.60
Total	**2,984**

[2] Source: Annual Report of the Energy and Water Services Regulatory Commission of the Republic of North Macedonia for 2024

When talking about the generation mix, electricity produced from renewable energy sources, including large hydropower facilities, amounted to 2,514 GWh in 2024. The output from thermal power stations reached 2,355 GWh, while cogeneration power plants contributed with 1,259 GWh.

The country has a relatively low level of electricity consumption per capita compared to the EU average, but demand is expected to grow with economic development.

Energy Imports

The net electricity consumption in 2024 was 5,781 GWh. In 2024 the Republic of North Macedonia was a net importer of electricity, but the imported amount was relatively low, around 185 GWh. Depending on a year and hydrological conditions, in periods of high demand or when hydropower generation is low, in some years the country imports significant amounts of electricity.

In addition, the country is heavily dependent on imports of primary energy, particularly oil and natural gas. This dependence exposes the country to energy security risks and price volatility.

Energy Infrastructure

The energy infrastructure is aging and in need of modernization. The transmission and distribution networks suffer from inefficiencies and losses, particularly in rural areas. Limited interconnections with neighbouring countries restrict the ability to trade electricity and integrate renewable energy into the grid.

The table below illustrates the net transfer capacities with the neighbouring countries in 2022.

Table 5 Interconnections with the Republic of North Macedonia

NTC (MW)	2022
BG00-MK00	250
GR00-MK00	212
MK00-BG00	100
MK00-GR00	400
MK00-RS00	400
MK00-XK00	250
RS00-MK00	400
XK00-MK00	220

The Republic of North Macedonia's energy system is at a crossroad, with significant challenges but also substantial opportunities for transformation. The country's heavy reliance on coal and imported energy sources underscores the need for a comprehensive energy transition strategy. By leveraging its renewable energy potential, improving energy efficiency, and aligning with EU climate and energy policies, the Republic of North Macedonia can build a more sustainable, secure, and resilient energy system. This transition will not only contribute to global climate goals but also enhance economic development, reduce energy poverty, and improve the quality of life for its citizens.

Dimension – Decarbonisation; GHG emissions

The Republic of North Macedonia, like many countries, faces the challenge of reducing its greenhouse gas (GHG) emissions to combat climate change and meet international commitments.

The Republic of North Macedonia is a small emitter in global terms, but its emissions intensity (emissions per unit of GDP) is relatively high compared to other European countries due to its reliance on coal and energy-intensive industries.

The country's GHG emissions are primarily driven by the energy sector, followed by industrial processes, agriculture, and waste.

The national GHG emissions have fluctuated over the past two decades, largely influenced by economic activity and energy consumption patterns. Emissions peaked in the early 2000s and have shown a slight decline in recent years due to improvements in energy efficiency and a gradual shift toward renewables.

According to the Fourth National Communication on Climate change, in 2019, the aggregate greenhouse gas (GHG) emissions and removals (net emissions), including the Forest and Other Land Use (FOLU) sector, were estimated at 12,329 Gg CO_2-eq. This represents a 13.9% increase compared to 1990 levels. Figure 1 illustrates the time series of emissions and removals from 1990 to 2019, showing significant fluctuations in net emissions in 2000, 2007, and 2012 due to intensified forest fires/wildfires, which led to increased emissions in the FOLU sector instead of removals.

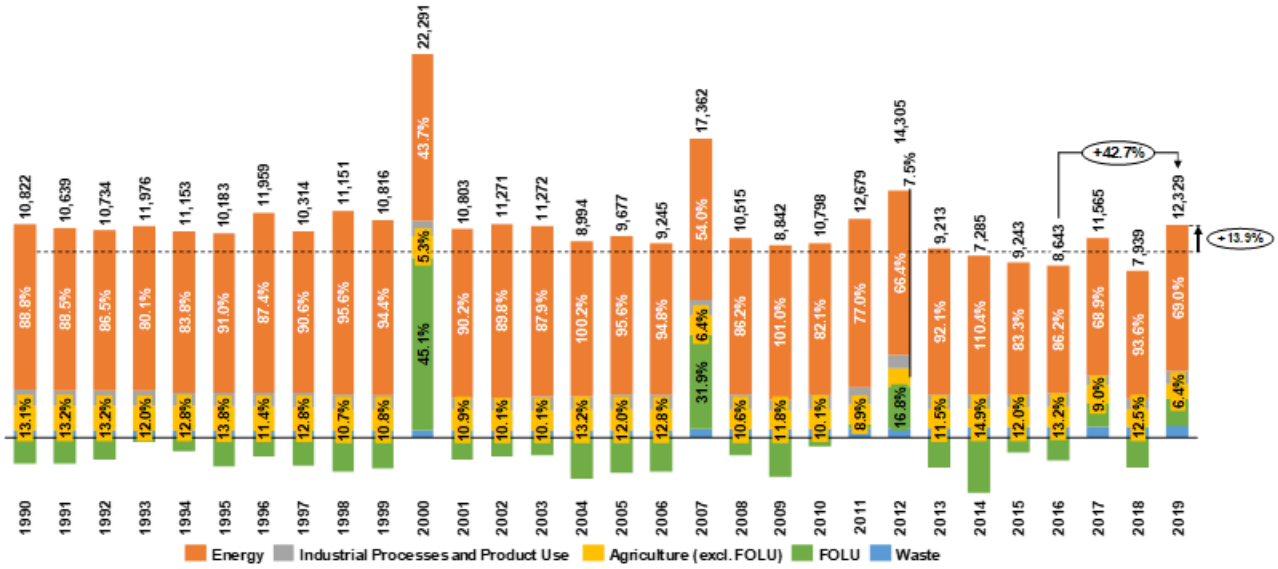


Figure 1 GHG emissions and removals by sector (in Gg CO_2-eq), source Fourth National Communication

In 2019, net GHG emissions (including FOLU) were estimated at 12,329 Gg CO_2-eq, marking a 13.9% increase compared to 1990. Due to the observed forest fires in 2019, the sector Forestry and Other Land use was a net source in 2019 therefore in the following text the GHG emissions sectoral breakdown excludes FOLU.

In 2019, the Energy sector accounted for 75.4% of total GHG emissions (excluding FOLU), followed by Agriculture (12.1%), IPPU (6.8%), and Waste (5,6%) (Figure 2). Waste sector emissions have shown a 58% increase since 1990.

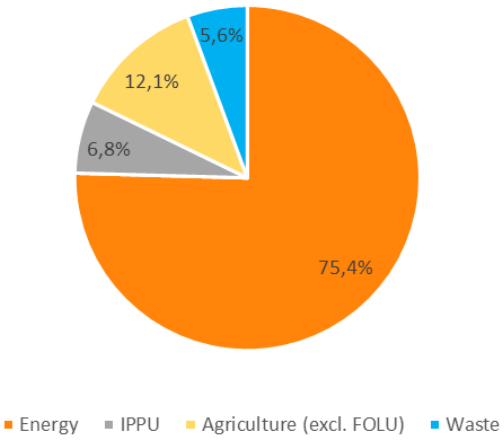


Figure 2 Sectoral share of GHG emissions in 2019, excluding FOLU

CO_2 emissions are the most significant, representing 81.3% of total GHG emissions (excluding FOLU) in 2019. Methane (CH4) contributed 10.5%, nitrous oxide (N2O) 5.5%, and fluorinated gases (HFCs) 2.7%.

The Energy sector shows a gradual decline in emissions post-2012, attributed to energy efficiency measures and renewable energy integration. However, forest fires and rising transportation activity challenge these gains. The Waste sector's growing emissions highlight the need for improved waste management systems. IPPU emissions reflect a shift from heavy industry to refrigerant use. Strengthened forest fire prevention, circular economy initiatives, and enhanced energy policies are crucial for further emission reductions.

The Republic of North Macedonia faces several challenges in its decarbonisation journey:

- Economic Dependence on Coal: The country's economy, particularly in regions like Bitola, has been heavily reliant on coal mining and coal-fired power generation. Transitioning away from coal will require careful planning to address socio-economic impacts.
- Financial Constraints: Limited financial resources may hinder the pace of decarbonisation efforts, necessitating innovative financing mechanisms and international support.
- Infrastructure Development: Significant investments are needed to develop the necessary infrastructure for renewable energy, electric transportation, and energy efficiency.

Despite these challenges, the Republic of North Macedonia also has numerous opportunities:

- Renewable Energy Potential: The country has substantial potential for solar, wind, and hydropower, which can be harnessed to diversify the energy mix.
- EU Integration: As a candidate for EU membership, the Republic of North Macedonia can access funding and technical assistance from the European Green Deal and other EU initiatives.
- Regional Cooperation: Collaborating with neighbouring countries on regional energy projects and climate initiatives can enhance energy security and foster economic growth.

The Republic of North Macedonia's energy sector has historically been dominated by coal, particularly for electricity generation. The need to decarbonise is not only an environmental imperative but also an economic and social opportunity. The country has already taken a path toward decarbonization of its electricity generation, with renewables now accounting for over 30% of total electricity production. By further embracing cleaner energy sources, improving energy efficiency, and fostering sustainable practices, the Republic of North Macedonia can enhance its energy security, create new jobs, and improve public health.

Dimension – Decarbonisation; Renewable energy sources

Renewable energy sources (RES) in the Republic of North Macedonia in 2023 accounted for 20.2% of gross final energy consumption, recording slow but steady growth compared to the previous years. Namely, in 2022 RES accounted for 19.2% of gross final energy consumption and reached 20.2% in 2023[3]. The target set for 2030 is 31.6%. The target set for 2020 was established under the Decision D/2018/2/MC-EnC of the Energy Community Ministerial Council amending Decision 2012/04/MC-EnC of 18 October 2012 on the implementation of Directive 2009/28/EC and amending Article 20 of the Energy Community Treaty[4] and set at 23%, which was not achieved.

The main reason for lagging behind the targets is underachievement in the transport sector. Namely, the target for RES in transport sector for 2020 was 10%, but the achieved share of RES in this sector has not progressed since 2018, and it is still at about 0.1%. Additionally, verification of the biofuels in line with sustainability criteria as required by Directive 2009/28/EC is needed.

[3] 2023 EC Progress Report on North Macedonia, Eurostat

[4] https://www.energy-community.org/dam/jcr:971631b7-7996-4c90-a855-bfe3d3876ad4/Decision_2018_02_MC_RE_MA_112018.pdf

Nevertheless, since 2018, the RES share in the Republic of North Macedonia's electricity production has been steadily increasing, from 24.8% in 2018, reaching 32.2% in 2023[5]. During 2021, 2022 and 2023 total of 852 new RE power plants were constructed, increasing the installed capacity of RE power plants to more than 50% of the overall electricity production capacity. The surge in construction of new RE power plants began with the year of energy crisis in Europe (2022) and is continuing to this day. Only in 2022 and 2023 new 516 MW of installed capacity in RES were added to the system, reaching installed capacity of 1,311 MW. Most of the newly added capacities were PV power plants, small-hydro and one wind power plant. Respectively, the production of electricity from RES increased from 1,498 GWh in 2020 to 2,173 GWh in 2023. The increase in RE production capacities was also supported by the introduction of RE support mechanism in the form of premium tariffs and implementation of e-auctions for PVs on state-owned (35 MW) and privately owned land (27 MW) in 2019 and signing of contracts for construction of PV plants and awarding the right to receive premium for the generated electricity. Additionally, another tender for awarding premiums for PVs on privately owned land was launched in 2021, attracting huge interest for the tendered 80 MW capacity, complementing the successful tenders for construction of PV power plants on the open pit of the depleted coal mine in Oslomej.

Subsidy programmes available to households to replace inefficient fossil fuel and biomass appliances with efficient heat pumps have been diligently implemented in previous years, which should be complemented by the concrete measures for integrating renewable energy or waste heat into the Skopje district heating system. Nevertheless, their efficiency is doubtful due to non-established monitoring system and the policy of granting the subsidies on a first-come, first-served basis, without considering the quality of the selected equipment and the specifics of the homes receiving the subsidies.

The Draft Renewable Energy Law adoption should play crucial role for creating legal framework to promote the use of renewable energy and waste heat in district heating.

Following figures are presenting renewable energy sources shares in gross final energy consumption (Figure 3), in electricity consumption (Figure 4), in transport sector (Figure 5) and in heating and cooling (Figure 6). The shares are referring to the latest available year (2023) and are enabling comparisons with several neighbouring states and the EU27[6].

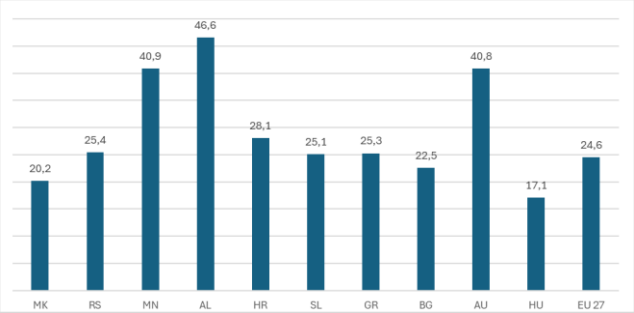


Figure 3 RES in gross final energy consumption

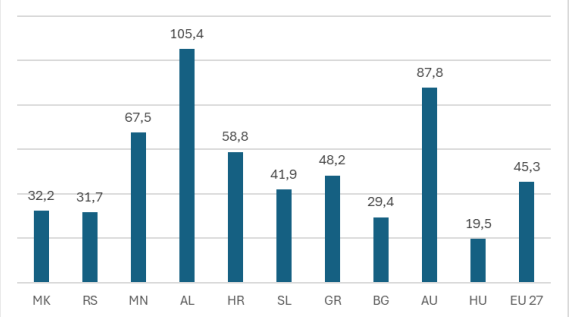


Figure 4 RES in electricity

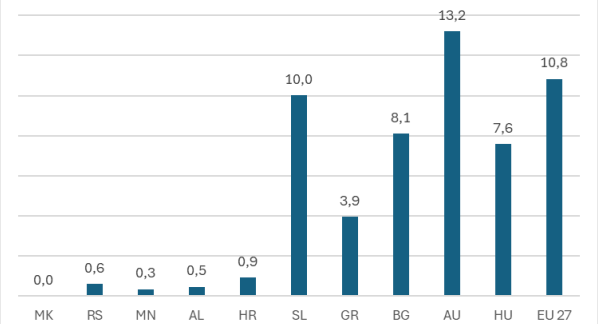


Figure 5 RES in transport

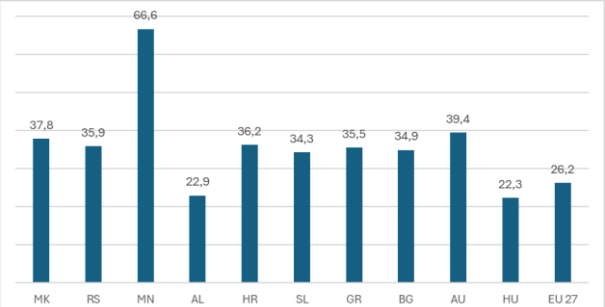


Figure 6 RES in heating and cooling

5 Annual Report on operations of the ERC in 2023.

6 https://ec.europa.eu/eurostat/databrowser/view/nrg_ind_ren/default/table?lang=en

Dimension – Energy efficiency

The Law on Energy Efficiency was adopted in 2020 and amended several times (Official Gazette 32/2020, 110/21, 236/22 and 147/24). However, the key by-laws, ensuring full transposition of the Energy Efficiency Directive 2012/27/EU, Energy Performance of Buildings Directive 2010/31/EC and its 2018 amendments (Directive (EU) 2018/844) are still pending and under development. The long-term buildings renovation strategy is still not finalized. By-laws on energy performance contracts, implementation of the energy performance control system and development of the long-term building strategy, by-laws on energy audits of buildings and on energy performance of buildings are also under development. The Draft Law on Energy Efficiency is being developed, along with respective by-laws and it is expected to be adopted during 2025.

In the meantime, the Amendments to the Law on Organization of Government Bodies in 2024, brought huge institutional reform in the institutional setup of the energy efficiency policy area. As part of the larger government restructuring process of the government bodies, the Energy Agency was abandoned and integrated with the newly created Ministry of Energy, Mining and Mineral Resources, which took over the responsibilities from the Energy Agency.

Additionally, Energy Efficiency Fund was established within the Development Bank of North Macedonia, by virtue of amending the Law on the Development Bank of Republic of North Macedonia. However, the legal and regulatory framework for its operationalization is still under preparation.

The implementation of consumption-based billing in the district heating system is missing, despite the transposition of district heat metering and billing provisions in the Law on Energy Efficiency. This is mainly due to the fact that consumption-based billing is not cost-effective under current conditions in the old buildings.

Dimension – Energy security

The Republic of North Macedonia's energy mix is still largely dominated by coal, with coal-fired plants providing reliable base-load power. However, the country is exposed to international price fluctuations for coal, and . the aging infrastructure of thermal power plants and their high carbon footprint have negative environmental and health impacts and rise concerns about energy security.

Despite producing a substantial amount of its electricity, the Republic of North Macedonia is dependent on electricity imports to meet domestic demand, particularly during periods of high consumption or when domestic generation is insufficient due to maintenance or hydrological variability.

The Republic of North Macedonia imports electricity mainly from neighbouring countries, including Serbia, Greece, and Bulgaria. The cost of imported electricity is subject to global energy market trends, making the country susceptible to price hikes.

The country also imports natural gas, making it vulnerable to geopolitical risks, particularly tensions between Russia and the EU. The country is dependent on natural gas for heating and industrial processes, and price volatility in global natural gas markets can lead to financial strain on both consumers and businesses. Energy imports contribute to the country’s vulnerability to external market fluctuations and geopolitical risks.

Several key challenges hinder the Republic of North Macedonia 's energy security and the long-term sustainability of its energy system including the aging infrastructure, renewable energy development, insufficient flexibility of the energy system, dependence on coal, and geopolitical risks.

On the other hand, the Republic of North Macedonia has several opportunities to improve its energy security and transition to a more sustainable and resilient energy system. Expanding the share of renewable energy in the energy mix is one of the most viable solutions to enhance energy security, alongside grid reinforcements and greater system flexibility. This includes further investment in solar and wind projects. Solar energy, in particular, holds high potential due to the country’s favourable solar irradiance. Small-scale solar projects could be deployed at the household and community level, improving local energy resilience and reducing dependency on the central grid. In addition, improving energy efficiency across sectors—in buildings, industry and transport—can reduce overall demand for energy and help

mitigate the impact of energy price fluctuations. This includes the adoption of energy-efficient technologies, retrofits of old buildings, and smart grid technologies that optimize electricity distribution and consumption. Moreover, investments in energy storage technologies, such as batteries, can help mitigate the intermittent nature of renewable energy generation. Modernizing the energy grid to accommodate smart grid systems that can efficiently distribute energy, integrate renewables, and optimize storage capacity is critical for improving energy security.

As the Republic of North Macedonia continues its path toward EU integration, it can benefit from EU policies, funding, and technical expertise aimed at supporting the green transition. The EU's Green Deal and various energy-related funding mechanisms (e.g., Horizon Europe, Cohesion Fund, and European Investment Bank loans) offer an opportunity to accelerate the transition to a more sustainable and secure energy system.

Dimension – Internal energy market

The energy market is undergoing significant changes, driven by the country's efforts to modernize its energy infrastructure, align with European Union (EU) energy policies, and transition towards a more sustainable and efficient energy system. However, the market still faces challenges related to market structure, competition, and integration of renewable energy sources.

The energy sector is regulated by the Energy Regulatory Commission (ERC), an independent body that oversees the overall functioning of the market. The ERC also ensures the transparency of market activities and helps promote competition.

In May 2023 power exchange started its operation for the day-ahead period, managed by the organized electricity market operator, MEMO. The power exchange operates according to the Rules on Operation of the Organized Electricity Market, approved by the Energy Regulatory Commission in April 2023.

MEPSO is a regular member of the ENTSO-e, while NOMAGAS is an observing member of ENTSOG. ERC joined ACER's electricity working group, and the Republic of North Macedonia participates as an observer in several European electricity balancing platforms (PICASSO, MARI and IGCC). To ensure a coordinated approach towards energy markets on the regional level, North Macedonia also joined the South East Europe regional group of the EU Energy Platform, agreeing on joint action plans on gas demand, including potential gas demand reduction, infrastructure opportunities and supply options.

It has been roughly estimated that between 59 thousand and 151 thousand households in the country are energy poor[7], but a more detailed analysis is required. With its definition of energy vulnerable consumers and legislation in place (Energy Law, The Law on Social Protection), the Republic of North Macedonia has taken significant steps in protecting the vulnerable consumers. This will be sustained by adopting annual programmes for protection of vulnerable energy consumers.

The most important legal development is the new Energy Law, which has been adopted in May 2025.

Dimension – Research, innovation and competitiveness

The Republic of North Macedonia's investment in Research and Development (R&D) remains low at around 0.3% to 0.4% of GDP, far below the EU average of 2.2% and regional peers like Serbia (1.1%) and Croatia (1.4%). This underinvestment hinders innovation, economic competitiveness, and the ability to access EU funding programs like Horizon Europe. In 2023, the Smart Specialization Strategy of the Republic of North Macedonia for the period 2023 to

[7] https://www.energy-community.org/dam/jcr:f201fefd-3281-4a1f-94f9-23c3fce4bbf0/DOOREIHP_poverty_122021.pdf

2027 has been adopted. Key recommendations include increasing R&D funding to at least 1% of GDP, leveraging EU programs, and encouraging private sector participation through incentives.

Further, in 2025, the draft National Small and Medium Entreprises Strategy 2025 – 2030 has been prepared for adoption. The new National SME Strategy is a continuation of previous efforts to support the SME sector in the country by defining priorities and implementing activities that will further strengthen their competitiveness and innovation efforts. Its priorities are: Competitive National Entrepreneurial Ecosystem, Access to Finance and Green and Digital Transition.

ii. Policy context of the national plan

The main cornerstone of the ***energy related policy context*** is the **Energy Law (Official Gazette No. 101/2025)**, adopted in May 2025, which transposes the Electricity Integration Package (EIP)[8] and the Clean Energy Package. Renewable energy aspects will be regulated by a separate Law on Renewable Energy, for the first time separating these two sectors in a specific law, transposing provisions related to active customers and citizen energy communities; smart metering; facilitating establishment of renewable energy communities; and implementing the system for guarantees of origin, all in line with the RED II. The Draft Law on Renewable Energy has been submitted to Parliament and is currently pending its adoption. In February 2020, the **Energy Efficiency Law (Official Gazette 32/2020, 110/21, 236/22, 147/24 and 74/25)** has been adopted, which, with the relevant by-laws, warranted partial transposition of the Energy Efficiency Directive 2012/27/EU, Energy Performance of Buildings Directive 2010/31/EC and package of regulation for energy efficient products (labelling and eco-design), as well as introduced a number of regulatory measures, such as building renovation strategy, EE obligation scheme, monitoring and verification of savings, comprehensive assessment of potential for efficient heating and cooling etc. However, some of these regulatory measures (such as building renovation strategy and EE obligation scheme) have not been implemented and are pending the adoption of the Draft Law on Amending the Law on Energy Efficiency, which are also expected to be adopted and in force during the course of 2025.

The country has so far submitted to the UNFCCC four **National Communications on Climate Change**[9] and three **Biennial Update Reports**[10].

The Long-term Strategy on Climate Action and Action Plan (adopted in August 2021) outlines the vision for the Republic of North Macedonia to become a prosperous, low-carbon economy by 2050, targeting a 72% reduction in national net greenhouse gas emissions compared to 1990 levels. It emphasizes transitioning to renewable energy, improving energy efficiency, and enhancing resilience to climate impacts. Key sectors include energy, agriculture, and transport, with specific measures like carbon taxation, fleet renewal, and adoption of renewable technologies. The strategy aligns with EU climate frameworks and stresses cross-sectoral coordination and local-level implementation for effective climate action.

The Just Transition Roadmap for North Macedonia, adopted in June 2023, provides a strategic framework to ensure that the country's shift away from coal is socially inclusive and economically balanced, particularly in regions like Bitola and Kičevo. Its implementation is advancing through the Just Energy Transition Investment Platform (JETIP), launched at COP28, which mobilizes 3 billion EUR to phase out 764 MW of coal capacity and deploy 700 MW of renewable energy by 2030. A Technical Support Unit has been established to coordinate the JETIP activities. The regulatory framework for

[8] In December 2022 the Energy Community Ministerial Council adopted Decision 2022/03/MC-EnC on the incorporation of the European Union's electricity market acquis in the Energy Community together with Procedural Act 2022/01/MC-EnC on fostering regional energy market integration, which was due to be integrated into national legal system by the end of 2023. It comprises of 4 acts (Electricity Directive (EU) 2019/944 (recast), Electricity Regulation (EU) 2019/943, Risk-preparedness Regulation (EU) 2019/941 (recast), ACER Regulation (EU) 2019/942) and five network codes and guidelines.

[9] https://klimatskipromeni.mk/article/32#/index/main

[10] https://klimatskipromeni.mk/article/28#/index/main

climate action in the Republic of North Macedonia is emerging with the Draft Law on climate action (LCA) which is currently under adoption procedure. The draft Law defines the Long term strategy for climate action and the National Energy and Climate Plans as basic planning documents for climate action, and also sets up the legal basis for the national adaptation actions. The Law transposes the MMR Directive and the EU ETS, as well as the relevant provisions from Energy Governance Regulation. The Draft LCA also foresees establishment of National Coordination Council on Climate Action (NCCCA), which among other mandated roles will also have advisory role in the government and will coordinate the national response to climate change (provide opinions, guidelines and recommendations for implementation, participate in development of strategic documents, allocate tasks for implementation of mitigation and adaptation actions and other staff related to the regulatory and strategic aspects for climate action).

The Republic of North Macedonia adopted the Just Transition Roadmap (JTD) to diversify regional economies, support coal-affected communities, and transition to sustainable energy. The strategy outlines pathways for investments, clean energy, and skills development. Supported by $85 million from the Climate Investment Fund, the government adopted an Investment Plan in January 2024 targeting coal retirement, socio-economic regeneration, and clean energy initiatives. A Just Energy Transition Investment Platform was established in December 2023, requiring 3 billion EUR but focusing on leveraging $676.3 million to ensure a just, low-carbon energy transition.

The **Reform Agenda** for the Republic of North Macedonia developed under the Reform & Growth Facility for the Western Balkans plays a crucial role in addressing climate change and shaping the country's response to environmental challenges. As the country seeks to align with EU standards and advance sustainable development, climate action is integrated into several key areas of the reform agenda.

Besides energy and climate change, ***other sectors also provide policy context of the national plan***.

Hence, regarding the Sustainable Development Goals (SDGs), a gap analysis on **SDGs Mainstreaming into the National Sustainable Development Planning for the Period 2016-2030** was undertaken in 2016 and a **Voluntary National Review** in May 2020. The results show that the SDG 13: "Take urgent action to combat climate change and its impacts" has been adequately covered into the national strategic documents in the areas of mitigation, vulnerability assessments, awareness and dissemination. Gaps have been identified with regards to the adaptation and resilience sectoral planning, as well as appropriate monitoring framework and quantifiable and measurable indicators of achievements in both, mitigation and adaptation.

As to the **Environment sector**, a high level of transposition of the Energy Community acquis has been achieved. The Environmental Impact Assessment Directive 2014/52/EU was transposed into national law by the **Environmental Law (Official Gazette 53/2005, 81/2005, 24/2007, 159/2008, 83/2009, 48/10, 124/10, 51/11, 123/12, 93/13, 42/14, 44/15)**[11] and by-laws following closely the structure and content of the Directive. The **legal framework regarding Sulphur in Fuels Directive** is in place specifying maximum thresholds for the Sulphur content of heavy fuel oil and gas oil compliant with those of the Directive. Also, Wild Birds Directive is transposed by the **Law on Nature Protection (Official Gazette 67/2004, 14/2006, 84/2007, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41/14, 146/15, 39/16, 63/16)**[12]. The Large Combustion Plants Directive is transposed by the **Rulebook on the Limit Values for the Permissible Levels of Emissions and Types of Pollutants in the Exhaust Gases and Vapour Emitted into the Air from Stationary Sources (Official Gazette 141/10, 223/19)**. The emission limit values for new and existing plants are aligned with those of the Directive. Amendments to the Rulebook are being prepared to transpose the Industrial Emissions Directive. The **Law on Control of Emissions from Industry** is in the process of being drafted and the Government adopted **National Emission Reduction Plan (NERP)** in 2017, which is being implemented over ten-year period starting from January 2018.

[11] http://www.moepp.gov.mk/?page_id=16546

[12] http://www.moepp.gov.mk/?page_id=16550

The emission reductions indicated therein are yet to be carried out in accordance with the time frames indicated in the NERP and the necessary emission abatement techniques still need to be installed.

Finally, some mainstreaming of climate change considerations and synergies have already been marked in the **latest strategic documents of the Transport and Forestry sectors, such as National Transport Strategy 2018 – 2030**. In particular, worth mentioning is the aligning of the targets for GHG emissions from transport sector strategy with the findings of the SBUR mitigation analyses. Main legislation for the waste sector consists of **Law on Waste Management (Official Gazette 68/2004, 71/2004, 107/2007, 102/2008, 143/2008, 124/10, 51/11, 123/12, 147/13,163/13 и 51/15, 156/15, 63/16)**[13] while the latest strategic and planning documents include **National Waste Management Strategy 2008-2020**[14] and **National Waste Management Plan 2009-2015 (Official Gazette 77/09)**[15]**.** The stipulated objectives - regulation of the ways of handling, labelling, treatment, processing, storage and removal of waste from asbestos and waste from products containing asbestos, development of an integrated regional waste management system and increasing the investments in waste separation and recycling could also positively affect climate change mitigation. Another example is the **health sector** with its now outdated **Climate Change Health Adaptation Strategy and Action Plan**[16], which defined adaptation measures for the health system to prevent and/or overcome existing and future risks and to respond promptly to the risks and problems for people's health and well-being that are expected as a result of climate change. Finally, green jobs are in the cross-cutting with the **education**, particularly through special programmes in adult education which is addressed in **the Education Strategy for 2018-2025 and Action Plan**[17].

Despite the abovementioned positive examples, the existing mainstreaming of climate change considerations in other sectoral policies does not ensure full exploitation of the synergetic potential of the relevant sectors. Some important strategic and planning documents are yet to be adopted, like for example National Adaptation Plan which development is expected to start soon and will be financed by GCF, and cooperation and communication among relevant sectors should be further enhanced or established in order to build synergies, reduce trade-offs, increase efficiency and improve governance among the sectors.

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

The key documents adopted by the government that encompass the relevant energy and climate policies and measures for the Republic of North Macedonia are:

- The **Strategy for development of the Energy Sector until 2040** (from 2019) and
- The initial National Energy and Climate Plan
- The Long Term Strategy on Climate Action until 2050
- The Fourth national communication on climate change
- The Law on Climate Action
- The Law on Energy
- The Law on Energy Efficiency
- The Reform agenda
- Just transition roadmap

[13] http://www.moepp.gov.mk/?page_id=16555

[14] http://www.moepp.gov.mk/wp-content/uploads/2014/12/Waste-Management-Strategy-of-the-RM-2008-2020.pdf

[15] http://www.moepp.gov.mk/wp-content/uploads/2014/12/NWMP_2009-2015_-of-RM_finaL.pdf

[16] https://www.euro.who.int/__data/assets/pdf_file/0018/144171/e95094.pdf

[17] http://mrk.mk/wp-content/uploads/2018/10/Strategija-za-obrazovanie-ENG-WEB-1.pdf

Currently, a number of important laws are in process of drafting and adoption. Namely, the Government is refining and fine-tuning the Draft Law on Climate Action, the Draft Law on Renewable Energy Sources and the Draft Law on Amending the Law on Energy Efficiency, which are expected to be adopted by the national parliament in the course of 2025 and to serve as major policy documents during the course of implementation of this NECP. The Law on Energy has been adopted in May 2025.

The policies and measures that are currently in place are mostly related to the **decarbonisation and energy efficiency dimension** and their focus is on:

- **Utilization of the RES potential** has been supported via feed-in tariffs since 2011. Currently a new mechanism is under preparation, mitigating price risk by granting payments based on the difference between the price to be agreed with the producer and the fluctuating market price. Producers will be selected in a public auction and will bear balancing responsibility in the electric market.
- **Implementation of EE measures in final energy consumption for household and commercial sector** that include highly efficient appliances in household, commercial and public sectors, exemplary role of public buildings (retrofit measures), insulation of existing and new residential buildings with introduction of nearly zero energy buildings, energy audits, energy management, promotion of higher utilization and expansion of district heating systems, stimulation of more efficient RES technologies to gradually replace inefficient use of biomass, as well as electrification of heating and cooling sector (heat pumps);
- **Implementation of EE measures in final energy consumption for industry sector** like utilization of efficient technologies that will enable fuel switch (from coal to gas) and use of efficient electric motors (in industry) as well as energy management in manufacturing industries;
- **Implementation of EE measures in final energy consumption for transport sector that include** replacement of old vehicles with energy-efficient ones, electrification of road transport, as well as modal shift from road to rail for freight transport and from car to bus for passenger transport, and more biking/walking in urban areas, and accelerating RES consumption in transport;
- **Implementation of technical measures to continuously decrease transmission and distribution network losses** in both electricity and district heating (DH) networks that include replacement of the existing (obsolete) lines, transformers and other network equipment, construction of new lines (where necessary) and automation and remote network management;
- **Modernization and expansion of existing and new DH systems taking into account development of other alternatives** that will include using CHP plants, heat pumps and RES and connection of new consumers, particularly from public and commercial sectors.

The EU's Carbon Border Adjustment Mechanism (CBAM) introduces a carbon price on selected imports, including steel, aluminium, and electricity, and is expected to have significant implications for North Macedonia. In the short term, CBAM will raise the cost of exports to the EU from carbon-intensive sectors, reducing the competitiveness of Macedonian goods. This is likely to result in a modest decline in industrial output and employment, with the steel sector—one of the country's key exporters—expected to be most affected. Aluminium producers face similar, though smaller, challenges. Electricity exports, especially from coal-fired sources, will also be constrained unless North Macedonia successfully integrates with the EU electricity market.

Despite these challenges, CBAM also creates a strong incentive for long-term structural change. By applying a carbon price at the EU border, it encourages the Republic of North Macedonia to accelerate decarbonisation efforts, invest in renewable energy, modernise industrial processes, and develop domestic carbon pricing mechanisms aligned with EU climate policy. As part of the evolving policy landscape, CBAM complements national objectives set out in the National Energy and Climate Plan and supports the development of the future Emissions Trading System.

iv. Key issues of cross-border relevance

The regional cooperation is crucial for the Republic of North Macedonia , being on the one hand a small import dependent country, and, on the other hand, a country connecting the transmission lines of Serbia and Greece, as well as a corridor for electricity transmission from Bulgaria to Greece. The importance and the need for regional cooperation is also recognized in the Energy Strategy, which outlines concrete measures and projects which are of great cross-border relevance. These include the project for share and exchange of auxiliary services (power control reserves and balancing energy) between Serbia, North Macedonia and Montenegro (SMM) control block, then construction of the interconnection transmission line to Albania, construction of gas pipeline to Greece and possibly to other WB6 (Kosovo*, Serbia and Albania), as the initiative to establish a regional electricity market.

The role of the Energy Community in this process is extremely important. In addition to having an advisory role, it also contributes greatly to increasing the level of communication between the countries that are Parties to the Energy Community. Communication is very important so that countries can jointly understand the different aspects of cross-border projects. The studies conducted and/or published by the Energy Community (e.g. Projects of Energy Community Interest (PECI) and PMI) cover all Parties and help in perceiving the real situation in the region. PECI and PMIs are projects that increase cross-border co-operation between Energy Community Contracting Parties and are deemed as common interest; while PMIs are projects between Energy Community Contracting Parties and European Union Member States not having received the PCI (Project of Common Interest) label in the European Union. This list is updated every two years. The projects that are part of this list can apply for funding sources at the Western Balkan Investment Framework (WBIF) with the cooperation of a lead International Financial Institution (IFI) such as EIB and EBRD. Projects that have been part of these lists for North Macedonia include the electricity project for construction of interconnection transmission line to Albania, and the gas projects for construction of pipelines to Greece, Kosovo* and Serbia.

As a landlocked country, the Republic of North Macedonia depends heavily on energy imports, particularly from Greece and Bulgaria. The country's energy security is a regional issue, as it requires cooperation with neighbors to ensure stable energy supplies. North Macedonia is also part of the Energy Community, which works to integrate the energy markets of the Western Balkans with the EU. This platform works to harmonize energy regulations, improve energy efficiency, and enhance cross-border energy trade. Ensuring stable electricity and gas supplies in North Macedonia requires coordinated regional efforts in market integration, pricing, and supply reliability. Cross-border energy infrastructure projects, including natural gas pipelines and electricity interconnectors, are essential to enhancing energy security and promoting regional cooperation in the energy sector.

The Republic of North Macedonia's energy infrastructure is integrated into the regional network, which means that disruptions or challenges in neighboring countries can directly affect the availability and cost of energy. This makes cross-border cooperation on energy infrastructure essential.

The Republic of North Macedonia is part of regional efforts to improve energy infrastructure, including electricity interconnectors with Bulgaria, Greece, and Serbia, as well as natural gas pipelines connecting the country to regional networks. Projects such as the Greece–North Macedonia gas pipeline are crucial for improving energy security by diversifying supply routes and sources.

One of the key aspects of North Macedonia’s energy transition is the development of renewable energy sources such as solar and wind, coupled with grid reinforcements and increased system flexibility, primarily by increasing storage capacities. However, the integration of renewable energy into the regional grid and ensuring a stable supply of green electricity requires significant cross-border cooperation. The Republic of North Macedonia has the potential to increase its share of renewable energy, especially solar power, given its favorable geographical conditions. Regional cooperation on electricity trading allows the country to export surplus renewable energy to neighboring countries during peak production times and import energy during periods of low production. This is particularly important as renewable energy production can be intermittent, requiring flexible grid systems and backup power sources.

Regional cooperation and investment in renewable energy, grid and storage infrastructure can help North Macedonia meet its climate goals while reducing its dependence on coal. Additionally, sharing expertise and technology in

renewable energy development with neighboring countries like Albania (which has a strong hydroelectric base) can help harmonize efforts to transition to cleaner energy across the region.

The Republic of North Macedonia's energy transition also aligns with the broader goals of the European Green Deal, which aims to achieve carbon neutrality by 2050. As a country on the path toward EU membership, North Macedonia is committed to reducing its greenhouse gas emissions, improving energy efficiency, and transitioning to renewable energy. Cooperation with the EU on the EU Emissions Trading System (ETS) and green energy certification can provide opportunities for cross-border financing and technology transfers that will help North Macedonia meet its climate goals.

The Republic of North Macedonia , like many Balkan countries, is vulnerable to the impacts of climate change, including droughts, extreme temperatures, and flooding, which can have a cross-border impact on shared water resources and ecosystems.

Air pollution is a significant concern for the Republic of North Macedonia , and it is a cross-border issue due to the interconnected nature of environmental impacts in the region. The country faces high levels of particulate matter (PM10), nitrogen oxides (NOx), and sulfur dioxide (SO_2) emissions, much of which is attributed to its reliance on coal-fired power plants and heavy industry. These emissions not only contribute to poor air quality in North Macedonia but also impact neighboring countries, especially in areas like Serbia, Bulgaria, and Greece, which share air and atmospheric currents.

The Republic of North Macedonia's energy and climate challenges are closely linked to regional dynamics, and addressing these issues requires regional cooperation and cross-border collaboration. Whether it's ensuring energy security, managing shared environmental resources, or transitioning to a sustainable energy future, the country must work closely with its neighbors and international partners to achieve its energy and climate goals. Cross-border energy infrastructure, renewable energy integration, and climate adaptation measures will play critical roles in ensuring the country's future energy stability and environmental sustainability.

v. Administrative structure of implementing national energy and climate policies

In order to allocate responsibilities for the implementation of the NECP and to adequately monitor the level of implementation, relevant institutions have been identified for each of the five dimensions. The work of all dimensions will be coordinated by the Ministry of Energy, Mining and Mineral Resources (MEMMR) and the Ministry of Environment and Physical Planning (MoEPP), as institutions with the ultimate responsibility for implementing the NECP. Figure 7 shows the grouping of the responsible institutions for each dimension. The Energy Community will observe and support the whole process, along with the EUD. To ensure institutional memory from the originally developed NECP, MANU will be included in the work of every working group of the NECP.

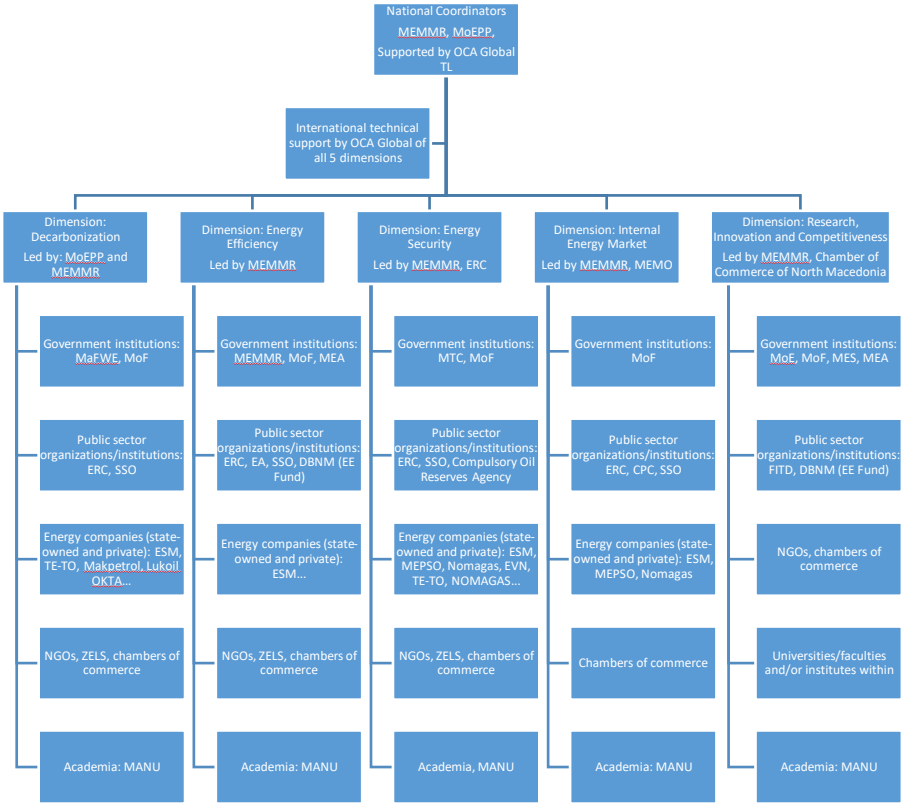


Figure 7 Implementing bodies

1.3. Consultation and participation of national and EU entities and the outcome of consultation

i. Participation of the national parliament

Participation of the Parliament in the process of preparation or adoption of the National Energy and Climate Plan is not envisaged by the Law on Energy. According to the Article 13 of the Law on Energy, the National Energy and Climate Plan of the Republic of North Macedonia is adopted by the Government of the Republic of North Macedonia.

ii. Involvement of local and regional authorities

In order to involve a broad range of stakeholders in the process of updating the NECP, working groups formed in the process of developing the initial version of the NECP have been revisited and broadened with additional organizations. Their representatives have been delivered the early version of the updated NECP in March 2025 and the first NECP draft in May 2025. They have participated in two hybrid meetings (at the premises of the Ministry of Energy, Mining and Mineral Resources and via MS Teams), one specifically targeted at sectors whose emissions are primarily stemming from fossil fuels combustion (energy industries and energy demand sectors) and the other targeted at sectors whose emissions are stemming from other sources (primarily waste, agriculture and forestry sectors).

Representatives of local and regional authorities have participated in the process through the Association of the Units of Local Self-Government (ZELS).

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

List of members of working groups formed in the process of developing the initial version of the NECP has been revisited and broadened with additional organizations. Their representatives have been delivered the early version of the updated NECP in March 2025 and the first NECP draft in May 2025, and have also participated in the two hybrid meetings held in April.

Their comments have been incorporated in the second NECP draft that is submitted to the public hearing in June 2025. The hearing duration is from June until August 2025. The comments received will be incorporated into the final draft updated NECP to be adopted by the Government.

The draft document will be shared with the donor community , and thematic meetings will be organized as needed to facilitate discussion and gather input. Their feedback will be reviewed and duly taken into account in the preparation of the final version.

iv. Consultations of other Contracting Parties and EU member states

Once the draft updated NECP has been prepared for public hearing, a copy of the document has been sent to neighbouring states' institutions in charge of adopting their respective NECPs, both to the neighbouring Energy Community Contracting Parties and the neighbouring Member States.

The representatives of the neighbouring states will be invited to an online meeting where the draft updated NECP of the Republic of North Macedonia will be presented, alongside with the NECPs of the neighbouring states. Opportunities for cooperation will be further discussed.

The document was accompanied by its Strategic Environmental Assessment (SEA). According to the SEA, it is not likely that the implementation of the updated NECP is likely to have significant effects on the environment in any of the neighbouring states. This will also be discussed at the online regional meeting.

v. Interactive process with the Energy Community

The Energy Community submitted its comments and recommendations on the earlier version of the draft NECP already November 2020. These comments have been observed in the process of updating NECP. Therefore, in the beginning of the process of the NECP update, an initial meeting with the Energy Community Secretariat has been organised and the approach to the comments and recommendations received in 2020 has been agreed.

Energy Community Secretariat has been delivered the first NECP draft in May 2025. A meeting with ECS representatives has been held, in order to discuss the revised 2030 targets and objectives and the updated document.

1.4. Regional cooperation in preparing the plan

i. Elements subject to joint or coordinated planning with other Contracting Parties and EU member states

The following elements of cross-border significance are parts of the NECP of the Republic of North Macedonia:

- cross-border infrastructure (electricity and natural gas infrastructure)
- energy market integration
- cross-border and regional scientific research cooperation.

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

The same document that is prepared for public hearing will also be submitted to cross-border stakeholders, for consultations and further inputs. The discussion and final conclusions about the draft NECP will be done at an online meeting where representatives of the Republic of North Macedonia and all neighbouring countries will be present.

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 2050 objectives of the Long Term Strategy on Climate Action have been defined as follows: *Reduction of national net GHG emissions (including Forestry and Other Land Use and excluding MEMO items*) of 72% by 2050 compared to 1990 levels (or GHG emission reduction of 42% by 2050 compared to 1990, excluding FOLU and MEMO items) and increased resilience of North Macedonia's society, economy and ecosystems to the impacts of climate change.*

The initial version of the NECP (also reflected in the Enhanced NDC) has set the following targets for 2030:

- 51% reduction in greenhouse gas (GHG) emissions by 2030 compared to 1990 levels.
- When carbon sequestration from forests and other sinks are included, the net emissions reduction target was set on 82% by 2030.

To enable comparison between previous and updated targets, some clarifications about the base year must be given, as the previous targets have been set in relation to the base year. Table 6 contains the greenhouse gas emissions in 1990, according to several important national documents. The most important difference between the documents is that in each subsequent document, it has been determined that the GHG emissions sinks were higher than previously assessed. Further, the values in all official documents have been calculated according to the Assessment Report 4[18] (published by the UNFCC in 2007), but the updated projections have been calculated according to the Assessment Report 5[19] (published by the UNFCC in 2013). To be able to compare values in 1990 and 2030, data from the 4th National Communication have been recalculated according to the AR5 by the NECP update team. Therefore, Table 6 contains the columns containing the 1990 GHG emissions without sinks, sinks, and emissions with sinks as given by the Third Biannual Update Report (3rd BUR), by the first version of the NECP (1st NECP) and by the Fourth National Communication (4th NC), as well as the Fourth National Communication values with the global warming potentials according to the AR 5 (unofficial, as calculated in the process of updating the NECP.

Table 6 National 1990 GHG emission level

	3rd BUR	1st NECP	4th NC	4th NC AR5
Mt CO_{2eq}, without sinks	12.48	12.48	12.32	12.48
Mt CO_{2eq}, sinks	-0.21	-1.21	-1.55	-1.55
Mt CO_{2eq}, with sinks	12.27	11.27	10.78	10.93

Initial targets for greenhouse gas emissions reductions in 2030 (total and indicative for each emission sector and subsectors) as well as updated 2030 targets are presented in Table 7.

[18] https://www.ipcc.ch/report/ar4/wg1/

[19] https://www.ipcc.ch/report/ar5/wg1/

Table 7 GHG total and sectoral emission in 2030, initial and updated

Emission sector&subsector	Initial 2030 target (Mt CO_{2eq})	Updated 2030 target (Mt CO_{2eq})	Reasons for the difference
Energy	**3.33**	**4.82**	Higher due to revised power-sector modelling (gas-CHP units, realistic CO_2 pricing) outweighing savings in other sub-sectors.
Energy transformations	0.5	1.72	Introduction of gas-CHP for energy security after lignite exit; earlier model assumed faster RES rollout.
Households	0.2	0.08	Lower target due to accelerated electrification and heat-pump uptake plus EE measures.
Services	0.2	0.11	Lower thanks to improved building efficiency, lighting retrofits, and partial electrification of heating; previous model over-estimated baseline demand.
Industry	1.0	0.69	Lower due to efficiency gains and partial fuel switch to gas/electricity
Transport	1.4	2.17	Higher target reflecting increased diesel use and slower EV adoption (in the previous model it was estimated that electricity will substitute 10% of the energy consumption in the road transport sector. .
Agriculture – energy demand	0.1	0.04	Lower due to decreased agricultural activities and improved energy efficiency.

Waste	**0.32**	**0.66**	Higher due to delayed waste-management infrastructure and including landfill-gas capture (the previous model assumed that by 2030 the entire national waste will be disposed on = sanitary landfills with MBT) .
IPPU	**1.35**	**0.82**	Lower due to moderated industrial growth and refrigerant controls. .
Agriculture, Forestry, and Other Land Use	**-2.80**	**-1.04**	Sinks are significantly reduced due to inclusion of forest and land damages/disturbances which hasn't been accounted before, as well as the impact of 2024 forest fires and low afforestation trends.
Livestock + Aggregate sources and non-CO_2 emissions sources on land	1.06	0.91	Reduced number of livestock.
Land + Other	-3.86	-1.95	Sinks are significantly reduced due to inclusion of forest and land damages/disturbances which hasn't been accounted before, as well as the impact of 2024 forest fires and low afforestation trends.
Total GHG emissions	**6.06**	**7.21**	Gross increase reflecting more realistic energy, transport, and waste projections.
Total GHG emissions and removals	**2.20**	**5.26**	Net rise driven by weaker forest sinks and increase in the emissions in several emitting sectors.

It can be seen that the largest difference between the initial and updated targets occurs in the sector of land use and land use change: the initial 2030 target has been set at -3.86 $MtCO_2$ to be removed from the atmosphere, while the updated target is set at -1.95 $MtCO_2$. The main reason for this difference lies in previous overestimation of the forest sinks due to inclusion of forest fires and damages in the modelling, the low afforestation trends, as well as the catastrophic forest fires that occurred in summer 2024, all together making the previous 2030 target unattainable in the remaining period.

Another important difference is visible in the energy sector, previously targeting 3.33 $MtCO_2$ but now updated at 4.82 $MtCO_2$. The most important reason for this difference lies in much higher GHG emissions stemming from the updated energy transformations sector (electricity and heat production), as in the updated NECP several CHP facilities powered by natural gas have been envisaged, to ensure energy security and power system stability. Updated projections of GHG emissions stemming from the transport sector are also significantly higher than previously anticipated, reflecting the changes that occurred in the transport sector since the initial projections were developed, primarily a substantial increase in diesel fuel consumption and low penetration rates of the electric vehicles (previously it was projected that 10% of the energy demand by the transport sector will be substituted by electricity).

Difference between the initial and updated 2030 indicative target for the waste sector is high in terms of percentual increase and is due to more realistic timelines regarding the construction of sanitary landfills with mechanical and biological treatment (the previous model assumed that all planning regions in Macedonia will get sanitary landfills with mechanical and biological treatment until 2030). However, due to a small share of the waste sector in total emissions, this difference was not crucial in updating 2030 overall target.

Therefore, the updated 2030 target in total GHG emissions equals 7.21 Mt CO_{2eq}, or -42.2 % compared to 1990 level. If both GHG emissions and removals are taken into account, the updated 2030 target equals 5.26 Mt CO_{2eq}, or -51.9% compared to 1990 level.

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.

No other national objectives and targets have been set.

iii. Outlook up to 2050

The Republic of North Macedonia is a candidate country for European Union (EU) membership, and as a Western Balkan Contracting Parity of Energy Community, committed to becoming climate neutral by the year 2050. Carbon neutrality is expected to be a focus of the period beyond 2030, expected to be achieved by a combination of switching from natural gas to hydrogen, by carbon caption, use and storage as well as other low carbon solutions whose economic viability is still to be demonstrated. Natural gas is expected to be dominantly used in combined heat and power generation facilities and in large industrial facilities where transitioning to hydrogen and/or adopting carbon capture technologies is technically possible.

2.1.2. Renewable energy

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

The indicative national targets for RES by 2030 are shown in the table below.

Table 8 Indicative national targets for RES shares until 2030

RES share, %	Achieved			Revised 2030 targets
	2021	2022	2023	
In the gross final consumption of energy	17.8%	19.2%	20.2%	31.6%
In the final consumption of electricity	22.8%	25.9%	32.2%	51.2%
In the final consumption of energy for heating and cooling	32.3%	37.8%	37.8%	38.9%
In the final consumption of energy in transport	0.1%	0.1%	0.0%	19.0%

The trajectory of the share of energy from renewable sources in gross final consumption of energy between 2021 and 2030 with an outlook towards 2040 is given by Figure 8.

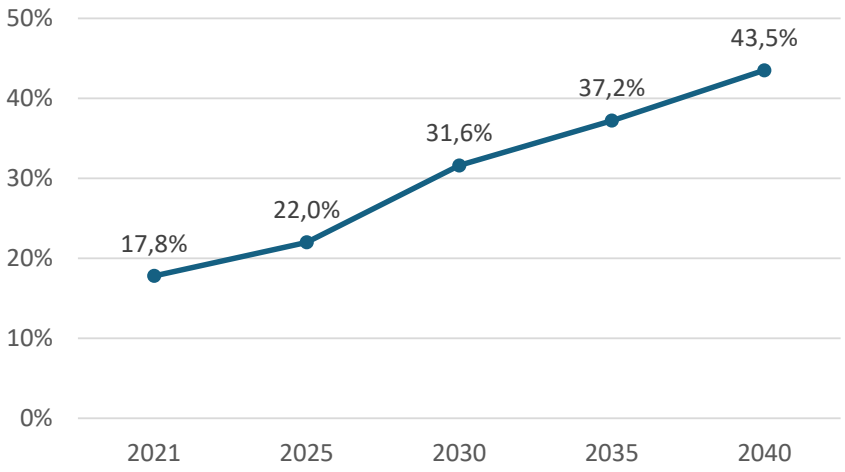


Figure 8 Indicative trajectory of RES shares in the gross final energy consumption, with achieved shares in 2021 - 2023

For comparison, the previously anticipated trajectory is given by Figure 9. It can be seen that already the starting values have been projected too optimistically and that in 2021 instead of 23% less than 18% has been achieved, while in 2023 the difference between the projection and the achievement was almost 6% (20.2% instead of 26%).

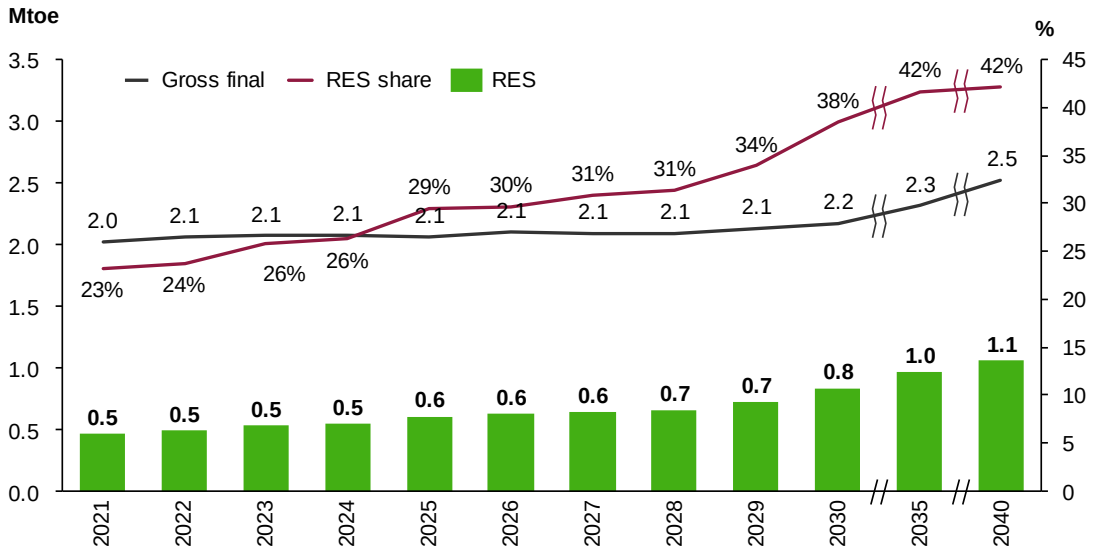


Figure 9 Indicative trajectory of RES shares in gross final consumption from the initial NECP

It is expected that the renewable energy share will continue to rise throughout the rest of the period, but that previously set target is not attainable anymore.

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 figures below show indicative RES shares in electricity (Figure 10), heating and cooling (Figure 11) and transport (Figure 12).

The share of RES in electricity consumption in the Republic of North Macedonia amounted to 22,8% in 2021 and increased to 32,2% by 2023. The indicative national goal for the share of renewable energy in final energy consumption in the electricity sector is 51.2% in 2030.

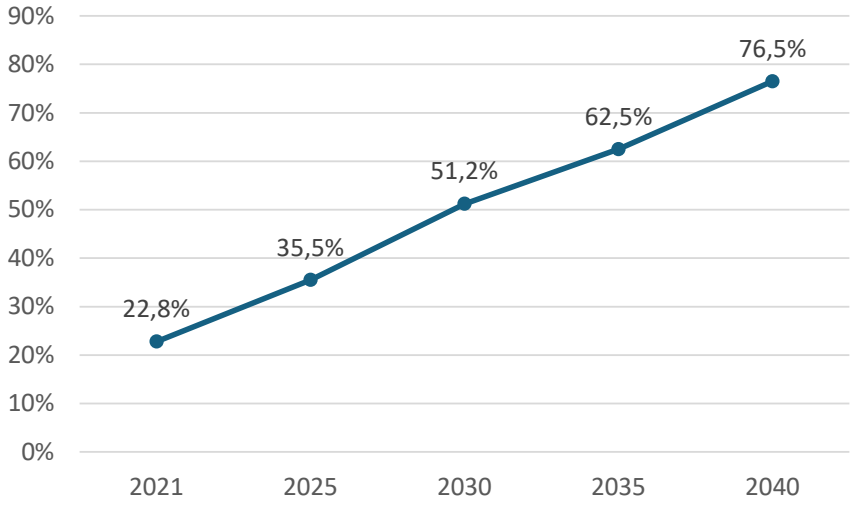


Figure 10 Indicative trajectory of RES shares in electricity

The share of renewable energy in final energy consumption in the heating and cooling sector amounted to 32,3% in 2021 and increased to 37,8% by 2023. The estimated target for the share of renewable energy in final energy consumption in the heating and cooling sector is 38,9% in 2030. (Figure 11).

According to the existing structure of energy consumption for heating and cooling, fuel wood accounts for almost 30%. Given the planned energy efficiency measures, i.e. increasing the insulation properties of buildings, a decrease in fuel wood consumption is expected, which will have a negative impact on increasing the share of RES. On the other hand, the application of new technologies such as heat pumps will contribute to reducing final energy consumption and increasing the share of RES in the heating and cooling sector.

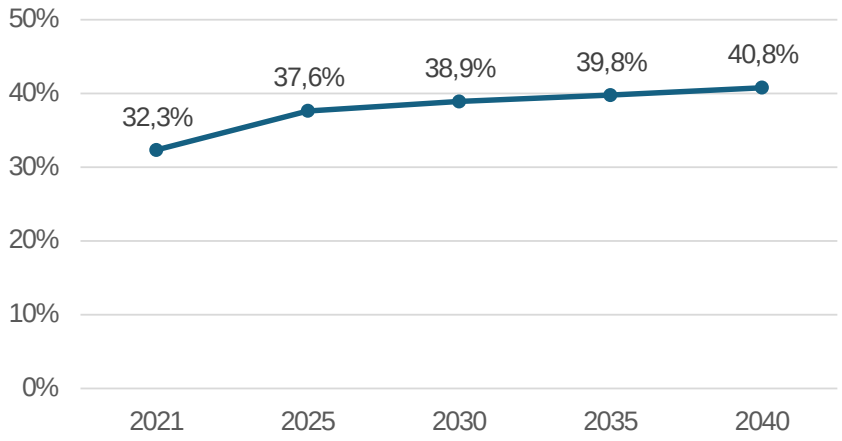


Figure 11 Indicative trajectory of RES shares in heating and cooling

The current share of renewable energy in transport in the Republic of North Macedonia is less than 0.1%, and is primarily related to electricity consumption in rail transport. With the aim of significantly increasing the share of renewable energy in transport by 2030, a legislative framework will be established to encourage the use of biofuels. In parallel, the implementation of measures aimed at developing infrastructure and increasing the share of vehicles using alternative fuels (electricity, hydrogen) will result in a further increase in the share of RES in transport.

The estimated target for the share of renewable energy in final energy consumption in transport sector is 19% in 2030 (Figure 12). The target shares of renewable energy in transport sector were calculated using multipliers in accordance with RED II.

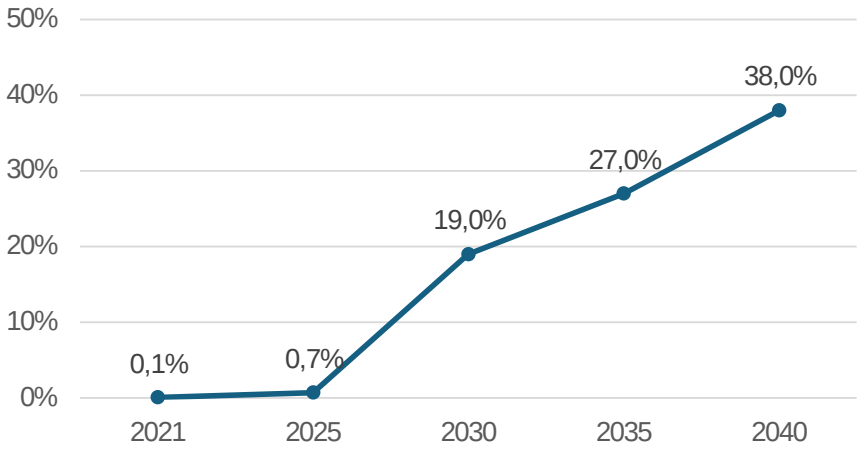


Figure 12 Indicative trajectory of RES shares in transport

Although a steady increase of RES share in all subsectors (electricity, heating&cooling and transport) is envisaged, previously set targets were even more ambitious and are not expected to be reached. Figure 13 presents the previously developed trajectories and 2030 targets, as well as the 2040 outlook.

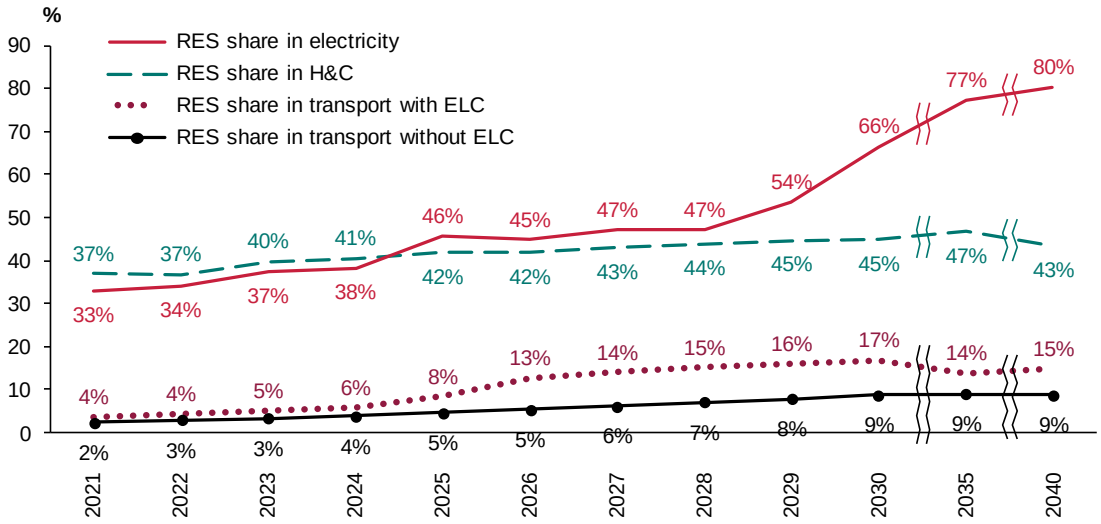


Figure 13 Indicative trajectory of RES shares in final consumption of electricity in the initial NECP

It can be seen that, similar to the situation with the gross final energy consumption, initial projections were too optimistic already at the beginning of the period, in 2021. The expected share of RES in final electricity consumption in 2021 was 33%, while the achieved share in 2021 was around 23%. The difference between the earlier 2021 projection and 2021 achievement in final consumption of energy in transport is also high – instead of projected 4-5% between 2021 and 2023, the achievement in 2023 was still close to 0%. The difference between the projected and the achieved share of RES in final energy consumption for heating and cooling is lower and both the initial projection and achievement in 2022 and 2023 are of similar values, around 37%. However, further increase is not expected due the aggressive implementation of energy efficiency measures envisaged in the buildings sector, leading to an overall decrease in energy consumption for heating and cooling, including of renewable energy sources for heating and cooling.

Additionally, it must be noted that verification in line with sustainability criteria as required by RES Directive 2018/2001 is still not resolved and that further regulatory framework development as envisaged within the measure "PM_D25: Developing a low-carbon fuel market" is required to be implemented in order to resolve this issue.

iii. Estimated trajectories by renewable energy technology that the projects 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;

The RES share target in the electricity sector of the Republic of North Macedonia is planned to be fulfilled by having 19% hydro, 55% solar, 22% wind, and 4% biogas and biomass production in the final energy consumption in the electricity sector in 2030 (Figure 14).

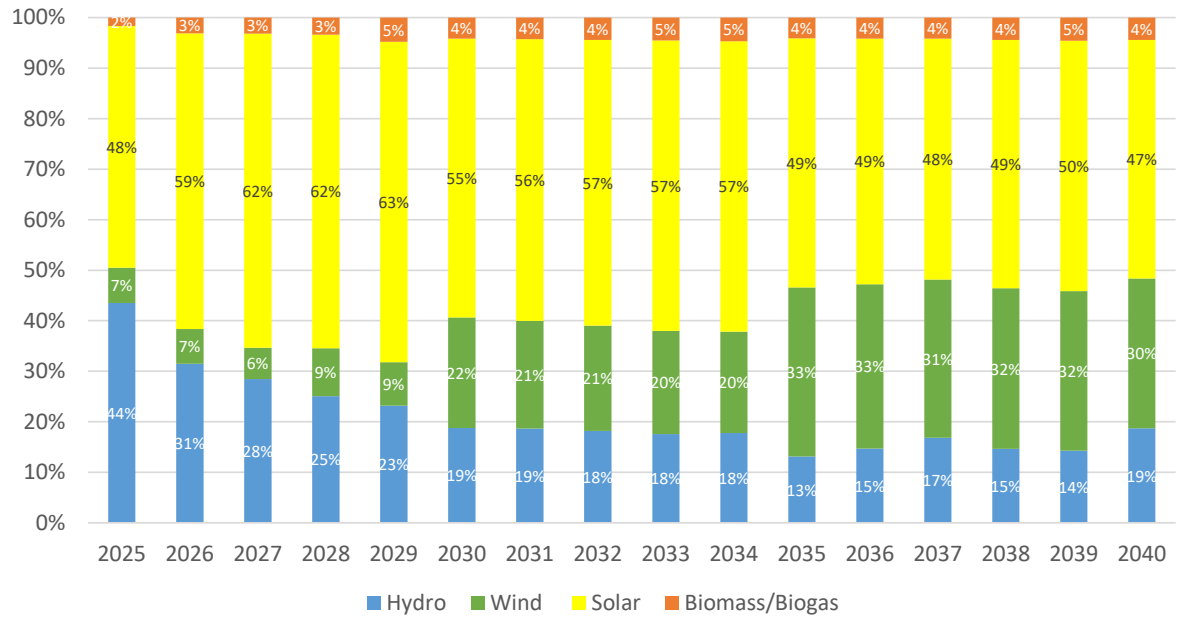
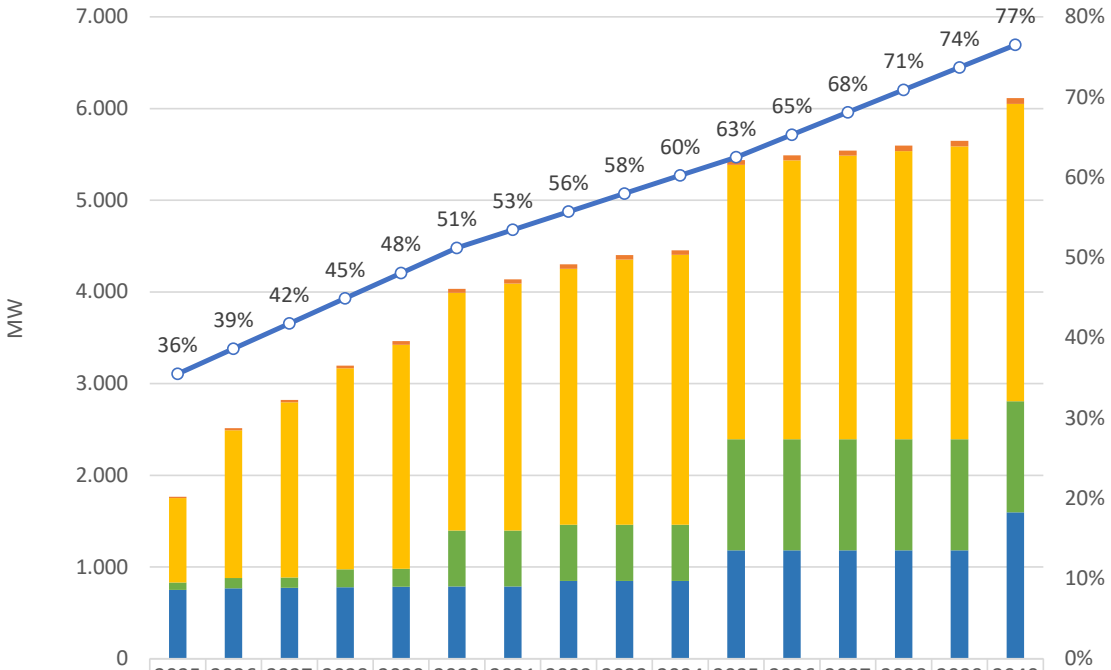


Figure 14 Estimated trajectory by RES technology in gross final energy consumption, electricity sector

Installed power plant capacity in 2024 in the Republic of North Macedonia amounted to about 2,980 MW, with renewable energy capacity accounting for around 56% (1,663 MW). The largest share of installed capacity from renewable sources is in hydropower plants (43%) and solar power plants (51%). The installed capacity of wind power plants is 82 MW (5%), while the capacity of biomass and biogas amounted to about 13 MW (1%). By 2030, the installed power capacity from renewable sources is expected to increase to around 4,000 MW, which is twice as much as the existing power capacity from renewable sources. The biggest increase is expected for solar power plants and wind power plants.

Increasing the installed power capacity from renewable energy sources will increase the share of renewable energy sources in final electricity consumption from the current 32% to 51.2% in 2030.



	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Biomass/Biogas	12	22	24	28	40	42	44	46	48	50	52	54	56	58	60	62
Solar	923	1.613	1.913	2.193	2.443	2.593	2.693	2.793	2.893	2.943	2.993	3.043	3.093	3.143	3.193	3.243
Wind	81	111	111	196	196	611	611	611	611	611	1.211	1.211	1.211	1.211	1.211	1.211
Hydro	749	768	773	778	783	787	787	849	849	849	1.182	1.182	1.182	1.182	1.182	1.597
RES-E	36%	39%	42%	45%	48%	51%	53%	56%	58%	60%	63%	65%	68%	71%	74%	77%

Figure 15 Estimated power plant capacities from RES, by technology

The goal of RES share in the heating and cooling sector is achieved by electrification of this sector and gradual elimination of inefficient biomass stoves (Figure 16). Biomass stoves will be replaced with high energy efficient heat pumps that are considered renewable energy sources. Therefore, in 2030, 90% of the final energy consumption will come from biomass, 7% from solar, 2.1% from heat pumps and RES in combined heat and power plants, 0.7% from hydrogen and 0.7% from geothermal sources.

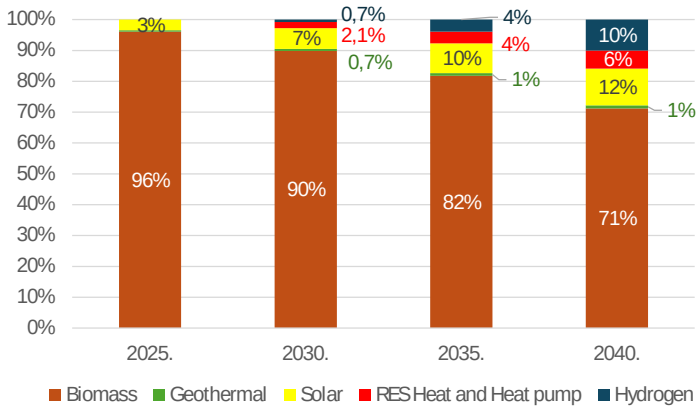
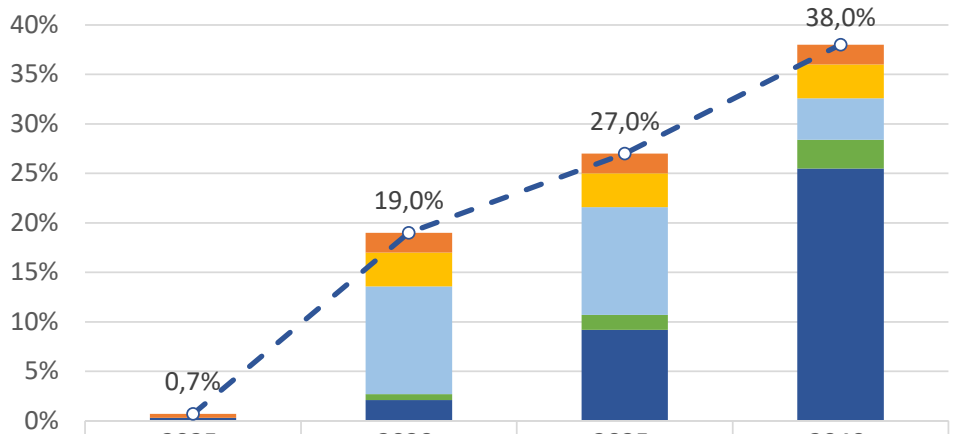


Figure 16 Estimated trajectory by RES technology in gross final energy consumption, heating and cooling sector

The current share of RES in transport is less than 1% and is planned to increase to 19% by 2030. By 2030, the largest contribution to the target (16.3 percentage points) is expected from biofuels, while electricity will contribute with 2.1 percentage points. When it comes to biofuels, the largest contribution is expected from advanced biofuels (10.9 percentage points), biofuels produced from used cooking oil (3.4 percentage points) and first-generation biofuels (2 percentage points). By 2030, the use of renewable fuels of non-biological origin (RFNBO), primarily hydrogen, is also expected to amount to 0.6 percentage points.



	2025.	2030.	2035.	2040.
1st gen. biofuels	0,4%	2,0%	2,0%	2,0%
Biofuels from UCO	0,0%	3,4%	3,4%	3,4%
Advanced biofuels	0,0%	10,9%	10,9%	4,2%
RFNBO	0,0%	0,6%	1,5%	2,9%
RES electricity	0,3%	2,1%	9,2%	25,5%
National target	0,7%	19,0%	27,0%	38,0%

Figure 17 Estimated trajectory by RES technology in final energy consumption, transport sector

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 shows that in 2030 the biomass demand is about 280 ktoe, of which 63% is for heat, 29% for biofuels in the transport sector and the remaining 8% for electricity production (Figure 18). There is an increase in 2030 by 36% compared to 2025 due to increase in biofuels demand in transport sector. In the upcoming period, a decrease in biomass demand for heating purposes is expected due to the implementation of energy efficiency measures in buildings, and at the same time, an increase in the use of biofuels in the transport sector is expected.

The biomass demand in the heat and electricity sector will be covered by domestic sources, while for the transport sector detailed study on domestic potential of biofuel production is needed, as specified in measure PM_EE19 Increasing the number of alternative fuel vehicles and the development of alternative fuel infrastructure in road transport.

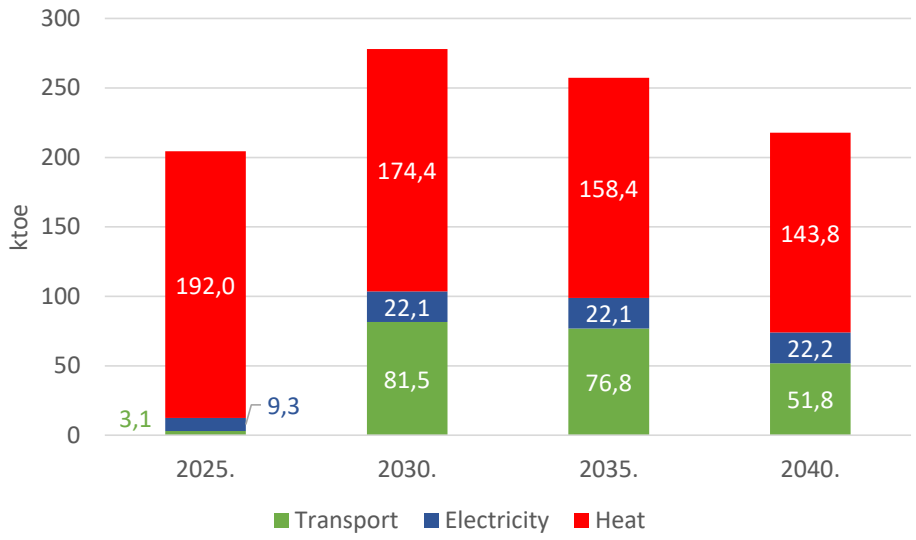


Figure 18 Estimated trajectory on biomass demand, disaggregated between heat, electricity and transport

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

Not applicable

2.2. Dimension: Energy efficiency

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

Indicative national target of increase in energy efficiency **by 2030**

The national targets for increasing energy efficiency by 2030 are shown in Table 9.

Table 9 Indicative national goals for energy efficiency in 2030

2030 targets	PJ	Mtoe
Primary energy consumption	100.5	2.40
Final energy consumption	78.3	1.87

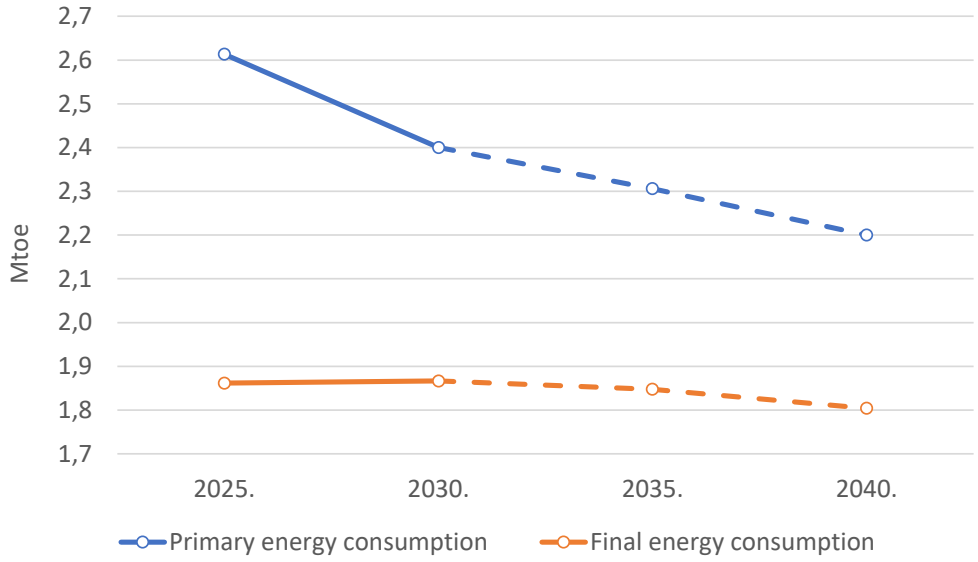


Figure 19 Indicative trajectory of primary and final energy consumption until 2050

The projection of the final energy consumption of all energy forms was made using a "bottom-up" approach, which allows for an overview of structural changes in energy use in different sectors (e.g., industry, households, service sector, transport) necessary to achieve the goals of mitigating climate change.

LEAP software tool (The Low Emissions Analysis Platform) was used to analyse final energy consumption. For the purposes of modelling the WEM and WAM scenarios, the "end-use" modelling technique was applied in such a way that for each sector and sub-sector the current and future need for useful energy was determined according to the purposes, and then, with the application of the appropriate efficiency of technologies and the predicted representation of energy sources, the final energy consumption was calculated.

When modelling energy needs in each individual consumption sector, the so-called "energy efficiency first" principle was applied. Using the example of buildings, the possibilities of implementing energy efficiency measures were first considered, followed by the introduction of new technologies for heating and cooling, replacement of energy sources, etc. The same principle was applied in other sectors.

The main determinants of changes in the energy sector applied in the preparation of projections of final consumption of all forms of energy are the following:

• increasing energy efficiency in all parts of the energy chain (production, transport/transmission, distribution and energy consumption) and applying the principle of energy efficiency first;
• switching as many activities as possible to the use of electricity (where this is technologically possible and cost-effective in the long term);
• increasing profitability of investments in RES technologies, due to the expected decline in the prices of these technologies and the increase in the prices of emission units.

On the energy production side, an increase in the efficiency of energy transformation is also expected through the construction of new cogeneration plants and gas-fired thermal power plants (TPPs), as envisaged by the Government Work Programme 2024-2028, with a higher degree of useful activity and an increase in the share of RES. On the side of transmission and distribution of electricity and heat, further reduction in losses is expected.

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.

No targets under point (b) of Article 7(1) have been set.

iii. The indicative milestones for 2030, 2040 and 2050, the domestically established measurable progress indicators, an evidence-based estimate of expected energy savings and wider benefits, and their contributions to the Union's energy efficiency targets as included in the roadmaps set out in the long-term renovation strategies for the national stock of residential and non-residential buildings, both public and private, in accordance with Art 4 of Directive 2012/27/EU on Energy Efficiency;

The national long-term renovation strategy for the national stock of residential and non-residential buildings has not yet been developed.

iv. 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.

Not applicable.

2.3. Dimension: Energy security

i. 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;

Diversification of energy sources will be supported by fulfilling the following national energy security objective:

1. **Increased diversification of energy supply**

The primary approach to achieving diversification of energy sources is by increasing the use of renewable energy resources, as described in paragraph 2.1.2, coupled with grid reinforcement and enhanced storage. The primary production of renewables and biofuels will be increased, primarily due to the implementation of the measure PM_D26: Developing a low-carbon fuel market.

In parallel, construction of new gas interconnections (as elaborated in PM_IEM2) is being planned. These connections will enable establishment of additional gas supply routes (natural gas from Azerbaijan and LNG from various sources, via LNG terminals in Greece), thus contributing also to security of gas supply of the neighbouring countries and the entire region, by enabling the fulfilment of supply security obligations and according to the infrastructure standard (N-1 criterion) under Regulation (EU) 2017/1938 of the European Parliament and of the Council of October 25th, 2017, on security protection measures gas supply and invalidation of Regulation (EU) no. 994/2010 (Text relevant to the EEA) (OJ L 280, September 28th, 2017).

Energy security will further be increased by introduction of additional gas fired cogeneration power plants, as envisaged within the measures PM_D15 Generation Portfolio Decarbonization: Sequential Coal Closure & Low-Carbon Build-out and PM_EE14 Enabling regulatory framework for development of new DHS, connection to existing DHS and individual metering and billing of heat consumption.

All gas infrastructure will be hydrogen ready, which will contribute to a gradual and full decarbonization of the national energy system. Institutional and legal framework for the hydrogen use will be developed.

The targets for diversification of energy supply are set for:

- Primary production of “Renewables and biofuels”: the value of this indicator is expected to reach at least 20 PJ until 2030 (to be monitored via PM_D26 indictor).
- Use of natural gas in cogeneration power plants: the value of this indicator is expected to reach at least 30 PJ in 2030 (to be monitored via PM_D15 indictor).

ii. National objectives with regard to reducing energy import dependency

The most important set of measures related to reducing energy import dependency from third countries are related to increasing the share of renewables and energy efficiency (as described in paragraphs 2.1.2 and 2.2, respectively), alongside with the overall electrification of final energy consumption. Diversifying gas supply routes will also contribute to this objective.

Currently, the most important fuels being imported from the third (non-EU and non-Enenergy Community) countries are oil and petroleum products. The target for reducing energy import dependency is therefore set for oil and petroleum products, currently entirely imported. In 2023 the import of oil and petroleum products was equal to 52.9 PJ and it is expected to significantly decrease in future. The target for **oil and petroleum products for 2030 is set at 35 PJ**. It is expected that the most important measure for reaching this target is the measure PM_D25: Developing a low-carbon fuel market.

iii. 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

System flexibility will be improved by increasing storage capacities in the electric power system and by strengthening the electric transmission grid, by further energy systems integration (in particular, by integrating transport system and heat system with the electric power system) and by enabling a more active role of final energy consumers in electricity markets. As all this requires increasing digitalization of the energy system, additional concern will be given to ensuring cybersecurity.

Therefore, the following national energy security objectives have been formulated

- Increased energy system flexibility

The energy system flexibility will be increased by constructing energy storage in electric power system (batteries and reversible hydro power plants), together with the introduction of demand response, aggregators and energy communities. Accompanying regulatory framework will be developed. It is expected that by 2030 battery energy storage systems of 200 MW total power and the ability to store 400 MWh of energy will be connected to the electric power system.

- Increased energy system resilience

This goal will be achieved by further development of the regulatory framework, primarily related to the Regulation (EU) 2019/941 and Regulation (EU) 2017/2196, and developing risk assessment procedures and emergency plans. Resilience of the electric power system will be measured by loss of load expectation (LOLE) and energy not served (ENS). In the upcoming period, measurable targets for 2030 will be set.

In 2022, a new Critical Infrastructure Law has been drafted, stipulating the energy sector as a sector of national critical infrastructure that needs to be protected of various threats, including from digital threats. The Republic of North Macedonia has adopted its Cybersecurity Strategy (2018-2022) and established a national Computer Incident Response Centre (MKD-CIRT) however the EU legislation on cybersecurity has not been transposed yet. Steps pursuant to the EU cybersecurity policy, standards, practices and legal framework – all relevant for the energy sector – have to be implemented.

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:
   1) Price differential in the wholesale market exceeding an indicative threshold of EUR 2/MWh between Member States, regions or bidding zones;
   2) Nominal transmission capacity of interconnectors below 30 % of peak load;
   3) Nominal transmission capacity of interconnectors below 30 % of installed renewable generation.

Current interconnectivity levels are much higher than the EU interconnectivity targets and no national targets have been set in terms of interconnectivity. However, energy market has not yet been fully integrated in the single EU market and actions must be undertaken primarily in this direction.

Full energy market coupling with the EU market is set as a key goal in this dimension, as elaborated in the measure "PM_IEM6 Align with electricity integration package to enable electricity market coupling of the EU and North Macedonia". Within the measure, it is envisaged that transmission capacities of the interconnectors in relation with the peak load and the installed renewable generation will be monitored and corrective measures undertaken as necessary.

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.

Although the interconnectivity levels are already high, there are several electricity and gas infrastructure projects – some of them are improving cross border capacities, while some of them are aiming at upgrading and strengthening the existing capacities within national borders:

- Construction of 400 kV power transmission interconnection line between North Macedonia and Albania (OHTL Bitola, North Macedonia – Elbasan, Albania): project is a part of the EU's initiative to establish an East-West electricity transmission corridor between Bulgaria, North Macedonia, Albania, Montenegro and Italy
- Develop natural gas cross-border infrastructure between North Macedonia and Greece, Serbia, Kosovo and Albania: projects will enable diversification of gas supply

ii. Where applicable, main infrastructure projects envisaged other than Projects of Energy Community Interest (PECIs)/ Projects of Mutual (PMIs)

There are several projects aiming at increased integration of renewable energy sources, enhanced grid stability and reliability and increasing energy security, other than PECI/PMI projects:

- Upgrade and strengthen power transmission to integrate renewable energy generators in North Macedonia
- Construction of new 400 kV hubs for easy integration and network access of RES
- Revitalization/reconstruction of 110 kV transmission line
- Upgrade the power transmission network in the western region of 110 kV overhead lines Gostivar-Kicevo-Bitola, constructing the in-out connection of 110 kV OHTL and additional transformer in TS Štip

- Build main gas pipeline sections: Gostivar-Kichevo, Sveti Nikole-Veles, Branch to Gevgelija, Branch to TPP Negotino, Branches to TIDZ, Kichevo-Ohrid, and Ohrid-Bitola
- Improvement and Upgrade of Skopje District Heating Network

2.4.3. Market integration

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

The main national objective related to market integration is to enable market coupling of the electricity markets in North Macedonia with Greece. In order to do this, it necessary to align the remaining regulatory framework with the the EU legislation.

The first step towards increasing the system flexibility is to improve the system monitoring and management, as well as to introduce smart components in the transmission network.

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;

One of the key national objectives is to ensure the non-discriminatory participation of renewable energy sources, demand response, and energy storage solutions—including through aggregation—in all energy markets**.** This objective supports the transition to a more flexible, decentralized, and decarbonized energy system, aligned with national climate goals and the long-term emissions reduction targets. To achieve this, measures will be implemented to remove regulatory and market barriers that prevent fair access for these resources, while fostering competitive and efficient market conditions.

For the period this document refers to, national objective is to align relevant legislation with the EU regulatory framework.

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;

One of the national objectives is to empower consumers to actively participate in the energy system and benefit from self-generation, energy efficiency, and the adoption of new technologies**,** including smart meters and intelligent energy management systems. This objective aims to place consumers at the heart of the energy transition, enabling them to reduce costs, increase energy independence, and contribute to decarbonization efforts. For the period this document refers to, national objective is to align relevant legislation with the EU regulatory framework.

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;

One of the national objectives is to ensure the adequacy and flexibility of the electricity system in line with increasing shares of variable renewable energy sources (RES). As the energy transition accelerates, maintaining a secure and stable

electricity supply becomes essential. Strategic investments in grid modernization, digitalization, and cross-border infrastructure will enhance system responsiveness and resilience. Additionally, market reforms will be introduced to incentivize flexibility services and support the integration of decentralized RES, ensuring that system adequacy and climate goals are met in parallel.

Risk of security of supply is evaluated through the calculation of LOLE and EENS metrics. National objective is to determine targets for these indicators and to establish a system of monitoring them.

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

The national objective is to strengthen consumer protection and enhance the competitiveness of the retail energy sector, ensuring that all consumers have access to affordable, transparent, and reliable energy services. This includes the implementation of clear billing information, robust complaint mechanisms, and protection measures for vulnerable consumers. For the period this document refers to, national objective is to align relevant legislation with the EU regulatory framework.

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 primary challenge in setting objectives to address energy poverty is determining which households qualify as energy-poor. To tackle this issue appropriately energy poverty should not be defined solely based on income criteria; instead, a comprehensive definition of energy poverty should be established, taking into account not only households income but also their energy efficiency.

Therefore, the objective is to establish a multidimensional definition of energy poverty and use it in the annual programs for vulnerable consumers.

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;

Among the three national development goals set by the National Development Strategy 2024 – 2044, the first goals is "Strengthening the competitiveness of the economy through a functional and innovative ecosystem, improving the skills, knowledge, inclusion and resilience of citizens". The first out of six key strategic areas is "Sustainable, Innovative and Competitive Economy". It can be seen that both the development goal and the strategic area could be related to the Energy union priority technologies, however no such link has been made yet.

In 2023 the Smart Specialization Strategy (S3) of the Republic of North Macedonia 2024-2027 has been adopted, with the four priority domains, based on the mapping analysis and entrepreneurial discovery process:

- Smart Agriculture and Food with Higher Added Value
- Information and Communication Technologies (ICT)
- Electro-Mechanical Industry – Industry 4.0
- Sustainable Materials and Smart Buildings.

Additionally, two horizontal domains have been identified: "Energy for future" and "Tourism". Energy for future is considered horizontal due to its strong cross-sectoral relations with other proposed priority areas and in line with the process of greening the industry and protecting the environment (energy efficiency, eco solutions, renewable energy, climate change, decarbonisation, reduce emissions etc.).

In terms of funding targets for research and development expenditure, the S3 strategy refers to 2019 as the base year, with the value of 0,37% R&D expenditures share of GDP and sets the target value of 1% in 2027. However, no specific targets related to the Energy Union R&I priorities have been set within the S3 strategy.

Therefore, this plan sets the following objectives:

- to increase the access to the EU funding programs for research and innovation (like Horizon Europe, the successor of Horizon 2020) and other international donors in the areas related to energy and climate
- to earmark a share of national funding targets for public research and innovation related to the Energy Union R&I priorities.

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

The most important technologies for power sector decarbonisation are solar PV, wind, biomass and biogas power plants, accompanied by a suite of technologies enabling their integration into the power system. The highest impact on decarbonization of final energy consumption is in transport sector, due to increased share of electric vehicles, also implying a sharp increase in electric chargers and batteries, acting not only as energy consumers but also as energy storage and a source of electricity. A growing importance of biofuels is also expected in transport sector.

It is expected that hydrogen will have a growing role in energy systems and that the number and importance of electrolysers will grow after 2030 and beyond. Further, it is expected that carbon capture, use and storage technologies will be necessary to reach carbon neutrality, primarily in electricity generation and industry sectors, and that they will play a decisive role after 2040. It is therefore recommended to consider these technologies in the smart specialization strategies for the periods from 2027 and beyond.

It must be noted that in October 2023 the Communication on the revision of the SET Plan was adopted, in order to harmonise the original strategic objectives with the European Green Deal, REPowerEU and the Green Deal Industrial Plan (primarily the Net-Zero Industry Act). The process of updating energy union priority strategies is underway, to be monitored and observed in the development of the new smart specialization strategy for the period 2028-2035.

iii. Where applicable, national objectives with regard to competitiveness.

The S3 strategy has set a number of objectives related to competitiveness, however no specific targets related to SMEs involvement in energy union priorities have been set. The Energy Strategy identified that promoting the expansion of RES projects and EE measures, in general, will support greater involvement of local SMEs in the energy transition.

On the other hand, the draft National Small and Medium Entreprises Strategy 2025 – 2030 sets a number of objectives to be achieved under each priority areas and a number of indicators to monitor the achievement, however no specific targets related to the Energy Union priority technologies have been set.

Therefore, the objective is to encourage and support SMEs to diversify their portfolio of services and products in clean energy technologies by providing suitable support mechanisms (co-financing grants, business accelerators, technology transfer offices, Science Technology Park, etc.).

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.

<table>
<tr><td colspan="3">PM_D1: Strengthening institutional and governance framework for effective NECP implementation</td></tr>
<tr><td colspan="3">Main objective: To establish robust institutional mechanisms, ensure financial planning, monitor progress, and maintain alignment with evolving EU energy and climate legislation, thereby enabling efficient and accountable NECP implementation.
Description: This measure establishes the institutional and governance foundations necessary to deliver on decarbonisation targets. It includes creating a governance board with representation from all relevant ministries, municipalities, agencies, regulatory bodies, business sector entities, academic institutions and civil society organizations; assessing the financial needs of all decarbonisation actions envisaged by NECP; setting up a monitoring and reporting system with defined roles and responsibilities; and aligning national legislation with the evolving EU climate acquis. The measure will strengthen cross-sectoral cooperation and ensure all responsible institutions are actively engaged in implementation. It will also support evidence-based decision-making by improving data collection, transparency, and public access to information. Furthermore, it will create the institutional conditions required to unlock international climate finance and donor support.
Key Activities:
• Establishment of a National Energy and Climate Governance Board
• Thorough budget assessment and planning for NECP measures, including multiannual, annual and mid-term budgeting framework and identifying funding gaps and strategies (national budget, EU and other donors, green finance)
• Monitoring and reporting mechanism for NECP implementation, including publicly accessible NECP progress dashboard to ensure transparency.
• Establish a dedicated EU Energy and Climate Acquis Alignment Taskforce, permanently monitoring updates to EU legislation, assessing their implications for the Republic of North Macedonia and preparing legal and regulatory proposals for timely transposition and implementation</td></tr>
<tr><td colspan="2">Timeframe</td><td>2025 – 2030</td></tr>
<tr><td colspan="2">Type</td><td>Enabling (governance, legal, administrative)</td></tr>
<tr><td colspan="2">Sector</td><td>All</td></tr>
<tr><td colspan="2">Relevant planning documents, legal and regulatory acts</td><td>• Long term strategy on climate action
• Draft Law on Climate Action
• Reform agenda for North Macedonia</td></tr>
<tr><td rowspan="3">Finance</td><td>Cost estimate until 2030</td><td>3 MEUR</td></tr>
<tr><td>Available budget</td><td>n.a.</td></tr>
<tr><td>Source of finance</td><td>State budget, bilateral/multilateral donors, technical assistance from Energy Community/EU</td></tr>
<tr><td colspan="2">Implementing entities</td><td>• Ministry of energy, mining and mineral resources
• Ministry of environment and physical planning
• Ministry of transport and communications</td></tr>
</table>

	• Ministry of economy and labour • Ministry of agriculture, forestry and water economy • Ministry of science and technology • Ministry of finance
Monitoring entity	Ministry of energy, mining and mineral resources
Progress indicators	• Governance board established; list of members; meeting minutes • Budget report produced and updated annually • NECP progress reports submitted • Public dashboard online • Taskforce established • Transposition tracking tool developed and functional
Relation with other dimensions	All dimensions

PM_D2: Introduction of MRVA and national carbon pricing mechanism in the period 2025 - 2029 as a preparatory work for full-fledged implementation of EU ETS in 2030		
Main objective: To establish a functional national carbon pricing mechanism supported by a robust MRVA system, serving as a transitional phase toward full alignment and integration with the EU Emissions Trading System (EU ETS) by 2030. **Description:** This measure entails the development and phased implementation of a domestic carbon pricing mechanism between 2025 and 2029, designed to reflect the structure and principles of the EU ETS. It will serve as a testing and capacity-building platform, enabling all relevant stakeholders—public and private—to adapt to the operational, technical, and institutional requirements of EU carbon market participation. A critical pillar of this measure is the establishment of a **comprehensive MRVA system**, ensuring environmental integrity, transparency, and credibility of the pricing mechanism. The MRVA framework will be fully aligned with EU ETS standards. **Key Activities:** • Adoption of a legal and institutional framework for carbon pricing and MRVA. • Pilot implementation of MRVA procedures in selected sectors. • Capacity building and training for operators, verifiers, and authorities. • Development and testing of a digital emissions registry and reporting platform. • Alignment with EU MRVA regulations and guidelines to ensure interoperability.		
Timeframe		2025 – 2030
Type		Regulatory, Institutional, Capacity building
Sector		All
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on Energy • Bylaws for renewable energy • Long term strategy on climate action • Draft Law on Climate Action • Reform agenda for North Macedonia
Finance	Cost estimate until 2030	500,000 EUR
	Available budget	TBD
	Source of finance	n.a.
Implementing entity		• Ministry of environment and physical planning • Ministry of Economy and Labour • Accredited verifiers • Institute for accreditation • JSC North Macedonian Power Plants (ESM AD) • Business chambers • Private sector
Monitoring entity		Ministry of environment and physical planning

Progress indicators	• Legislation drafted, adopted, and published • Competent authorities designated • Institutional roles defined and operational • Number of participating installations • Monitoring plans and verified reports submitted • Pilot evaluation report completed • Number of trainings and participants and training materials developed • Digital platform designed, developed, and tested • Roadmap for alignment with EU MRVA regulations adopted • Procedures harmonized with EU standards • Number of industrial facilities included in the national carbon pricing mechanisms • Amount of emissions reduced (CO_2-eq.) • Energy savings (ktoe/GWh)
Relation with other dimensions	Internal energy market

PM_D3: Improved manure management on small dairy cows and swine farms and reduction of the N_2O emissions and N-loss in line with the Nitrate Directive		
Main objective: Establishment of on farm systems for prolonged disposal of the manure and improved manure management practices, ensuring alignment with the EU Nitrate Directive (91/676/EEC). **Description:** This measure aims to enhance environmental sustainability and reduce greenhouse gas emissions from the agricultural sector, specifically from smaller-scale livestock operations, including SMEs. Poor manure management is a key source of N_2O emissions and nitrogen leaching into water bodies, contributing to air and water pollution. The measure is expected to result in 5% of small dairy caws and swine farms improving their manure management systems by 2030. **Key activities:** • **Promotion of good agricultural practices** for manure storage, handling, and application in line with the Nitrate Directive. • **Support for low-emission manure application techniques**, such as injection or trailing shoe systems. • **Upgrading or construction of covered manure storage facilities** to reduce volatilization and runoff. • **Training and advisory services** for farmers on nutrient management planning and compliance with environmental standards. • **Monitoring and demonstration activities** to showcase best practices and build capacity among smallholders.		
Timeframe		2025 – 2030
Type		Institutional and technical
Sector		Agriculture
Relevant planning documents, legal and regulatory acts		• Long Term Strategy on Climate Action • The national strategy for agriculture and rural development for the period 2021-2027 • Strategic plan of the MAFAWE for 2023-2025 • National program for the development of agriculture and rural development for the period of 2023-2027
Results to be achieved		• Reduction of the N_2O emissions from the manure management practices on the small dairy farms for up to 30%.
Finance	Cost estimate until 2030	n.a.
	Source of finance	IPARD programme, national payment programme, private investors
Implementing entity		Agency for Financial Support of the Agriculture and Rural Development
Monitoring entity		Ministry of agriculture, forestry and water economy
Progress indicators		• Number of farms (dairy cows and swine as a percentage of the total population) used modified manure management in 5 years

	• Number of farms (dairy cows and swine as a percentage of the total population) adopting good agricultural practices for manure management / Number of farms using low-emission equipment (e.g., injectors, trailing shoes). • Number of new or upgraded covered manure storage facilities. • Total manure storage capacity (m^3) improved through the measure. • Number of training sessions and workshops conducted for farmers. • Number of demonstration sites established and farm visits conducted. • Reduction in N and N_2O losses, estimated or monitored at pilot sites. • Emissions reduction (Gg CO_2-eq)
Relation with other dimensions	Research, innovation and competitiveness (competitiveness)

PM_D4: Improved manure management, increased use of organic fertilisers and waste to biogas/energy production on the big farms in the Republic of North Macedonia		
Main objective: To reduce greenhouse gas emissions and environmental pollution from large-scale farming in North Macedonia by improving manure management, promoting the use of organic fertilisers, and converting agricultural waste into renewable energy through biogas production. **Description:** This measure incentivizes green investments in infrastructure and technology, such as biogas systems and composting facilities. Capacity-building programs will train farmers and technical staff in advanced manure, fertilizer, and biogas management practices, while research and demonstration projects will promote the adoption of best practices. Robust monitoring systems will track emissions, nutrient use, and farm performance to ensure compliance and measure impact. Additionally, the measure fosters stakeholder collaboration among farms, municipalities, and waste providers to optimize resource efficiency and circular economy integration. The measure is expected to result in 10% of the manure produced from the cattle population and 25% of the manure produced from the swine population being used for biogas production by 2030. **Key Activities:** • Align national policies with EU standards on waste, energy, and agriculture. • Provide financial support and incentives (e.g. IPARD, subsidies, feed-in tariffs). • Train farmers and technical staff on manure, fertiliser, and biogas management. • Provision of financial instruments for investments in infrastructure and technology (storage, composting, biogas systems) • Support research and demonstration projects to showcase best practices. • Establish monitoring systems for emissions, nutrient use, and farm performance. • Promote stakeholder cooperation among farms, municipalities, and waste providers.		
Timeframe		2025 - 2030
Type		Institutional and technical
Sector		Agriculture
Relevant planning documents, legal and regulatory acts		• Long Term Strategy on Climate Action • The national strategy for agriculture and rural development for the period 2021-2027 • Strategic plan of the MAFAWE for 2023-2025 • National program for the development of agriculture and rural development for the period of 2023-2027 •
Finance	Cost estimate until 2030	TBD
	Source of finance	IPARD programme, national payment programme, private investors
Implementing entity		Agency for Financial Support of the Agriculture and Rural Development
Monitoring entity		Ministry of agriculture, forestry and water economy
Progress indicators		• Number of national policies aligned with relevant EU directives on waste, energy, and agriculture. • Total funding disbursed to farms through IPARD, subsidies, or energy incentives.

	• Number of farmers and technical staff trained in manure, fertiliser, and biogas management. • Number of farms equipped with improved storage, composting, or biogas systems. • Number of research or demonstration projects implemented and shared. • Number of farms used modified manure management in 5 years Emissions reduction (Gg CO_2-eq) • Number of stakeholder partnerships or joint projects established between farms and local actors
Relation with other dimensions	Energy security, Internal energy market, Research, Innovation and Competitiveness

PM_D5: Sustainable Forest Management

Main objective: Enhance the resilience, biodiversity, and productivity of forest ecosystems through the implementation of sustainable forest management practices, ensuring legal and sustainable use of forest resources.

Description: This measure strengthens institutional capacities to implement Sustainable Forest Management practices in alignment with national and EU environmental commitments. It introduces climate-resilient forest management plans, leveraging remote sensing, GIS technologies, and periodic forest inventories to enhance monitoring and adaptive management. The initiative also considers alignment and implementation of relevant IPARD forestry related measures, and also enforces sustainable and legal timber harvesting through improved forestry regulations, enhanced monitoring systems, and stricter law enforcement to combat illegal logging. Additionally, it promotes community-based forest stewardship by engaging local stakeholders in conservation efforts and sustainable resource utilization. Activities supporting natural regeneration and forest restoration are also part from this measure and include protecting naturally occurring seedlings through assisted natural regeneration, preparing soil to enhance germination, and controlling competing vegetation and invasive species. Restoration efforts also involve protecting sites from grazing, fire, pests, and erosion, while hydrological rehabilitation helps restore soil moisture and ecosystem functions. The integrated approach ensures biodiversity protection, carbon sequestration, and long-term forest ecosystem resilience while supporting rural livelihoods. The measure is expected to result in improved forest health, increased biodiversity, enhanced productivity, and sustainable use of forest resources by 2030 and 2050.

Key actions:

- Build institutional capacities to implement sustainable forest management (SFM) practices.
- Develop and implement climate-resilient forest management plans supported by remote sensing, GIS, and regular forest inventories.
- Enhance the alignment and improve the administrative capacities for implementation of IPARD forestry related measures
- Natural regeneration and forest restoration activities focused on protecting seedlings, enhancing soil conditions, controlling threats, and restoring ecosystem functions for long-term forest recovery.
- Ensure sustainable and legal harvesting through improved forestry practices, monitoring, and stronger law enforcement.
- Engage and empower local communities in forest stewardship and sustainable use of forest resources.

Timeframe	2025 - 2030
Type	Institutional and technical
Sector	AFLOU-Forestry
Relevant planning documents, legal and regulatory acts	• Law on forest, • Special rule book for forest fire protection, • Strategy for development of the forest fire protection, diseases and insects with action plan for realization of the projects and procurements for the needs of PE "Makedonski sumi" • Strategy for Sustainable Development of Forestry in the Republic of North Macedonia

		• National Plan for Sustainable Development of Forestry • Standards for Sustainable Forest Management Draft Revised Strategy for sustainable development of the forestry sector (2026 – 2046)
Finance	Cost estimate until 2030	1 MEUR
	Available budget	n.a.
	Source of finance	PE "National forests", other forest enterprises, National Parks, Crisis Management Centre, private forest owners, IPARD
Implementing entity		Ministry of Agriculture Forestry and Water Economy, through PE "National forests", Crisis Management Centre
Monitoring entity		Ministry of Agriculture Forestry and Water Economy, through PE "National forests"
Progress indicators		• Number of forestry staff and institutions trained on updated sustainable forest management (SFM) practices. Target 2030: 300 staff trained across public enterprises, municipal services, and relevant institutions. • Number of developed climate-resilient forest management plans covering designated forest areas. Target 2030: 15 forest management plans developed and approved, covering priority forest areas vulnerable to climate impacts. • Amount of IPARD funds used for forestry related measures; • Area (in hectares) of forest land under natural regeneration and restoration measures implemented and maintained. • Percentage of annual timber production certified under recognized sustainable forest management standards. Target 2030: 30% of annual timber production certified under relevant standards. • Number of local community groups actively participating in forest stewardship initiatives. Target 2030: 30 local community groups engaged in formal forest stewardship and protection activities.
Relation with other dimensions		Research, Innovation and Competitiveness

PM_D6: Forest Fire Prevention and Early Warning Systems (EWS)

Main objective: Strengthen institutional capacities for forest fire prevention, early detection, and response through the establishment of an effective early warning system and utilization of Copernicus Emergency Management Service (CEMS).

Description: This measure strengthens national wildfire prevention and response capacities through systematic risk reduction and institutional coordination, through procuring modern firefighting equipment and mitigating fire hazards. A national early warning system will be established, integrating advanced monitoring technologies such as Copernicus EMS, satellite data, and drone surveillance for real-time threat detection. The initiative enhances inter-agency emergency response protocols while building technical expertise through specialized training programs for fire management institutions. Additionally, it fosters community-based fire prevention by engaging local stakeholders in awareness campaigns and participatory protection activities, ensuring a multi-level approach to safeguarding forest ecosystems. The measure is expected to result in a decrease of the burned forest areas in the period 2026-2030 for 50% in comparison with the burned forest areas in the period 2021-2025 and increase the area of forests certified for SFM.

Key actions:

- Identification of needs and procurement of firefighting equipment and vehicles
- Apply fuel reduction and thinning measures to reduce forest fire risk in vulnerable areas
- Establish and operate a national early warning system for forest fires using integrated data sources
- Train institutions in using Copernicus EMS and invest in firefighting infrastructure and technology (e.g., drones, satellite monitoring)
- Improve inter-agency coordination and response mechanisms for effective fire detection, prevention, and control

• Engage and empower local communities in fire prevention and protection activities		
Timeframe		2025 – 2030
Type		Institutional and technical
Sector		AFOLU-Forestry
Relevant planning documents, legal and regulatory acts		• Law on Forests • Special Rulebook for Forest Fire Protection • Strategy for Development of Forest Fire Protection • Action Plan for Projects and Procurements for PE "Makedonski Sumi" • Draft Revised Strategy for sustainable development of the forestry sector (2026 – 2046) • National Strategy for Protection and Rescue • Law on Protection and Rescue • Law on Crisis Management • Draft National Plan for landscape fire management
Finance	Cost estimate until 2030	3 MEUR
	Available budget	n.a.
	Source of finance	Source of finance: GCF, PE "National forests", Crisis Management Centre, private forest owners
Implementing entity		Ministry of Agriculture, Forestry and Water Economy, through PE "National forests", Crisis Management Centre
Monitoring entity		Ministry of Agriculture, Forestry and Water Economy, through PE "National forests"
Progress indicators		• Number of firefighting equipment units and vehicles procured and operationalized. Target 2030: 30 new units (vehicles, water tanks, drones, and other specialized equipment) delivered and operational. • Total forest area treated annually with fuel reduction and thinning measures in high-risk zones. Target 2030: 5,000 hectares of fire-prone forest area treated annually with preventive measures (thinning, fuel breaks, prescribed burning). • Operational status of the national forest fire early warning system (Yes/No) Target 2030: Fully operational early warning system with integrated data sources (Copernicus, national GIS, sensors). • Number of institutions trained in the application of Copernicus EMS tools and technologies. Target 2030: 10 institutions trained (Ministry, Crisis Management Centre, local authorities, fire brigades). • Number of joint protocols and operational procedures adopted for inter-agency coordination. Target 2030: 5 joint protocols formalized between key agencies (MoAFWE, Crisis Management Centre, Fire Brigades, Municipalities). • Number of local community groups actively participating in fire prevention and protection initiatives. Target 2030: 30 community groups engaged in fire prevention actions (awareness, monitoring, volunteer firefighting units).
Relation with other dimensions		Research, Innovation and Competitiveness

PM_D7: Large scale afforestation projects, financial instruments and urban forests
Main Objective: To enhance climate resilience, biodiversity, and environmental quality **Description**: The measure enhances climate resilience, biodiversity and environmental quality through the implementation of large-scale afforestation and restoration initiatives, the development of innovative financial instruments supporting sustainable forestry, and the expansion of urban forests to improve ecosystem services and quality of life in urban areas. The measure is expected to result in annual afforestation and reseeding rates of 10,000 hectares per year during the period 2026 – 2030, including restoration of degraded and burned areas

Key Actions:

- Identify and restore degraded, marginal, and burned forest areas through large-scale afforestation and reseeding with climate-resilient species (e.g., Oak Quercus spp., mixed forests).
- Develop and implement a dedicated action plan for the regeneration of burned forest areas in line with the Law on Forestry, ensuring ecosystem restoration and climate adaptation.
- Strengthen the nursery production capacities to support afforestation, reforestation, and urban forestry initiatives trough PPP and subsidy programmes.
- Design and deploy innovative financial mechanisms (e.g., forest bonds, subsidies, carbon credits) to incentivize investments in afforestation, forest restoration, and sustainable forest management.
- Execute targeted reforestation initiatives to rehabilitate degraded lands and enhance forest ecosystem services, contributing to national climate and biodiversity objectives.
- Expand urban forests and green spaces to mitigate urban heat islands, improve air quality, strengthen urban climate resilience, maintain biodiversity and ecosystem services provisioning .
- Integrate urban forestry into local spatial planning frameworks and promote community engagement in tree planting and stewardship activities.

Timeframe		2025 – 2030
Type		Technical
Sector		AFLOU-Forestry
Relevant planning documents, legal and regulatory acts		• Law on forest, • Special rule book for forest fire protection, • Law on urban greenery • Strategy for development of the forest fire protection, diseases and insects with action plan for realization of the projects and procurements for the needs of PE "Makedonski sumi" • Strategy for Sustainable Development of Forestry in the Republic of North Macedonia • National Plan for Sustainable Development of Forestry • National Standards for Sustainable Forest Management • Draft Revised Strategy for sustainable development of the forestry sector (2026 – 2046) • National Strategy for Protection and Rescue • Law on Protection and Rescue • Law on Crisis Management
Finance	Cost estimate until 2030	7.8 MEUR
	Source of finance	PE “National forests”, other forest enterprises, National parks, Ministry of Agriculture Forestry and Water Economy
Implementing entity		Ministry of Agriculture Forestry and Water Economy, LSGUs
Monitoring entity		Ministry of Agriculture Forestry and Water Economy
Progress indicators		• Total area afforested or reseeded annually with climate-resilient species. Target 2030: 10,000 hectares per year of degraded, marginal, or burned lands afforested or reseeded. • Approval and implementation status of the Burned Forest Regeneration Action Plan. Target 2030: Action Plan fully approved and implemented by 2027, with annual progress reports delivered until 2030. • Annual production of forest tree seedlings in public and private nurseries (units). Target 2030: 10 million seedlings produced per year by public, and private nurseries. • Number of operational financial instruments supporting afforestation and forest restoration projects. Target 2030: At least 2 financial instruments operational, including forest bonds, afforestation subsidies, and carbon credit schemes.

	• Total area reforested through targeted rehabilitation projects annually. Target 2030: 5,000 hectares per year rehabilitated through targeted reforestation projects. • Total area of newly established or expanded urban forests and green infrastructure. Target 2030: 500 hectares of urban forests and green spaces established or expanded nationwide. Number of municipalities with integrated urban forestry plans and active citizen participation initiatives. Target 2030: 20 municipalities with prepared urban forestry plans and ongoing citizen engagement programs (e.g., tree planting, stewardship).
Relation with other dimensions	Research, Innovation and Competitiveness

PM_D8: Sustainable Land Management on Sloped Agricultural Terrains		
Main objective: To reduce soil erosion and preserve soil organic matter (SOM) through improved land use practices on sloped agricultural terrains (>5% incline), contributing to carbon sequestration and climate resilience in the AFOLU sector. **Description**: **Key activities:** • Map and assess sloped agricultural land (>5%) by slope class and land use type using GIS and remote sensing. • Classify land into zones for conversion, contour cultivation, or perennial ground cover, and develop targeted plans. • Provide technical support and financial incentives for: • Land use conversion on slopes >15%, • Contour cultivation on field crop land with 5–15% incline, • Establishment of perennial grasses between rows in orchards and vineyards (>5%). • Develop and distribute guidelines and conduct training for farmers and extension services. • Establish demonstration plots to showcase good practices in each land category. • Monitor changes in land use, erosion reduction, SOM levels, and carbon sequestration using remote sensing, field surveys, and sampling.		
Timeframe		2025 - 2030
Type		Education, Technical
Sector		AFLOU-Land
Relevant planning documents, legal and regulatory acts		• Law on agricultural land • Law on water • Rulebook on GAP • Rulebook on cross compliance for minimum requirements of GAP and environmental protection • National Strategy for Agriculture and Rural Development (2021–2027) • Country Programming Framework (CPF) 2021–2025
Finance	Cost estimate until 2030	1.5 MEUR
	Source of finance	Private sector, IPARD programme
Implementing entity		• Ministry of Agriculture Forestry and Water Economy
Monitoring entity		• Ministry of Agriculture Forestry and Water Economy
Progress indicators		• Number of hectares of sloped agricultural land (>5%) mapped and classified by erosion risk and land use type. Target: 10,000 ha mapped and classified by 2030. • Percentage of total targeted sloped land with completed land use classification and transition plans Target: 50% of targeted sloped land (5,000 ha) with transition plans by 2030. • Area (ha) of land >15% slope converted to perennial systems with technical and financial support provided (including number of supported farmers). Target: 500 ha converted by 2030, min 100 farmers financially supported . • Area (ha) of field crop land (5–15% slope) under contour cultivation practices with technical and financial support provided (including number of supported

	farmers). Target: 500 ha managed with contour cultivation by 2030, min 100 farmers financially supported • Area (ha) of orchards and vineyards on sloped terrain (>5%) with perennial grass cover established through financial and technical support (including number of supported farmers). Target: 500 ha of orchards/vineyards with perennial grass cover by 2030, min 50 farmers financially supported • Number of farmers and extension officers trained in sustainable slope management practices. Target: 350 farmers trained, 25 extension officers trained by 2030. • Number of demonstration plots established for sustainable slope management practices. Target: 5 demonstration plots established by 2030. • Annual percentage increase in soil organic matter (SOM) on treated sloped agricultural lands. Target: SOM increase of 0.2–0.3% per year on treated areas. Achieving a cumulative +1% SOM increase by 2030 on intervention sites.
Relation with other dimensions s	Research, Innovation and Competitiveness

PM_D9: Mechanical and biological treatment (MBT) in new landfills with composting

Main objective: Opening of new regional landfills in all waste management regions with installed system for mechanical and biological treatment and composting

Description: Development of new regional landfills in all waste management regions, equipped with Mechanical and Biological Treatment (MBT) systems and integrated composting units. Facilities will include mechanical systems for sorting, shredding, and pre-treating biodegradable waste, alongside aerobic or anaerobic composting of organic municipal waste. High-quality compost will be promoted for agricultural and land restoration use. Monitoring of waste inputs, compost quality, and emissions (odour, leachate) will ensure compliance with environmental regulations. Operator training and public awareness campaigns will support effective waste separation and highlight composting benefits. New landfill with mechanical and biological treatment will be open in East and Northeast region.

Key activities:

- Identify and develop MBT facility sites with integrated composting units, ensuring environmental compliance
- Install mechanical systems for waste sorting, shredding, and pre-treatment of biodegradable waste.
- Implement composting processes (aerobic or anaerobic) for organic fractions of municipal waste.
- Promote the use of quality compost in agriculture, landscaping, or land restoration projects.
- Monitor waste inputs, compost quality, and manage emissions (e.g. odour, leachate) to meet regulations.
- Train operators and raise public awareness on waste separation and compost benefits.

Timeframe		2025– 2030
Type		Technical
Sector		Waste – Solid waste disposal
Relevant planning documents, legal and regulatory acts		• National Waste Management Plan • Strategy for Waste Management in the Republic of North Macedonia • Regional Waste Management Plans (Northeast, Southeast, Pelagonia, Polog and Skopje region) – final and draft versions • Draft Strategy for Waste Management 2025 – 2036 • Law on Extended Producer Responsibility • Law on the Management of Special Waste Streams
Finance	Cost estimate until 2030	Included in PM_D11
	Source of finance	Local self-government through Public Utilities, Public Private Partnership, EU funds
Implementing entity		• Regional waste management companies • Ministry of Environment and Physical Planning • Public municipal enterprises for waste management • State Environmental Inspectorate • Inter-Municipal Waste Management Board • Authorized Inspectors of Environment (Municipalities)

Monitoring entity	Ministry of Environment and Physical Planning
Progress indicators	• Number of MBT facilities with composting units constructed and operational. • Percentage of municipal waste processed through mechanical and biological treatment. • Tons of biodegradable waste diverted from landfill and treated biologically (composted). • Tons of compost produced annually and percentage meeting national/EU quality standards. • Number of personnel trained in MBT operations and number of public outreach events or campaigns conducted • Amount of compost (kt) • Emissions reduction (Gg CO_2-eq)
Relation with other dimensions	Research, Innovation and Competitiveness

PM_D10: Enhanced circularity practices at industrial facilities		
Main objective: Reduction of generation of industrial solid waste **Description**: The measure promotes circular economy in industrial facilities, including SMEs, by setting mandatory and incentivized targets for waste reduction, reuse, recycling, and treatment, supported by Extended Producer Responsibility (EPR) for key waste streams. Targets will be set for reduction of generation, selection, reuse, recycling and treatment of waste at industrial installations and implement EPR system for the defined waste streams (packaging waste, waste electrical and electronic equipment, waste bacteria and batteries, used vehicles, waste oils, textile waste and other waste streams) determined in accordance with the regulations on additional waste streams. The measure is expected to result in a 5% decrease of the industrial solid waste by 2030 **Key activities:** • Require IPPC operators to assess and report on waste generation, selection, reuse, recycling, and treatment. ○ Set progressive 5-year circularity targets in integrated environmental permits, including mandatory and incentivized levels. • Implement the Extended Producer Responsibility (EPR) system for defined waste streams (e.g. packaging, WEEE, batteries, oils, textiles). • Develop financial and tax incentives for operators exceeding circular economy goals. • Establish digital systems to track waste flows, EPR compliance, and progress on targets. • Provide technical guidance and training to industry and producer responsibility organizations (PROs). • Ensure transparency and public participation through stakeholder engagement and regular progress reporting.		
Timeframe		• 2025 – 2030
Type		Regulation, technical
Sector		Waste – Solid waste disposal
Relevant planning documents, legal and regulatory acts		• National Waste Management Plan • Strategy for Waste Management in the Republic of North Macedonia • Law on Waste Management and bylaws • Law on Finance and bylaws • Regional Waste Management Plans (Northeast, Southeast, Pelagonia, Polog and Skopje region) – final and draft versions • Draft Strategy for Waste Management 2025 – 2036 • Law on Extended Producer Responsibility • Law on the Management of Special Waste Streams • Law on environment (where IPPC permitting is regulated) • Draft Law on Industrial pollution
Finance	Cost estimate until 2030	1 MEUR
	Source of finance	Ministry of Environment and Physical Planning, Municipalities and city of Skopje, Industrial facilities, EU funds

Implementing entity	• Industries • Authorised collective waste handler • Public utility companies • Regional waste management companies • Ministry of Environment and Physical Planning • Municipalities and city of Skopje • State Environmental Inspectorate • Inter-Municipal Waste Management Board • Authorized Inspectors of Environment (Municipalities) • Business associations and Chamber of commerce
Monitoring entity	Ministry of Environment and Physical Planning
Progress indicators	• % of IPPC installations submitting annual circularity reports based on waste assessment criteria. • % of IPPC permits with integrated 5-year circularity targets (mandatory and incentivized). • Number of active EPR schemes implemented for defined waste streams. • Number of operators receiving financial or tax incentives for exceeding circular targets. • Operational status of digital waste tracking system and % of facilities using it for reporting. • Number of industry stakeholders and PROs trained in circular economy practices. • Number of public reports published and stakeholder consultations held annually on circularity progress. • Industrial waste collected (kt) • Emissions reduction (Gg CO_2-eq)
Relation with other dimensions	Research, Innovation and Competitiveness

PM_D11: Reduced generation of municipal solid waste	
Main objective: Reducing the generation of municipal solid waste per capita by 5% until 2030 **Description**: This measure aims to minimize the generation of municipal solid waste through waste prevention strategies, improved consumption patterns, public awareness, and incentives for reuse, repair, and responsible product design. It supports a shift towards a circular economy by targeting reductions at the source, enhancing household and commercial waste separation (including SMEs), and promoting sustainable lifestyles and business models. **Key activities:** • Establish targets to reduce municipal solid waste (MSW) generation per capita by 5% by 2030. • Provide local infrastructure for waste selection and composting • Introduce a revised waste collection fee structure that promotes waste minimization . • Establish private Material Recovery Facilities (MRFs) to improve the separation and recycling of plastics, metals, paper, and glass (in line with the EPR) • Establish secondary selection and MRFs in the landfill for the East and Northeast • Primary waste selection on a level of waste producer • Develop enabling environment to align with EU standards to recycle 65% of MSW and 75% of packaging waste by 2035. • Launch public awareness campaigns and education programs to promote waste prevention and sustainable consumption. **Projected results:** Reduction of the waste generation rate per capita for 5% in 2030 (was 467 in 2022)	
Timeframe	2026 – 2030
Type	Regulation, technical
Sector	Waste – Solid waste disposal

Relevant planning documents, legal and regulatory acts		• National Waste Management Plan • Strategy for Waste Management in the Republic of North Macedonia • Law on Waste Management and bylaws • Law on Finance and bylaws • Regional Waste Management Plans (Northeast, Southeast, Pelagonia, Polog and Skopje region) – final and draft versions • Draft Strategy for Waste Management 2025 – 2036 • Law on Extended Producer Responsibility • Law on the Management of Special Waste Streams
Finance	Cost estimate until 2030	n.a.
	Source of finance	Ministry of Environment and Physical Planning, Municipalities and city of Skopje, EU funds
Implementing entity		• Authorised collective waste handler • Public utility companies • Regional waste management companies • LSGUs
Monitoring entity		MoEPP
Progress indicators		• % reduction in MSW generated per capita compared to the baseline year. • % of population with access to local waste separation and composting infrastructure. • Tariff system formally adopted and implemented by local authorities by 2026. • Tons of recyclables processed annually at operational Material Recovery Facilities (MRFs). • Number of businesses receiving financial incentives for recycling and circular economy investments. • National recycling rate for MSW and packaging waste in alignment with EU targets. • Number of public awareness campaigns conducted and measured increase in citizen participation in waste prevention. • Amount of waste collected and landfilled • Amount of waste recycled
Relation with other dimensions		Research, Innovation and Competitiveness

PM_D12: Improved landfill management
Main objective: Improved landfill management **Description**: Improved landfill management aims to reduce environmental and climate impacts by capturing methane emissions and minimizing the landfilling of recyclable and biodegradable waste. This includes installing methane capture, flaring, and utilization systems in existing and new landfills, enforcing legal bans on landfilling untreated waste, and expanding pre-treatment infrastructure. Non-compliant landfills will be closed and high-emission sites rehabilitated, including those in the East (closed) and North East (planned for closure). Monitoring systems will be established to track emissions, environmental risks, and compliance. Local authorities will receive training and technical support for gas management and site rehabilitation, while public engagement will support landfill diversion and planning. New managed landfills will be opened in phases: East/North East by 2028, Southeast/Pelagonia and Polog by 2030, Vardar/Southeast by 2035, and Skopje by 2040.. **Key activities:** • Install methane capture and flaring/utilization systems in existing and new managed landfills. • Legally prohibit the disposal of recyclable and biodegradable waste in landfills and expand pre-treatment infrastructure. • Close non-compliant landfills and rehabilitate old sites with high methane emissions (Closed in the East region, to be closed in the North East). • Establish monitoring systems for landfill emissions, environmental risks, and compliance tracking.

• Train local authorities and provide technical assistance for landfill gas management and site rehabilitation. • Engage the public and stakeholders in landfill diversion efforts and rehabilitation planning.		
Timeframe		2020– 2030
Type		Technical
Sector		Waste – Solid waste disposal
Relevant planning documents, legal and regulatory acts		• National Waste Management Plan • Strategy for Waste Management in the Republic of North Macedonia • Regional Waste Management Plans (Northeast, Southeast, Pelagonia, Polog and Skopje region) – final and draft versions • Draft Strategy for Waste Management 2025 – 2036 • Law on Extender Producer Responsibility • Law on the Management of Special Waste Streams
Finance	Cost estimate until 2030	36.1 MEUR
	Source of finance	Local self-government through Public Utilities, Public Private Partnership, EU funds
Implementing entity		• Regional companies for waste management • Ministry of Environment and Physical Planning • Public municipal enterprises for waste management • State Environmental Inspectorate • Inter-Municipal Waste Management Board • Authorized Inspectors of Environment (Municipalities)
Monitoring entity		Ministry of Environment and Physical Planning
Progress indicators		• Number of landfills equipped with methane capture and flaring/utilization systems and volume of methane captured annually (m^3/year). • % reduction in biodegradable and recyclable waste landfilled and number of pre-treatment facilities established or upgraded. • Number of non-compliant landfills closed and area (ha) of rehabilitated landfill sites. • Operational status of landfill monitoring systems and frequency of emission and compliance reporting. • Number of local authority staff trained and number of technical assistance projects delivered for landfill management. • Number of public engagement activities conducted and % of local population reached or involved in landfill-related consultations. • Emissions reduction (Gg CO_2-eq)
Relation with other dimensions		Research, Innovation and Competitiveness

PM_D13: Sludge to energy development and improved energy management for waste water treatment plants
Main objective: Preparation for establishing sludge-to-energy facilities **Description**: This measure assesses the feasibility of establishing sludge-to-energy (STE) facilities to process non-recyclable sludge from Skopje's wastewater treatment plants (WWTPs), aiming to enhance energy recovery and environmental performance. A detailed feasibility study will evaluate suitable STE technologies based on sludge characteristics, quantity, and energy potential. The results will inform the concept design and site plan for the facility. Energy efficiency audits of WWTPs will identify opportunities to reduce consumption and support the integration of recovered energy into plant operations or local energy systems. Stakeholder engagement and institutional coordination will ensure cross-sector alignment. A funding strategy and investment roadmap will explore public-private partnerships and EU financing options. **Key activities**: • Conduct a feasibility study to assess suitable sludge-to-energy (STE) technologies for Skopje WWTPs.

• Analyse sludge quantity, composition, and energy potential to inform technology selection. • Develop a concept design and site plan for an STE facility based on study results. • Perform energy efficiency audits of WWTPs to identify opportunities for reducing energy use. • Plan integration of recovered energy from sludge into WWTP operations or local energy systems. • Engage stakeholders and ensure institutional coordination across relevant sectors. • Prepare a funding strategy and investment roadmap, exploring public-private and EU financing options		
Timeframe		2025 - 2030
Type		Technical
Sector		Waste – Solid waste disposal
Relevant planning documents, legal and regulatory acts		• National Waste Management Plan • Strategy for Waste Management in the Republic of North Macedonia • Regional Waste Management Plans (Northeast, Southeast, Pelagonia, Polog and Skopje region) – final and draft versions • Draft Strategy for Waste Management 2025 - 2036 • National Strategy for Sludge Management from Municipal Wastewater Treatment Plants (2024-2034).
Finance	Cost estimate until 2030	0.2 MEUR
	Source of finance	Local self-government through Public Utilities, Public Private Partnership, EU funds
Implementing entity		• Ministry of Environment and Physical Planning • Public municipal enterprises for waste management • WWTP Operators • Regional Companies for Waste Management
Monitoring entity		Ministry of Environment and Physical Planning
Progress indicators		• Feasibility study completed for sludge-to-energy (STE) technologies for Skopje WWTPs (Yes/No, with date of completion). • Sludge characterization report produced, including volume, composition, and energy potential (Yes/No + frequency of updates). • Concept design and siting plan developed for the STE facility (status: draft/finalized). • Number of WWTPs with completed energy efficiency audits and identified savings potential (% or kWh/year). • Plan developed for energy recovery integration (Yes/No) and estimated % of WWTP energy demand to be met by recovered energy. • Number of stakeholder engagement meetings held and institutional agreements or MOUs signed. • Funding strategy completed and number of financing sources identified or secured (e.g. grants, PPPs, EU funds).
Relation with other dimensions		Energy efficiency, Research, Innovation and Competitiveness

PM_D14: Implementation of the Just transition roadmap, establishment of structures and implementation of JT measures
Main objective: Implement the Just transition roadmap **Description:** This measure supports the implementation of the Just Transition Roadmap by establishing national and regional governance structures, developing regional strategies for economic diversification, and providing reskilling programs and social support for affected workers. It will also mobilize funding from EU, national, and private sources and ensure inclusive stakeholder engagement throughout the transition process. In parallel to the implementation of the Just transition roadmap, the Investment Plan to accelerate coal transition will enable the coal phase out, as described in the measure PM_D15: Generation Portfolio Decarbonization: Sequential Coal Closure & Low-Carbon Build-out . **Key activities:** • Establish national and regional governance structures to coordinate transition efforts. • Develop regional transition strategies and action plans focused on economic diversification.

• Roll out reskilling programs, employment services, and social support for affected workers. • Mobilize funding from EU, national, and private sources to support transition measures. • Engage stakeholders (citizens, commercial sector – including SMEs and others) through inclusive consultations and continuous dialogue. • Monitor, evaluate, and report on transition progress using defined social, economic, and environmental indicators The measure is related to implementation of PM_D15 and PM_IEM11 and requires continuous monitoring of its impacts on employment and consumer energy prices, focusing on energy poverty.		
Timeframe		2026 – 2030
Type		Regulatory
Sector		Energy
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on Energy • Just transition roadmap for North Macedonia • JETIP declaration • JETIP investment plan • NECP • ACT Roadmap
Finance	Cost estimate until 2030	n.a.
	Available budget	8.5 MEUR
	Source of finance	EBRD, Climate Investment Fund/Clean Technology Fund
Implementing entity		• Government of the Republic of North Macedonia • Ministry of Economy and Labour • JSC North Macedonian Power Plants (ESM AD) • Ministry of labour and social policy
Monitoring entity		• Ministry of Energy, Mining and Mineral Resources
Progress indicators		• Number of national and regional governance bodies (e.g. committees, councils) established and operational for just transition coordination. • Number of regional just transition strategies or action plans developed and officially adopted. • Number of affected workers enrolled in reskilling or social support programs and % successfully reemployed. • Amount of funding secured and allocated from EU, national, and private sources for transition-related projects (EUR). • Number of stakeholder engagement events held and % of local population or key groups represented. • Frequency of published monitoring reports and number of tracked indicators showing progress in social, economic, and environmental outcomes.
Relation with other dimensions		Internal energy market; Energy security

PM_D15: Generation Portfolio Decarbonization: Sequential Coal Closure & Low-Carbon Build-out
Main objective: Deliver a reliable, affordable transition of ESM's generation portfolio toward net-zero by 2050 through a managed coal phase-out, comprehensive site remediation/repurposing, and accelerated build-out of renewables, storage, and flexible low-carbon firm capacity, while safeguarding security of supply and system stability. **Description:** Coal TPPs (Oslomej, Bitola) currently underpin system adequacy but are the largest source of power-sector emissions. This measure sequences coal retirements, executes decommissioning and mine remediation, and repowers brownfield sites with clean capacity (RES + storage + CHP/CCGT), coordinated with grid reinforcements and digitalization. It integrates with PM_D14 (Just Transition) and PM_IEM10/PM_IEM11 (market integration, consumer protection) to ensure socio-economic fairness and protect vulnerable customers.

Key activities include: 1) **ESM Decarbonization Strategy** to be finalized by the end of 2025 including economic/environmental assessment; unit-by-unit retirement pathways; adequacy safeguards. 2) **Sequential coal closure** based on the action plan for coal phase-out developed by the end of 2025 presenting the staged retirement of TPP Oslomej and TPP Bitola on a schedule aligned with adequacy studies. 3) **Decommissioning, remediation & repurposing** including detailed plans for coal plants and mine lands; environmental remediation; brownfield repowering with RES on decommissioned sites. 4) **Low-carbon replacement capacity** including accelerated build-out of wind and solar, roughly two-thirds solar and one-third wind, prioritizing brownfield and grid-ready sites, including repurposing decommissioned coal sites. This should also include system flexibility via BESS and progress on PSH Chebren. 5) Commission a **new CHP plant** to support energy system reliability. 6) Grid enablement through transmission reinforcements, increased connection capacity, and grid digitalization measures to integrate RES/storage/CHP reliably. **7)** Just Transition and financing through structured engagement with workers, municipalities and social partners; reskilling and local regeneration in Pelagonia and Southwest region; mobilization of national/EU/IFI finance. **8)** Social impact monitoring of effects on employment and consumer energy prices with focus on energy poverty; timely mitigation measures.		
Timeframe		2025– 2030
Type		Regulatory, Technical
Sector		Energy
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on Energy • Long term strategy on climate action • NDCs • Government-adopted Just Transition Roadmap (June 2023) • Investment Plan for Accelerated Coal Transition (ACT) (March 2024) • Liquidity/transition facilities to ESM (EBRD, KfW) and related IFI programmes
Finance	Cost estimate until 2030	1.2 billion EUR
	Sources of finance	State budget, CIF – ACT IP, bilateral/multilateral donors, technical assistance from Energy Community/EU
Implementing entity		• JSC North Macedonian Power Plants (ESM AD)
Monitoring entity		• Government of the Republic of North Macedonia • Ministry of Energy, Mining and Mineral Resources
Progress indicators		• Decarbonization Strategy of ESM developed and adopted by 2025 (Yes/No + date of adoption). • National coal phase-out plan developed and adopted by 2025 (Yes/No + date of adoption). • Coal TPP status (commercial closure achieved). • Annual volume of natural gas used in CHP facilities. • New RES capacity (MW) and share by technology; share on repurposed sites. • BESS in service (MW/MWh) and reserve sufficiency (aFRR/mFRR deficits eliminated). • PSH Chebren progress and hydro upgrades completed. • H_2-ready CCGT and gas pipeline status. • Grid-enabler milestones met. • Portfolio emissions (Mt) and RES share vs NECP trajectory; capacity margin ≥15%. • Number of stakeholder engagement sessions held. • EUR of funding secured from national, EU, and international sources for clean energy infrastructure and workforce transition programs.
Relation with other dimensions		Energy security, Research, innovation and competitiveness

PM_D16: Transpose and implement the Taxonomy Regulation 2020/852/EU and its implementing and delegated acts		
Main objective: Implementation of the Taxonomy Regulation **Description**: This measure aims to implement the EU Taxonomy Regulation (2020/852) by establishing a national classification system that defines environmentally sustainable economic activities in line with EU environmental objectives. Key activities include transposing the regulation and its delegated acts into national law, designating a competent authority, and developing reporting and disclosure frameworks for financial institutions and companies. The measure will also provide training and technical guidance for stakeholders, ensure inclusive consultations, and establish mechanisms for monitoring, evaluation, and alignment with future EU updates.. **Kay activities:** • Transpose the EU Taxonomy Regulation and its delegated acts into national legislation. • Establish a national classification system for environmentally sustainable economic activities. • Designate a competent authority to oversee implementation, compliance, and coordination. • Develop reporting and disclosure mechanisms for financial institutions and companies. • Provide capacity building, training, and technical guidance for public and private stakeholders. • Conduct stakeholder consultations to ensure practicality and alignment with national needs. • Set up monitoring, evaluation, and update mechanisms to align with future EU revisions.		
Timeframe		2026– 2030
Type		Regulatory
Sector		Energy
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on Energy • Long term strategy on climate action
Finance	Cost estimate until 2030	n.a.
	Source of finance	IPA funding
Implementing entity		MoEPP, MoF
Monitoring entity		• Government of the Republic of North Macedonia • Ministry of Energy, Mining and Mineral Resources
Progress indicators		• National legislation transposing the EU Taxonomy Regulation adopted (Yes/No + date of adoption). • National taxonomy framework established and aligned with all six environmental objectives (Yes/No + % alignment). • Competent authority designated and operational with a defined mandate and coordination mechanism (Yes/No). • Number of institutions (financial and non-financial) complying with taxonomy-aligned reporting requirements. • Number of training sessions and guidance documents delivered to public and private stakeholders. • Number of stakeholder consultations conducted and % of feedback integrated into implementation framework. • Monitoring system in place and frequency of updates to the national taxonomy in line with EU revisions (Yes/No + annual update status).
Relation with other dimensions		/

PM_D17: Carbon Capture and Utilization (CCU) in the cement and the steel industry
Main objective: Preparation for CCU in industrial facilities **Description**: This measure aims to prepare for the deployment of Carbon Capture and Utilization (CCU) technologies in the cement and steel industries by assessing feasibility, partnering with international technology providers, and supporting pilot projects. Activities include mapping CO_2 emission sources, identifying local utilization opportunities, developing a supportive policy and regulatory framework, and establishing financial mechanisms such as grants and

public-private partnerships. The measure also includes monitoring project outcomes to evaluate their impact on emission reductions. **Key activities**: • Conduct feasibility studies to assess CCU potential in cement and steel plants. • Map major CO_2 emission sources and identify local utilization opportunities. • Partner with international CCU technology providers and research platforms. • Support pilot and demonstration projects to test CCU applications. • Develop a national policy and regulatory framework to enable CCU deployment. • Establish financial support mechanisms such as grants, tax incentives, or PPPs. • Monitor CCU project outcomes and evaluate their contribution to emission reductions.		
Timeframe		2026– 2030
Type		R&D
Sector		Industry
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on Energy • Long term strategy on climate action • Draft Law on climate action • Industrial Strategy of North Macedonia 2018-2027
Finance	Cost estimate until 2030	TBD
	Source of finance	Donor projects, FITR
Implementing entity		MoEPP
Monitoring entity		• Government of the Republic of North Macedonia • Ministry of Energy, Mining and Mineral Resources
Progress indicators		• Number of CCU feasibility studies completed for cement and steel facilities. • National inventory/map of CO_2 emission sources and utilization opportunities published (Yes/No + update frequency). • Number of international partnerships or collaborations established for CCU technology transfer or R&D. • Number of CCU pilot or demonstration projects launched and operational. • National CCU policy and regulatory framework developed and adopted (Yes/No + date). • Amount of public or blended financing allocated to CCU projects (EUR) and number of projects supported. • Tons of CO_2 captured and utilized annually through CCU projects supported under this measure.
Relation with other dimensions		Research, innovation and competitiveness

PM_D18: Green hydrogen production facilities for industrial applications focusing on steel, cement and petrochemical production
Main objective: Preparation for hydrogen use in industrial facilities **Description**: This measure focuses on advancing green hydrogen production for industrial applications, specifically targeting the steel, cement, and petrochemical sectors to support carbon capture and utilization (CCU) readiness. The measure involves conducting feasibility studies, mapping hydrogen demand, and identifying infrastructure requirements to facilitate large-scale adoption. It also includes launching pilot projects, developing a national green hydrogen strategy aligned with EU goals, and fostering international partnerships for technology transfer. Financial incentives such as grants and public-private partnerships (PPPs) will be introduced to support early-stage projects, while monitoring outcomes to assess emission reductions and scalability. This initiative complements PM_ES1, which builds broader hydrogen production, storage, and distribution capacities.. **Key activities:** • Conduct feasibility studies to assess the viability of green hydrogen in cement, steel, and petrochemical plants.

• Map industrial hydrogen demand and identify key infrastructure needs for production and distribution. • Launch pilot and demonstration projects to test green hydrogen applications in targeted industries. • Develop a national green hydrogen strategy and roadmap aligned with EU initiatives. • Establish international partnerships for technology transfer and collaborative innovation, including also SMEs. • Create financing mechanisms and incentives (e.g., grants, PPPs) to support early-stage projects. • Monitor project outcomes, emission reductions, and scalability to inform future industrial hydrogen deployment. • The measure is related to PM_ES1 Developing capacities for hydrogen production, transport, storage and use.		
Timeframe		2026– 2030
Type		R&D
Sector		Industry
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on Energy • Long term strategy on climate action • Draft Law on climate action • Industrial Strategy of North Macedonia 2018-2027
Finance	Cost estimate until 2030	n.a.
	Source of finance	Donor projects, FITR
Implementing entity		MoEPP
Monitoring entity		• Government of the Republic of North Macedonia • Ministry of Energy, Mining and Mineral Resources
Progress indicators		• Number of feasibility studies completed for green hydrogen use in cement, steel, and petrochemical industries. • National hydrogen demand and infrastructure assessment published (Yes/No + year). • Number of pilot or demonstration projects launched for industrial green hydrogen applications. • Adoption of a national green hydrogen strategy and roadmap (Yes/No + date of adoption). • Number of international partnerships or MOUs signed with technology providers or industry stakeholders. • EUR of public/private funding allocated to green hydrogen projects and number of supported projects. • Estimated tons of CO_2 emissions avoided annually through green hydrogen substitution in industrial processes.
Relation with other dimensions		Research, innovation and competitiveness; Energy security

ii. Where relevant, regional cooperation in this area;

The Republic of North Macedonia is strengthening regional cooperation to advance decarbonization and energy transition. Partnering with neighbouring countries and international organizations, it is implementing initiatives to cut emissions and enhance energy security.

In November 2024, North Macedonia's state-owned utility, ESM, signed an MoU with Azerbaijan's SOCAR to improve natural gas access, ensuring energy stability and competitive pricing.

As a member of the Southeast European Cooperative Initiative (SECI), the Republic of North Macedonia collaborates on energy, trade, and infrastructure projects, fostering regional stability and EU integration

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.

The Republic of North Macedonia heavily relies on international, EU, and bilateral financial support to implement its decarbonisation activities, given the scale of investment required and current fiscal constraints. Key partners include international financial institutions such as the World Bank, EBRD, and EIB, as well as EU instruments like IPA III and the Western Balkans Investment Framework, alongside bilateral donors. This external support plays a critical role in institutional capacity building and in financing just transition and coal phase out activities.

In particular, coal phase-out and just transition initiatives receive robust backing from the Climate Investment Funds (CIF) via its $85 million Accelerating Coal Transition (ACT) programme, expected to leverage as much as $591 million through co-financing by EBRD, the World Bank, and private sector actors. Additionally, the EBRD-led Just Energy Transition Investment Platform, supported by the European Commission, EIB Global, IFC, KfW, and others, aims to mobilise up to 3 billion EUR for coal phase-out, renewables deployment, grid investments, and societal support for affected communities. Furthermore, EIB Global has committed over 100 million EUR in green investments and technical assistance to accelerate clean transition efforts in North Macedonia. All public funding and financial support mechanisms will be designed and implemented in full compliance with applicable State aid rules to ensure alignment with EU competition law and market principles.

3.1.2. Renewable energy

i. Policies and measures to achieve the national contribution to the binding 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 (1)

PM_D19: Identification and use of the proper location for new energy facilities, in particular, solar, wind power plants and energy storage facilities
Main objective: Increase in renewable energy sources in the electricity sector; increase in renewable energy in the heating and cooling sector; reduce energy dependency from third countries; improve the resilience of energy supply infrastructure, including ensuring energy supply in case of major disruptions to the network; increase the ability of the power network to absorb increased share of renewable generation; other energy supply. **Description**: As specified by the Recommendation 2024/1-MC-EnC on accelerating the deployment of renewable energy projects and implementing the energy efficiency first principle, Contracting Parties should prepare the legal and institutional preconditions for the mapping of areas for the deployment of renewable energy and the necessary grid and storage infrastructure in their jurisdictions, as well as designating renewable acceleration areas. In this direction, already in 2023, under the project implemented by The Nature Conservancy, MANU and the Center for environmental research and information “Eko-svest”, have developed a study on Using Brownfields and Barren Lands for Wind and Solar Energy Siting in North Macedonia. This study offers a blueprint for North Macedonia to continue building on its leadership in renewable energy, identifying areas of land suitable for development of renewables, without undue impact on nature and local communities. The study should serve as a guidance for the development of Methodology. The Methodology should aim for legal certainty, designating areas and categories of land where development of renewable energy projects and storage facilities will be fully or partially excluded. Also, the preconditions for the potential development of renewable energy projects will be determined taking into account different criteria for the designation of suitable areas, such as physiognomy, environmental protection, the actual technical and economic potential for the exploitation of renewable energy sources and the anthropogenic activities for each installation area separately. The adopted Methodology will be in compliance with the “do no harm” principle. Along the same lines, North Macedonia in developing PV power plants in Oslomej and Bitola, Bogdanci Wind Power Plant, rehabilitates existing hydropower plants and develops a project of Bitola Solar District Heating Facility. Investment grants have been of around 26 MEUR have been ensured for the PV, wind and hydroelectric projects by EBRD and KfW, while

technical assistance of 1.2 MEUR is provided by KfW for the Bitola district solar heating preparatory works (pre-feasibility and feasibility study, ESIA, general design and main specifications). **Key activities**: - Develop the Methodology in line with the on Using Brownfields and Barren Lands for Wind and Solar Energy Siting in North Macedonia; - Adopt the Methodology through a respective legislation act (MoEPP); - Organize public awareness campaign about the objectives and proper implementation of the Methodology (MoEPP); - Monitor its implementation effects (MoEPP); - Develop PV, WPP, hydroelectric and solar DHS (27.2 MEUR) - Integrate lessons learned from implementation of the measure into the plans for renewable energy acceleration areas according to the Directive 2023/2413/EU (MEMMR).		
Timeframe		2025 – 2030
Type		Regulatory, Policy
Sector		Energy supply
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on Renewable Energy Sources • Recommendation 2024/1-MC-EnC on accelerating the deployment of renewable energy projects and implementing the energy efficiency first principle • Biennial report on the progress of increased utilization of renewable energy sources
Finance	Cost estimate until 2030	Up to 30 MEUR
	Available budget	n.a.
	Source of finance	State budget, EBRD, KfW, EIB
Implementing entity		• Government of the Republic of North Macedonia • Ministry of Environment and Physical Planning
Monitoring entity		• Ministry of Energy, Mining and Mineral Resources
Progress indicators		• Methodology developed and in force • Installed capacity (MW) of RE and storage power plants constructed in line with the Methodology
Relation with other dimensions		• Energy security

PM_D20: Photovoltaic Irrigation systems
Main objective: Increase in renewable energy sources in the electricity sector; switch to less carbon-intensive fuels; other energy supply. **Description**: Installation of photovoltaic system for irrigation purposes with 2.4 kW installed capacity, capable to run 1.1 kW 3 phase pump. The two cases are considered as mitigation practice, replacing the petrol pump with consumption of 0,3l petrol per hour (one of the most popular pumps in the country) with 3 phase AC pump and adding photovoltaic and replacing 1.1 kW electricity pump with 3 phase AC pump and adding the photovoltaic. The measure is suitable for already established on farm irrigation systems, but also for new establishing of the irrigation systems with on-farm water source. The measure is compatible with IPARD 2 measure "Production of energy from renewable resources for self-consumption, through processing of plant and animal products from primary and secondary biomass (except biomass from fishery products) for production of biogas and/or biofuels, use of solar energy, windmills, geo-thermal energy etc". **Key activities**: - Identify suitable agricultural producers with already established on-farm irrigation systems using the petrol pumps for irrigation and using electricity pumps for irrigation, identified in the description (MAFWE); - Organise public awareness campaign among the identified group of agricultural producers (MAFWE);

- Support pilot and demonstration projects to test the installation of the photovoltaic irrigation systems replacing the petrol pumps and electricity pumps for irrigation (MAFWE); - Establish financial support mechanisms for the implementation of the measure, such as grants, tax incentives, soft-loans (MAFWE and MoF); - Monitor its implementation effects (MAFWE).		
Timeframe		2025 – 2030
Type		Technical, Investment
Sector		Energy supply
Relevant planning documents, legal and regulatory acts		• Law on Agriculture and Rural Development • National strategy on Agriculture and Rural Development • IPARD2
Finance	Cost estimate until 2030	47 MEUR
	Source of finance	Private sector, IPARD Programme
Implementing entity		• Ministry of Agriculture, Forestry and Water Economy
Monitoring entity		• Ministry of Energy, Mining and Mineral Resources
Progress indicators		• Number of installed PV systems for irrigation purposes • Increase in installed capacity (MW) • Increase in electricity generation (GWh) • Emissions reductions (Gg CO_2-eq)
Relation with other dimensions		

PM_D21: Implementation of the system of guarantees of origin (GoOs) for energy from renewable energy sources

Main objective: increase in renewable energy sources in the electricity sector; increase price convergence of electricity markets; increase consumer participation in energy markets.

Description: The only way to declare that electricity is produced by renewable energy sources is with guarantee of origin. The GoOs provide end customers with information about the share or amount of energy from renewable energy sources in the energy mix of suppliers and the energy delivered to end consumers according to the contracts that are marketed by stating the consumption of energy from renewable sources, in an objective, transparent and non-discriminatory manner. For that purpose, RED II requires implementation of the system of GoOs in North Macedonia, through establishing of a national electronic registry/domain for administering GoOs. The registry will be managed by the issuing body, the electricity market operator (MEMO), defined in the Energy Law as the responsible entity for issuance of the GoOs and running of the registry. In this regard, a reliable national domain for issuing GoOs in line with European standards for issuing GoOs, should be established and operated by MEMO. MEMO will provide services such as registration of market participants, RE producers, traders; managing the trading of GoOs; issuing and cancellation of GoOs; connecting of different domains of registries; and signing contracts with reliable vendors.

In the beginning, the activities will be focused on the preparation of assessment of the existing regulatory and administrative barriers that should be removed with recommendations for improvements that reflected in the new Energy Law, followed by the development of the register of guarantees of origin and finalized by developing of trading platform on GoOs. Currently, MEMO has obtained observer status in the AIB and is working with GREXEL, one of the leading energy certificate registry providers from EU, for setting up the register of GoOs and the trading platform.

This measure is compatible with the measures related to promotion of energy communities (PM_D24), introduction of long-term renewables PPAs (PM_D25) and the measure for the simplification of permitting procedures and introduction of one-stop shops facilitating deployment of RE (PM_D23), as they all relate to implementation of the RED II being a commitment under the ECT.

Key activities:

- Adoption of Rules for administering of GoOs in line with the Energy Law and with the Principles and Rules of Operation of the Association of Issuing Bodies (AIB) for the European Energy Certificate System (EECS) (by MEMO);
- Establishing and managing the Register of GoOs (MEMO
- Develop functional trading platform for GoOs (MEMO)
- Organise public awareness campaign for RE producers and industry representatives (MEMMR and MEMO)

• Extension of the GoO system to high-efficient cogeneration, by developing and adoption of the Rulebook for GoOs on high-efficient cogeneration (MEMMR); • Apply for full membership into AIB (MEMO)		
Timeframe		2025 – 2030
Type		Regulatory
Sector		Energy supply
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on Energy • Law on Renewable Energy • Law on Energy Efficiency • Bylaws for renewable energy and energy efficiency
Finance	Available budget	8.5 MEUR (jointly with PM_D22,23)
	Source of finance	Central government budget, EU funds
Implementing entity		• Ministry of Energy, Mining and Mineral Resources • MEMO
Monitoring entity		• Energy Regulatory Commission (Energy, Water Services and Municipal Waste Management Services Regulatory Commission of the Republic of North Macedonia)
Progress indicators		• Trading platform on GoOs operational and trading with guarantees of origin is taking place • Number of issued GoOs
Relation with other dimensions		• Internal Energy Market, Energy Efficiency

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

National goals referring to the share of renewable energy in final electricity consumption are closely related to the electricity infrastructure development, both of national transmission and distribution grid, as well as cross-border electricity infrastructure. The most important measure with regional aspect is the measure "PM_IEM1: Build or upgrade power transmission network in North Macedonia including interconnectivity to Albania's transmission network", in particular its cross-border activity of constructing the 400 kV power transmission interconnection line between North Macedonia and Albania.

Currently, no transfers from or to the other Member States or Contracting Parties have been envisaged. The achievement of the national RES targets is projected solely based on domestic use of renewable energy sources.

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

PM_D22:Contracts for Difference
Main objective: Increase in renewable energy sources in the electricity sector; Reduce energy dependency from third countries; Increase price convergence of electricity markets; Increase consumer participation in energy markets; Increase electricity system flexibility and adequacy. **Description**: Construction of solar and wind power plants supported by contracts-for-differences (CfDs) to stimulate the construction of renewable energy plants, on the basis of the organized auctions and its results.

Republic of North Macedonia is implementing competitive based auctions, granting contracts for difference in line with the EU acquis and the state aid rules, and moving away from the feed-in tariffs applied so far for small-hydro and wind power plants, fostering RES producers limited market exposure. This measure is expected to bring the incentive system for renewable in North Macedonia, fully in line with the applicable EU state aid rules.

This measure will continue the implementation of the support scheme for the production of electricity from renewable energy sources according to the provisions of the Law on Renewable Energy (being currently under preparation) fostering electricity production from renewable technologies through an open, transparent, competitive, non-discriminatory and cost-effective procedure. In this regard, the Ministry of Energy, Mining and Mineral resources will develop 3-year auction plan for facilitating development of new renewable energy installations, with a view of avoiding electricity market distortions, enhancing system integration costs and the respecting required grid stability. The 3-year auction plan will be updated on an annual basis, to reflect recent market developments or expected allocation of support.

On a five-year term basis, the effectiveness of the support schemes for electricity from renewable sources and their major distributive effects on different consumer groups, and on investments, will be assessed. The assessment shall take into account the effect of possible changes to the support schemes and shall be included in the updates of the integrated national energy and climate plan and progress reports in accordance with Regulation (EU) 2018/1999. Each following 3-year auction plan and long-term planning governing the decisions of the support and design of new support shall take into account the results of the assessment.

Key activities:

- Organize public awareness campaign about the implementation of the incentive system for renewables and regarding planned auction for renewable energy (MEMMR);
- Develop the 3-year auction plan in line with the Energy Law and best practices in designing auctions which will include the indicative timing, the frequency of tendering procedures where appropriate, the expected capacity and budget or maximum unitary support expected to be allocated, and the expected eligible technologies, if applicable (MEMMR)
- Organize subsequent auction rounds according to the 3-year auction plan (MEMMR)
- Each 5-years assess the effects of the RE support schemes and embed the conclusions into the long-term planning documents (MEMMR).

Timeframe		2025 – 2030
Type		Regulatory, Financial, Investment
Sector		Energy supply
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on Energy • Law on Renewable Energy • Bylaws for renewable energy
Finance	Cost estimate until 2030	n.a.
	Source of finance	Private sector, banks, donor community, central government budget
Implementing entity		• End-users, Ministry of Energy, Mining and Mineral Resources
Monitoring entity		• Energy Regulatory Commission (Energy, Water Services and Municipal Waste Management Services Regulatory Commission of the Republic of North Macedonia)
Progress indicators		• Increase in installed capacity (MW) • Increase in electricity generation (GWh) • Emissions reductions (Gg CO_2-eq
Relation with other dimensions		Energy security, Internal Energy Market

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

According to the Article 6(4) of Directive (EU) 2018/2001, Member States shall, at least every five years, assess the effectiveness of their support schemes for electricity from renewable sources and their major distributive effects on different consumer groups, and on investments. Until now, such assessment was not conducted in the Republic of North

Macedonia but its implementation has beet envisaged within the measure "PM_D22: Incentives Premium, Contracts for Difference", as the activity "Each 5-years assess the effects of the RE support schemes and embed the conclusions into the long-term planning documents" to be conducted by the end of 2027. The assessment results will be considered for possible revisions to the support scheme and taken into account in drafting the NECP for 2031 to 2040.

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

PM_D23: Simplification of permitting procedures and introduction of one-stop shops facilitating deployment of RE
Main objective: Increase in renewable energy sources in the electricity sector; Increase in renewable energy in the heating and cooling sector; Switch to less carbon-intensive fuels; Reduce energy dependency from third countries; Increase consumer participation in energy markets. **Description**: Renewable energy projects are facing lengthy, costly and time-consuming authorization and permitting procedures. Hence, the complexity, variety and excessive duration of those procedures constitutes a major barrier to the swift necessary deployment of renewable energy and to achieving a more affordable, secure, and sustainable energy system. Delays in processing project authorizations are putting at risk the achievement of the energy and climate targets, jeopardize energy supply and increase the cost of the projects necessary to do so. Delays can also lead to the installation of less efficient renewable energy installations due to dynamic innovation processes. In order to achieve faster deployment of renewables, this measure aims to establish clearly defined, accelerated and as short as possible deadlines for all the steps required for the granting of permits to build and operate renewable energy projects, including grid connection procedures. Those barriers have been defined in the EU/ECT legislation (RED II, in particular) which North Macedonia as a member of the ECT has an obligation to transpose into national legislation. The Law on Renewable Energy Sources, which includes the provisions on simplifying permitting procedures, is under development. However, in order to have stable and streamlined policies for RES deployment, other cross-cutting legislation needs to be adjusted, in particular those related to construction, spatial planning and environment). In a nutshell, this measure aims to update, simplify and optimise the existing authorization, certification, permit-granting and licensing procedures, so as to make them more operational, quicker and less expensive, while at the same time ensure the protection of public interest, environmental goals and guarantee smooth integration into the grid networks. The measures should refer to large installations, households, public buildings and small consumers. Moreover, one-stop shop system will be introduced, through establishing contact points for guiding investors and applicants through the administrative permit application process in a transparent manner up to the delivery of one or several decisions by the responsible authorities at the end of the process, providing the applicants with all necessary information and involve, other administrative authorities. The one-stop shop system will provide the required information and technical guidance to the interested investors facilitating the realization of the planned investments (in accordance with articles 15 and 16 of RED II), especially for the small-scale and self-consumers, which is expected to further enhance deployment of roof-top PVs on private or public buildings. This measure is compatible with the measures related the identification of the proper location for new energy facilities, in particular, solar, wind power plants and energy storage facilities (PM_D19), promotion of energy communities (PM_D24) and introduction of long-term renewables PPAs (PM_D25), as they all relate to implementation of the RED II being a commitment under the ECT. Furthermore, it is interlinked with the energy efficiency dimension (the promoted RES technologies will deliver primary energy savings contributing to the achievement of the relevant targets); the energy security dimension (the penetration of RES technologies will reduce energy import dependency and increase use of domestic energy sources); as well as with the other two dimensions (Internal energy market and Research, Innovation and Competitiveness). **Key activities**: • Finalize and adopt the Law on Renewable Energy (MEMMR) • Establish working group with representatives from relevant stakeholders that deal with permit issuance procedures, including: MEMMR, ERC, MoEPP, MAFWE, MoTC, Agency for Cadastre, MEPSO, EVN (the GoNM)

• Perform gap analysis of the Law on Renewable Energy and other relevant legislation including but not limited to the environmental, urban planning, construction and agricultural sectors (the GoNM with all the relevant ministries) • Design and adopt legislative package of improvements aligning them with the Law on Renewable Energy and EU/ECT relevant legislation (the GoNM with all the relevant ministries) • Establish functional monitoring mechanisms as prescribed in the legislation including the entities responsible for monitoring (the GoNM with all the relevant ministries) • Organize and implement public awareness campaign (MEMMR) • Develop specific guidelines and streamlined procedures to support permitting of self-consumption renewable energy systems, especially for households and SMEs (MEMMR)		
Timeframe		2025 – 2030
Type		Regulatory, Technical, Investment
Sector		Energy supply
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on Energy • Law on Renewable Energy • Law on Energy Efficiency • Bylaws for renewable energy • Law on Construction
Finance	Available budget	8,6 MEUR (jointly with PM_D20,23)
	Source of finance	Central government budget, EU funds
Implementing entity		• Ministry of Energy, Mining and Mineral Resources • Ministry of Transport and Communications • Ministry of Agriculture, Forestry and Water Management • Ministry of Environment and Physical Planning • MEPSO • DSO company
▪ Monitoring entity		• Energy Regulatory Commission (Energy, Water Services and Municipal Waste Management Services Regulatory Commission of the Republic of North Macedonia)
▪ Progress indicators		• Reduced timespan from the request to the permit issuance by 6 months for households, public buildings and small consumers, from the current one • Established and operation one-stop shop system for RES permitting • Established predictable and transparent RES permitting in line with articles 14, 15 and 16 from RED II
▪ Relation with other dimensions		• Energy Security

PM_D24: Promotion of energy communities
Main objective: Increase in renewable energy sources in the electricity sector; Switch to less carbon-intensive fuels; Increase consumer participation in energy markets; Other energy supply. **Description**: Republic of North Macedonia has huge potential for installing small-scale PV systems on degraded land and on roof-tops. One of the possibilities for increasing the installed capacity of solar roof-top systems is through energy communities (citizen energy communities and renewable energy communities). This measure aims to create favourable conditions for these communities along with raising public awareness. In addition to the Law on Energy and Law on Renewable Energy Sources, in May 2023, the Parliament has adopted the Law on Cooperatives where it is stated that, according to the activity, the type of cooperative can be (besides agricultural, housing, etc.) also energy one. For the issues that are not regulated by this law, and refer to the energy sector, the regulations in the field of energy shall apply accordingly. This measure is expected to result in favourable conditions for development and operation of energy communities and removal of administrative and regulatory barriers for their establishment and operation.

This measure is compatible with the measures for the simplification of permitting procedures and introduction of one-stop shops facilitating deployment of RE (PM_D23), as well as introduction of long-term renewables PPAs (PM_D25), as they all relate to implementation of the RED II being a commitment under the ECT. It is also compatible with the measure PM_EE2 (Retrofitting of residential buildings) as roof-top technical solutions are particularly applicable to multi-apartment buildings and interesting to homeowners' associations.

Furthermore, it is interlinked with the energy efficiency dimension (the promoted RES technologies will deliver primary energy savings contributing to the achievement of the relevant targets); the energy security dimension (the penetration of RES technologies will reduce energy import dependency and increase use of domestic energy sources); as well as with the other two dimensions (Internal energy market and Research, Innovation and Competitiveness).

Key activities:

- Finalize and adopt the Law on Renewable Energy, introducing the energy communities' concept (MEMMR);
- Whenever feasible, enhance simplified permitting procedures applicable to energy communities, in line with EU legislation (MEMMR);
- Implement pilot projects to showcase feasibility of energy communities' concept and the sustainability of the business model (MEMMR);
- Organize and implement public awareness campaign to promote energy communities and deployment of more RE installations (MEMMR);
- Establish financing incentives, and financing models in cooperation with the commercial banks (in the form of grants, low-interest loans and other financing instruments) to incentivize and support the promotion of energy communities (MEMMR);
- Implement training programs to support operation of the energy communities (MEMMR).

Timeframe		2025 – 2030
Type		Regulatory
Sector		Energy supply
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on Energy • Law on Renewable Energy • Bylaws for renewable energy • Law on Cooperatives
Finance	Available bugdet	8,EUR6 MEUR (jointly with PM_D20,22)
	Source of finance	Central government budget, EU funds
Implementing entity		• Ministry of Energy, Mining and Mineral Resources • Ministry of Agriculture, Forestry and Water Management • Ministry of Environment and Physical Planning
Monitoring entity		• Energy Regulatory Commission (Energy, Water Services and Municipal Waste Management Services Regulatory Commission of the Republic of North Macedonia)
Progress indicators		• Number of energy communities established
Relation with other dimensions		• Energy Security, Research, Innovation and Competitiveness (Competitiveness)

PM_D25: Market-Based Support Incentives and promotion of long-term PPAs

Main objective: Increase in renewable energy sources in the electricity sector; Reduce energy dependency from third countries.

Description: This measure will complement with the PM_D19 towards shift to oriented renewable energy and electricity generation and storage, by fostering electricity production from renewable technologies and other technologies through an open, transparent, competitive, non-discriminatory and cost-effective procedure. In this regard, the Government, through the Law on Strategic Investments, under the operational support of the Ministry of Energy, Mining and Mineral Resources implement the procedure for granting the strategic investor status for selected facilities, including facilities considered to be strategic in line with the criteria set out by the Law on Strategic Investments.

This measure supports the construction of new renewable energy power plants and other large energy generation power plants (such as gas/hydrogen CCGT/storage capacities) under the Law on Strategic Investments from 2020, providing for incentives to large investments over 30 MEUR, (in a rural municipality), over 50 MEUR (in urban municipality) and over 100 MEUR in two or more municipalities. Under the Law on Strategic Investments, in order to be qualified as a strategic investment project, a project must fulfil at least two of the goals: (i) improvement of wellbeing and living conditions in the country (e.g. displacing coal generated electricity, improving air quality, contributing to climate change goals) and (ii) employment and application of new technologies. The strategic investment project qualification procedure is competitive based, in line with the EU acquis.

Also, the new Law on Renewable Energy, implementing RED II, shall foresee the introduction of long-term renewables power purchase agreements (PPAs) between RE producers and final energy consumers for the purpose of selling produced electricity for a predefined period, thus facilitating further deployment of renewable energy. Further, it will ensure that these bilateral PPAs are not subject to disproportionate or discriminatory procedures or charges, and additional tools shall be introduced to facilitate the uptake of the PPAs, such as guidelines, contract templates, etc. In this regard, this measure will be compatible with the measures related to introduction of energy communities, implementation of the system for guarantees of origin of produced RE energy and the measure for the simplification of permitting procedures and introduction of one-stop shops facilitating deployment of RE (PM_D21, PM_D23 and PM_D24).

Key activities:

- Assess the so far results of the implementation of the Law on Strategic Investments and understand gaps and hurdles in the legislation resulting in its poor implementation so far (the GoNM, with assistance of responsible ministries);
- Align the Law on Strategic investments with the relevant state aid legislation and with the new Energy Law (MEMMR);
- Organize additional requests for expression of interests for strategic investments in the energy sector in line with the Law on Strategic Investments (MEMMR);
- Finalize and adopt the Law on Renewable Energy (MEMMR);
- Prepare PPA guidelines and contract templates as part of the sub-ordinate legislation to the Law on Renewable Energy.

Timeframe		2025 – 2030
Type		Regulatory
Sector		Energy supply
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on Energy • Law on Renewable Energy • Bylaws for renewable energy • Law on Strategic Investments
Finance	Budget	/
	Source of finance	Private sector, banks
Implementing entity		• RE producers, investors, end-users, Ministry of Energy, Mining and Mineral Resources
Monitoring entity		• Energy Regulatory Commission (Energy, Water Services and Municipal Waste Management Services Regulatory Commission of the Republic of North Macedonia)
Progress indicators		• Increase in installed capacity (MW) • Increase in electricity generation (GWh) • Emissions reductions (Gg CO_2-eq
Relation with other dimensions		• Energy security

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

Greater integration of renewable energy sources into district heating systems and support the future development of district cooling systems is supported by the measure "PM_EE14 Enabling regulatory framework for development of new DHS, connection to existing DHS and individual metering and billing of heat consumption". The measure envisages the activity where the analysis of necessary infrastructure for district heating and cooling produced from RES will be conducted.

Furthermore, the measure envisages the establishment of necessary conditions for connecting and operating production facilities that generate heating and cooling energy from RES, together with assessing costs of such facilities. It is expected that increased integration of RES and the expansion of district cooling systems are expected to deliver competitively priced thermal energy, thereby driving the need to develop new and upgrade existing distribution infrastructure.

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 import dependent

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

PM_D26: Developing a low-carbon fuel market	
Main objective: To achieve North Macedonia's 2030 Renewable Energy Sources (RES) share target in the transport sector by establishing a thriving market for sustainable and environmentally friendly low-carbon fuels. This involves significantly increasing the share of fuels derived from renewable energy sources in the final energy consumption within transport. **Description**: This measure will establish a comprehensive regulatory framework, including legislative amendments, guarantees of origin, and blending mandates, to provide clarity and certainty for investors. It will promote a diversified low-carbon fuel portfolio, encompassing advanced biofuels, e-fuels, and biomethane, through targeted financial incentives and pilot projects. Infrastructure development will be prioritized to ensure compatibility with these fuels. Education and training programs will build capacity within the transport and energy sectors, while public awareness campaigns will encourage consumer adoption. Research and innovation will be supported through national programs and international collaborations, focusing on sustainable feedstocks and efficient production processes (including, for example, using waste generated during wine production and other production activities). International and regional cooperation will be leveraged to access best practices and technical assistance, particularly through the Energy Community framework. A robust monitoring, reporting, and verification (MRV) system will track progress and ensure compliance with sustainability criteria. **Key activities**: **Legislative and Regulatory Framework Development:** This activity focuses on creating the necessary legal foundation for a low-carbon fuel market. It involves amending existing laws to define low-carbon fuels, establish sustainability criteria, and implement blending mandates. A robust monitoring, reporting, and verification (MRV) system will be created to ensure compliance. **Market Development and Incentives:** This involves stimulating the market through financial incentives, pilot projects, and infrastructure development. Market analyses will identify the potential for diverse low-carbon fuels, and targeted incentives will encourage production and uptake. Infrastructure upgrades will ensure compatibility with these new fuels. **Education, Training, and Awareness:** Building capacity and raising awareness are crucial for successful adoption. Training programs will educate professionals on low-carbon fuel technologies, and public campaigns will inform consumers about the benefits of these fuels. **Research and Innovation:** This activity supports the development of advanced low-carbon fuel technologies. National research programs will fund projects on sustainable feedstocks and efficient production processes, while international collaborations will facilitate knowledge sharing.	
Timeframe	2025 – 2030
Type	Regulatory, policy
Sector	Transport
Relevant planning documents, legal and regulatory acts	• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Biennial report on the progress of increased utilization of renewable energy sources

Finance	Cost estimate until 2030	n.a.
	Source of finance	Central government budget, EU funds, bilateral/multilateral donors
Implementing entity		• Government of the Republic of North Macedonia • Ministry of Energy, Mining and Mineral Resources • Companies that sell oil products
Monitoring entity		• Ministry of Energy, Mining and Mineral Resources
Progress indicators		• Share of the biofuels in the total final energy consumption in transport (%) • Annual primary production of "Renewables and biofuels" • Annual consumption of oil and petroleum products
Relation with other dimensions		• Energy security, Internal energy market, Research, innovation and competitiveness

3.1.3. Other elements of the dimension

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

The Republic of North Macedonia is working towards aligning with the EU's Emissions Trading System (ETS) as part of its accession process to the European Union. The country needs to fully implement the MRVA package to introduce carbon pricing. Once introduced and implemented, national policies will be fully aligned with the EU ETS.

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

No other national targets relevant for the decarbonisation dimension have currently been introduced.

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

Policies and measures and measures related to low emission mobility have been introduced as a part of the energy efficiency dimension. The measures related to transport are:

- PM_EE15: Development of energy-efficient rail transport
- PM_EE16: Regulatory instruments to promote a cleaner transport system
- PM_EE17: Advanced mobility
- PM_EE18: Construction of the eastern section of the railway Corridor VIII (North Macedonia – Bulgaria)
- PM_EE19: Increasing the number of alternative fuel vehicles and the development of alternative fuel infrastructure in road transport.

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

Phasing out the fossil fuel energy subsidies is envisaged as an activity within the measure "PM_IEM11: Addressing energy poverty while ensuring further market liberalization". Within this activity, a comprehensive assessment and inventory of existing energy subsidies across all sectors will be done. Subsidies to be phase out will be prioritised based on their financial, social and environmental impacts. The legally binding timeline for phase out of fossil fuel subsidies is expected to be established by 2029.

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;

PM_EE1: Energy efficiency obligation schemes

Main objective: Reduction of the energy costs and improvement of energy efficiency

The core objectives of this measure are to align with the requirements of Article 7 (8) of the Energy Efficiency Directive (EED) and to create a framework that enables achievement of energy savings in end-use sectors through activities of obligated parties (energy distributors and/or suppliers), contributing to national energy efficiency targets

Description: The cumulative energy saving targets in the period 2021-2030 will be set, based on the average annual final energy consumption from the period 2014-2016 as a baseline. Aligning with EED Article 7, the scheme will exclude transport sector consumption (paragraph 1) from the overall obligation due to its unique challenges and reduce the consumption in the industry sector (paragraph 2). The scheme will clearly define obligated parties (energy distribution and/or retail companies) and establish specific energy savings targets within defined timeframes for the scheme as well as for individual obligated parties. A robust monitoring and verification process will be put in place to ensure compliance, along with clear penalties for non-achievement of targets.

Key activities:

Background Analysis for establishment of the Energy Efficiency Obligation Scheme:

This activity involves setting up the framework for the obligation scheme, including determining the baseline energy consumption, calculation of cumulative energy saving targets, defining obligated parties (based on detailed analysis of options), and determining the expected contribution of the EEOS to the overall EED target.

Adoption of the Regulation on the Energy Efficiency Obligation Scheme:

The secondary legislative act defining the rules of the EEOS operation shall be developed and adopted, based on the findings of the Background analysis and in line with EE Law.

Establish Monitoring and Reporting Systems:

This activity focuses on setting up a robust monitoring and reporting system to track the progress and effectiveness of the obligation scheme. Key performance indicators will be established, and regular reports will be published to assess the achievement of energy savings targets by individual obligated parties and the overall impact of the scheme.

Timeframe		2025 – 2030
Type		Technical, regulatory
Sector		All sectors (excl. transport and part of the industry according to Annex I of the Directive 2003/87/EC)
Relevant planning documents, legal and regulatory acts		Strategy for Energy Development of the Republic of North Macedonia up to 2040 Law on Energy Efficiency
Finance	Cost estimate until 2030	n.a.
	Available budget	n.a.
	Source of finance	Obligated parties' budgets
Implementing entity		• Ministry of Energy, Mining and Mineral Resources • Obligated parties
Monitoring entity		Ministry of Energy, Mining and Mineral Resources
Progress indicators		Energy savings (ktoe; GWh) per obligated party and for the whole scheme: annual and cumulative
Relation with other dimensions		Energy security, Decarbonization

ii. Long-term renovation strategy to support the renovation of the national stock of residential and non-residential buildings, both public and private (2), 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;

The long-term renovation strategy has not yet been adopted. It will be developed as a strategic document, providing the detailed analysis of the building stock and targets for its decarbonisation until 2050. However, the Strategy will be implemented through dedicated programmes for renovation of specific types of buildings, which are listed hereafter. (Note: instead of the strategy, national plan for renovation of the building stock may be developed as prescribed by the 2024 revision of the EPBD).

PM_EE2: Retrofitting of residential buildings

Main objective: Reduction of the energy costs and improvement of energy efficiency

The primary objective of this measure is to significantly reduce energy costs and improve energy efficiency within the residential building sector in North Macedonia. This will be achieved through the implementation of a comprehensive retrofitting program that encourages homeowners to undertake energy-saving renovations, thereby reducing overall energy consumption and enhancing living conditions.

Description: This measure focuses on incentivizing and supporting the reconstruction of residential buildings, including essential upgrades such as window replacement, initiated by homeowners and potentially supported by commercial banks and funds. To ensure quality and compliance, the measure mandates the issuance of Energy Performance Certificates (EPCs) as a prerequisite for obtaining the incentives for the renovation. EPCs will be mandatory as a proof of implemented renovation measures as well. This way, the EPCs will be established as a mechanism for confirming the effects of the renovation. The aim is to progressively achieve a 3% annual renovation rate, indicating a sustained and progressive effort towards improving the energy efficiency of the residential building stock.

The program will promote comprehensive retrofitting projects, addressing various aspects of building performance, and establish quality standards for materials and workmanship. Worst performing buildings will be given a priority in incentive schemes and energy efficiency first principle will be respected, focusing firstly to reduce energy demand of the building and then to replacing the building systems with more efficient one. Financial incentives, such as grants, subsidies, and low-interest loans, will be provided to encourage homeowners to participate. Collaboration with commercial banks will aim to develop specialized loan products for retrofitting, and funds will be utilized to support projects, particularly for low-income households. A robust monitoring and reporting system will be put in place to track progress and evaluate the effectiveness of the retrofitting program.

Key activities:

Establish a financial incentive framework for retrofitting:

This activity involves designing and implementing a system of financial incentives, such as grants, subsidies, and low-interest loans, to encourage homeowners to undertake retrofitting projects. This will make retrofitting more financially accessible and attractive, driving participation in the program.

Develop partnerships with commercial banks and funds:

This activity focuses on establishing partnerships with commercial banks to develop specialized loan products for energy efficiency retrofits. Collaboration with funds will ensure that retrofitting projects are supported, especially for low-income households, addressing equity concerns.

Implement a mandatory Energy Performance Certificate (EPC) system:

This activity involves implementing a system that requires the issuance of EPCs for all retrofitted buildings. This will ensure compliance with energy efficiency standards and provide homeowners with valuable information about the energy savings potential of their retrofits. Tools for issuing EPCs as well as register of EPC must be established (measure **PM_EE6)**

Promote comprehensive retrofitting and quality standards:

This activity focuses on promoting comprehensive retrofitting projects that address multiple aspects of building performance, such as insulation, windows, and heating systems. Promotional campaigns shall be launched by the institutions implementing financing scheme, with clearly visible support from the Ministry.

Establish a Monitoring and Reporting System for retrofitting progress:

This activity involves setting up a comprehensive monitoring and reporting system to track the progress of the retrofitting program, including the number of buildings retrofitted, energy savings achieved, and investment in retrofitting projects. Regular reports will be published to evaluate the program's effectiveness and make necessary adjustments.		
Timeframe		2025 – 2030
Type		Technical, regulatory
Sector		Households
Relevant planning documents, legal and regulatory acts		Strategy for Energy Development of the Republic of North Macedonia up to 2040 Law on Energy Efficiency
Finance	Cost estimate until 2030	• 1.194 M€ (investment needs)
	Available budget	n.a.
	Source of finance	• Private sources; donors through commercial EE loans; EE Fund
Implementing entity		• Ministry of Energy, Mining and Mineral Resources • Donors and financial institutions • EE Fund
Monitoring entity		Ministry of Energy, Mining and Mineral Resources
Progress indicators		• Energy savings (ktoe; GWh): annual and cumulative • Renovated useful surface of buildings (m2) according to depth of renovation (low, medium, deep) • nZEB/ZEB achievement
Relation with other dimensions		Energy security, Decarbonization

PM_EE3: Retrofitting of central government buildings

Main objective: Reduction of the energy costs and improvement of energy efficiency

The primary objective of this measure is to significantly reduce energy costs and improve energy efficiency within central government buildings in North Macedonia. By implementing a comprehensive retrofitting program, aligned with Article 5 of EED (and article 5 and 6 of EED3), the measure aims to set an exemplary standard for energy efficiency in the public sector, leading to substantial energy savings and responsible resource management.

Description: This measure focuses on the reconstruction of existing public buildings under the jurisdiction of the central government, including those in the healthcare, education, social care, and administrative sectors.

In absence of recent information about the public building stock, in the calculations the heated area of building stock from the National Program for EE in public buildings (Draft version) is considered (including health care sector, universities, student dormitories, science institutions, social care institutions, centres for social affairs, as well as state administrative sector. In addition, the specific consumption given in the same document is used (average 214 kWh/m2).

The implementation will require the issuance of Energy Performance Certificates (EPCs) before and after the renovation, ensuring compliance with energy efficiency standards. The program aims to achieve a 3% annual renovation rate, demonstrating a committed and consistent effort to upgrade the energy efficiency of public buildings. This will involve comprehensive retrofitting projects that address all aspects of building energy performance, utilizing high-quality materials and technologies. Energy efficiency first principle will be respected, and priority will be given to the worst performing buildings.

Key activities:

Conduct a comprehensive building stock assessment:

This activity involves conducting a thorough assessment of the energy performance of all central government buildings, including data collection and analysis to update and refine the building stock information and specific consumption data. This will provide a solid foundation for the retrofitting program. This assessment needs to be a part of the development of long-term renovation strategy (national renovation plan).

Develop implementation plan to achieve 3% annual renovation rate:

This activity involves creating an action plan to achieve the 3% annual renovation rate, prioritizing buildings with the highest energy consumption and potential for savings. This plan shall also be used for budgeting and planning the use of EU and other

donor funds. The plan shall also include the promotional activities, i.e. visibility of renovated projects to communicate the benefits to the general public.

Implement a mandatory Energy Performance Certificate (EPC) system:

This activity involves implementing a system that requires the issuance of EPCs for all retrofitted buildings. This will ensure compliance with energy efficiency standards and provide a means to track progress and evaluate the effectiveness of retrofitting projects. Tools for issuing EPCs as well as register of EPC must be established (measure **PM_EE6)**

Establish a Monitoring and Reporting System for retrofitting progress:

This activity involves setting up a comprehensive monitoring and reporting system to track the progress of the retrofitting program, including the number of buildings retrofitted, energy savings achieved, and investment in retrofitting projects. Regular reports will be published to evaluate the program's effectiveness and make necessary adjustments.

Timeframe		2025 – 2030
Type		Technical, regulatory
Sector		Central government buildings
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on Energy Efficiency
Finance	Cost estimate until 2030	• 94 MEUR (investment needs)
	Available budget	• 2.14 MEUR (preparation of the 3-year Plan) • 6.42 MEUR (renovation of 89,000 m^2)
	Source of finance	• EU support (Reform Agenda) • Central government budget, donors, EE Fund
Implementing entity		• Ministry of Energy, Mining and Mineral Resources • Donors and financial institutions • EE Fund
Monitoring entity		Ministry of Energy, Mining and Mineral Resources
Progress indicators		• Energy savings (ktoe; GWh): annual and cumulative • Renovated useful surface of buildings (m2) according to depth of renovation (low, medium, deep) • nZEB/ZEB achievement
Relation with other dimensions		Energy security, Decarbonization

PM_EE4: Retrofitting of local self-government buildings

Main objective: Reduction of the energy costs and improvement of energy efficiency

The primary objective of this measure is to significantly reduce energy costs and improve energy efficiency within local self-government buildings in North Macedonia. By encouraging and supporting local authorities in undertaking comprehensive retrofitting projects, the measure aims to achieve substantial energy savings, enhance community well-being, and contribute to national energy efficiency targets.

Description: This measure focuses on incentivizing and supporting the reconstruction of existing public buildings under the jurisdiction of local self-governments, including schools, kindergartens, and municipal buildings.

For the calculations, the heated area of building stock from the National Program for EE in public buildings (Draft version) is considered (including primary and secondary schools, kindergartens, pupils' dormitories, municipalities and the City of Skopje buildings). In addition, the specific consumption given in the same document is used (average 214 kWh/m2).

The implementation will require the issuance of Energy Performance Certificates (EPCs) before and after the renovation, ensuring compliance with energy efficiency standards. The program aims to achieve a 3% annual renovation rate, demonstrating a committed and consistent effort to upgrade the energy efficiency of public buildings. This will involve comprehensive retrofitting projects that address all aspects of building energy performance, utilizing high-quality materials and technologies. Energy efficiency first principle will be respected, and priority will be given to the worst performing buildings.

Key activities:

Conduct a comprehensive building stock assessment at local level:

This activity obligates the local authorities to develop register of their building stock (EMIS shall be used for this purpose) and to evaluate energy performance of their buildings. The central government will provide technical assistance and training to local self-governments, enabling them to effectively assess potentials for building retrofitting projects. It will also provide financial support for this, which should result in the development of detailed implementation plan (see next activity).

Develop implementation plan to achieve 3% annual renovation rate:

This activity involves creating an action plan of the local authority to achieve the 3% annual renovation rate, prioritizing buildings with the highest energy consumption and potential for savings. This plan shall also be used for budgeting and planning the use of EU and other donor funds. The plan shall also include the promotional activities, i.e. visibility of renovated projects to communicate the benefits to the general public. Financial support from the central government for developing these plans shall be ensured.

Establish a financial incentive framework for retrofitting:

This activity involves designing and implementing a system of financial incentives, such as grants, subsidies, and low-interest loans, to encourage local authorities to undertake retrofitting projects. This will encourage local authorities to undertake energy efficiency improvements and leverage private sector investment.

Implement a mandatory Energy Performance Certificate (EPC) system:

This activity involves implementing a system that requires the issuance of EPCs for all retrofitted buildings. This will ensure compliance with energy efficiency standards and provide a means to track progress and evaluate the effectiveness of retrofitting projects. Tools for issuing EPCs as well as register of EPC must be established (measure **PM_EE6)**

Establish a Monitoring and Reporting System for retrofitting progress:

This activity involves setting up a comprehensive monitoring and reporting system to track the progress of the retrofitting program, including the number of buildings retrofitted, energy savings achieved, and investment in retrofitting projects. Regular reports will be published to evaluate the program's effectiveness and make necessary adjustments.

Timeframe		2025 – 2030
Type		Technical, regulatory
Sector		Local self-government buildings
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on Energy Efficiency
Finance	Cost estimate until 2030	• 180 M€ (investment needs)
	Available budget	n.a
	Source of finance	• Local government budget, donors, EE Fund
Implementing entity		• Ministry of Energy, Mining and Mineral Resources • Donors and financial institutions • EE Fund
Monitoring entity		Ministry of Energy, Mining and Mineral Resources
Progress indicators		• Energy savings (ktoe; GWh): annual and cumulative • Renovated useful surface of buildings (m2) according to depth of renovation (low, medium, deep) • nZEB/ZEB achievement
Relation with other dimensions		Energy security, Decarbonization

PM_EE5: Retrofitting of commercial buildings

Main objective: Reduction of the energy costs and improvement of energy efficiency

The primary objective of this measure is to significantly reduce energy costs and improve energy efficiency within the commercial building sector in North Macedonia. By incentivizing and supporting building owners to undertake comprehensive retrofitting projects, the measure aims to achieve substantial energy savings, enhance business competitiveness, and contribute to national energy efficiency targets.

Description: There is lack of data for the commercial building stock, but according to third National Energy Efficiency Action Plan the commercial building area is estimated to nearly 8 million m^2. This measure considers reconstructions of existing commercial buildings including windows replacement initiated by the owners and/or supported by commercial banks and funds. EPCs before and after renovation will be mandatory for this measure.

The program aims to encourage commercial building owners to view retrofitting as a strategic investment that enhances asset value and operational efficiency. To achieve a 3% annual renovation rate, the measure will focus on creating a supportive environment that facilitates access to information, financing, and qualified service providers. This includes developing clear retrofitting guidelines, promoting best practices through industry workshops and information campaigns, and establishing a network of certified energy auditors and contractors.

Key activities:

Establish Financial Incentive Mechanisms for Commercial Retrofitting Projects:

This activity focuses on creating financial incentives, such as grants, subsidies, and tax breaks, to encourage businesses to undertake retrofitting projects. This will make retrofitting more financially accessible and attractive, driving participation in the program.

Develop Partnerships with Commercial Banks and Funds for Retrofitting Support:

This activity involves establishing partnerships with commercial banks to develop specialized loan products for energy efficiency retrofits. Collaboration with funds will ensure that retrofitting projects are supported, especially for small and medium-sized enterprises (SMEs).

Implement a mandatory Energy Performance Certificate (EPC) system:

This activity involves implementing a system that requires the issuance of EPCs for all retrofitted buildings. This will ensure compliance with energy efficiency standards and provide a means to track progress and evaluate the effectiveness of retrofitting projects. Tools for issuing EPCs as well as register of EPC must be established (measure **PM_EE6)**

Establish a Monitoring and Reporting System for retrofitting progress:

This activity involves setting up a comprehensive monitoring and reporting system to track the progress of the retrofitting program, including the number of buildings retrofitted, energy savings achieved, and investment in retrofitting projects. Regular reports will be published to evaluate the program's effectiveness and make necessary adjustments.

Timeframe		2025 – 2030
Type		Technical, regulatory
Sector		Commercial sector
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on Energy Efficiency
Finance	Cost estimate until 2030	• 360 M€ (investment needs)
	Available budget	n.a.
	Source of finance	• Private funding, donors through commercial EE loans
Implementing entity		• Ministry of Energy, Mining and Mineral Resources • Financial institutions
Monitoring entity		Ministry of Energy, Mining and Mineral Resources
Progress indicators		• Energy savings (ktoe; GWh): annual and cumulative • Renovated useful surface of buildings (m^2) according to depth of renovation (low, medium, deep) nZEB/ZEB achievement
Relation with other dimensions		Energy security, Decarbonization

PM_EE6: Minimal energy performance standards and energy certificates for new and refurbished buildings
Main objective: Reduction of the energy costs and improvement of energy efficiency

The primary objective of this measure is to establish and enforce minimal energy performance standards for new buildings in North Macedonia, aligning with the requirements of the Energy Performance of Buildings Directive (EPBD). This aims to ensure that all new constructions meet nearly zero-energy building (nZEB) or zero-emission building (ZEB) standards, thereby significantly reducing energy consumption and promoting sustainable building practices.

Description: This measure focuses on the adoption of technical regulations that prescribe minimal energy performance standards for new buildings, based on cost-optimal calculations as mandated by the EPBD. These regulations will clearly define the requirements for nZEB or ZEB, ensuring that new buildings incorporate high-efficiency technologies and renewable energy sources. The implementation will require the development of comprehensive regulations that cover all aspects of building energy performance, including insulation, HVAC systems, and lighting.

Furthermore, the measure will mandate the issuance of Energy Performance Certificates (EPCs) for all new and refurbished buildings to demonstrate compliance with energy performance standards. A system for quality assurance of EPCs will be established to ensure accuracy and reliability. While the initial focus is on new buildings, the measure will also address refurbished buildings, promoting deep renovations and allowing for flexibility in applying standards to existing structures. Tools for calculating energy performance and issuing EPCs as well as register of issued EPCs is envisaged by this measure.

Key activities:

Develop and adopt technical regulations for nZEB/ZEB standards:

This activity involves creating and implementing comprehensive technical regulations that define the minimal energy performance standards for new buildings, based on cost-optimal calculations and aligned with EPBD requirements. These regulations will clearly outline the requirements for nZEB or ZEB, ensuring that new buildings are highly energy efficient. Standards for renovated buildings shall be addressed as well. The minimal energy performance requirements must be in line with cost-optimal calculation defined by EPBD. Hence, these calculation must be performed as a basis for adoption of the regulations.

Implement a quality assurance system for Energy Performance Certificates:

This activity involves establishing a system for quality assurance of EPCs to ensure accuracy and reliability. This will guarantee that EPCs are a credible reflection of a building's energy performance. The regulation on this matter shall be put in place.

Develop tools to facilitate issuing of EPCs and monitor the changes in the energy performance of the building stock:

Tool for calculation energy performance based on standard should be determined to facilitate the tasks of energy assessors and enable comparability of results. The Ministry shall establish and keep the register of issued EPCs, which will facilitate the monitoring of the changes in the building stock, especially increase of number of nZEB/ZEB buildings, which is mandatory NECP reporting requirement.

Timeframe		2025 – 2030
Type		Regulatory
Sector		Buildings sector
Relevant planning documents, legal and regulatory acts		Strategy for Energy Development of the Republic of North Macedonia up to 2040 Law on Energy Efficiency
Finance	Cost estimate until 2030	• n.a. (regular activities of the Ministry)
	Available budget	• 8.56 M€ (technical support to the Ministry)
	Source of finance	• EU support (Reform Agenda)
Implementing entity		Ministry of Energy, Mining and Mineral Resources
Monitoring entity		Ministry of Energy, Mining and Mineral Resources
Progress indicators		• Regulation adopted (yes/no) • Regulation implemented (yes/no)
Relation with other dimensions		Energy security, 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 (1);

PM_EE7: Improvement of street lighting in the municipalities

Main objective: Reduction of the energy costs and improvement of energy efficiency

The primary objective of this measure is to significantly reduce energy costs for municipalities in North Macedonia while simultaneously improving energy efficiency in street lighting. This will be achieved by replacing inefficient light bulbs with high-efficiency LED technology, thereby minimizing energy consumption and freeing up municipal budget resources for other essential services.

Description: This measure focuses on a comprehensive upgrade of street lighting systems across municipalities, transitioning from outdated and inefficient light bulbs to modern LED technology. Recognizing the substantial impact of street lighting costs on municipal budgets, the measure emphasizes the procurement of LED lights that meet the highest energy efficiency standards. This transition not only reduces energy consumption but also enhances public safety and improves the overall quality of life for residents through better illumination.

The implementation will involve a phased replacement program, prioritizing the oldest and most inefficient fixtures. Quality standards will be established to ensure that all new LED installations meet stringent energy efficiency, light output, and durability criteria. The measure also encourages the integration of smart lighting technologies for enhanced control and management, further optimizing energy usage. The ESCO model will be promoted.

Key activities:

Develop and implement a Phased Replacement Program for energy retrofit of public lighting at local level:

Local authorities shall assess the current state of the public lighting systems and prepare plans to renovate them (in phases) giving priorities to the worst parts of the system. They shall be provided with technical assistance for this purpose.

Promote ESCO model for public lighting retrofit:

Local authorities shall be capacitated to implement public procurement of energy services for retrofit of public lighting. Clear guidelines and model energy performance contracts shall be developed. ESCO model shall be promoted and dialogues with service provider organised, in order to ensure market response.

Monitoring:

All implemented projects shall be monitored. For that purpose, EMIS shall be used. Automatic metered data collection from electricity supplier shall be ensured. Saving could be calculated based on metered data.

Timeframe		2025 – 2030
Type		Technical
Sector		Local self-government
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on Energy Efficiency
Finance	Cost estimate until 2030	• 25.3 M€ (investment needs)
	Available budget	8.56 MEUR (for projects in 54 municipalities)
	Source of finance	• EU support (Reform Agenda) • Local government budget, ESCOs
Implementing entity		• Ministry of Energy, Mining and Mineral Resources • Local self-government
Monitoring entity		Ministry of Energy, Mining and Mineral Resources
Progress indicators		Energy savings (ktoe; GWh) annual and cumulative
Relation with other dimensions		Energy security, Decarbonization

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 (2), consumer information and training measures (3), and other measures to promote energy efficiency (4));

PM_EE8: Green procurement

Main objective: Efficiency improvements of buildings and appliances; efficiency improvements of vehicles

The primary objective of this measure is to significantly reduce energy costs and improve energy efficiency within public sector in North Macedonia. By implementing Article 6 of EED (Article 7 revised EED from 2023), the measure aims to ensure that central government purchases only high energy-efficiency products, services, and buildings, thereby driving market transformation and promoting sustainable procurement practices. Gradually, the obligation shall spread to all levels of public sector.

Description: This measure focuses on the implementation of green procurement practices in line with Article 6 of the EED, mandating that public sector entities prioritize energy efficiency in their procurement procedures. This involves developing and implementing clear procurement guidelines that include mandatory energy efficiency requirements for products, services, and buildings. To ensure effective implementation, intensified activities will focus on building the legal and technical knowledge and skills of public sector entities.

The measure emphasizes the application of the most economically advantageous tender criteria, incorporating life-cycle costing and environmental and social considerations alongside energy efficiency. Also, Environmental Product Declaration (EPD) use shall be considered, due to the importance of construction materials in energy efficiency and green procurement. This approach will ensure that procurement decisions are based on long-term value and sustainability. A robust monitoring and reporting system will be established to track progress, analyse data on green procurements, and publish regular reports on the energy savings and environmental benefits achieved.

Key activities:

Develop and implement clear procurement guidelines with mandatory energy efficiency requirements:

This activity involves creating and implementing detailed procurement guidelines that prioritize energy efficiency criteria. These guidelines will be mandatory for all public sector entities and will ensure that energy efficiency is a key consideration in all procurement decisions. It shall contain principles of most economically advantageous tender and life-cycle costing.

Provide legal and technical training to public sector entities:

This activity focuses on building the capacity of public sector procurement officers through comprehensive legal and technical training. This will equip them with the necessary knowledge and skills to effectively include and evaluate energy efficiency requirements in procurement procedures.

Establish a data collection and analysis system for green procurements:

This activity focuses on setting up a system to collect and analyse data on green procurements. This will enable the tracking of energy savings and environmental benefits achieved through green procurement practices and provide insights for continuous improvement.

Publish regular reports on green procurement progress and impact:

This activity involves publishing regular reports on the progress of the green procurements program. These reports will ensure transparency and accountability and demonstrate the impact of green procurement practices on energy efficiency and environmental sustainability.

Timeframe		2025 – 2030
Type		Regulatory
Sector		Public bodies
Relevant planning documents, legal and regulatory acts		Strategy for Energy Development of the Republic of North Macedonia up to 2040 Law on Energy Efficiency
Finance	Cost estimate until 2030	• n.a. (regular activities of competent bodies for establishing the system; value of procurements depend on needs of public procurers)
	Available budget	• n.a.
	Source of finance	Central and local government budget
Implementing entity		• Ministry of Energy, Mining and Mineral Resources • Public Procurement Bureau • Local self-government
Monitoring entity		Ministry of Energy, Mining and Mineral Resources
Progress indicators		• Energy savings (ktoe/GWh) annual and cumulative

	• Number of public procurements with integrated EE criteria
Relation with other dimensions	Energy security, Decarbonization

PM_EE9: Eco-design requirements for energy-using equipment and labelling of electric appliances and equipment		
Main objective: Efficiency improvements of buildings and appliances The primary objective of this measure is to significantly reduce energy costs and improve energy efficiency in North Macedonia by implementing comprehensive labelling of electric appliances and equipment. This will provide consumers with essential information on product energy consumption, enabling informed purchasing decisions and driving market transformation towards energy-efficient products, while ensuring alignment with EU regulations. **Description**: This measure focuses on the application of EU energy labelling and eco-design regulations to electric appliances and equipment sold in North Macedonia. It involves establishing a robust labelling scheme that provides clear and standardized information on product energy consumption, empowering consumers to choose energy-efficient options. This will be coupled with the implementation of minimum eco-design requirements to ensure that products meet energy efficiency and environmental performance standards, aligning with the latest EU regulations. To ensure compliance and effectiveness, a robust market surveillance system will be implemented for monitoring and verifying product energy performance. Enforcement measures will be established to address non-compliance and protect consumers from misleading information. Public awareness campaigns will be conducted to educate consumers about the benefits of energy labelling and eco-design, and training will be provided to retailers to ensure accurate information dissemination. **Key activities**: **Implement Comprehensive EU Energy Labelling Scheme:** This activity involves establishing a comprehensive energy labelling scheme that covers a wide range of electric appliances and equipment, ensuring clear and standardized labels that provide consumers with easy-to-understand information about product energy consumption. Appropriate regulation shall be adopted. **Apply Minimum EU Eco-Design Requirements:** This activity focuses on implementing minimum eco-design requirements for electric appliances and equipment, ensuring that products meet energy efficiency and environmental performance standards in line with the latest EU regulations. Appropriate regulation shall be adopted. **Establish a Robust Market Surveillance and Enforcement System:** This activity involves setting up a robust system to monitor the compliance of electric appliances and equipment with energy labelling and eco-design regulations. This includes conducting regular testing and implementing enforcement measures to address non-compliance. Inspection system requires legislative solutions. **Conduct Public Awareness Campaigns and Retailer Training:** This activity focuses on educating consumers about the benefits of energy labelling and eco-design through public awareness campaigns. Training will also be provided to retailers to ensure they can accurately inform consumers about product energy efficiency. **Establish a Monitoring and Reporting System for Labelling and Eco-Design Compliance:** This activity involves setting up a robust system to track the progress of the energy labelling and eco-design program, including monitoring compliance and reporting on the impact of the program.		
Timeframe		2025 – 2030
Type		Regulatory
Sector		Households and commercial sector
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on Energy Efficiency
	Cost estimate until 2030	• n.a. (regular activities of competent bodies for establishing and implementing the scheme)
Finance	Available budget	• n.a.
	Source of finance	• Private investments

Implementing entity	• Ministry of Energy, Mining and Mineral Resources (regulation and inspection) • Producers and suppliers of electrical equipment and household appliances (implementation of regulation) • End-users (purchase of equipment)
Monitoring entity	Ministry of Energy, Mining and Mineral Resources
Progress indicators	• Regulation adopted (yes/no) • Regulation implemented (inspection reports)
Relation with other dimensions	Energy security, Decarbonization

PM_EE10: Increased use of heat pumps

Main objective: Reduction of the energy costs and improvement of energy efficiency; Efficiency improvements of buildings and appliances

The primary objective of this measure is to significantly reduce energy costs and improve energy efficiency in North Macedonia's heating sector. This will be achieved by phasing out inefficient heating devices, specifically resistive heaters and fuel wood stoves, and promoting their replacement with high-efficiency heat pumps, thereby contributing to decarbonization and improved air quality.

Description:

This measure focuses on a strategic transition from inefficient heating devices to heat pumps, recognizing the significant energy savings and environmental benefits that this technology offers. The phasing out of resistive heaters will be incentivized through financial assistance and public awareness campaigns, highlighting the cost savings and energy efficiency of heat pumps. Similarly, inefficient fuel wood stoves will be replaced through stove replacement programs and the enforcement of air quality regulations, addressing local air pollution concerns. A good example may be found in Baba Municipality and the City of Skopje, where households applying for subsidies are required to hand over their wood-burning stoves to ensure the desired effect is achieved. This good practice example shall be incorporated in the programme, to ensure the fulfilment of desired effects in both energy consumption and air pollution reduction. Special attention in this programme shall be given to the citizens in risk of energy poverty – for them, 100% subsidies shall be ensured.

The measure will promote the adoption of heat pumps through the establishment of technical standards, installer training, and the integration of heat pumps with smart grids and renewable energy sources. This approach aims to create a sustainable and efficient heating sector, reducing reliance on fossil fuels and biomass, and enhancing energy security. A robust monitoring and reporting system will track progress and evaluate the impact of the program.

Key activities:

Implement incentive programs to replace resistive heaters and fuel wood stoves with heat pumps:

This activity involves developing and implementing financial incentive programs, such as grants or subsidies, to encourage households and businesses to replace resistive heaters with heat pumps. Public awareness campaigns will also be conducted to educate consumers about the benefits of this transition. The scheme shall be established by EE Fund. ESCO model shall also be promoted.

Develop and enforce technical standards for heat pump installations:

This activity involves establishing technical standards for heat pump installations to ensure quality and safety. Training will be provided to installers to ensure they are qualified to install and maintain heat pump systems. Qualification schemes and trainings are also required of EU directives, hence appropriate regulation needs to be adopted.

Promote the integration of heat pumps with smart grids and renewable energy sources:

This activity focuses on exploring and promoting the integration of heat pumps with smart grids to optimize energy consumption. The use of renewable energy sources, such as solar PV and geothermal, to power heat pumps will also be encouraged.

Establish a monitoring and reporting system for heat pump adoption and impact:

This activity involves setting up a robust system to track the progress of the heat pump promotion program. Regular reports will be published to evaluate the energy savings achieved, the reduction in greenhouse gas emissions, and the improvement in air quality.

Timeframe	2025 – 2030
Type	Regulatory

Sector		Households and commercial sector
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on Energy Efficiency
Finance	Cost estimate until 2030	• 26.4 M€
	Available budget	• n.a.
	Source of finance	• Private, EE fund, incentives from the central and local government budget, donors
Implementing entity		• Ministry of Energy, Mining and Mineral Resources • EE Fund (incentive programme)
Monitoring entity		Ministry of Energy, Mining and Mineral Resources
Progress indicators		Energy savings (ktoe; GWh) annual and cumulative
Relation with other dimensions		Energy security, Decarbonization

PM_EE11: Public awareness campaigns and network of energy efficiency (EE) info centres

Main objective: Reduction of the energy costs and improvement of energy efficiency

The primary objective of this measure is to significantly reduce energy costs and improve energy efficiency in North Macedonia by enhancing public awareness and knowledge about energy efficiency benefits. This will be achieved through comprehensive public awareness campaigns and the establishment of a network of Energy Efficiency (EE) info centres, directly addressing the requirements of Article 12 of EED and empowering small energy customers, including domestic consumers, to adopt energy-efficient practices.

Description: This measure focuses on bridging the knowledge gap regarding energy efficiency by establishing a network of EE info centres within local self-governments. These centres will serve as accessible hubs for information dissemination, providing residents with expert advice and educational resources on energy efficiency measures. To complement this, a multi-faceted approach will be implemented, including the integration of energy efficiency education into school curricula starting from kindergarten, and comprehensive training for employees in public institutions at both central and local levels.

Furthermore, the measure will involve the creation of a user-friendly calculation tool that demonstrates the financial and environmental benefits of implementing specific energy efficiency measures. This tool will be made widely accessible to the public, facilitating informed decision-making. Public awareness campaigns will be strategically designed to reach a broad audience, promoting energy-efficient practices and highlighting the tangible advantages of adopting such measures.

Key activities:

Establish a network of energy efficiency (ee) info centres in local self-governments:

This activity involves setting up a network of accessible information centres within local self-governments to provide residents with expert advice, educational materials, and resources on energy efficiency measures, fostering local engagement and knowledge dissemination.

Integrate energy efficiency education into school curricula starting from kindergarten:

This activity focuses on embedding energy efficiency and sustainability concepts into the educational framework, starting from early childhood education. this will cultivate a culture of energy awareness and responsibility from a young age.

Provide comprehensive training to employees in public institutions:

This activity involves delivering targeted training programs to employees in public institutions at both central and local levels. this will equip them with the knowledge and skills to implement energy-efficient practices within their respective roles and organizations.

Develop and disseminate a user-friendly calculation tool:

This activity focuses on creating a practical calculation tool that clearly demonstrates the financial and environmental benefits of implementing energy efficiency measures. This tool will be made widely accessible to the public, empowering them to make informed decisions. Tools already developed will be utilised for this purpose. Also, the tool will be promoted to ensure its wide acceptance and use.

Conduct public awareness campaigns to promote energy efficiency:

This activity involves designing and implementing strategic public awareness campaigns to educate and inform the general public about the benefits of energy efficiency. These campaigns will utilize various communication channels to reach a broad audience and encourage the adoption of energy-efficient practices. Each campaign shall be accompanied by a survey before and after to enable the evaluation of impacts. In this activity, strong cooperation with civil sector is envisaged, as civil sector may contribute as both proposers of public campaigns and implementers of certain components thereof.		
Timeframe		2025 – 2030
Type		Information, Education
Sector		Households and commercial sector
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on Energy Efficiency
Finance	Cost estimate until 2030	• 704 M€ (establishment and operation of local EE info centres)
	Available budget	• n.a.
	Source of finance	• Central and local government, donors
Implementing entity		• Ministry of Energy, Mining and Mineral Resources • Local governments
Monitoring entity		Ministry of Energy, Mining and Mineral Resources
Progress indicators		• Energy savings (ktoe; GWh) annual and cumulative • Number of EE centres • EE school curriculum developed (yes/no) • Calculation tool (yes/no)
Relation with other dimensions		Energy security, Decarbonization

PM_EE12: Energy management in manufacturing industries

Main objective: Reduction of the energy costs and improvement of energy efficiency

The primary objective of this measure is to significantly reduce energy costs and improve energy efficiency within North Macedonia's manufacturing industries. This will be achieved through the implementation of mandatory energy audits for large companies, the promotion of ISO 50001 certification, and the adoption of advanced measurement and IT technologies, ultimately leading to better process control and defect prevention.

Description: This measure focuses on driving energy efficiency improvements in manufacturing industries through a combination of regulatory requirements and technological advancements. It mandates that large companies conduct regular energy audits to identify energy-saving opportunities. Additionally, it promotes the adoption of the ISO 50001 standard, providing a structured framework for energy management. The largest energy consumers should be obligated to introduce energy management systems as per requirements of the revised EED from 2023 (companies with average energy consumption over 85 TJ).

To further enhance energy efficiency, the measure encourages the implementation of advanced measurement and IT technologies, such as real-time monitoring systems and data analytics platforms. This will enable companies, including SMEs, to optimize energy consumption, improve process control, and proactively prevent defects. Knowledge sharing and best practices will be facilitated through industry forums and information dissemination, ensuring that companies have access to the latest energy management technologies and practices.

Key activities:

Implement mandatory energy audits for large companies:

This activity involves establishing clear requirements for energy audits, including audit frequency and reporting standards. Qualified auditors will conduct these audits to identify energy-saving opportunities and provide recommendations for improvement. Appropriate regulation shall be adopted. Obligatory introduction of ISO 50001 shall be prescribed for large energy consumers.

Promote ISO 50001 certification and adoption of advanced measurement and it technologies through incentive programs and support:

This activity focuses on encouraging SMEs to adopt the ISO 50001 standard by providing incentive programs and technical assistance, when they are not obligated to do so as per regulation. Promotion and incentives will be also directed towards the use

of advanced measurement and IT technologies, such as real-time monitoring systems and data analytics platforms, that will support continuous monitoring and managing of energy consumption.

Facilitate knowledge sharing and best practices through industry forums and information dissemination:

This activity focuses on organizing industry forums and workshops to share best practices and case studies on energy management. Information resources will also be developed and disseminated to promote the adoption of energy-efficient technologies and practices. Ministry shall implement this activity in cooperation with industrial and commercial associations (chambers).

Establish a monitoring and reporting system for energy management progress:

This activity involves setting up a robust system to track the progress of the energy management program. Data collection and regular reports will be published to evaluate the energy savings achieved and the impact of the program.

Timeframe		2025 – 2030
Type		Regulatory, technical
Sector		Industry
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on Energy Efficiency
Finance	Cost estimate until 2030	• n.a.
	Available budget	• n.a.
	Source of finance	• Private, donors through commercial EE loans
Implementing entity		• Ministry of Energy, Mining and Mineral Resources (regulation preparation, adoption and enforcement) • Companies (implementing obligation)
Monitoring entity		Ministry of Energy, Mining and Mineral Resources
Progress indicators		Number of companies with introduced energy management system or implemented energy audits
Relation with other dimensions		Energy security, Decarbonization

PM_EE13: Improvement of processes in manufacturing industries

Main objective: Reduction of the energy costs and improvement of energy efficiency

To achieve substantial reductions in energy costs and drive improvements in energy efficiency within North Macedonia's manufacturing sector, this measure focuses on the adoption of advanced industrial technologies and the replacement of outdated machinery. It aims to foster a transition towards more efficient processes, thereby enhancing both economic and environmental sustainability.

Description: The introduction of cutting-edge industrial technologies presents a significant opportunity to minimize energy consumption, leading to lower operational costs and reduced environmental impact. In particular, the high energy usage associated with electric motors necessitates targeted action. Therefore, a core component of this measure involves the systematic replacement of obsolete machines with newer, more efficient electric motors. Furthermore, the measure will actively promote the implementation of data analytics, artificial intelligence, and advanced control systems to optimize process efficiency and minimize energy waste.

Beyond direct equipment upgrades, the program will encourage the redesign and optimization of industrial processes through the adoption of lean manufacturing and circular economy principles. This will encompass the reduction of resource consumption, minimization of waste, and promotion of closed-loop production systems. Knowledge sharing and best practices will be facilitated through industry forums, workshops, and online resources, ensuring widespread dissemination of information on advanced technologies and energy-efficient practices.

Key activities:

Facilitate industrial energy efficiency improvements:

Targeted financial incentives and technical support will be provided to manufacturers (including SMEs) to facilitate the implementation of the optimal EE measures. Industrial EE measures usually have very good rates of return; hence incentives shall be used only as driver to implemented ESCO model and to stimulate obligated parties of EEOS to ensure their obligatory savings

from these measures. Potential subsides shall not be an obstacle for development of market-based models for EE in industry. Ministry shall design and promote this scheme among all parties involved – industry, ESCOs and EEOS obligated parties.

Facilitate knowledge sharing and best practices through industry forums and information dissemination:

Industry forums, workshops, and online resources will be developed to promote the exchange of knowledge and best practices related to advanced industrial technologies and energy-efficient processes.

Establish a monitoring and reporting system for process improvement and energy savings:

A robust monitoring system will be implemented to track the progress of process improvements and measure the resulting energy savings, with regular reports published to assess the impact of the program.

Timeframe		2025 – 2030
Type		Technical
Sector		Industry
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on Energy Efficiency
Finance	Cost estimate until 2030	• 113 M€
	Available budget	• n.a.
	Source of finance	• Private (industrial companies); ESCOs; obligated parties under EEOS
Implementing entity		• Ministry of Energy, Mining and Mineral Resources • Private companies
Monitoring entity		Ministry of Energy, Mining and Mineral Resources
Progress indicators		Energy savings (ktoe/GWh) annual and cumulative
Relation with other dimensions		Energy security, Decarbonization

PM_EE14: Enabling regulatory framework for development of new DHS, connection to existing DHS and individual metering and billing of heat consumption (EED requirements)

Main objective: Efficiency improvement of buildings; efficiency improvement in the energy and transformation sector; increase in renewable energy in heating and cooling sector

The proposed measure aims to enhance the efficiency and sustainability of district heating systems (DHS) in North Macedonia by aligning them with the requirements of the revised Energy Efficiency Directive (EED). The measure will facilitate the development of new district heating networks based on renewable energy sources (RES) and high-efficiency cogeneration, while also decarbonizing existing DHS. Apart from focusing on heat supply, the measure also aims to empower end-users through ensuring individual metering and billing of heat consumption.

Description: To achieve this, a supportive regulatory framework will be established, addressing both the supply and consumption of heat. On the supply side, the framework will promote the integration of RES, utilization of waste heat, and overall system modernization. On the consumption side, the measure will introduce individual metering and billing, empowering consumers to manage their energy use effectively. This will require mandatory installation of metering devices at both the building and apartment levels or heat cost allocators, ensuring fair and transparent billing.

Furthermore, financial and regulatory incentives will be introduced to encourage connections to district heating networks and support the installation of individual heat meters in residential buildings. A pilot project will be implemented to test and refine the cost allocation and billing methodology before full-scale deployment.

Key activities:

Introduce regulatory changes related to EE and RES requirements for DHS and individual metering and billing:

As revised EED and RED form 2023 bring new obligations for DHS, these requirements shall be transposed into national legislation (EE and/or Energy Law). Secondary legislation for heat cost allocation at the building level shall be drafted and adopted, taking into account the results of the pilot phase. Within this regulatory framework it has to be envisaged to perform comprehensive assessment of potential for energy efficient heating and cooling, including development of high-efficient co-generation. The comprehensive assessment need to be done for the national level, while large local authorities (>45,000 inhabitants) need to prepare their heating and cooling plans. Additionally, DHS operators need to prepare the plans for decarbonisation of their

systems. All this is in line with EED requirements, and requires firstly strong legal basis, and secondly development of all these detailed analyses and plans to enable decarbonisation of heating and cooling.

Analysis of DHS role in energy security:

The construction of new district heating systems plays an important role in enhancing a country's energy security, particularly as global energy markets face increasing volatility and supply uncertainties. A thorough analysis of such projects will be carried out to ensure that they are economically viable, environmentally sustainable, and resilient to future energy disruptions.

By evaluating factors such as fuel sources, infrastructure integration, technological efficiency, and long-term operational costs, the system will be designed in a way that reduces dependency on imported fossil fuels, promotes the use of local and renewable energy sources, and strengthens the stability of the national energy supply. This strategic approach supports the transition to a low-carbon economy but also safeguards households and industries against energy shortages.

Investment support mechanism for existing and new DHS:

For modernizing existing DHS and developing new RES-based DHS require significant investments. The Ministry, local authorities and DHS operators shall seek the opportunities for funding such projects through public-private partnerships (PPPs) or international funding. A dedicated funding program to support such projects shall be established. The assessment of the necessity to build new infrastructure for RES based DHS will be done, together with assessing the associated costs.

Implementing pilot project for individual metering and billing:

One or more municipalities with existing district heating networks will be selected for a pilot project, where individual heat meters or heat cost allocators in residential buildings will be installed. Meter readings and billing methodology will be tested to ensure fair and transparent cost allocation. The results will be used to refine the methodology and to rollout the nation-wide implementation.

Awareness raising campaign:

The Ministry will launch a comprehensive information campaign to raise awareness among consumers about the benefits of individual metering and energy-efficient heating, empowering them to make informed decisions about their energy use. Guidance and technical assistance will be provided to building owners and consumers to support their transition to the new system, ensuring they understand the installation process, operation, and cost-saving potential of individual heat meters. Active collaboration with municipalities and heating service providers will be established to ensure a smooth implementation process, address potential challenges, and optimize the effectiveness of the new district heating measures.

Timeframe		2025 – 2030
Type		Regulatory
Sector		Industry
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on Energy Efficiency
Finance	Cost estimate until 2030	• n.a. (to be determined according to analyses and plans od DHS operators)
	Available budget	• 4.28 MEUR (pilot implementation of individual metering in 30 existing buildings)
	Source of finance	• EU financial support (Reform Agneda) – for piloting individual metering • DHS operators' budgets, private capital, EU funding for DHS construction and modernisation projects
Implementing entity		• Ministry of Energy, Mining and Mineral Resources • DH companies
Monitoring entity		Ministry of Energy, Mining and Mineral Resources
Progress indicators		• Regulatory framework established (yes/no) • Number of buildings with individual metering
Relation with other dimensions		Energy security, Decarbonization

PM_EE15: Development of energy-efficient rail transport

Main objective: The primary objective of this measure is to significantly improve energy efficiency within North Macedonia's rail transport sector, concurrently increasing the modal share of rail in total traffic. By modernizing infrastructure, electrifying lines, and promoting rail usage, the measure aims to reduce overall energy consumption and greenhouse gas emissions associated with transportation, while fostering a more sustainable and efficient transportation system.

Description: This measure entails a comprehensive approach to revitalizing the rail network, focusing on strategic investments in renovation, modernization, construction, and maintenance of railway infrastructure. These investments will enable higher-quality rail transport services, attracting a greater number of users and thereby increasing rail's share in total traffic. The strategy includes the implementation of advanced technologies such as energy-efficient signalling and regenerative braking systems, and the elimination of bottlenecks to reduce travel times and energy consumption. Furthermore, the measure prioritizes the electrification of railway lines, beginning with high-traffic routes, and the gradual replacement of diesel locomotives with electric counterparts. This transition will be supported by investments in modern electrification infrastructure and the exploration of renewable energy sources to power the system. Simultaneously, enhancements to station accessibility, including integration with other modes of transport and improved facilities for passengers with disabilities, will be implemented. Network security will be strengthened through advanced monitoring systems, and strategic expansion projects will aim to connect underserved areas, enhancing regional connectivity.

The measure will also focus on raising public awareness of the benefits of rail transport through targeted campaigns, highlighting its energy efficiency, environmental advantages, and cost-effectiveness. Key performance indicators (KPIs) will be established to monitor progress, including energy consumption per passenger-kilometre or tonne-kilometre, the percentage of electrified lines, and the overall modal share of rail. Continuous monitoring and reporting will ensure the measure's effectiveness and facilitate necessary adjustments.

Key activities:

Infrastructure Modernization and Expansion:

This activity involves a thorough evaluation of the current rail network to pinpoint areas needing upgrades, followed by the implementation of improvements to signalling, track layout, and station amenities. Strategic network expansion projects will be launched to extend coverage, and smart parking solutions will be introduced around stations to enhance accessibility.

Within this measure, planning for the construction of additional railway corridors (e.g. Corridor X) and modernization activities on individual corridors will be defined.

Electrification and Fleet Replacement:

A phased plan will be developed and executed to electrify railway lines, starting with high-traffic routes. Modern electric locomotives and rolling stock will be procured and deployed, replacing older diesel models. The feasibility of using renewable energy sources to power the electric rail network will be investigated.

Enhancement of Station Accessibility and Intermodality:

Improvements will be made to ensure stations are fully accessible to passengers with disabilities. Rail stations will be integrated with other modes of transport, such as bus and bicycle networks, to create seamless intermodal connections, making rail travel more convenient.

Public Awareness and Promotion:

Targeted public awareness campaigns will be developed and launched to highlight the benefits of rail transport. Digital and social media platforms will be utilized to reach a broad audience, promoting rail's energy efficiency and environmental advantages.

Timeframe		2025 – 2030
Type		Technical, information
Sector		Transport
Relevant planning documents, legal and regulatory acts		• National Transport Strategy • Strategy for Energy Development of the Republic of North Macedonia up to 2040
Finance	Cost estimate until 2030	700 MEUR
	Source of finance	Central government budget
Implementing entity		• Government of the Republic of North Macedonia • Ministry of Transport and Communications

	• Ministry of Economy and Labour • JSC North Macedonian Railway Transport • End-users • Private companies
Monitoring entity	Public entity responsible for transport
Progress indicators	• Number of kilometres of electrified railway lines • Number of kilometres of renovated railway lines • Number of renovated railway stations • Number of electric locomotives in operation
Relation with other dimensions	Energy security, Decarbonisation

PM_EE16: Regulatory instruments to promote a cleaner transport system

Main objective: The primary objective of this measure is to significantly reduce environmental pollution stemming from the transport sector and to foster a transition towards a more sustainable transport system in North Macedonia. This will be achieved through the strategic implementation of regulatory instruments that incentivize the adoption of low-emission vehicles, encourage the utilization of public transport, and promote active modes of transportation such as walking and cycling.

Description: This measure leverages a combination of regulatory tools, financial incentives, and public sector leadership to drive a shift towards cleaner transport. It entails the application of regulations, standards, and taxes designed to discourage the use of high-polluting vehicles and encourage the uptake of low-emission alternatives. Specifically, this includes implementing stricter emission standards, establishing low-emission zones in urban areas, and revising parking policies to prioritize electric vehicles and bicycles. Financial incentives play a crucial role, with provisions for a reduced VAT rate and subsidies for the purchase of electric vehicles, as well as revisions to excise duties on energy sources to reflect their environmental impact. These instruments are designed to make electric vehicles more accessible and to increase the relative cost of high-emission fuels.

Critically, this measure mandates a progressive transition to zero-emission vehicles within the public sector. Public institutions are obligated to ensure that, by the end of 2027, at least 20% of all newly purchased vehicles will have zero CO_2 emissions. This target will then increase to at least 50% of all newly purchased vehicles having zero CO_2 emissions after 2028. This clear mandate serves as a powerful signal, demonstrating government commitment and driving market demand for electric vehicles. Furthermore, investments will be made in the expansion and modernization of public transport systems, ensuring that they offer reliable and convenient alternatives to private vehicle use. Simultaneously, infrastructure development will prioritize the creation of safe and accessible pedestrian and bicycle paths, promoting active transport.

Key activities:

Implement Emission Standards and Urban Access Regulations:

This activity aims to guide customer choices towards cleaner vehicles. By implementing emission standards that limit the types of vehicles allowed in urban areas, and by creating low-emission zones, this activity encourages consumers to select vehicles with lower environmental impacts.

Provide Financial Incentives for Electric Vehicles:

This activity focuses on making electric vehicles more attractive and affordable to customers. A reduced VAT rate and direct subsidies will lower the initial cost of electric vehicles, making them a more competitive option for consumers. Revising excise duties on fuels will also incentivize customers to choose cleaner energy sources.

Mandate Public Sector Zero-Emission Vehicle Procurement:

This activity uses the public sector as a leading customer. By setting clear targets for zero-emission vehicle procurement, public institutions will demonstrate the viability of electric vehicles and create a visible demand, encouraging broader consumer confidence and adoption.

Invest in Public Transport and Active Transport Infrastructure:

This activity focuses on providing customers with viable and convenient alternatives to private vehicle use. Expanding and modernizing public transport systems will improve accessibility and reliability, while developing safe pedestrian and bicycle infrastructure will encourage customers to choose active transport options.

Timeframe		2025 – 2030
Type		Regulatory, policy, information
Sector		Transport
Relevant planning documents, legal and regulatory acts		• National Transport Strategy • Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on vehicles • Law on vehicle tax
Finance	Cost estimate until 2030	8.4 MEUR
	Source of finance	Private, EE fund, incentives from the central government budget
Implementing entity		• Government of the Republic of North Macedonia • Ministry of Transport and Communications • Ministry of Economy and Labour • End-users
Monitoring entity		• Ministry of Economy and Labour • Ministry of interior
Progress indicators		• Amount of financial resources allocated to subsidize the purchase of electric vehicles • Number of zero-emission vehicles used by the public sector • Number of kilometres of cycle paths
Relation with other dimensions		Energy security, Decarbonisation

PM_EE17: Advanced mobility

Main objective: The primary objective of this measure is to significantly reduce local air pollution in urban areas of North Macedonia by promoting the sustainable development of urban transport systems. This will be achieved through the implementation of intelligent traffic management solutions, the introduction of advanced mobility services, and the promotion of active transport modes, ultimately improving the quality of life for urban residents.

Description: This measure aims to foster a gradual transformation of urban mobility through a combination of technological advancements and strategic planning. The promotion of intelligent traffic management solutions will be encouraged, including the analysis and potential deployment of smart traffic lights powered by renewable energy, advanced traffic monitoring equipment, and central operational centers for traffic management. The exploration and encouragement of sustainable urban mobility solutions will be prioritized, such as the analysis of intelligent parking management, the promotion of car-sharing systems, the potential implementation of low-emission zones, and the development of public bicycle-sharing programs, alongside the expansion of cycling infrastructure. Cities will be encouraged to develop Sustainable Urban Mobility Plans (SUMPs) that integrate principles of participation and evaluation, aiming to address their specific mobility challenges and meet the evolving needs of their citizens.

Furthermore, the measure will focus on promoting a shift towards active transport modes. Public awareness campaigns and potential subsidy programs will encourage the use of bicycles, electric scooters, and walking, particularly for short distances. The analysis of parking policies, aiming to discourage excessive private car use in city centres, will be promoted, with a focus on making active transport and public transport more attractive options. This measure seeks to cultivate a more livable, sustainable, and less polluted urban environment by encouraging and supporting cities in their efforts to adopt advanced and sustainable mobility practices.

Key activities:

Promote the Adoption of Intelligent Traffic Management Systems:

This activity encourages cities to explore and implement smart technologies to optimize traffic flow. This includes promoting the analysis and potential deployment of adaptive traffic lights powered by renewable energy, advanced monitoring equipment, and central operational centres, with the aim of reducing congestion and minimizing idling.

Support the Development of Sustainable Urban Mobility Plans (SUMPs):

This activity aims to guide and assist cities in adopting a strategic and participatory approach to urban mobility planning. Cities will be encouraged to develop SUMPs that address their specific mobility challenges, incorporating principles of integration, participation, and evaluation.

Promote Active Transport through Awareness and Potential Incentives:

This activity focuses on raising awareness of the benefits of active transport modes, such as walking, cycling, and electric scooter use. Public awareness campaigns will be conducted, and the potential for incentive programs will be explored to make these modes more attractive and accessible.

Analyse and Encourage the Implementation of Parking Policies to Promote Sustainable Transport:

This activity aims to encourage cities to analyse and consider implementing parking policies that promote the use of sustainable transport options. This could include exploring options to discourage excessive private car use in city centres, and making alternative transport options more appealing.

Timeframe		2025 – 2030
Type		Regulatory, technical, information, financial
Sector		Transport
Relevant planning documents, legal and regulatory acts		• National Transport Strategy • Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Local Sustainable Urban Mobility Plans
Finance	Cost estimate until 2030	/
	Source of finance	Private, EE fund, incentives from the central and local government budget, donors
Implementing entity		• Ministry of Transport and Communications • Local self-government
Monitoring entity		Ministry of Economy and Labour Local self-government
Progress indicators		• Number of SUMPs developed • Number of car-sharing systems • Number of bike and scooter rentals
Relation with other dimensions		Energy security, Decarbonisation, Research, innovation and competitiveness

PM_EE18: Construction of the eastern section of the railway Corridor VIII (North Macedonia – Bulgaria)

Main objective: A pivotal objective of this measure is to complete the eastern section of Railway Corridor VIII, a crucial link connecting North Macedonia with Bulgaria, and integral to the Western Balkans - Eastern Mediterranean European Corridor and the EU's Global Gateway initiative. The project aims to establish a direct, efficient rail connection, thereby reducing travel times, fostering regional integration, and stimulating economic growth.

Description: The core of this project involves constructing a 24km railway line from Kriva Palanka to the Bulgarian border, alongside electrifying the 88km section from Kumanovo to the border. This development will eliminate the current 120km detour via Serbia, significantly enhancing transport efficiency. The project will adhere to EU standards, ensuring rail interoperability and facilitating seamless cross-border transport.

Moreover, the completed railway will expand export opportunities for North Macedonian businesses, opening up markets in Southeast Europe and Turkey. Multimodal transport hubs will be developed to support the efficient transfer of goods between various transport modes. This initiative will not only bolster regional trade but also promote sustainable freight transport, reducing reliance on less environmentally friendly road transport.

Key activities:

Undertake the Construction of the Kriva Palanka-Deve Bair Railway Line:

A phased construction plan will be executed, ensuring modern railway infrastructure development, including tracks, bridges, and tunnels, while complying with environmental and social safeguards.

Implement Electrification of the Kumanovo-Deve Bair Railway Section:

Infrastructure for electrification, encompassing overhead catenary systems and substations, will be installed, prioritizing energy-efficient technologies and compatibility with EU standards.

Establish a Direct Rail Link Between Sofia and Skopje:

By eliminating the current detour through Serbia, a direct rail link will be established, reducing travel times and transport costs for both passengers and freight.

Develop Multimodal Transport Hubs to Enhance Export Markets:

Facilities to facilitate the seamless transfer of goods between rail, road, and sea transport will be constructed, thereby expanding export opportunities for North Macedonian businesses in the Southeast Europe and Turkey region.

Timeframe		2025 – 2030
Type		Technical, policy
Sector		Transport
Relevant planning documents, legal and regulatory acts		• Work Program of the Government of the Republic of North Macedonia • National Transport Strategy
Finance	Cost estimate until 2030	324 MEUR (Eastern section of Corridor VIII in North Macedonia)
	Source of finance	• EBRD, EIB, WBIF, own contribution
Implementing entity		• Government of the Republic of North Macedonia • Ministry of Transport and Communications • Ministry of Economy and Labour
Monitoring entity		• Ministry of Transport and Communications • Ministry of Economy and Labour • Ministry of Finance
Progress indicators		• Increase of the tonnes km in the railway transport (tkm) • Increase of the passenger km in the railway transport (tkm)
Relation with other dimensions		Energy security, Decarbonisation

PM_EE19: Increasing the number of alternative fuel vehicles and the development of alternative fuel infrastructure in road transport

Main objective: To facilitate a decisive shift from a fossil fuel-dependent society towards a low-carbon future, this measure aims to significantly increase the adoption of alternative fuel vehicles and develop a robust alternative fuel infrastructure within North Macedonia's road transport sector. This transition will prioritize renewable energy and the electrification of transportation, ensuring a sustainable and environmentally responsible mobility landscape.

Description: Recommendations from the "Study on the transport sector, analysis of policies and measures" will be implemented. Specifically, methodologies for calculating environmental taxes and CO_2 excise duties will be established to incentivize a move away from traditional vehicles, while guidelines for handling the vehicles being replaced by alternative fuel vehicles will be developed. To further encourage zero-emission vehicle adoption, they will be exempt from excise duties, and direct subsidies will be offered to reduce purchase costs. Additionally, public parking lots will reserve green parking spaces, integrating charging infrastructure for convenient use. The use of sustainable biofuels in transport will also be promoted as a measure to reduce greenhouse gas emissions from the existing vehicle fleet, , supported by an assessment of the potential for domestic biofuel production.

Crucially, the measure will foster the development of a comprehensive alternative fuel infrastructure. This necessitates a national plan for deploying charging stations and hydrogen refuelling stations, with strategic placement in urban areas and along major transport routes. Public-private partnerships will be encouraged to accelerate infrastructure development, and standardization will be prioritized to ensure interoperability and seamless user experience.

Key activities:

Develop Methodologies for Environmental Taxes and CO_2 Excise Duties:

Transparent and scientifically sound methodologies will be created to calculate environmental taxes and CO_2 excise duties, providing a clear economic signal to reduce fossil fuel consumption. Alongside, guidelines for handling the existing vehicles being replaced with alternative vehicles will be developed.

Implement Excise Duty Exemptions and Direct Subsidies for Zero-Emission Vehicles:

Financial incentives, including excise duty exemptions and direct purchase subsidies, will be introduced to make zero-emission vehicles more economically attractive to consumers.

Establish Reserved Green Parking with Integrated Charging Infrastructure:

Public parking lots will be equipped with dedicated green parking spaces, coupled with integrated charging infrastructure, to provide convenient charging options for electric vehicle users.

Develop a National Plan for Alternative Fuel Infrastructure Deployment:

A comprehensive national plan will be created to guide the strategic deployment of charging stations and hydrogen refuelling stations, ensuring adequate coverage and accessibility.

Foster Public-Private Partnerships for Infrastructure Development and Ensure Standardization:

Collaborative partnerships between the public and private sectors will be promoted to accelerate infrastructure development, with a focus on standardization and interoperability.

Promote the Use of Sustainable Biofuels in Transport

Incentives and policy measures will be introduced to support the uptake of sustainable biofuels in the transport sector.

In-depth analysis of the potential for domestic production of sustainable biofuels, identifying available feedstocks, production capacities, and opportunities to develop a local biofuel industry.

Timeframe		2025 – 2030
Type		Regulatory, policy, information, financial
Sector		Transport
Relevant planning documents, legal and regulatory acts		• National Transport Strategy • Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Law on vehicles • Law on vehicle tax
Finance	Cost estimate until 2030	• - EUR 45 million for the construction of alternative fuel infrastructure • - EUR 76 million for energy-efficient vehicles with low greenhouse gas emissions
	Source of finance	Private, EE fund, incentives from the central government budget
Implementing entity		• Government of the Republic of North Macedonia • Ministry of Transport and Communications • Ministry of Economy and Labour • Ministry of Finance
Monitoring entity		• Ministry of Economy and Labour • Ministry of interior
Progress indicators		• Number of charging stations for electrical and hydrogen vehicles • Installed power for supplying electric vehicles • Share of vehicles powered by alternative energy sources in the total number of registered vehicles
Relation with other dimensions		Energy security, Decarbonisation, Research, innovation and competitiveness

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;

Energy communities (both citizens energy communities and renewable energy communities) are supported via measures PM_D23 Promotion of energy communities and PM_ES2 Increasing energy system flexibility.

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

<table>
<tr><td colspan="3">PM_EE20: Reduction of network losses</td></tr>
<tr><td colspan="3">Main objective: Reduction of the energy costs and improvement of energy efficiency
To significantly reduce energy costs and improve energy efficiency within North Macedonia's electricity distribution and heating sectors, this measure focuses on implementing targeted technical upgrades. These upgrades include overhead line replacement, voltage level adjustments, transformer station installations, network automation, and heat pipeline modernization, all aimed at minimizing energy losses and enhancing system reliability.
Description: In the electricity distribution sector, a multi-pronged approach will be adopted to minimize losses. Where feasible, overhead lines will be replaced with underground cables, reducing exposure to environmental factors and lowering transmission losses. To shorten low-voltage lines and optimize distribution, new transformation stations will be strategically installed. Automation and remote network management systems will be implemented to facilitate real-time monitoring and control, leading to improved System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) indicators, reflecting enhanced network reliability.
According to the Energy Regulatory Commission’s 2024 Annual Report, distribution system losses amounted to 13.30%, while transmission system losses stood at 1.30%.
For the heating sector, the focus shifts to modernizing the heat distribution infrastructure. Continuous replacement of existing heat pipelines with pre-insulated pipes will significantly reduce thermal losses during transport. Additionally, optimization of substation operations through automatic control systems will improve efficiency and responsiveness, minimizing energy waste and ensuring stable heat supply.
Key activities:
All activities will be implemented in line with 10-year plans of DSO for electricity networks and plans of DHS operators for district heating network.</td></tr>
<tr><td colspan="2">Timeframe</td><td>2025 – 2030</td></tr>
<tr><td colspan="2">Type</td><td>Technical</td></tr>
<tr><td colspan="2">Sector</td><td>Electricity and heat distribution operators</td></tr>
<tr><td colspan="2">Relevant planning documents, legal and regulatory acts</td><td>Strategy for Energy Development of the Republic of North Macedonia up to 2040
Law on Energy Efficiency</td></tr>
<tr><td rowspan="2">Finance</td><td>Budget</td><td>170 MEUR</td></tr>
<tr><td>Source of finance</td><td>Electricity and heat distribution companies</td></tr>
<tr><td colspan="2">Implementing entity</td><td>Electricity distribution companies
Heat distribution companies</td></tr>
<tr><td colspan="2">Monitoring entity</td><td>Ministry of Energy, Mining and Mineral Resources</td></tr>
<tr><td colspan="2">Progress indicators</td><td>Energy savings, i.e. reduction of distribution network losses (ktoe/GWh)</td></tr>
<tr><td colspan="2">Relation with other dimensions</td><td>Internal energy market</td></tr>
</table>

vii. Regional cooperation in this area, where applicable;

Through the Energy Community, the Republic of North Macedonia benefits from a comprehensive regional framework, linking policy reform, finance, technical expertise, and citizen engagement—to effectively advance energy efficiency measures. The country actively cooperates in multiple key initiatives:

- Regional Energy Efficiency Programme (REEP): implemented by EBRD and the Energy Community Secretariat and funded by the EU, the programme facilitates ESCO projects in municipalities; it also includes technical assistance and policy dialogue to support aligning North Macedonia's energy efficiency legislation with EU directives
- EBRD's Green Economy Financing Facility deployed under the REEP Plus umbrella, co-funded by the EU, Japan, and the Energy Community Secretariat, offers loans through domestic banks for residential energy efficiency measures, with incentive grants up to 20%.

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

EU Reform Agenda for the Western Balkans includes energy efficiency as a key component under green transition and decarbonisation. It enables access to budget support, technical assistance, and policy-based grants, conditional on implementing reforms like improving building energy performance, establishing energy efficiency obligation schemes and upgrading monitoring, reporting, verification systems. EU funding for energy efficiency is also accessible through IPA III and Western Balkans Investment Framework, providing grants, loans, and technical assistance for large-scale energy efficiency projects (e.g., public buildings, district heating upgrades) and often combined with EIB, EBRD, or KfW financing.

EBRD's Green Economy Financing Facility (GEFF) partners with local banks to provide households and SMEs with loans for efficiency upgrades. The regional REEP Plus programme, funded by the EU, EBRD, KfW, and Austria, offers credit lines and technical assistance to small-scale energy efficiency and renewable energy projects across public and private sectors. The Green Finance Facility (GFF), supported by the UN Joint SDG Fund, national government, EBRD, and local banks, delivers performance-based payments and technical support to SMEs and underserved households investing in energy efficiency and renewables. The Green for Growth Fund (GGF), backed by EIB and KfW, provides a $10 million credit line for SMEs and households, combining funding with capacity-building services.

3.3. Dimension: Energy security

i. Policies and measures related to the elements set out in point 2.3 (7);

For the Energy security dimension, three objectives were defined in Chapter 2. Some measures defined in other dimensions also contribute to these objectives, primarily those related to Internal energy market (dealing with new gas and electricity infrastructure), Renewable energy sources and Energy efficiency. For these measures, on top of their primary objective (e.g. increase in renewable sources, efficiency improvements, increased consumer participation in the markets), additional objective related to energy security has been attributed.

It must be noted that, considering that currently the country has only one gas interconnection (with Bulgaria), the N-1 formula is equal to 0. However, the implementation of gas project interconnection with Greece in 2027 and additional one with Serbia is expected to increase the level of the security of supply above 100%, depending on the gas demand scenario. Additional gas transmission capacity should be introduced to the gas system in order to maintain the security of supply at riskless level.

- **Objective 1 – Increased diversification of energy supply**

The most important factor contributing to the increased diversification of energy supply is the increased use of renewable energy sources – in electricity production, in heating and cooling and in transport, and of the natural gas in cogeneration power plants. The implementation of measures PM_D18 – PM_D25 will lead to increased use of renewable energy, while measures PM_D14 and PM_EE14 will lead to increased use of high-efficiency cogeneration, all leading to increased diversification of energy supply. The targets for diversification of energy supply are given as the:

- Use of natural gas in cogeneration power plants[20], of at least 30 PJ in 2030
- Primary production of renewables and biofuels, of at least 20 PJ for 2030.

Further diversification of energy supply is expected to be achieved by introducing hydrogen in the energy supply, by green hydrogen production and imports. The following measure elaborates steps to be undertaken until 2030.

PM_ES1: Developing capacities for hydrogen production, transport, storage and use	
Main objective: Enabling the use of hydrogen **Description**: To enable the use of hydrogen, relevant legal framework must be adopted and capacities of relevant institutions must be increased. **Key activities**: - Capacity building activities for the relevant institutions (Ministry of Energy, Mining and Mineral Resources, Energy Regulatory Commission, NOMAGAS) will be organized, alongside with best practice dissemination, in 2026 - Pilot projects will be proposed and implemented, to test its production, storage possibilities, adoption in the existing gas networks, delivery to end-consumers, thereby serving as inputs for the specifications and permitting procedures, from 2026 until 2029 - Permitting procedures for hydrogen related facilities will be developed, in 2029 - Technical guidelines and specifications for hydrogen production, transport, storage and use will be developed, in 2030 The measure is strongly related to PM_D18 Green hydrogen production facilities for industrial applications focusing on steel, cement and petrochemical production and complements the measures stipulated in chapter 3.4.2 Energy transmission infrastructure in "Internal energy markets" dimension. Natural gas infrastructure will be hydrogen ready and able to adopt a growing share of hydrogen in the future. The measure is related to the Hydrogen study, to be developed within the Technical Assistance project "North Macedonia – Serbia gas interconnection: Feasibility study and ESIA", funded by the Western Balkans Investment Forum, to be finalized in 2025.	
Timeframe	2025 – 2030

[20] all cogeneration power plants are expected to be highly efficient and hydrogen ready

Type		Regulatory, organizational
Sector		Energy supply
Relevant planning documents, legal and regulatory acts		Strategy for Energy Development of the Republic of North Macedonia up to 2040
Results to be achieved		Regulatory framework developed
Finance	Cost estimate until 2030	n.a.
	Source of finance	Central government budget
Implementing entity		Ministry of energy, mining and mineral resources
Monitoring entity		Energy Regulatory Commission
Progress indicators		• No of capacity building events • No of pilot projects implemented • Permitting procedures developed • Technical guidelines developed
Relation with other dimensions		Decarbonization; Internal energy market

- **Objective 2 – Increased energy system flexibility**

To allow for the increased share of renewable electricity generation, it is necessary to increase energy system flexibility. The flexibility will be significantly improved by the implementation of measures foreseen in the paragraph on internal energy markets: by further grid development and regional markets integration, including the balancing markets. The ongoing initiative of SMM control block for cross-border balancing will enable a cost-effective solution in mid-term to partially supply secondary and tertiary reserves.

The energy system flexibility will further be increased by implementation of the following measure.

PM_ES2: Increasing energy system flexibility

Main objective: Increase the ability of the power network to absorb increased share of renewable generation

Description: The energy system flexibility will be increased through a combination of regulatory, planning and technical measures.

It is necessary to determine what are flexibility needs as well as flexibility potential for regional exchange. Alongside with flexibility needs (slow, fast, in MW), current coverage of flexibility needs (% of time or power) and the balancing costs will be determined. This will provide a basis for potential incentives for flexibility providers.

The most important regulatory aspect of increasing the energy system flexibility consists of adopting the legal framework relevant for active consumers, aggregators and energy communities (Directive on common rules for the internal market for electricity EU/2019/944 and the Regulation on the internal market for electricity EU/2019/943, amended by the Directive EU/2024/1711 and Regulation EU/2024/1747; once the legal framework has been adopted under the Energy Community Treaty).

Planning and technical measures are dealing with the upgrades of energy storage infrastructure, necessary to absorb an increased share of renewable electricity generation. Stationary batteries of at least 200 MW installed capacities and 400 MWh storage capacity are expected to be connected to the power system until 2030. Further, until 2035 a 333 MW reversible hydroelectric power plant Čebren is expected to be connected to the grid.

Key activities:

- Assessment of flexibility needs, potential, coverage and costs (2025)
- In order to simplify and streamline activities within specific life cycle stages of grid scale batteries, a guidance document for designers, developers, regulators and operators will be developed (2025)
- To enable entrance of RHE Čebren into operation by 2035, construction works are expected to begin
- Once adopted by the ECT, legal framework relevant for electricity markets (directive and regulation on internal electricity marker) will be transposed into the national legal framework

N.B. Environmental and Social Impact Assessment (ESIA) for the Čebren Power Project has been conducted within WBIF IPF9 Project: Optimisation of the Energy Utilisation of the Crna Reka: Environmental and Social Impact Assessment (WB20-MKD-ENE-01)"

Timeframe		2025 – 2030
Type		Regulatory, technical
Sector		Energy supply
Relevant planning documents, legal and regulatory acts		Strategy for Energy Development of the Republic of North Macedonia up to 2040
Results to be achieved		200 MW and 400 MWh in stationary batteries connected to the electric grid
Finance	Cost estimate until 2030	TBD
	Source of finance	• Central government budget • Reform agenda - batteries • WBIF – Čebren ESIA, 1 MEUR
Implementing entity		Ministry of energy, mining and mineral resources
Monitoring entity		Energy Regulatory Commission
Progress indicators		• Guidelines for stationary large scale batteries developed • Preparatory documents for RHE PP Čebren finalized • Capacity of grid connected stationary batteries
Relation with other dimensions		Internal energy market; Decarbonization)

- **Objective 3 – Increased energy system resilience.**

PM_ES3: Increasing energy system resilience

Main objective: Improve the resilience of energy supply infrastructure, including ensuring energy supply in case of major disruptions to the network.

Description: To increase the energy system resilience, it is necessary to identify critical energy infrastructure, the most vulnerable spots and main threats, and to develop crisis scenarios, both on national and regional level. Methodologies for risk assessment and technical standards for cybersecurity in the energy sector will be developed and applied, as well as methodologies for regional risks assessment.

Necessary level of security of supply will be given and expressed as “expected energy not served” and “loss of load expectation”. National risk preparedness plan will be developed, containing planned preventive and response measures, together with the EENS and LOLE targets for 2030.

National resource adequacy will be monitored, with an indication of the necessary level of capacity and reserves to meet reliability standards.

Participation in regional platforms dealing with energy security will be continued. Cooperation in cross border and regional cooperation will ensure coordinated adequacy assessments, security analyses and crisis management. Cross border and regional cooperation in cyber incident response within the interconnected energy networks will be strengthened.

Key activities:

- Definition of critical infrastructure and essential services in the energy sector
- Identification of risks to the infrastructure and services (including but not limited to natural disasters related risks, climate related risks, cybersecurity risks, supply chain risks etc)
- Analysis of the current resilience level of the power system and setting targets for 2030
- Development of risk preparedness plans, with national and regional crisis scenarios, including also cybersecurity issues
- Network code on cybersecurity will be transposed into the national framework once adopted under the Energy Community Treaty

Timeframe	2025 – 2030
Type	Regulatory, policy
Sector	Energy supply

Relevant planning documents, legal and regulatory acts		Strategy for Energy Development of the Republic of North Macedonia up to 2040
Finance	Cost estimate until 2030	n.a.
	Source of finance	Central government budget
Implementing entity		• Ministry of energy, mining and mineral resources • Ministry of interior
Monitoring entity		Energy Regulatory Commission
Progress indicators		• Critical infrastructure and services in energy sector defined • Risks identified • ENS&LOLE 2030 targets set • Climate-related risks to energy infrastructure assessed
Relation with other dimensions		Internal energy market

ii. Regional cooperation in this area;

MEPSO is a regular member of the ENTSO-e, while NOMAGAS is an observing member of ENTSOG. ERC joined ACER's electricity working group, and North Macedonia participates as an observer in several European electricity balancing platforms (PICASSO, MARI and IGCC). North Macedonia, Serbia and Montenegro cooperate by exchanging auxiliary services in their respective power systems.

The country also joined the Southeast Europe regional group of the EU Energy Platform, jointly developing gas supply options. North Macedonia is an Energy Community contracting party.

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

The budget and source of finance for each of the proposed policy and measure are included in the tables, where available.

3.4. Dimension: Internal energy markets

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;

PM_IEM1: Build or upgrade power transmission network in North Macedonia including interconnectivity to Albania's transmission network

Main objective: Strengthen power transmission to integrate renewable energy generators; Improve interconnectivity level between neighbouring countries

Description: Connection to Albania's power transmission network at 400 kV level and upgrade and strengthen North Macedonia's power transmission network to integrate renewable energy generators is crucial for the country's energy transition. This supports decarbonization by ensuring that renewable sources like solar, wind, and hydropower can be effectively integrated into the national grid. Enhancing grid infrastructure is also vital for ensuring energy security, efficiency, and compliance with EU environmental standards. All cross-border interconnectors transmission capacities in relation to the peak load and to the installed renewable generation will be continuously monitored. Corrective measures will be reflected in MEPSO's Ten Year Development Plans, as needed.

The following projects have been identified for implementation by MEPSO:

1. **Construction of 400 kV power transmission interconnection line between North Macedonia and Albania (OHTL Bitola, North Macedonia – Elbasan, Albania) - MK part and 400/110 kV Substation Ohrid**

This project represents the final segment of **Corridor VIII** for power transmission from Bulgaria, through North Macedonia and Albania, to Italy. It is included in the **List of Projects of Energy Community Interest (PECI)** and is co-financed through the **Western Balkans Investment Framework (WBIF)** and the **European Bank for Reconstruction and Development (EBRD)**.

Project Scope:

- Construction of approximately **150 km of 400 kV overhead transmission line (OHTL)** between **Bitola (MK) and Elbasan (AL)**.
- Development of a new **400/110 kV Substation Ohrid**, including installation of a **300 MVA transformer**.
- Extension of **Elbasan Substation (Albania)** with a **120 MVAr reactor**.

Implementation Timeline: 2025–2027.

Key Activities:

- **Procurement and Tendering:**
  - Conduct a transparent procurement process for contractor selection.
- **Construction and Commissioning:**
  - Build the transmission line and substation in compliance with technical, environmental, and safety standards.
  - Conduct testing for full system integration to ensure stable cross-border operation.
- **Cross-Border Coordination:**
  - Coordinate closely with the Albanian transmission system operator to ensure seamless integration into the regional electricity market.

Expected Outcomes:

- Enhanced **system stability** and reliability.
- Establishment of the **MK–AL–GR transmission ring**, strengthening regional interconnection.
- Improved **voltage control** and reactive power management via the 120 MVAr reactor.
- Compliance with N-1 security standards and improved resilience against **sub-synchronous resonance (SSR)** and **oscillatory stability constraints (OSC)**.

- Increased cross-border electricity exchange, supporting integration with the wider EU electricity market.

2. Western 110 kV backbone upgrade (Vrutok–Skopje & Gostivar–Oslomej–Kičevo–Sopotnica–Bitola)

The western transmission network of North Macedonia is facing critical load challenges, particularly under wet hydrology conditions and with the expected integration of significant photovoltaic capacity in this part of the grid. Security analyses (N-1) have shown overloading risks on the 110 kV corridors **SS Gostivar – TPP Oslomej – SS Kičevo – SS Sopotnica – SS Bitola 1** and **HPP Kozjak – HPP Sv. Petka – SS Skopje**.

To address these constraints, it is foreseen a **phased reconstruction and modernization program (2025–2034)** of the entire western 110 kV backbone, including the application of low-sag, high-ampacity AAAC conductors, accompanied by system modernization and digitalization measures.

Key Activities:

1. Design and Planning

- Assess the existing 110 kV overhead lines and substations to identify upgrade needs for present and future load, with consideration of renewable integration.
- Undertake detailed relay coordination studies accounting for new thermal ratings and impedance changes.

2. Infrastructure Improvement

- Upgrade transformers, circuit breakers, and protection devices to enhance grid stability and reliability.
- Implement Dynamic Line Rating (DLR) to optimize transmission capacity and improve operational security.

3. Expansion and Modernization

- Extend and modernize network sections to manage renewable growth.
- Digitalize key substations for advanced monitoring and control.
- Strengthen interconnection capacity with Greece to ensure regional system adequacy.

MEPSO Investment Program (2025–2034):

The Transmission System Operator (MEPSO) defines a **comprehensive investment package of €52.4 million**, consisting of the following **nine components**:

1. Reconstruction of 110 kV OHL Gostivar–Oslomej–Kičevo–Sopotnica–Bitola 1 (116 km)
2. Reconstruction of 110 kV OHL Vrutok–Gostivar–Jegunovce–Skopje 3–G. Petrov–Skopje 1 (75 km)
3. Reconstruction of 110 kV OHL Ohrid–Struga–Globocica–Špilje–Vrutok (105 km)
4. Connection of 110 kV OHL HPP Vrutok–Skopje 1 to a Polog-region substation
5. Upgrade of 400 kV Bitola (MK)–Meliti (GR) interconnection
6. Digitalization of SS Bitola 1 and SS Sopotnica
7. Deployment of a Dynamic Line Rating (DLR) system
8. Rehabilitation of the pole testing station in Ohrid
9. Establishment of a training center for dispatchers and HV operators
    -

3. Strengthening the infrastructure in East and Northeast parts of North Macedonia

The east and northeast regions of North Macedonia have significant renewable energy potential, particularly in solar and wind generation, but require targeted transmission upgrades to ensure secure integration and reliable delivery to major load centers such as Skopje, Bitola, Kumanovo, and the Polog Region. The revitalization of **SS Shtip 400/110 kV** and potential development of new 400/110 kV substations and lines are essential for enabling the timely connection of renewable energy projects.

Key Activities:

1. Identify Strategic Locations

- Determine optimal points for new 400 kV hubs based on proximity to renewable generation sites and alignment with key transmission corridors.

2. Design and Construction

- Design new 400 kV substations and associated overhead transmission lines to facilitate efficient access for renewable projects.
- Ensure modular design of substations, allowing for scalability as renewable integration grows.

3. System Integration

- Integrate new assets into the existing 400/110 kV network and reconfigure the 110 kV grid in the region to improve operational flexibility.
- Prepare the system to balance both conventional and renewable generation flows.

MEPSO Investment Program (2025–2035):

The Transmission System Operator (MEPSO) defines a concrete investment plan of **€15.4 million** over the period 2025–2035, including the following components:

1. Construction/reconstruction of 110 kV OHL Kochani–Shtip 1 (28 km)
2. Construction/reconstruction of 110 kV OHL Probishtip–Kratovo (16 km)
3. Construction/reconstruction of 110 kV OHL Kratovo–Kumanovo 1 (33.5 km)
4. Construction/reconstruction of 110 kV OHL Shtip 1–Shtip 2–Bučim (27 km)
5. Construction/reconstruction of 110 kV OHL Buchim–Radovish–Berovo (48 km)
6. **Digitalization of SS Kriva Reka**

4. Southeast Transmission Reinforcement – Miletkovo and Associated 110 kV Works

Reinforcement of the transmission network in the Southeast region is a priority to enhance system reliability and enable the integration of new renewable generation capacities. The core investment consists of the **construction of a new 400/110 kV substation Miletkovo**, connected to the Dubrovo–Thessaloniki 400 kV interconnection, accompanied by targeted upgrades on the regional 110 kV network.

Key Activities (2025–2027):

- **New 400/110 kV Substation Miletkovo**, strategically located to strengthen cross-border exchange and support renewable integration.
- **Reinforcement of associated 110 kV lines and substations** in the Southeast region, ensuring reliable evacuation of generation and secure supply to demand centers, as follows:
    1) **Reconstruction of 110 kV Overhead Line Valandovo–Strumica 2**, ensuring higher transmission reliability in the Southeast corridor.
    2) **Construction of 110 kV cable Strumica 2–Strumica 1**, reinforcing local transmission capacity and operational flexibility.

This reinforcement will provide greater transmission flexibility, reduce congestion in the Southeast corridor, and ensure timely connection of renewable energy projects to the national grid and regional markets.

5. Reactive Power and Voltage Control – 400 kV Dubrovo Shunt Reactor

The shunt reactor at Dubrovo will mitigate overvoltage conditions in the 400 kV grid, particularly during low-load and high-generation scenarios, thereby safeguarding equipment and ensuring secure operation of the transmission system. The investment supports compliance with ENTSO-E operational requirements for voltage/reactive power management and enhances the resilience of North Macedonia's cross-border interconnection with Greece and Bulgaria.

Key Activities:

- Procurement, delivery, and installation of a **150 MVAr shunt reactor** at the 400 kV Dubrovo substation.
- Integration with the substation's protection and control systems.
- Testing, commissioning, and operational integration into MEPSO's system operation procedures.
- Operator training for long-term asset management and maintenance.

Expected Outcomes:

- Improved voltage stability and secure operation of the 400 kV grid.
- Enhanced ability to manage reactive power flows and maintain system reliability under variable load and generation conditions.

- Contribution to regional grid stability and improved cross-border operational security.

6. Digitalization of Asset Management System

The Asset Management System (AMS) provides a digital platform for systematic monitoring, evaluation, and management of MEPSO's transmission infrastructure. By centralizing data on equipment condition, performance, and maintenance history, the AMS supports informed decision-making, prioritization of investments, and proactive asset renewal. The system is designed in line with international best practices for asset lifecycle management and will serve as a key tool for enhancing operational resilience and reliability of the national grid.

Key Activities:

- Development and deployment of a digital AMS platform for MEPSO.
- Integration of asset condition monitoring, performance data, and predictive analytics.
- Implementation of risk-based maintenance planning and lifecycle-cost analysis methodologies.
- Training of staff in the use of AMS tools for data-driven decision-making.
- Establishing links with other digitalization initiatives, including SCADA/EMS and smart grid platforms.

Expected Outcomes:

- Improved asset reliability and reduced failure rates through predictive and risk-based maintenance.
- Optimized investment planning and resource allocation over the full lifecycle of transmission assets.
- Enhanced transparency and accountability in infrastructure management.
- Contribution to overall system reliability, reduced operational risks, and support for renewable integration.

Timeframe		2025 – 2030
Type		Technical
Sector		Energy
Relevant planning documents, legal and regulatory acts		• PECI List • MEPSO Development Plan 2025-2035 • Strategy for Energy Development up to 2040
Finance	Available budget	1) 32.7 MEUR 2) 52.4 MEUR 3) 15.4 MEUR 4) 35.66 MEUR 5) 7.94 MEUR 6) 1.2 MEUR
	Source of finance	EBRD, WBIF, CIF, IFIs, MEPSO, Ministry of Energy, Mining and Mineral Resources
Implementing entity		• MEPSO
Monitoring entity		• Ministry of Energy, Mining and Mineral Resources • Energy Regulatory Commission (ERC): • IFIs
Progress indicators		• Projects completed
Relation with other dimensions		• Energy security

ii. Regional cooperation in this area;

North Macedonia is actively engaged in regional cooperation to develop electricity infrastructure as part of its commitments under the Energy Community Treaty and broader European energy market integration goals. This cooperation focuses on cross-border interconnections, market coupling, grid modernization, and decarbonisation of the power sector, all aimed at enhancing regional security of supply and facilitating the transition to clean energy.

MEPSO is upgrading its transmission infrastructure with support from:

- EBRD and KfW for SCADA modernization, cybersecurity, digital substations, and transmission line refurbishment
- EU IPA and WBIF grants for regional transmission planning and cybersecurity enhancements

These upgrades prepare the grid for variable renewable integration, demand-side management and cross-border balancing.

Regular communication is established with the neighbouring states TSOs and through Energy Community fora. North Macedonia actively participates in ENTSO-E and Energy Community regional system planning (e.g., TYNDP, NECP coordination, and long-term energy scenarios); the Security of Supply Coordination Group under the Energy Community to align emergency and capacity strategies regionally; and the Regional Capacity Allocation and Congestion Management coordination.

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

Although state owned enterprises invest in grid modernization and cross border integration, the Republic of North Macedonia relies heavily on loans and grants from IFIs and the Union support for energy infrastructure. The World Bank, EBRD and EIB support grid modernization, renewable energy integration, and battery storage.

IPA III and WBIF support energy sector reforms, infrastructure development and technical assistance. Connecting Europe Facility (CEF) funds cross-border electricity interconnections.

3.4.2. Energy transmission infrastructure

i. Policies and measures related to the elements set out in point 2.4.2, including, where applicable, specific measures to enable the delivery of Projects of Common Interest (PCIs) and other key infrastructure projects.

PM_IEM2: Develop natural gas cross-border infrastructure to diversify supply routes and increase market competitiveness
Main objective: Provide diversification of gas supply from different sources, increase competitiveness, and reduce gas prices. **Description**: The construction of the gas interconnectors will help mitigate market failures in the energy sector, diversify energy sources, enhance the security of supply, and increase the competitiveness of the energy market for the benefit of consumers. It will also help the entire region gradually move away from coal while increasing connectivity and creating the conditions for a common regional market and attracting new investments. Successful completion of these interconnectors will help integrate North Macedonia into the regional gas market, enhance energy security, and contribute to the country's economic and energy transition goals. Below are the key projects for natural gas cross-border infrastructure: **1. Construction of the Gas Interconnector with Greece (Gevgelija to Negotino)** This interconnector will connect North Macedonia to the Trans Adriatic Pipeline (TAP), a major route bringing natural gas from Azerbaijan to Europe. Key Actions include: • Regulatory approvals: Secure necessary permits from national and local authorities. • Construction: Begin pipeline construction of 68 km0long pipeline once financing is secured. This includes excavation, laying of pipes, and building the required compression and metering stations. • Testing and commissioning: Conduct tests to ensure pipeline safety and operational readiness before connecting to the existing national gas network. **2. Construction of the Gas Pipeline from Skopje – Deve Bair to the Serbian Border**

Key Actions include:

- Route planning and design: Plan and design a 23 km pipeline from the Skopje-Deve Bair pipeline (at Klečevce) to the Serbian border.
- Feasibility and Environmental Studies: Conduct feasibility studies to assess technical and financial feasibility and EIAs to comply with environmental regulations (funded by WBIF under Flagship 5 – Transition from coal of the Economic and Investment Plan for the Western Balkans)
- Construction: Carry out the physical construction of the pipeline, including excavation, installation of pipelines, and creation of necessary compression and metering stations.
- Cross-border coordination: Work with Serbian authorities to ensure that the interconnector connects smoothly to Serbia's existing gas infrastructure.

3. Construction of the Gas Interconnector Between North Macedonia and Kosovo

Key Actions include:

- Route and design: Plan the interconnector between North Macedonia and Kosovo, assessing the optimal route and technical specifications for the pipeline.
- Environmental and feasibility studies: Conduct a detailed feasibility study and environmental impact assessments to identify potential risks and ensure that construction will meet both local and EU standards.
- Regional coordination with Kosovo authorities to align national gas network policies, construction timelines, and to establish the legal framework for cross-border gas trade.
- Construction: Build the pipeline, ensuring the required technical infrastructure is in place to handle the expected gas volumes.
- Testing and integration: Ensure that the pipeline is fully integrated into the regional gas network once construction is completed.

4. Construction of the Gas Interconnector Between North Macedonia and Albania

Key Actions include:

- Route selection and design: Assess and select the most feasible route for a new gas pipeline between North Macedonia and Albania. The pipeline will further enhance energy security by connecting North Macedonia to Albania's gas infrastructure, which is connected to the Southern Gas Corridor.
- Environmental and feasibility studies: Conduct the necessary studies to evaluate the viability of the pipeline, ensuring it complies with both environmental and technical standards.
- Regional coordination with Albanian authorities to ensure that the construction and operation of the pipeline are aligned with national energy strategies.
- Construction: Build the pipeline and related infrastructure, including metering and compression stations.
- Testing and integration: Integrate the new interconnector into the wider Balkan energy market, facilitating regional gas trade and helping to stabilize supply.

Timeframe		2025 – 2030
Type		Technical
Sector		Energy
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development up to 2040 • List of Projects of Mutual Interest • List of Projects of Energy Community Interest
Finance	Available budget	161,7 MEUR
	Source of finance	EBRD, EIB, WBIF, Central Government
Implementing entity		• NOMAGAS
Monitoring entity		• Ministry of Energy, Mining and Mineral Resources • IFIs • Energy Regulatory Commission

Progress indicators	• Projects completed
Relation with other dimensions	• Energy security

PM_IEM3: Build main gas pipeline sections: Gostivar-Kichevo, Sveti Nikole-Veles, Branch to Gevgelija, Branch to TPP Negotino, Branches to TIDZ, Kichevo-Ohrid, and Ohrid-Bitola.

Main objective: Provide access to natural gas as fuel to industrial customers, thus improving air quality

Description: Building the main gas pipeline sections is a crucial step for expanding and diversifying the energy infrastructure in North Macedonia. These pipelines will connect key regions and industrial areas, improving energy security, enhancing the efficiency of energy use, and supporting the country's transition to a more sustainable energy mix.

This is a complex, multi-phase project that involves careful planning, regulatory compliance, financial investment, construction, and integration into the national energy grid. The key actions include:

1. Feasibility Studies and Planning

- Conduct feasibility studies for each of the pipeline sections to assess technical, economic, and environmental viability.
- Route selection: Determine the most efficient and safe routes for each pipeline section, considering geographical and environmental factors.
- Demand assessment: Evaluate the expected demand for natural gas along each pipeline route, including residential, commercial, and industrial consumers.
- Environmental Impact Assessments (EIA): Perform EIAs to identify and mitigate any potential environmental risks associated with construction, including disruption of ecosystems, air and water pollution, and noise.
- Social impact assessment: Evaluate how the pipeline construction will affect local communities and ensure proper compensation or resettlement measures if needed.

2. Legal and Regulatory Framework Development

- Revise and implement legal frameworks that support gas infrastructure development, ensuring clear guidelines for construction, safety, and operation.
- Update licensing processes for gas operators, including construction permits, land use permits, and safety clearances.
- Set tariffs and regulations for the operation and maintenance of the new pipelines.
- Ensure that construction and operation comply with EU energy regulations and align with the Energy Community Treaty.

3. Funding and Financial Planning

- Develop a financial model to estimate the cost of construction, operation, and maintenance of the pipelines.
- Explore funding opportunities from international financial institutions like the European Bank for Reconstruction and Development (EBRD) or the World Bank.
- Consider the involvement of private sector investors, particularly in the form of public-private partnerships to share the financial burden.

4. Procurement and Tendering Process

- Issue tenders for the design, construction, and commissioning of each pipeline section.
- Evaluate potential contractors and select the best-suited firms based on experience, technical capabilities, and cost.
- Ensure that contractors comply with safety standards, environmental regulations, and construction timelines.

5. Construction and Pipeline Installation

- Excavation: Dig trenches for pipeline placement while ensuring minimal disruption to local environments and communities.
- Pipeline laying: Install high-pressure and low-pressure pipelines, ensuring all safety protocols are followed.
- Compressor and metering stations: Build necessary facilities for regulating gas pressure, monitoring consumption, and ensuring efficient gas flow.
- Safety systems: Install necessary equipment for leak detection, emergency shutdown, and real-time monitoring

6. Testing, Commissioning, and Integration • Conduct pressure testing, leak testing, and integrity checks to ensure that the pipelines are fit for use and meet safety standards. • Commission the infrastructure and integrate the pipelines into the national gas transmission and distribution system. • Perform final inspections to ensure that all components of the pipelines meet operational standards.		
Timeframe		2025 - 2028
Type		Technical
Sector		Energy
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development up to 2040
Finance	Budget	189.8 MEUR
	Source of finance	IFIs, Central Government Budget
Implementing entity		• NOMAGAS
Monitoring entity		• Ministry of Energy, Mining and Mineral Resources • Energy Regulatory Commission
Progress indicators		• Feasibility analyses completed • ESIA completed • Financial contracts concluded • Pipelines built and in operation
Relation with other dimensions		• Energy security

PM_IEM4: Develop gas distribution network		
Main objective: Provide access to natural gas as fuel to industrial, public/commercial, and residential customers, and thus decrease electricity consumption and improve air quality. **Description**: The Republic of Macedonia has an ambitious gasification plan and natural gas is one of the fuels that will significantly contribute to the energy transition up to 2040. In addition, with the implementation of this measure the air quality will be significantly improved.		
Timeframe		2025 – 2030
Type		Technical
Sector		Energy
Relevant planning documents, legal and regulatory acts		• Gasification plan of North Macedonia
Finance	Budget	~ 206 MEUR
	Source of finance	
Implementing entity		• Municipalities, NOMAGAS
Monitoring entity		• Ministry of Energy, Mining and Mineral Resources
Progress indicators		• Number of natural gas consumers
Relation with other dimensions		

PM_IEM5: Improvement and Upgrade of Skopje District Heating Network
Main objective: Increase security of supply of district heating **Description**: Improving and upgrading the Skopje District Heating Network is a critical step in enhancing energy efficiency, reducing environmental impacts, and providing reliable heating to residents. Skopje relies heavily on district heating, and the system's modernization is necessary for the transition to a more sustainable and efficient energy model. The purpose of the Project is to

create a more sustainable, cost-effective, and efficient district heating for Skopje. By integrating renewable energy sources, optimizing heat resources and strategically upgrading the network, the aim is to improve the system's reliability, reduce environmental impact, and potentially lower costs for consumers.

The Improvement and Upgrade of the Skopje District Heating Network is a multi-phase project that involves upgrading infrastructure, integrating renewable energy, expanding the network, and implementing advanced monitoring and control systems.

Key activities:

1. Assessment of the Existing District Heating Infrastructure

- This includes analyzing the age, condition, and capacity of existing pipelines, boilers, heat exchangers, and other critical equipment.
- The audit should also assess energy losses, particularly from outdated systems, and determine opportunities for the introduction of renewable energy sources.
- Identify inefficiencies, technical issues, and areas for improvement.

2. Financial Support and Funding Mechanisms

- Secure funding for the upgrade and improvement of the district heating network, through both domestic sources and international financial institutions.
- Explore opportunities for public-private partnerships (PPPs).

3. Modernization and Replacement of Outdated Infrastructure

- Replace outdated distribution pipes, particularly those that are prone to leakage, with insulated and corrosion-resistant materials to minimize heat loss.
- Install high-efficiency boilers and heat exchangers to replace older, inefficient models.
- Implement advanced metering systems for precise tracking of heating consumption, enabling better load management and customer billing.

4. Upgrade of the Control and Monitoring Systems

- Use smart grid technologies to allow for real-time monitoring and control of the heating supply.
- Install sensors and automated control systems to optimize the operation of heating plants, distribution networks, and end-user connections.

5. Expansion of the District Heating Network

- Extend the district heating network to reach underserved areas of Skopje, particularly residential neighborhoods, and public buildings that are currently not connected.
- Focus on increasing access to district heating in high-density residential areas and public institutions (e.g., schools, hospitals, and government buildings).

6. Enhancing Energy Efficiency and Consumer Awareness

- Promote energy efficiency measures among consumers, such as the installation of thermostats, insulation, and efficient heating controls in homes and businesses.
- Launch public awareness campaigns to educate citizens about energy-saving practices, the benefits of district heating, and how to optimize their heating consumption.

Timeframe		2025 - 2030
Type		Technical
Sector		Energy
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development up to 2040
Finance	Budget	93 MEUR EUR
	Source of finance	• IFIs
Implementing entity		• ESM Heat Supply
Monitoring entity		• Ministry of Energy, Mining and Mineral Resources

	• Energy Regulatory Commission
Progress indicators	• Increased number of customers
Relation with other dimensions	• Energy security, Decarbonization

It should be noted that the results of the Hydrogen study, to be developed within the Technical Assistance project "Hydrogen study - hydrogen introduction in the gas pipeline network in North Macedonia and Serbia, funded by the Western Balkans Investment Framework(WB25-MKD-ENE-01), are expected to serve as an important roadmap for further development of gas infrastructure, to be included in relevant development plans.

The Hydrogen study aims to provide guidelines regarding the hydrogen potential in the energy sector of North Macedonia and Serbia in terms of a) hydrogen demand, b) integration of renewable energy technologies and electrolytic power, c) need for importing hydrogen to meet higher demands and d) hydrogen penetration in industry, transportation, blend with natural gas, etc. Serbia and North Macedonia play a crucial role in the hydrogen infrastructure within the Pan-European network.

ii. Regional cooperation in this area;

The Republic of North Macedonia actively engages in comprehensive regional cooperation initiatives with neighbouring countries, including Albania, Bulgaria, Greece, Kosovo*, and Serbia, through structured multilateral platforms and bilateral working groups to ensure harmonization of critical energy infrastructure development. This strategic coordination encompasses the alignment of national gas network regulatory frameworks, synchronization of major infrastructure project implementation timelines, and the establishment of standardized legal and technical protocols to facilitate seamless cross-border natural gas transportation and trading arrangements. The cooperation framework specifically focuses on developing interoperable gas transmission system operator (TSO) procedures, creating compatible market rules compliant with EU Energy Community regulations, and implementing joint capacity allocation mechanisms to optimize regional gas flows. These efforts are formally institutionalized through participation in the Energy Community Treaty framework, the Western Balkans Six (WB6) regional energy cooperation initiatives, and various EU-supported connectivity programs.

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

Financing of gas infrastructure in the Republic of North Macedonia relies primarily on a mix of EU funds and international financial institutions (IFIs), which provide crucial support for the country's efforts to diversify its energy sources and integrate into regional gas markets. As an EU candidate country, North Macedonia benefits significantly from EU funding instruments, including the Connecting Europe Facility (CEF Energy), which offers grants for cross-border Projects of Common Interest (PCIs). Additionally, the Instrument for Pre-Accession Assistance (IPA III) supports regulatory reforms and feasibility studies, while the Western Balkans Investment Framework (WBIF) provides blended grants and loans to enhance energy connectivity.

Key IFIs play a central role in financing gas infrastructure projects, with the European Bank for Reconstruction and Development (EBRD) and the European Investment Bank (EIB) serving as the primary lenders. The World Bank supports broader sector reforms and infrastructure planning, and KfW explores financing for future regional gas links, including potential interconnectors with Serbia and Bulgaria. Together, these institutions not only provide funding but also technical expertise to ensure projects meet environmental and EU compliance standards.

3.4.3. Market integration

i. Policies and measures related to the elements set out in point 2.4.3, including, where applicable, specific measures to enable the delivery of Projects of Common Interest (PCIs) and other key infrastructure projects.

PM_IEM6: Align with electricity integration package to enable electricity market coupling of the EU and the Republic of North Macedonia

Main objective: Establish the day-ahead electricity market, operationalise the package in line with the market coupling operator integration plan by the end of 2025.

Description: The electricity market integration provides all marketplaces to be accessible to the stakeholders for electricity trading (long term, day-ahead, intraday, and balancing market). The complete transposition of the Electricity Integration Package entails fully adopting and integrating EU electricity market directives and regulations into national legislation, ensuring that the national electricity market aligns with the principles and standards established by the EU. This process aims to foster market competition, enhance operational efficiency, and facilitate seamless integration with the European energy market, ultimately contributing to lower costs and increased energy security.

Establishing a day-ahead electricity market and operationalizing the package in line with the market coupling operator integration plan by the end of 2025 in North Macedonia is an essential step towards integrating the country's electricity market with regional and European energy markets.

Key activities:

1) **Complete transposition of the electricity integration package and continue its implementation, in line with Energy Community requirements (by June 2025)**

The first step in transposition **of the electricity integration package** was achieved with the adoption of new Energy Law (May 2025). To complete the process, relevant bylaws arising from the Energy Law have to be developed. When legal framework is in place, MEPSO will continue with the implementation of the relevant rules and procedures.

2) **Continue the implementation of the electricity integration roadmap by the Transmission System Operator (TSO) and the Nominated Electricity Market Operators (NEMOs) joining day ahead market coupling with the EU, in line with Energy Community requirements (by December 2025)**

The day-ahead market is functional since 10 of May 2023 in line with European practice. New NEMO designation is in line with CACM regulations. This designation should be performed in a way that the new NEMO (MEMO) will be recognized by European Commission as NEMO in North Macedonia. In order to enable the integration the North Macedonian with the European electricity market, i.e. market coupling, a memorandum of understanding was signed between PXs, TSO and NRA from the countries North Macedonia, Albania, Kosovo and Greece. According to MoU, the market coupling will be implemented on the borders of North Macedonia-Greece, Albania-Greece and Albania-Kosovo. It is important to be mentioned that the process of establishing market coupling it is to define a CCR configuration that must have all TSO's approval and ACER decision. According to the first estimates, SDAC market coupling at the MK-GR border should be realized by January 2026.

Timeframe		2025- 2026
Type		Technical, Regulatory
Sector		Energy
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of North Macedonia up to 2040 • Electricity integration roadmap by the Transmission System Operator (TSO) and the Nominated Electricity Market Operators (NEMOs)
Finance	Available budget	15 MEUR
	Source of finance	• EU funds • Central government budget
Implementing entity		• National Electricity Market Operator (NEMO) • Transmission System Operator (MEPSO) • Ministry of Energy, Mining and Mineral Resources
Monitoring entity		• National Electricity Market Operator (NEMO)

Progress indicators	• Complete transposition of the electricity integration package and its implementation, in line with Energy Community requirements • Joined day-ahead market coupling with the EU, in line with Energy Community requirements.
Relation with other dimensions	• Energy security, Decarbonization)

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.

PM_IEM7: Smart grid technology for power system management, digital and green substations

Main objective: Smart grid technology for power system management, digital and green substations

Description: The modernization of North Macedonia's transmission system will be driven by the introduction of **smart grid technology**, **digital and green substations**, and **progressive alignment with European market integration obligations**. These measures will enhance efficiency, reliability, sustainability, and ensure full interoperability with the regional and European grids.

Smart Grid and Substation Digitalization (2025–2027)

MEPSO will implement a package of projects to improve network monitoring, optimize asset management, and integrate renewable energy into the system.

Key Activities:

1. **Design and Development of Smart Grid Components**
   - Real-time monitoring, communication, and control systems including AMI, DSM, and automation of transmission/distribution lines.
   - Integration of smart sensors and PMUs for advanced protection and situational awareness.
2. **Financing and Resource Mobilization**
   - Public-private partnerships, national funding, and international support (EBRD, World Bank, EU grants).
3. **Digitalization of Substations**
   - Deployment of digital relays, SCADA systems, predictive maintenance tools, and green substation concepts to minimize environmental impact.
   - Priority substations include **Bitola 2** and **Sopotnica**.
4. **Network Automation and Remote Control Systems**
   - Remote operation, automated reclosers, RTUs, and advanced SCADA for resilient and autonomous grid management.
5. **Integration with Regional and European Smart Grid Networks**
   - Interoperability with ENTSO-E standards for coordinated cross-border operation and renewable integration.

Improved Market Integration and Coupling Milestones (2025–2027)

In parallel, North Macedonia will ensure alignment with the EU energy market framework, enabling stronger cross-border flows and integration with regional markets.

Planned milestones include:

1. **Regulatory Code Adoption (2025–2026)**
   - Transposition of CACM (Capacity Allocation & Congestion Management) into national law by Q4-2025.
   - Preparation for adoption of FCA (Forward Capacity Allocation) in 2025–2026.
   - Approval of national Terms, Conditions & Methodologies (TCMs) under the Electricity Balancing Guideline (EBGL) by Q1-2026.

2. **Regional Coordination & Security (2026)**
    - MEPSO to formally join **SELENE RCC** (Regional Coordination Center) in Thessaloniki in Q1-2026, participating in coordinated security analysis, capacity calculation, and outage planning.
    - Compliance with ENTSO-E operational security standards as a prerequisite for coupling.
3. **Market Coupling (2027)**
    - **Day-Ahead Market Coupling with Greece** to go live in 2027, ensuring efficient cross-border trading and full alignment with ENTSO-E/EnC integration roadmaps.

Expected Outcomes:

- Increased reliability, efficiency, and sustainability of the transmission system.
- Improved renewable energy integration through digital, automated, and green grid infrastructure.
- Full market integration with Greece and the EU regional market, securing North Macedonia's role in the wider European energy transition.

Timeframe		2025 - 2026
Type		Technical
Sector		Energy
Relevant planning documents, legal and regulatory acts		• Law on Energy
Finance	Available budget	14 MEUR
	Source of finance	• IFIs, MEPSO
Implementing entity		• MEPSO
Monitoring entity		• Ministry of Energy, Mining and Mineral Resources • Energy Regulatory Commission
Progress indicators		• Project activities implemented
Relation with other dimensions		• Energy security

PM_IEM8: Ensuring the national electricity system stability and adequacy

Main objective: Market integration

Description:

To achieve the main objective of market integration and support the development of effective energy policies and decisions in North Macedonia, a detailed analysis and calculation of VOLL (Value of Lost Load), CONE (Cost of New Entry), and RS (Reliability Standards) are critical. These values, along with an understanding of flexibility needs and potential, are essential for formulating comprehensive national energy strategies, including the National Resource Adequacy Assessment, Ten-Year Network Development Plan (TYNDP), and Cost-Benefit Analyses (CBA) of infrastructure projects.

The successful integration of smart grid technology, market design improvements, and resource adequacy assessments in North Macedonia requires comprehensive calculations of VOLL, CONE, and RS, as well as an in-depth understanding of flexibility needs and the economic viability of power generation units. By accurately assessing flexibility needs, the Economic Viability Assessment (EVA), and resource adequacy, North Macedonia can enhance the resilience, efficiency, and sustainability of its power system and integrate more effectively with regional energy markets.

Key Activities:

1. Calculation and Definition of VOLL, CONE, and RS

- VOLL (Value of Lost Load): Estimate the economic impact of power outages, based on operational data and specific regional factors (e.g., load types, consumption patterns, and economic activity).
- CONE (Cost of New Entry): Assess the cost of building new power generation units, including both capital and operational costs. This helps in determining whether existing capacity is sufficient or new investments are required.

- RS (Reliability Standards): Develop and set national standards for the reliability of power supply, including acceptable levels of energy not served (ENS) and loss of load duration (LOLD).

2. Determining Flexibility Needs and Flexibility Potential for Regional Exchange

- Analyse and quantify flexibility needs, distinguishing between slow and fast flexibility required to balance supply and demand in the grid.
- Quantify flexibility in terms of MW and determine costs of balancing, particularly focusing on balancing mechanisms, reserve requirements, and demand-side response.
- Assess the flexibility potential for regional exchange, determining how much flexibility the country can import or export from/to neighbouring grids (e.g., Kosovo, Greece, Bulgaria, Serbia), and how this can support power system stability.

3. National Resource Adequacy Assessment (NRAA)

- Develop scenarios to simulate different conditions, such as variations in hydrology, changes in renewable generation, load patterns, and the unavailability of thermal power plants.
- Assess the impact of these variations on the country's ability to meet its energy needs and ensure sufficient resource adequacy.

4. Economic Viability Assessment (EVA) for Power Generation Units

- Assess which units are financially non-viable (i.e., "out of money") and should be considered for decommissioning.
- Provide recommendations on the best options for introducing new units/technologies to the market to enhance resource adequacy. This could include assessing new investments in renewable energy, energy storage, or more efficient thermal generation.

5. Support for Improvements in Electricity Market Design and Operation

- Adjustments to market mechanisms, such as the introduction of incentives for flexibility providers, improvements in capacity markets, balancing markets, and the integration of demand response.
- Consideration of market coupling with neighbouring countries, providing an opportunity for increased efficiency and access to a broader market.

6. Incentives for Flexibility Providers

- Create mechanisms to reward flexibility providers for offering services that help balance the grid, especially in scenarios with high renewable energy penetration or demand fluctuations.
- These incentives can include capacity payments, contractual agreements, or participation in balancing markets..

Timeframe		2026 – 2030
Type		Regulatory, organizational
Sector		Energy
Relevant planning documents, legal and regulatory acts		• Law on Energy • Methodology for calculating the value of lost load, the cost of new entry and the reliability standard
Finance	Cost estimate until 2030	n.a.
	Source of finance	• IFIs, MEPSO
Implementing entity		• MEPSO
Monitoring entity		• Energy Regulatory Commission • Ministry of Energy, Mining and Mineral Resources
Progress indicators		• Methodology established, calculations implemented
Relation with other dimensions		• Energy security

PM_IEM9: System control, SCADA/EMS and cyber/OT topics

Main Objective: To modernize the system control infrastructure of North Macedonia's transmission network through the supply and installation of a new SCADA/EMS system, ensuring continuity of National Dispatch Centre (NDC) operations, compliance with ENTSO-E requirements, and enhanced cybersecurity and operational technology (OT) resilience.

Description:

The measure involves the replacement of MEPSO's existing SCADA/EMS platform with a state-of-the-art system that enables secure, reliable, and efficient monitoring and control of the transmission grid. The new system will integrate real-time data acquisition, energy management functionalities, and cyber/OT protection. This investment is a cornerstone for ensuring compliance with ENTSO-E operational standards and for strengthening the capacity of the National Dispatch Centre to manage increased renewable integration, regional market coupling, and modern grid automation.

Key Activities:

1. **Design and Procurement**
   - Preparation of technical specifications and procurement of a modern SCADA/EMS system in line with ENTSO-E and Energy Community standards.
2. **Installation and Commissioning**
   - Deployment of the SCADA/EMS hardware and software platform at the NDC, including redundancy systems and backup control facilities.
3. **Cyber/OT Security Enhancements**
   - Integration of advanced cybersecurity solutions, firewalls, and monitoring tools to safeguard grid operations against cyber threats.
4. **Training and Capacity Building**
   - Training programs for system operators and engineers to ensure smooth transition and effective use of the new platform.
5. **Testing and ENTSO-E Compliance**
   - Verification of interoperability, reliability, and performance benchmarks to meet ENTSO-E operational requirements for data exchange, monitoring, and control.

Expected Outcomes:

- Secure and continuous operation of the National Dispatch Centre with state-of-the-art SCADA/EMS infrastructure.
- Compliance with ENTSO-E standards for operational security, data exchange, and regional coordination.
- Improved situational awareness, decision-making, and operational efficiency in real-time system management.
- Enhanced resilience of the transmission grid to cyber/OT threats.
- Enabling factor for integration of renewable energy, cross-border exchanges, and market coupling processes.

Timeframe		2025 - 2026
Type		Technical
Sector		Energy
Relevant planning documents, legal and regulatory acts		• Law on Energy
Finance	Available budget	9 MEUR
	Source of finance	• IFIs, MEPSO, EU/EnC support mechanisms
Implementing entity		• MEPSO
Monitoring entity		• Ministry of Energy, Mining and Mineral Resources • Energy Regulatory Commission
Progress indicators		• Project activities implemented
Relation with other dimensions		• 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;

The non-discriminatory participation of renewable energy, demand response, storage and aggregators will be ensured by further legal developments, in particular in transposing the EU legal framework and developing the supporting secondary legislation. The most important measures in this respect are measures PM_D22: Simplification of permitting procedures and introduction of one-stop shops facilitating deployment of RE (where the activity "Finalize and adopt the Law on Renewable Energy" has been foreseen) and PM_IEM6: Align with electricity integration package to enable electricity market coupling of the EU and North Macedonia (where development of relevant by-laws stemming from the new Energy Law has been foreseen).

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;

Policies and measures protecting consumers vulnerable to energy poverty, as well as energy poor consumers is measure "IEM11 Addressing energy poverty while ensuring further market liberalization", as described in paragraph 3.4.4

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

PM_IEM10: Price signal demand response

Main objective: Introduce price signals to consumers in order to implement demand response

Description: Introducing price signals to consumers in North Macedonia to implement demand response (DR) is a crucial step in creating a more flexible, efficient, and sustainable electricity market. Demand response refers to the ability of suppliers and consumers to modify their energy consumption patterns to either:

- Reduce demand during times of high prices (when supply is tight).
- Increase demand during times of low prices (when there is surplus energy).

This behaviour will help stabilize the grid and balances supply with demand. By responding to price signals, electricity suppliers can take advantage of cheaper electricity when it's abundant and reduce consumption during periods when the price spikes due to high demand or low supply.

The introduction of price signals to implement demand response in North Macedonia requires a comprehensive approach, involving multiple stakeholders and coordinated actions. Key actions include the development of dynamic pricing structures, deployment of smart meters, consumer incentives, public awareness campaigns, and the creation of a robust regulatory framework. The Energy Regulatory Commission (ERC) plays a central role in regulating pricing and ensuring fair access to demand response programs, while electricity provider is tasked with implementing the technologies and incentive structures. The Ministry of Energy, Mining and Mineral Resources ensures that these initiatives align with national energy policy, market reforms, and long-term sustainability goals. By integrating demand response into the national energy framework, North Macedonia can improve grid stability, promote energy efficiency, and reduce consumer costs.

Key Activities:

1. Regulatory Framework for Demand Response

- Establish a regulatory framework for demand response that defines the roles and responsibilities of all stakeholders and sets clear rules for consumer participation, compensation, and data privacy.
- The framework should outline how consumers will be compensated for participation, how data will be collected and used, what protections will be in place for vulnerable consumers.
- Integrate demand response mechanisms into broader energy market reforms, ensuring that price signals, grid flexibility, and demand-side management are aligned with the ongoing liberalization of the energy market.
- This includes ensuring that demand response is fully integrated into wholesale energy markets and that it can be used as a tool for balancing supply and demand.

2. Development of a Dynamic Pricing Structure (Price Signals)

- Introduce time-of-use (TOU) tariffs or dynamic pricing: Establish pricing mechanisms that incentivize consumers to shift their electricity consumption to off-peak hours, where prices are lower, and reduce usage during peak hours when electricity is more expensive.
- Options include real-time pricing, critical peak pricing, and time-of-use tariffs that offer lower prices during non-peak hours and higher prices during peak demand periods.

3. Deployment of Smart Meters and Metering Infrastructure

- Upgrade the metering infrastructure by deploying smart meters that can measure consumption in real time and relay that information back to electricity providers and consumers.
- Smart meters will enable accurate billing for time-of-use tariffs, provide consumers with detailed feedback on their consumption patterns, and allow electricity providers to manage demand more effectively.

4. Designing and Implementing Consumer Incentive Programs

- Create financial incentives or rebates for consumers who actively participate in demand response programs by reducing their electricity usage during peak hours.
- Incentives may include discounts, rebates on energy bills, or direct payments for cons
- mers who reduce usage during critical peak times or as part of automated demand response programs.

5. Developing/Using and Integrating Demand Response Technology and Platforms

- Develop or use existing platforms and technologies to enable automated demand response, such as smart home devices, energy management systems, and software that allows consumers to automatically adjust their consumption based on price signals (for example, consumers could install smart thermostats or appliances that respond to price signals, turning off or reducing consumption when electricity prices are high).

Timeframe		2025-2030
Type		Regulatory
Sector		Energy
Relevant planning documents, legal and regulatory acts		• Law on Energy • Study on automated demand response, MEPSO
Finance	Cost estimate until 2030	n.a.
	Source of finance	• Central Government, donors
Implementing entity		• Distribution system operator • Electricity suppliers
Monitoring entity		• Ministry of Energy, Mining and Mineral Resources • Energy Regulatory Commission
Progress indicators		• Number of suppliers on the market with price signals
Relation with other dimensions		• Energy security

3.4.4. Energy poverty

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

PM_IEM11: Addressing energy poverty while ensuring further market liberalization
Main objective: Protect vulnerable customers. **Description**: Newly adopted Law on Energy envisages development of the Methodology for Measuring the Level of Energy Poverty (Article 6) by the Ministry of Energy and the ministry in charge of social protection and the yearly Programme for the Protection of Vulnerable Customers (Article 10), to be adopted by the GoNM. Due to the country's ongoing market liberalization process, future energy prices are expected to reach market levels. This may further worsen the status of those already experiencing energy poverty

and place additional households at risk. Therefore, any price increases must be designed in a way that is predictable for households and businesses, while avoiding an increase in energy poverty and ensuring that additional vulnerable consumers are not put at risk.

The new Law on Energy introduces significant measures to protect vulnerable energy consumers, building upon previous initiatives and aligning with the country's broader energy and climate strategies. By combining financial assistance with structural reforms, the government aims to ensure equitable access to energy and reduce energy poverty.

Key Activities:

Identification and Definition of Vulnerable Consumers and for Energy Poverty

- Develop Methodology for Measuring the Level of Energy Poverty, by establishing clear criteria for energy poverty and vulnerable consumers (income level, household size, other special circumstances
- Identify vulnerable consumers, based on the developed Methodology
- Set a target and time frame for reduction of energy poverty

Development of Programme for the Protection of Vulnerable Customers

- Based on the developed Methodology and the targets for energy poverty reduction, annual programmes for protection of vulnerable consumers will be developed and adopted by the Government
- Create financial support mechanisms such as targeted subsidies, social tariffs, or cash transfers to reduce electricity bills for vulnerable consumers.
- Develop and implement energy efficiency measures at vulnerable consumers, such as home energy audits, subsidies for energy-efficient appliances, and low-cost home insulation.
- The programme will be developed joinly by the Ministry of Energy, Mining and Mineral Resources and ministry in charge of social protection, to integrate it with other existing social welfare programs, ensure no overlapping and streamline activities.

Consumers protection from energy market shocks

- Conducting a comprehensive assessment and inventory of existing energy subsidies across all sectors.
- Identifying and prioritizing subsidies for reform based on their fiscal, social, and environmental impacts, including setting legally binding timeline for phase out of fossil fuel subsidies (by 2029)
- Developing further measures to mitigate the impact of subsidy reform on vulnerable households and industries, including targeted compensation or support programs.

The measure is related to implementation of PM_D14 and PM_D15 and requires continuous monitoring of its impacts on employment and consumer energy prices, focusing on energy poverty.

Timeframe		2025 – 2030
Type		Regulatory, financial
Sector		Energy
Relevant planning documents, legal and regulatory acts		▪ Strategy for Energy Development of the Republic of North Macedonia up to 2040
Finance	Cost estimate until 2030	n.a.
	Source of finance	Central government budget
Implementing entity		• Ministry of Energy, Mining and Mineral Resources • Ministry of Social Affairs, Demography and Youth • EVN Macedonia (energy provider)
Monitoring entity		• Ministry of Energy, Mining and Mineral Resources • Energy Regulatory Commission
Progress indicators		• Methodology developed • Annual program adopted • Target for energy poverty reduction set
Relation with other dimensions		• Energy Efficiency, Decarbonization

3.5. Dimension: Research, innovation and competitiveness

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

S3 strategy considers green, digital and sustainable transition as horizontal principles and overarching objectives, therefore achieving the S3 targets directly contributes to climate and energy priorities. However, no specific targets related to the Energy Union R&I priorities have been set.

Similarly, in the draft National Small and Medium Entreprises Strategy 2025 – 2030 some support measures could be closely related to the Energy Union priorities, such as enhancing existing and establishing new SME and innovation support infrastructure, promoting new models of business clustering, strengthening technology transfer at universities, however no specific links to priority technologies have been established.

Therefore, the following measure is proposed, with a goal of aligning the S3 and SME strategy with the Energy Union priorities.

<table>
<tr><td colspan="3">PM_RIC1: Aligning S3 and SME strategy with the Energy union priorities</td></tr>
<tr><td colspan="3">Main objective: Mainstreaming Energy union priorities into the Smart specialization strategy

Description: In the SME strategy and Smart specialization strategy national priority domains and a number of specific objectives and goals have been set, however the Energy union priority technologies have not been stipulated. Within the S3 monitoring framework, monitoring of research, innovation and competitiveness in these specific areas is not possible.

Therefore, national objectives related to funding targets and competitiveness in clean energy technologies will be defined in both strategies. This will enable earmarking the funds allocated to R&D in clean energy technologies and tracking of scientific production in this area, clean energy industries participation in overall industrial production and other important parameters.

For that purpose, a task force will be created, with members of relevant ministries and funding institutions, to guide the process of aligning the S3 and SME strategy with the Energy union priorities. An analysis of current state and potential of clean energy technologies in terms of research and industry sector capabilities, national market uptake potential and export possibilities will be analysed.

Based on the conducted research, national targets for clean energy technologies will be defined as sub-targets in S3 and SME strategy, inter alia:
- R&D expenditure – public and private, total and as GDP share
- No of relevant scientific publications
- No of patents
- Mobilities of researchers and students, geographical and sectoral (between academia and industry)

The priorities will be used for the update of both strategies.

In the meantime, the programmes offered and funding provided by the FITD will be used.</td></tr>
<tr><td colspan="2">Timeframe</td><td>2025 – 2026</td></tr>
<tr><td colspan="2">Type</td><td>Policy</td></tr>
<tr><td colspan="2">Sector</td><td>All sectors</td></tr>
<tr><td colspan="2">Relevant planning documents, legal and regulatory acts</td><td>Smart Specialization Strategy 2024-2027</td></tr>
<tr><td colspan="2">Results to be achieved</td><td>Monitoring specific Energy union priority technologies within the S3 monitoring framework</td></tr>
<tr><td rowspan="2">Finance</td><td>Cost estimate until 2030</td><td>TBD</td></tr>
<tr><td>Source of finance</td><td>n.a.</td></tr>
<tr><td colspan="2">Implementing entity</td><td>Ministry of science and technology</td></tr>
<tr><td colspan="2">Monitoring entity</td><td>Ministry of Energy, Mining and Mineral Resources</td></tr>
<tr><td colspan="2">Progress indicators</td><td>(%)</td></tr>
<tr><td colspan="2">Relation with other dimensions</td><td>Decarbonization; Energy Efficiency</td></tr>
</table>

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 national context;

The Republic of North Macedonia participates in EU Research and Innovation programmes since 2007 and the country has become a fully associated member to Horizon Europe in January 2021. Also, since 2023 organizations from North Macedonia are eligible to apply for funding under the LIFE programme, mobilising public and private resources for climate action, biodiversity protection, circular economy and clean energy transition.

EU funding is available for cross-border cooperation with all neighbouring countries. Scientific cooperation is not among priorities of the IPA programmes, however research organizations are eligible for participation.

SET Plan objectives and policies will be translated into the national context by implementing the measure PM_RIC1.

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

The most important source of national funding for innovation is the Fund for Innovation and Technology Development (FITD). It offers technical assistance via tech accelerators and provides co-financed grants for improvement of innovation, co-financed grants for newly established start-up and spin-off companies, as well as co-financed grants and conditioned loans for innovation commercialisation for different sectors. The national support to research, innovation and competitiveness through the FITD will be continued.

4. Current Situation and Projections with Existing Policies and Measures

The projections shown in this chapter are referring to the scenario with existing measures (WEM).[21]

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

i. Macroeconomic forecasts (GDP and population growth)

Based on historical trends[22] and using the macroeconomic drivers from the Strategy for Energy Development up to 2040 of the Republic of North Macedonia, an average GDP growth rate of 3.3% is forecasted for the period 2024-2040 (Figure 20).

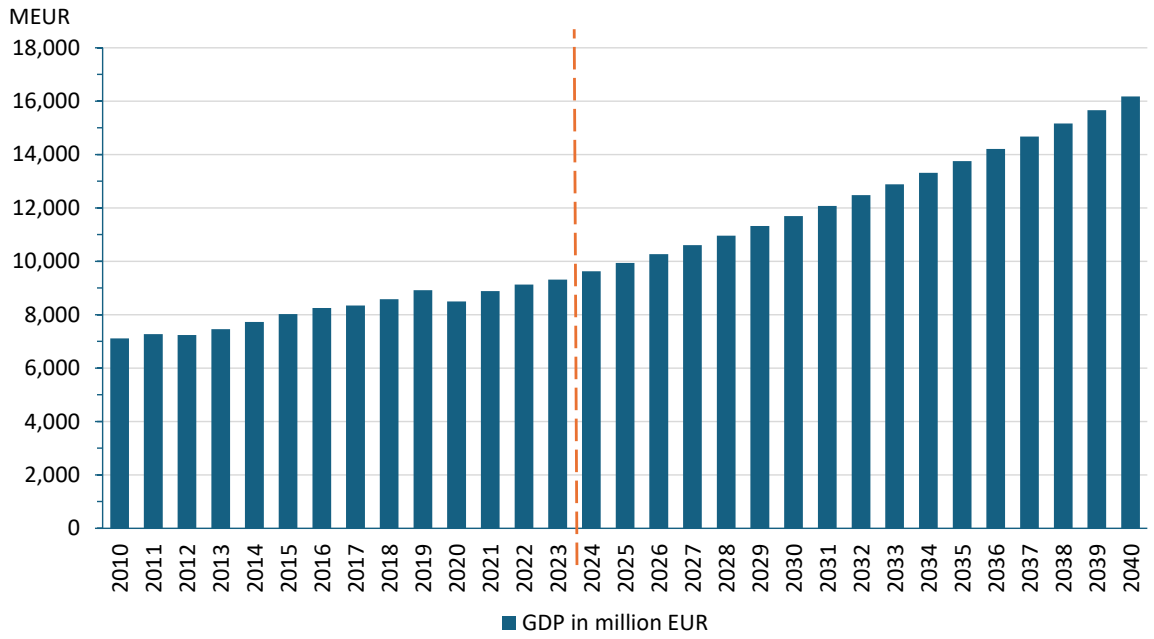


Figure 20 GDP – historical and projected values up to 2040 in the Republic of North Macedonia

Based on the population projections[23], the population of the Republic of North Macedonia is expected to decline by 19.8% in 2040 compared to 2024 (Figure 21).

[21] For the scenario with additiona measures (WAM), please refer to the Chapter 5.1

[22] https://ec.europa.eu/eurostat/databrowser/view/nama_10_gdp/default/table?lang=en

[23] https://www.stat.gov.mk/PrikaziPoslednaPublikacija_en.aspx?id=92

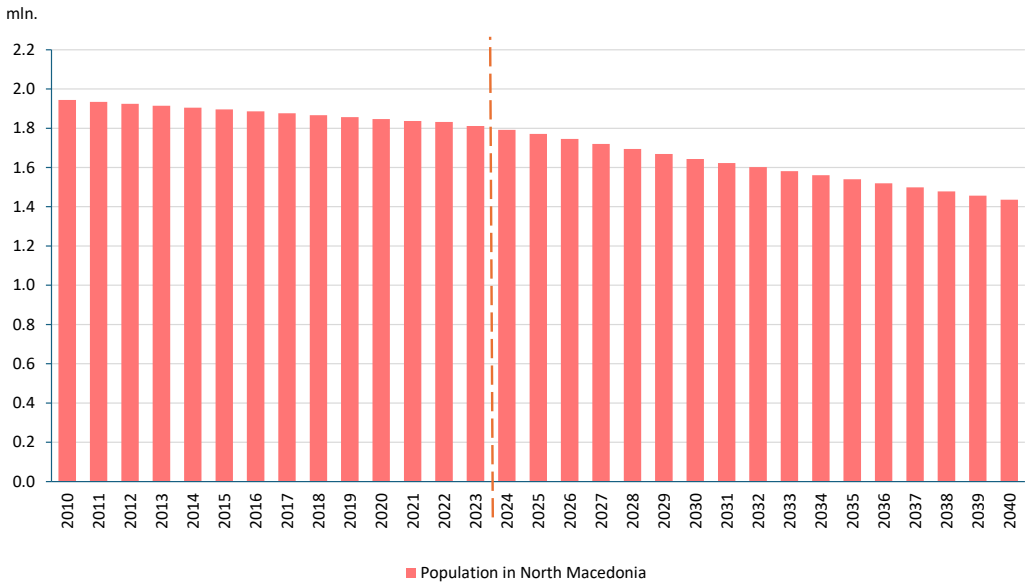


Figure 21 Population in the Republic of North Macedonia – historical and projected values

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

Besides the population and GDP, the distribution of households between rural and urban areas is also important for useful energy consumption projection in the household sector. Figure 22 displays the distribution of households between rural and urban areas in 2021. Specifically, 64% of the households are in urban areas, while 36% are in rural areas[24]. This distribution reflects the ongoing shift towards urban living, driven by factors such as access to better infrastructure, services, and employment opportunities in cities.

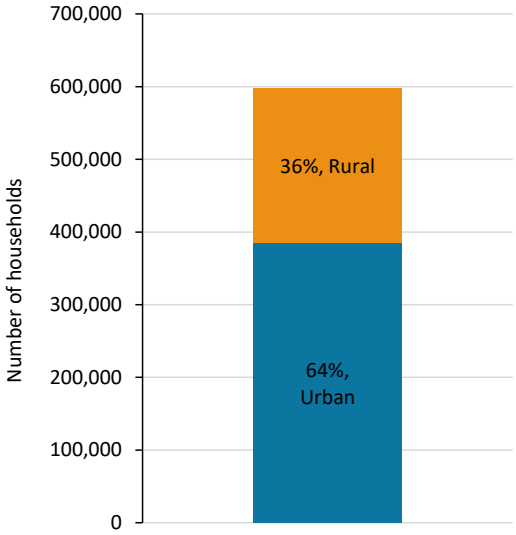


Figure 22 Distribution of households (rural and urban) in 2021

[24] https://makstat.stat.gov.mk/PXWeb/pxweb/en/MakStat/MakStat__Popisi__Popis2021__NaselenieVkupno__Domakinstva/T2006P21.px/?rxid=46ee0f64-2992-4b45-a2d9-cb4e5f7ec5ef

Figure 23 illustrates the structure of households in terms of their heating methods[25]. A significant portion, 51%, rely on stove heating, indicating a strong reliance on individual heating systems such as stoves or fireplaces fuelled by solid fuels. Additionally, 20% of households use central heating with their own installations, while 8% are connected to district heating.

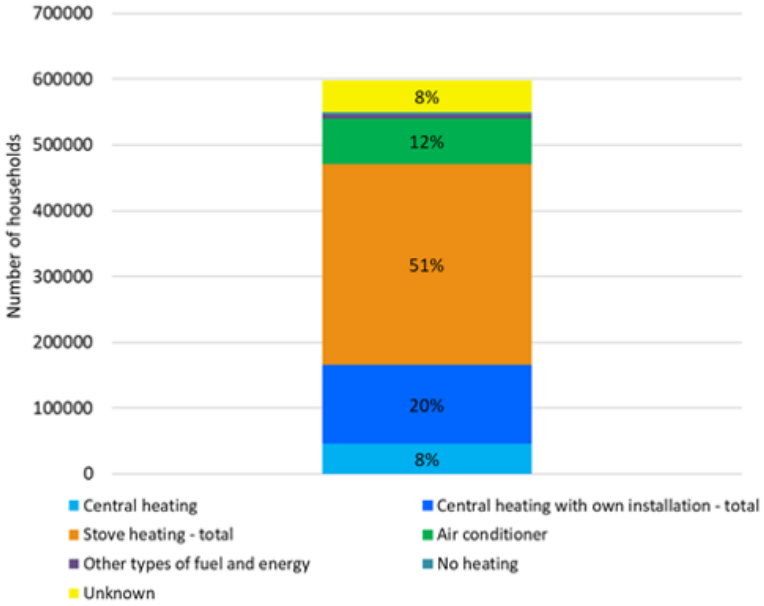


Figure 23 Distribution of households by heating method in 2021

Current public area of buildings occupied by the public sector equals 2,265.9 thousand m^2, which is equivalent to 1.24 m^2 per citizen. Structure of area of public buildings is presented in Figure 24. It is expected that the area per citizen will grow by approximately 20% until 2040, up to 1.5 m^2.

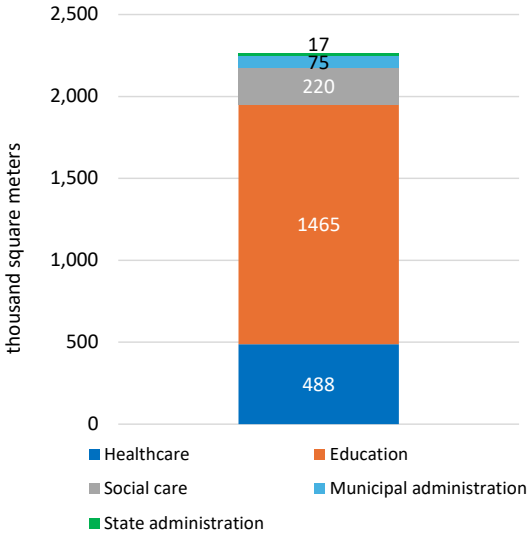


Figure 24 Public sector area and sub-area, 2022

[25]https://makstat.stat.gov.mk/PXWeb/pxweb/en/MakStat/MakStat__Popisi__Popis2021__NaselenieVkupno__Domakinstva/T2006P21.px/?rxid=46ee0f64-2992-4b45-a2d9-cb4e5f7ec5ef

Area of commercial buildings is estimated to 7,030.4 thousand m2, which amounts 3.2m2 per citizen in 2022. It is expected that the area per citizen will grow to approximately 6 m2 in 2040.

The expected increase of energy consumption in the public and commercial sector in the WEM scenario is shown in Figure 25. The increase is due to the increase of the total area occupied by the public sector but somewhat counteracted by increased energy efficiency of the buildings sector.

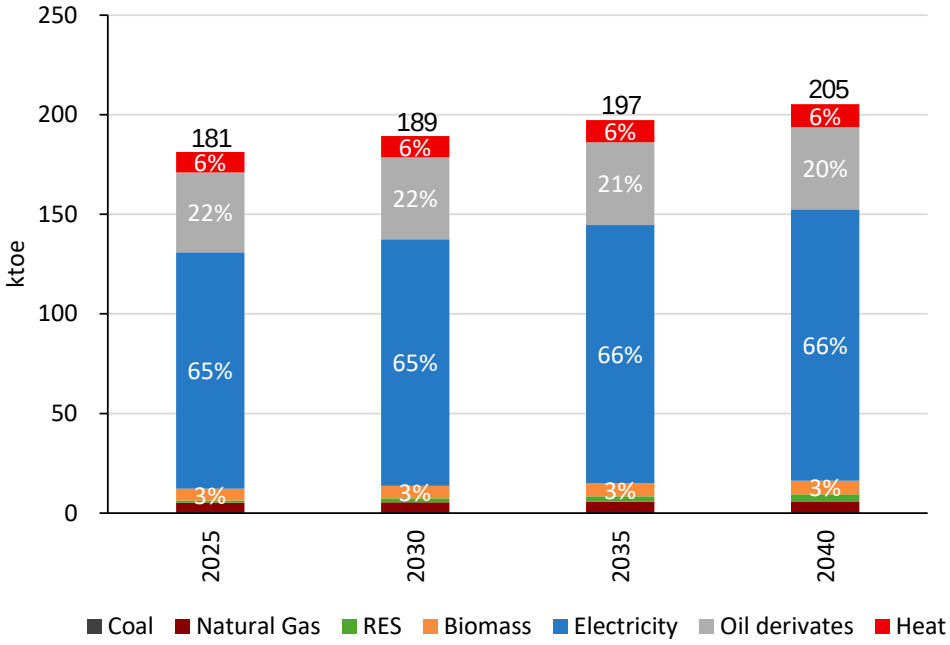


Figure 25 Projection of final energy demand in public and commercial sector, WEM scenario

Based on GDP and population growth, energy demand in passenger and freight kilometres has been estimated (Figure 26 and Figure 27). In the WEM scenario, diesel vehicles are expected to remain dominant in the passenger segment, accounting for approximately 60 percent of the market in 2040, which is 4 percent lower than the projected share in 2025. Electric cars are projected to remain below 1 percent until 2030 and reach only 1.5 percent by 2040. For freight transport, heavy-duty diesel trucks will continue to be the primary mode of transportation. The WEM scenario reflects a situation where no additional measures are implemented.

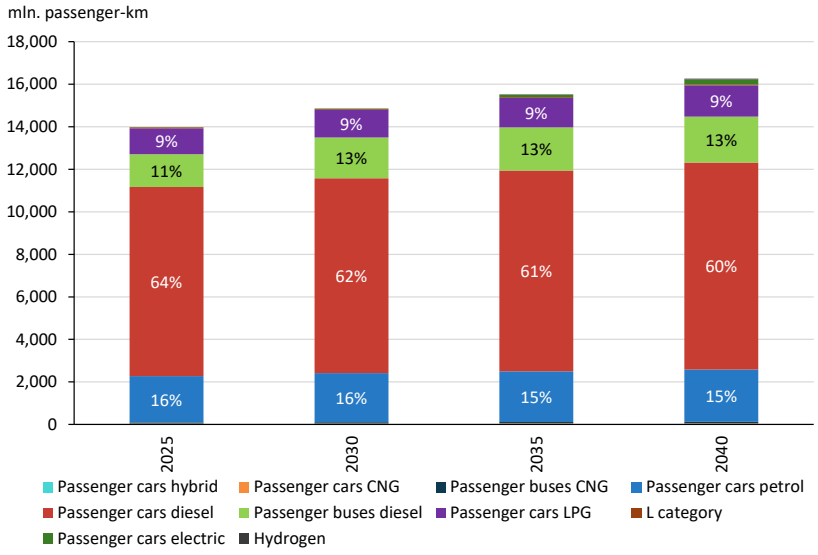


Figure 26 Passenger transport evolution, WEM scenario

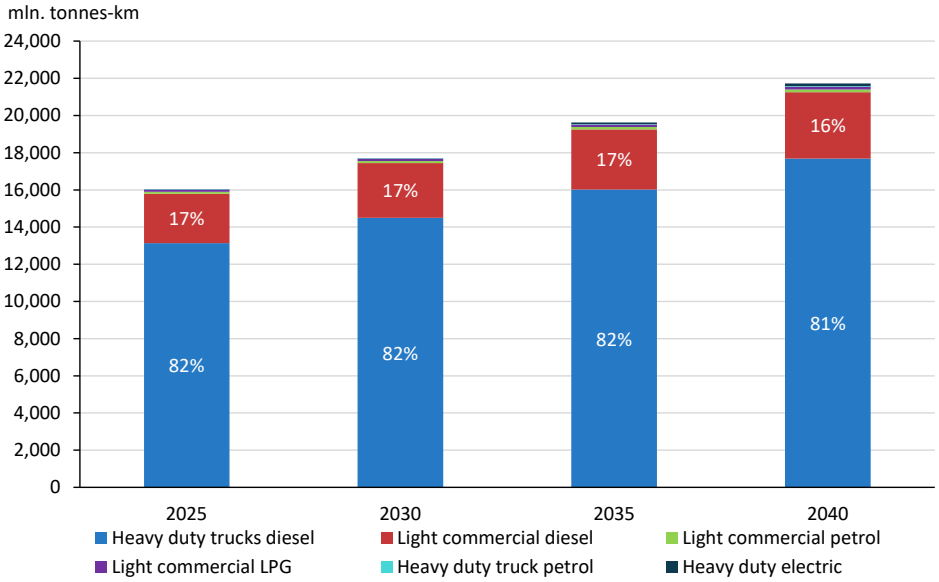


Figure 27 Freight transport evolution, WEM scenario

According to the National industry development strategy, it is expected that the value added by industry will rise by 4.9% per year until 2029, assuming different growth rates for industrial subsectors. The industrial production has experienced a significant drop in 2022 due to decreased production of iron and steel industry, and has not recovered in 2023. Therefore the same growth trend as in the national strategy has been assumed, but with a lower starting point. From 2029 until 2040, the annual value growth rate has been assumed to be equal to 3%. The expected energy consumption in industry in the WEM scenario is presented in Figure 28.

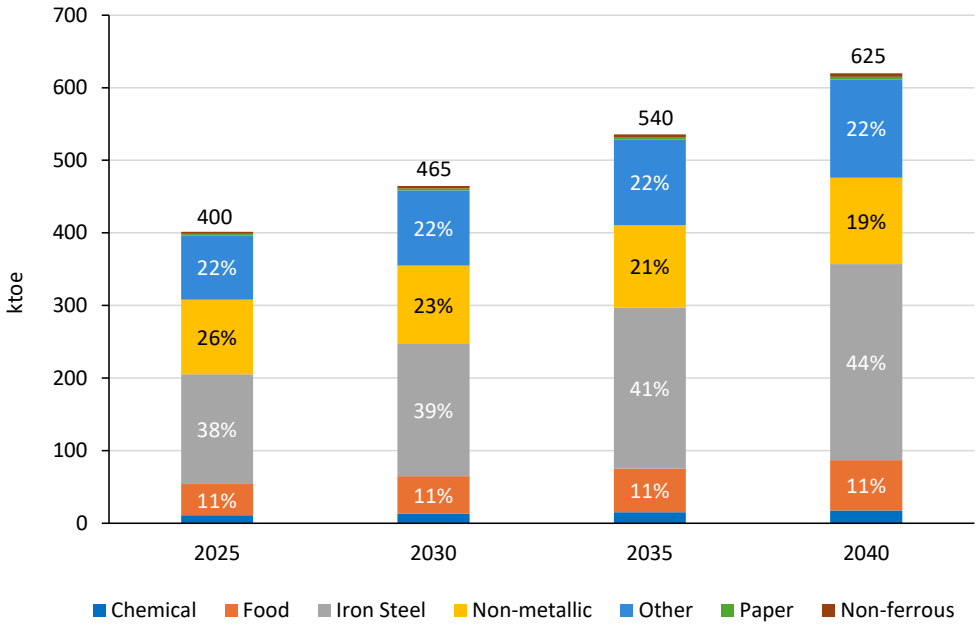


Figure 28 Projection of final energy demand by industrial subsectors, WEM scenario

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

When evaluating electricity supply options, the fuel prices suggested by the European Commission were taken into account[26], both for WEM and WAM scenario.

International fuel prices

Table 10 and Figure 29 present projected fuel prices for 2050.

Table 10 Estimated fuel prices by 2050

	Crude oil EUR/GJ	Natural gas (NCV) EUR/GJ	Coal EUR/GJ
2025	15.4	13.2	3.1
2030	15.4	11.3	3.1
2035	15.4	11.3	3.1
2040	16.3	11.3	3.3
2045	17.6	11.3	3.5
2050	19.7	11.8	3.7

Source: EU Recommended parameters for reporting on GHG projections in 2023

Figure 29 illustrates the projected fuel price trends up to 2050, in comparison to 2021—the last year before major disruptions and price fluctuations in the energy market.

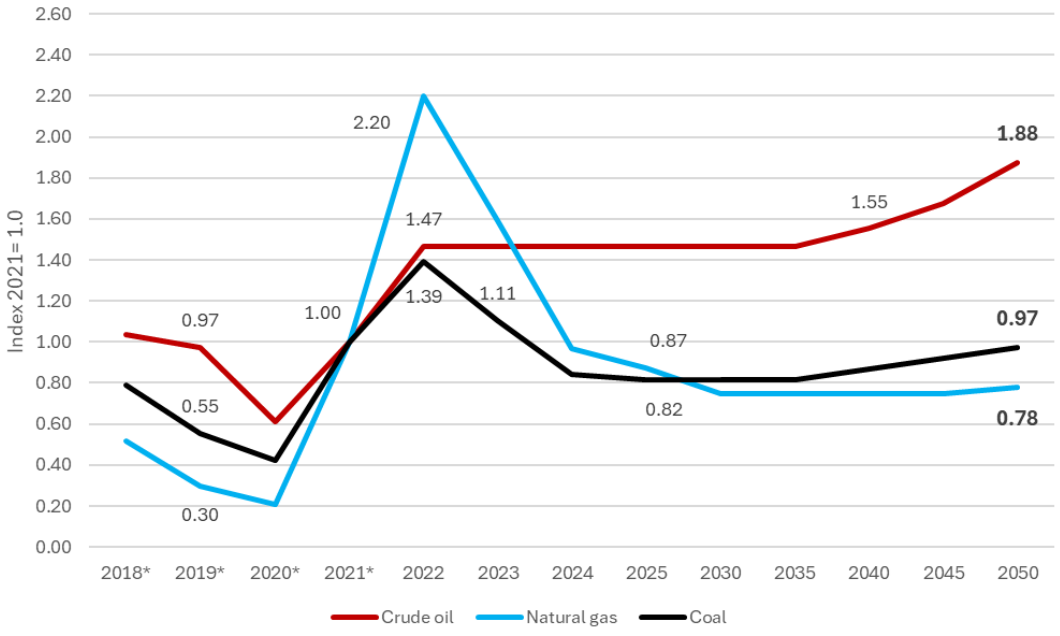


Figure 29 Fuel price change index until 2050

Source: EU Recommended parameters for reporting on GHG projections in 2023

A constant price of 4.6 EUR/GJ and EUR 1.4 EUR/GJ is assumed for biomass and lignite, respectively.

[26]Recommended parameters for reporting on GHG projections in 2023, European Commission Directorate-General for Climate Action

Emission unit prices

All fossil fuel power plants with an input nominal thermal power above 20 MW are assumed to participate in the European Emission Trading System. To support the development of national energy and climate plans, the European Commission has provided recommended price levels for emission units until 2050, as shown in the table below.

Table 11 Recommended emission allowance prices by 2050

Emission unit prices	2021	2025	2030	2035	2040	2045	2050
NECP - EC Recommendation EUR2020/t CO_2, Scenario with existing measures (WEM)	54	80	80	82	85	130	160
NECP - EC Recommendation EUR2020/t CO_2, Scenario with additional measures (WAM)	54	80	80	120	250	360	410

Source: EU Recommended parameters for reporting on GHG projections in 2023

Two emission unit price trajectories were recommended: one for the WEM (With Existing Measures) scenario and another for the WAM (With Additional Measures) scenario.

iv. Technology cost developments

Electricity generation technologies

The projected trends for specific investments in electricity generation technologies from 2020 to 2050 have been sourced from the IEA WEO 2022 for the EU region. The expected specific investments are presented in the following table.

Table 12 Expected specific investments in power plants[27]

Technology	2021	2030	2050
	Specific investment (EUR2020/kW)		
CCGT	824	824	824
CCGT + CCS	2,556	2,473	1,814
OCGT	412	412	412
Nuclear	5,441	4,205	3,710
Solar PV (large)	668	437	338
Solar PV (buildings)	923	627	495
Wind power plants (land)	1,311	1,245	1,195
Wind power plants (sea)	2,506	1,649	1,237
Biomass and biogas	3,092	3,009	2,927
Geothermal plants	2,350	2,267	2,102

Technological advancements in natural gas-fired thermal power plants are expected to be limited, except in the area of carbon capture and storage. Significant cost reductions are anticipated for renewable energy sources, particularly solar

[27] Source: IEA WEO 2022

power plants. However, no major technological or cost improvements are foreseen for large and small hydropower plants or biomass power plants.

Batteries

The development of lithium-ion batteries is also considered for storing excess electricity and providing flexibility in the power system. The power-to-capacity ratio is assumed to be 1:4, meaning the battery can charge or discharge fully within four hours. Specific investment costs are shown Table 13.

Table 13 Specific investments in battery systems (4 hours of storage)

Component	EUR2020	2021	2030	2050
The cost of the battery-tank	EUR/kWh	171	124	61
The cost of the management system	EUR/kW	619	493	297
Fixed cost	EUR/kW	7.9	5.7	2.8
Variable cost	EUR/MWh	2.2	1.4	0.5
Total specific cost (4 hours)	EUR/kW	1,311	995	544

Hydrogen production technologies

The entire projected hydrogen volume is assumed to be produced via electrolysis. The expected costs of such facilities are shown in the following table.

Table 14 Specific investments in hydrogen production facilities (electrolysis)[28]

Item	Unit	2020	2030	2050
CAPEX (at the level of technology input)	EUR/kW_e	836	650	418
Efficiency (NCV)	%	64	69	74
OPEX (5 in relation to CAPEX)	%	1.5	1.5	1.5
"Stack" lifetime	H	95,000	95,000	100,000

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 most recent officially published data is from the year 2019. The emissions amounted to 11.3 Mt CO_2-eq, the net emissions (including FOLU) equalled to 12.9 MT CO_2-eq, and FOLU emissions amounted to 1.6 Mt CO_2-eq, due to catastrophic forest fires.

It must be noted that in the modelling conducted in the process of updating the NECP, the GHG inventory for the sectors Energy, Waste, IPPU and Agriculture has been extended until 2022, while the inventory for the sector FOLU until 2024 in order to take into consideration the huge forest fires which occurred in 2024.

Projections of total GHG emissions and removals according to the WEM scenario is given in Figure 30.

[28] Source: IEA G20 Hydrogen report: Assumptions, Revised version, December 2020

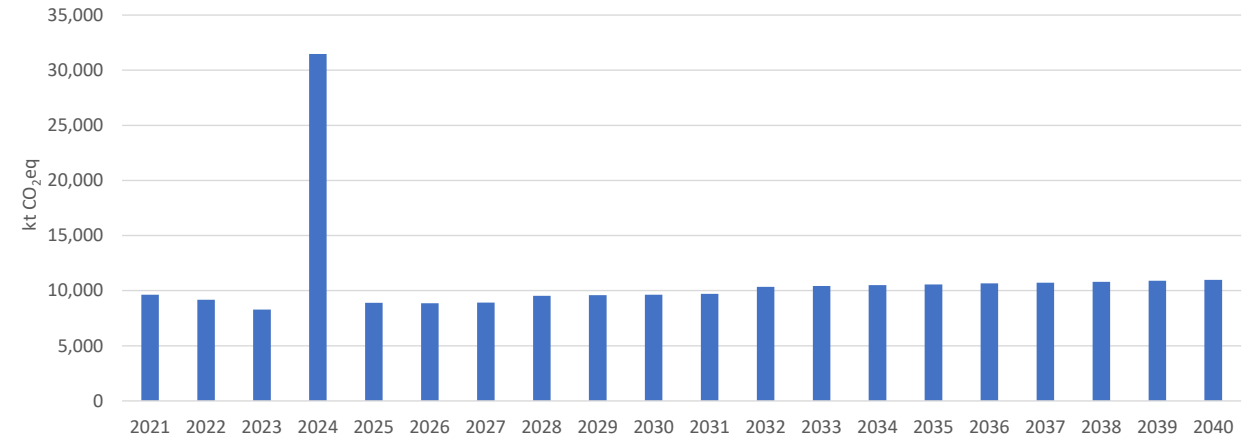


Figure 30 GHG net emissions projection, WEM scenario 2021 -2040

It can be seen that with the existing measures, net GHG emissions are expected to continue increasing throughout the observed period (Figure 30). Due to the 2024 forest fires that turned the FOLU sector into the most significant source of emissions (it has been assessed that the FOLU sector contributed to GHG emissions with more than 20 Mt CO_2, while the remaining emissions sector total contribution was around 11 Mt $CO_{2\text{-eq}}$), the following graph shows the projection of total GHG emissions without the FOLU sector.

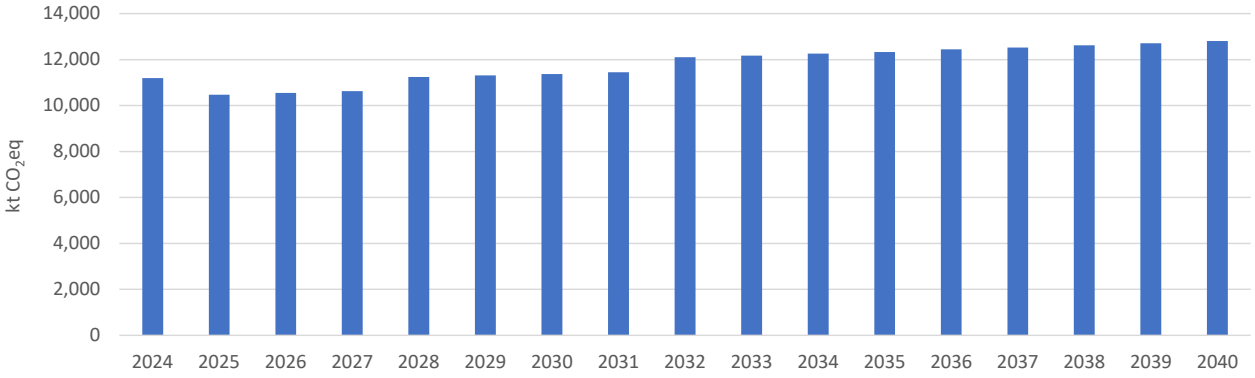


Figure 31 GHG gross emissions projection, WEM scenario 2024 -2040

In the following chapter sectoral contributions to the GHG emissions projection are shown, together with the main assumptions governing the WEM scenario.

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

Figure 32 shows the net GHG emission projections in the period from 2025 to 2040, split into the emission sectors. 2025 has been chosen as the first year to avoid the issue of FOLU sector enormous contribution in 2024. GHG emissions in 2040 are projected to rise compared to 2025 in all subsectors.

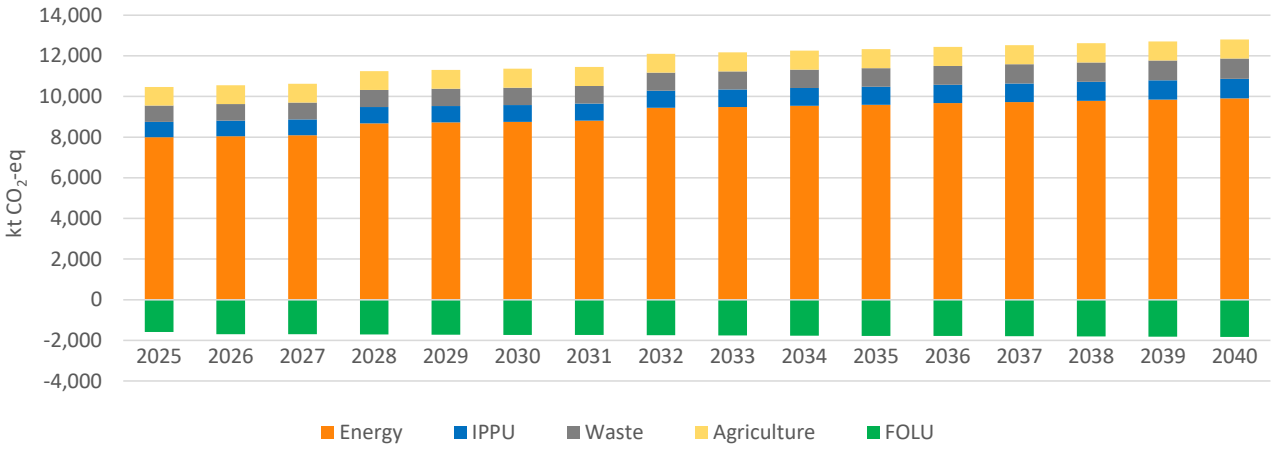


Figure 32 GHG emission sectoral breakdown, WEM scenario 2025 - 2040

The highest rise in 2040 compared to 2025 is projected in the industry sector, due to the expected growth of industrial production that is not expected to be accompanied by fuel switching and energy efficiency measures as in the WAM scenario. Emissions resulting from energy consumption in this subsector are projected to rise by 45% until 2040. This rise is followed by the emissions from the energy transformations (electricity and heat production), projected to increase by 25% until 2040. GHG emissions from the transport sector are expected to rise by 12% in the same period.

The energy sector is expected to remain the main source of GHG emissions in the WEM scenario, throughout the observed period. To provide more clarity, energy sector GHG emissions have been divided into sub-sectors and presented in Figure 33.

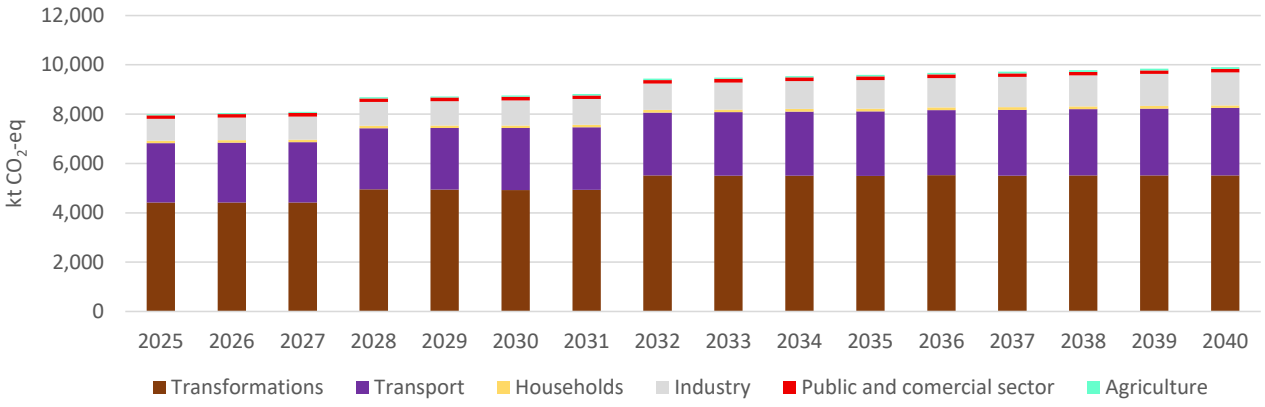


Figure 33 GHG emissions from the subsectors of the energy sector, WEM scenario 2025 - 2040

In the energy sector transformations, it has been assumed that the currently existing lignite fired power plants remain in operation until 2040. Renewable power plants are also expected to enter operation, but at a slower pace. The volume of electricity delivered by the lignite power plants slightly increases, due to the expected increase of electricity demand in the WEM scenario.

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 Republic of North Macedonia's share of RES in 2023 was 20% (Figure 34)[1]. In 2010, the share of RES in gross final energy consumption was 21%, and it was the same in 2017, representing the highest share in the analysed period. The lowest share was recorded in 2012 and 2019, at 16%.

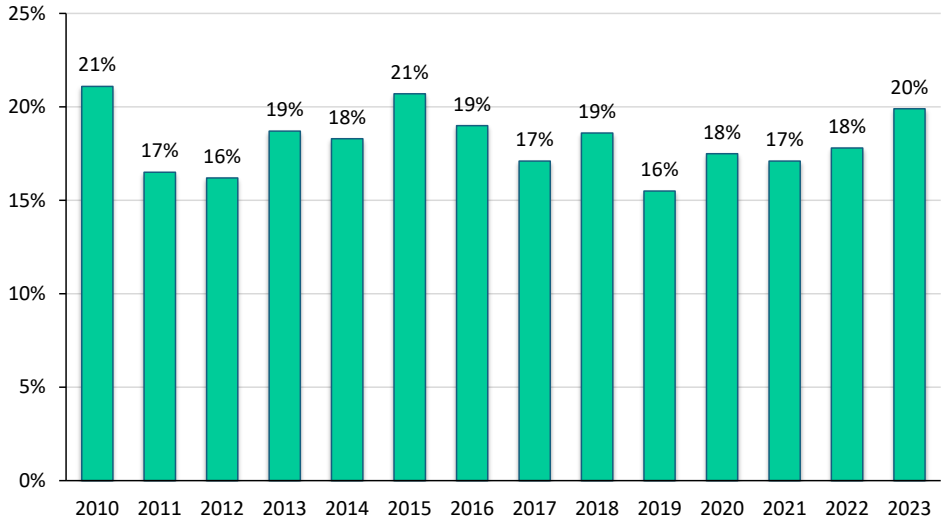


Figure 34 Share of energy from renewable sources in gross final consumption of energy, 2010-2023

Concerning the RES share per technology, in the electricity sector, it can be noted that up to 2012, almost 100% is supplied by hydro power plants (Figure 35). In 2023, 74% of the gross final energy consumption in the electricity sector is from hydro power plants, 16% PV, 7% wind, and 3% biogas[2].

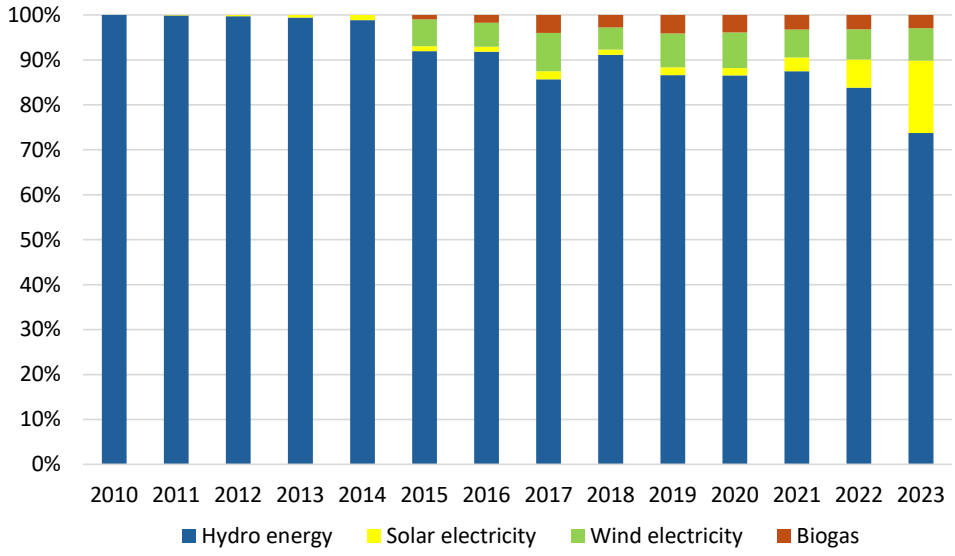


Figure 35 RES share by technology in gross final energy consumption, electricity sector

RES technologies that are used in the building sector in North Macedonia are biomass, solar and geothermal (Figure 36). By far, the highest share in the final energy consumption in this sector is from biomass, reaching 97.8% in 2023[3].

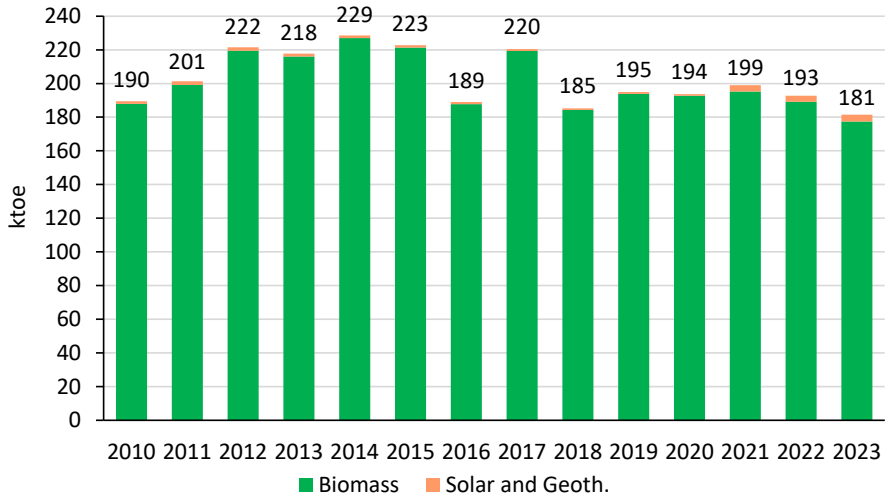


Figure 36 RES share in final energy consumption, building sector

In the transport sector, small amounts of biofuels are used, with a maximum value of almost 0.9 ktoe in 2013 (Figure 37)[4].

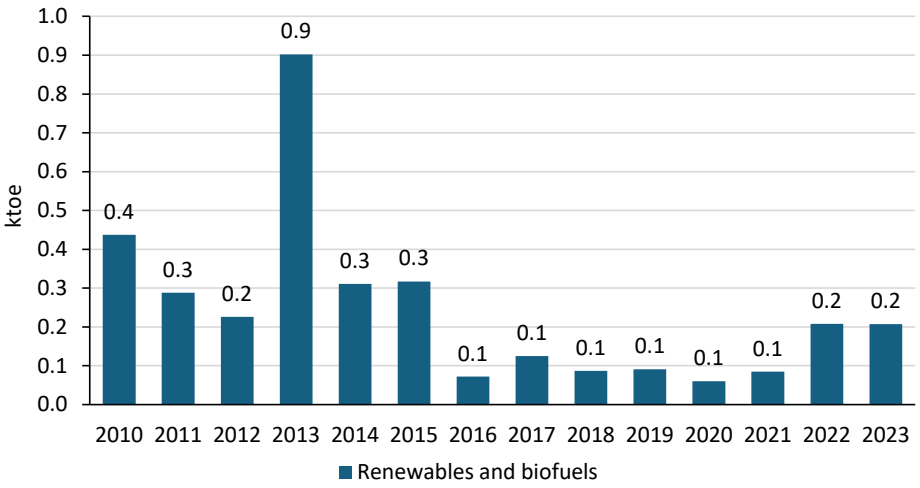


Figure 37 RES technology in gross final energy consumption, transport sector

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

The indicative projections show that if only existing policies and measures are applied, the share of renewable energy sources (RES) in gross final energy consumption could reach 34% by 2040 (Figure 38). The RES share in the electricity sector is projected to reach approximately 71% by 2040 (Figure 39). A downward trend is observed in the share of RES in heating and cooling, which is expected to fall to 32% by 2040 (Figure 40). In the transport sector, there is a significant increase in the RES share, reaching 8% by 2040 (Figure 41).

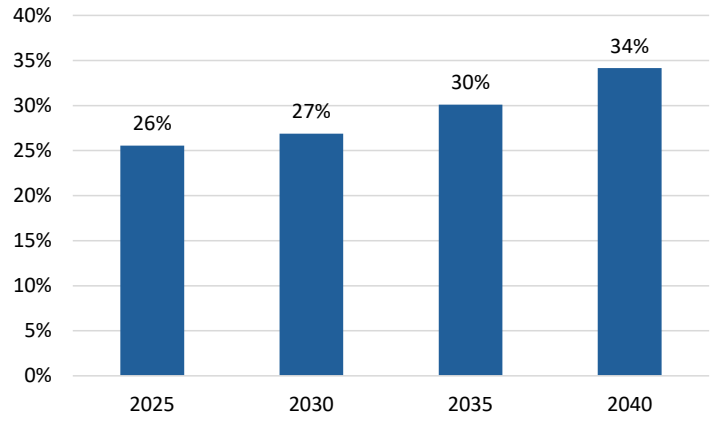


Figure 38 RES share in gross final energy consumption, WEM scenario

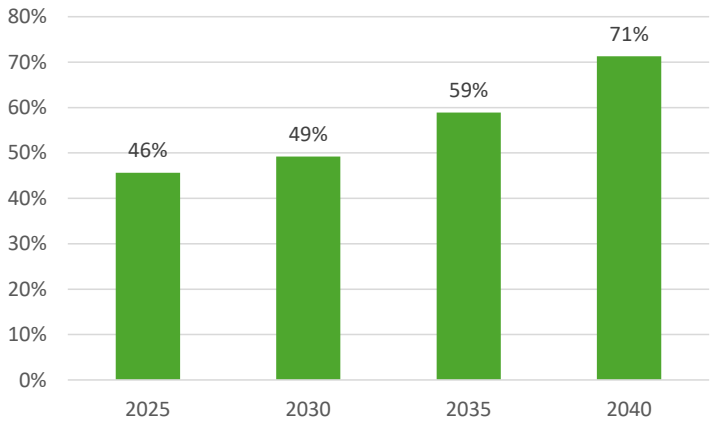


Figure 39 RES share in electricity, WEM scenario

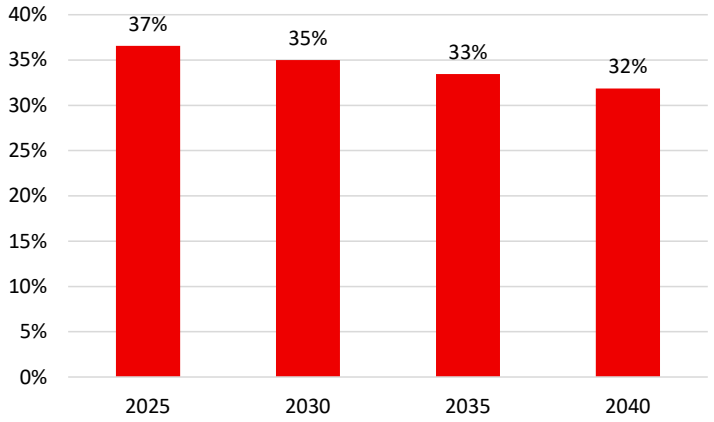


Figure 40 RES share in heating and cooling, WEM scenario

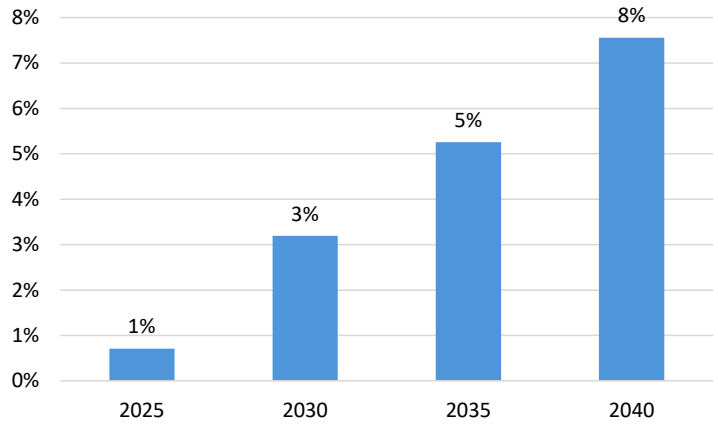


Figure 41 RES share in transport, WEM scenario

4.3. Dimension: Energy efficiency

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

Up until 2015, coal (primarily lignite) was the most dominant fuel in North Macedonia, accounting for an average of around 46% of primary energy consumption from 2010 to 2015. However, its share has been steadily decreasing due to reduced electricity production from lignite, and in 2016, coal was no longer the dominant fuel in primary energy consumption for the first time. On the other hand, the increasing number of vehicles, driven by transport policies and measures in North Macedonia, has led to a rise in the consumption of oil products, which now have the highest share from 2016 to 2023 (averaging 42%). Biomass consumption has remained stable throughout the analysed period. Additionally, there has been a significant increase in natural gas consumption from 2016 to 2023, driven by electricity production from gas-based combined heat and power (CHP) plants in North Macedonia (Figure 42).

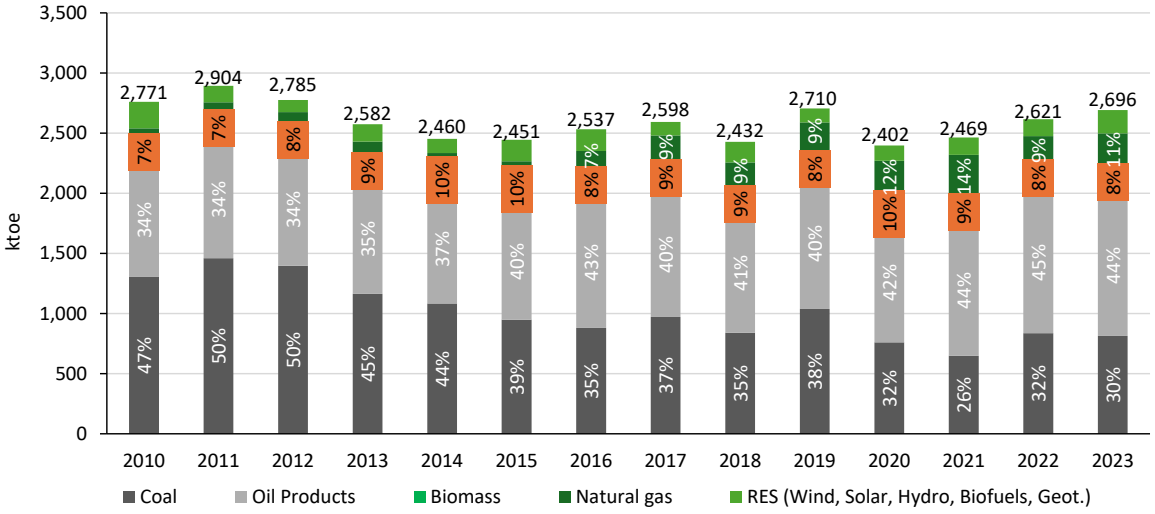


Figure 42 Primary energy consumption by fuels, 2010-2023

The final energy consumption remained stable between 2010 and 2023, except for two consumption peaks in 2019 and 2021, with values of 1,984 ktoe and 1,987 ktoe, respectively (Figure 43). As with primary energy consumption, the growing number of vehicles has made oil derivatives the dominant fuel (56% in 2023) in final energy consumption. After 2021, a trend of decreasing final consumption has emerged. The lowest consumption during this period (since 2021) was recorded in 2023, with 1,794 ktoe.

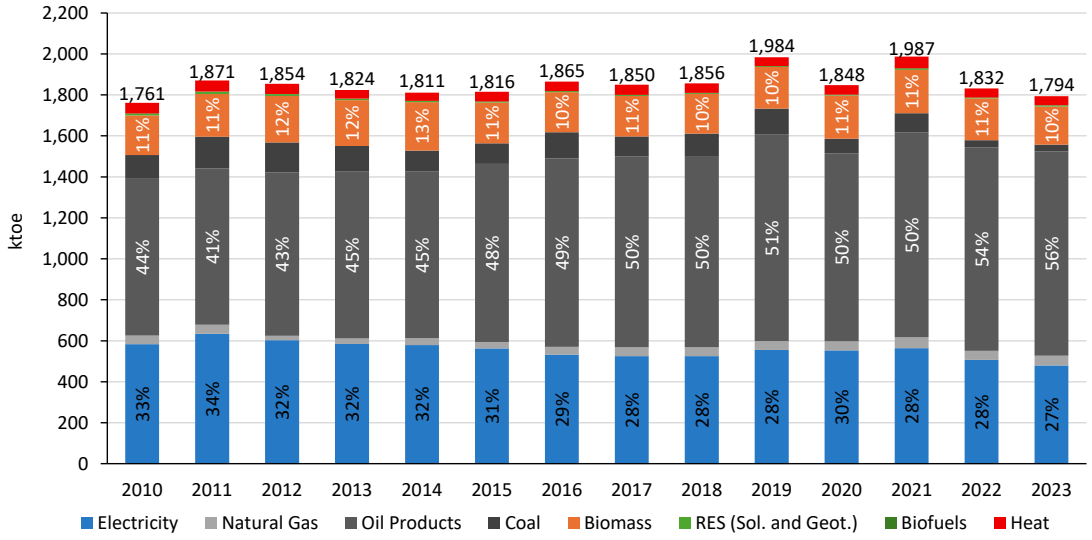


Figure 43 Final energy consumption by fuels, 2010-2023

The trends observed in primary and final energy consumption for the transport sector are further illustrated by the results from final energy consumption by sectors (Figure 44). It is evident that consumption in the transport sector has dramatically increased, accounting for 45% share of final energy consumption in 2023, which is 19% higher compared to 2010. In contrast, the industrial sector saw a 13% decrease in its share compared to 2010. The public and commercial, as well as the household sector, experienced slight reductions in their shares, by around 4% and 3%, respectively, relative to 2010.

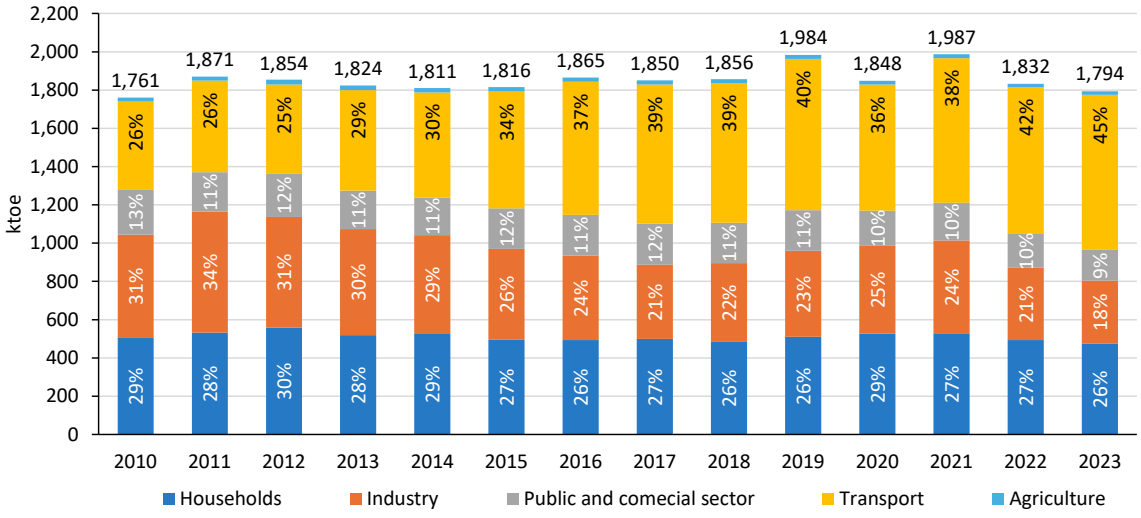


Figure 44 Final energy consumption by sectors, 2010-2023

ii. Current potential for the application of high-efficiency cogeneration and efficient district heating and cooling

The current consumption of heat energy through centralized heating systems amounted to about 50 ktoe. All heat energy is produced using natural gas, with around 68% of heat produced in cogeneration plants and around 32% in natural gas boiler houses.

In the coming period, an increase in heat production in CHP plants and a decrease in production in natural gas boilers is expected. The use of heat pumps and solar energy in heat production is also expected to increase by 2030 and beyond.

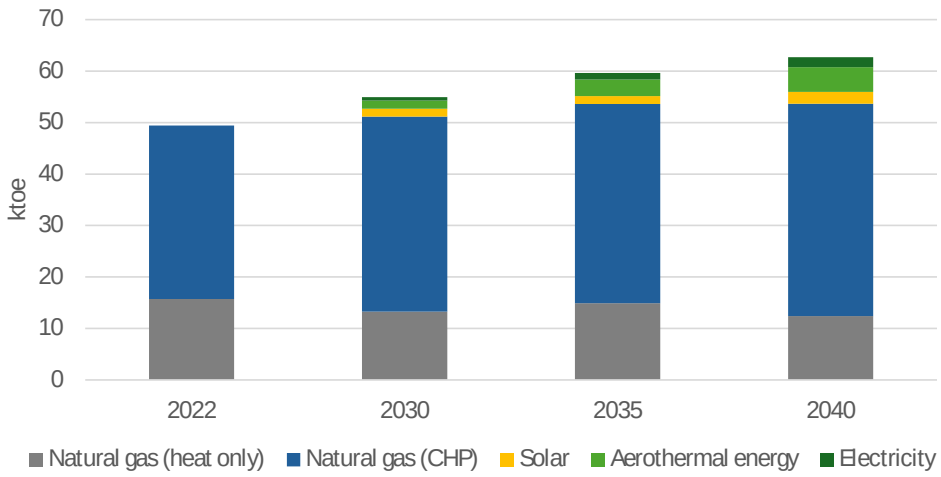


Figure 45 Structure of energy sources used for thermal energy production, 2022-2040

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 primary energy consumption is projected to increase by 19% by 2030 compared to 2023. In the same period the share of coal is expected to decline slightly, RES will increase their share for 4 percent points, and the share ofnatural gas in primary energy consumption will increase the most, by 12 percent points in 2030 compared to 2023.

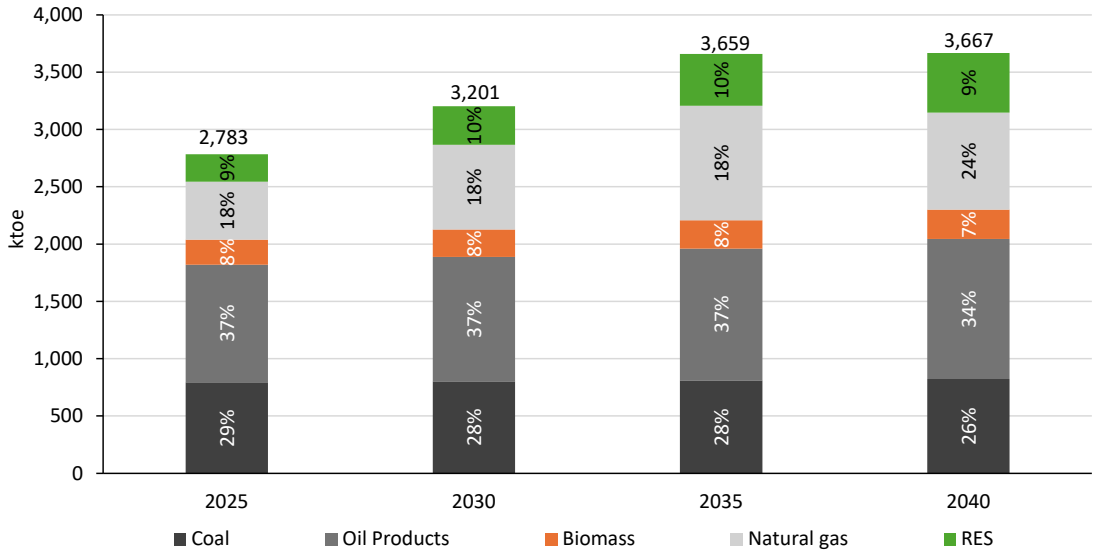


Figure 46 Projection of primary energy consumption (WEM scenario)

In the projections with existing policies and measures, around 44% increase in final energy consumption in the industrial sector is expected and a 33% rise in coal consumption by 2030 compared to 2023 (Figure 47 and Figure 48). Additionally, the electrification of the heating, cooling, and transport sectors will raise electricity consumption by 15% in 2030 compared to 2023. However, the electrification of the heating and cooling sectors, along with improvements in building performance, will prevent a significant increase in final energy consumption in the household sector, which is projected to grow by only 5% in 2030 relative to 2023.

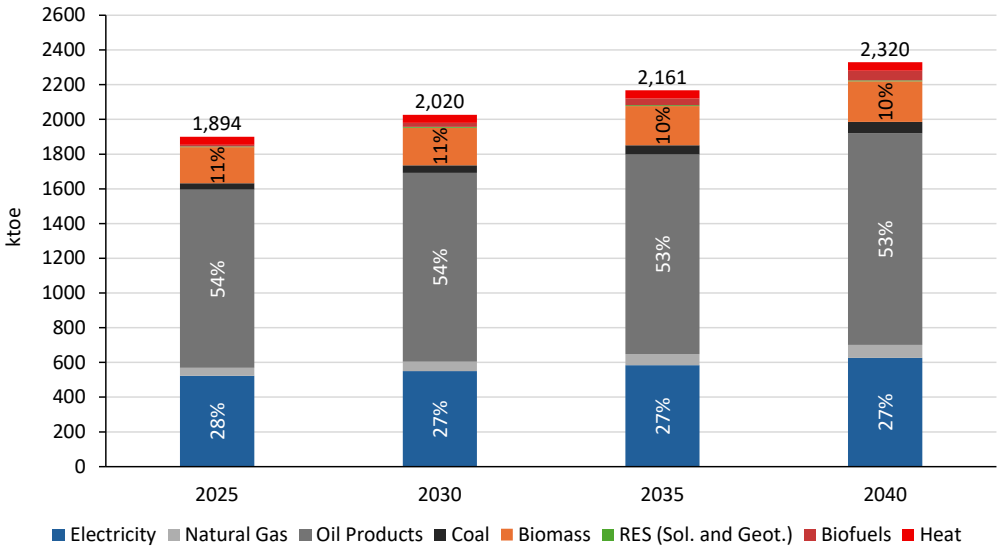


Figure 47 Projections of final energy consumption by fuels (WEM scenario)

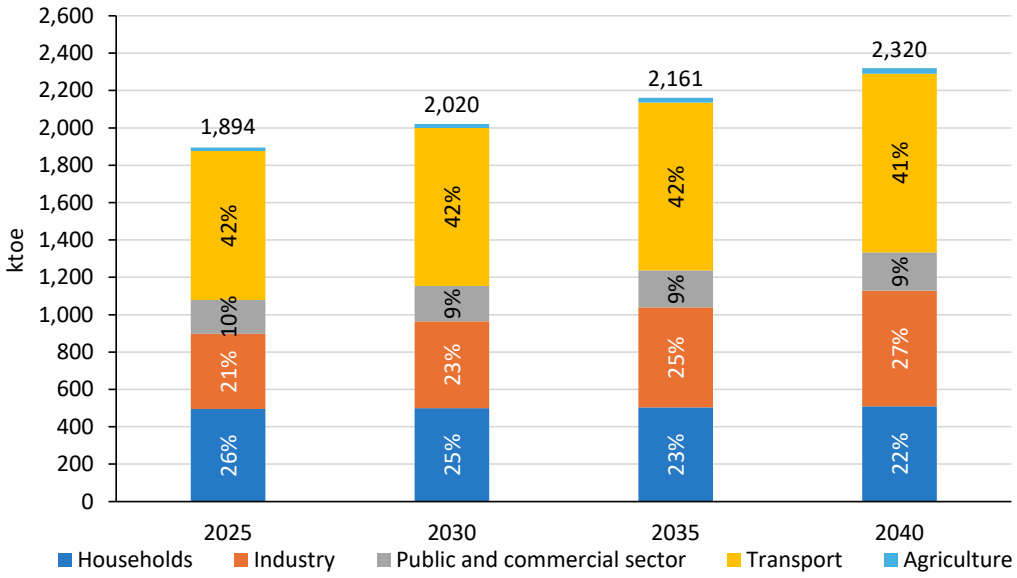


Figure 48 Projections of final energy consumption by sectors (WEM scenario)

iv. Cost-optimal levels of minimum energy performance requirements resulting from national calculations, in accordance with Article 5 of Directive 2010/31/EU

National calculations to determine the cost-optimal levels of minimum energy performance requirements in accordance with Article 5 of Directive 2010/31/EU have not yet been performed. Therefore, the measure PM_EE6: *Minimal energy performance standards and energy certificates for new and refurbished buildings* envisages firstly to perform these calculations, which will be a basis for adoption of the technical regulation.

4.4. Dimension: Energy security

i. Current energy mix, domestic energy resources, import dependency including relevant risks

The energy mix from domestic resources in North Macedonia is dominantly based on coal (lignite), biomass and, depending from the hydrology for electricity production from hydro power plants (Figure 49). It is obvious that there is a need for diversification of domestic resources, because of the dominant role that lignite plays in the system, which can be a potential risk in the near future in the absence of lignite or the introduction of CO_2 tax. Starting from 2011, the domestic production is reduced by 46% in 2023, mainly as a result of reduction of the electricity production from lignite.

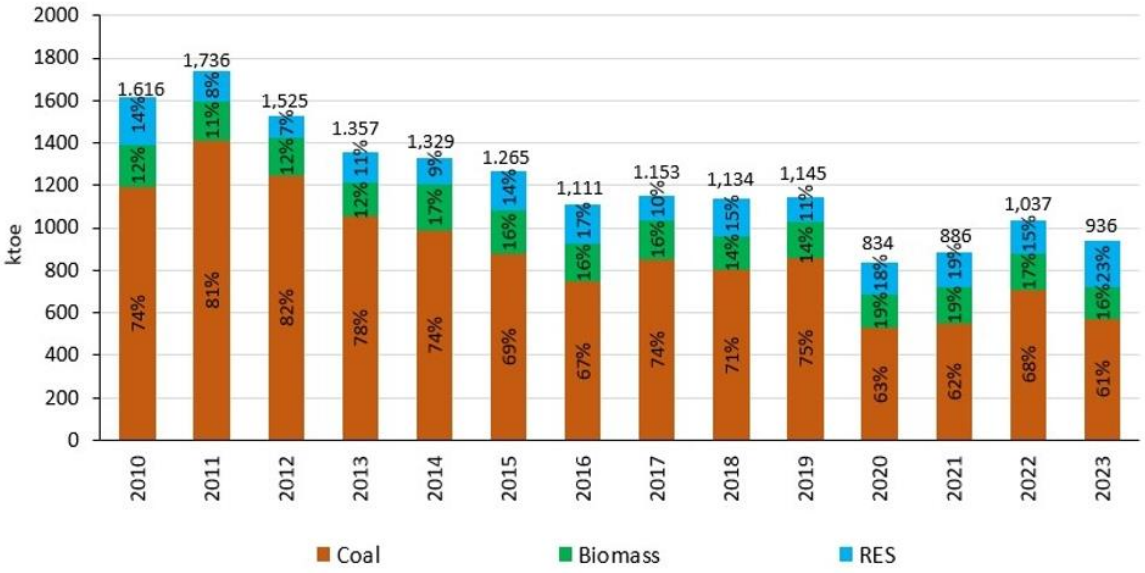


Figure 49 Current energy mix by domestic resources, 2010-2023

The overall import dependence has remained above 60% in the last four years of the analysed period, peaking at 68% in 2021 (Figure 50). In 2023, import dependence was 63%, which is around 19 percentage points higher than in 2010. If this already high level of import dependence continues to rise, it could pose a risk as it may impact the financial market and the overall economy.

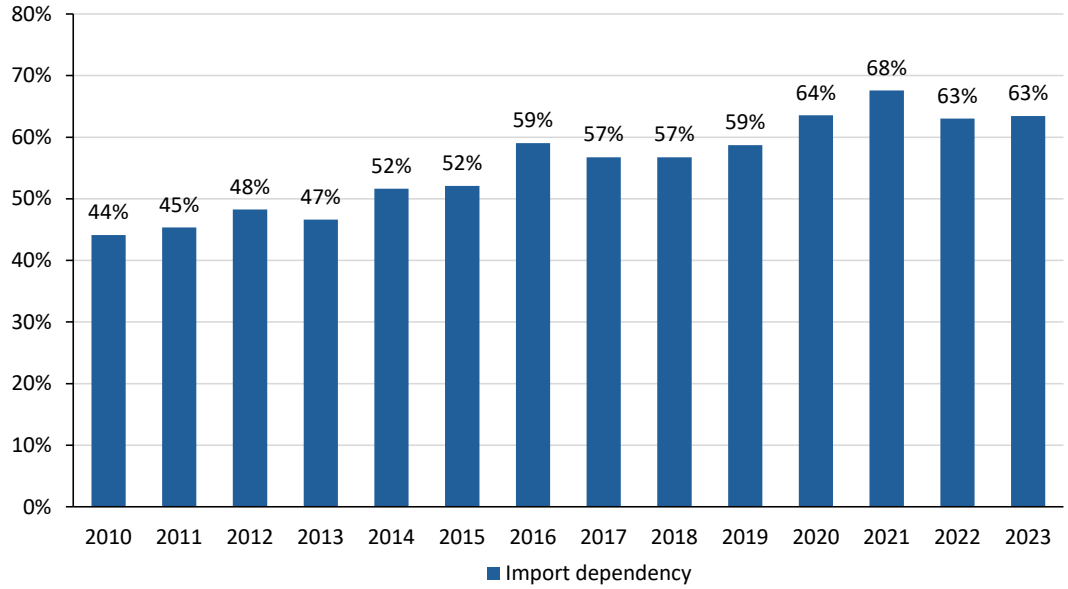


Figure 50 Import dependency (2010-2023)

ii. Projections of development with existing policies and measures at least until 2040 (including for the year 2030)

The projection of domestic production indicates an increase in production, with the largest contributions coming from solar and wind power. Although domestic production is increasing, import dependency is expected to stay at similar levels as in 2023. The main reason for this trend is the growing energy demand in North Macedonia (as presented in Chapter 4.1), which outpaces the increase in domestic production (Figure 51).

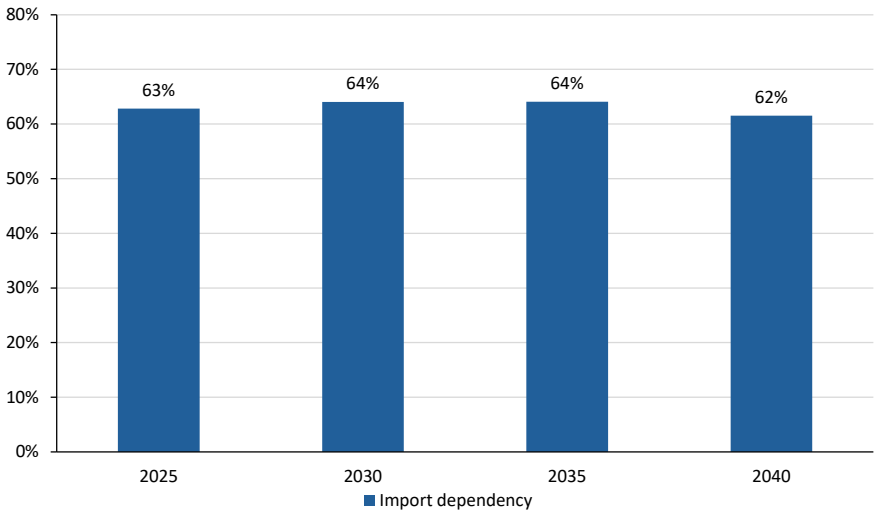


Figure 51 Projection of the import dependency

4.5. Dimension: Internal energy market

4.5.1. Electricity interconnectivity

i. Current interconnection level and main interconnectors

The Republic of North Macedonia's electricity transmission system is well connected with the systems of the neighbouring countries on 400 kV and 110 kV voltage levels (Figure 77). There are five interconnections at 400 kV with:

- Serbia (SS Stip 1 –SS Vranje 4), with length of 70.2 km, started in operation in 2015
- Greece (SS Bitola 2 –SS Meliti), with length of 17.3 km, started in operation 2007
- Greece (SS Dubrovo –SS Thessaloniki), with length of 54.7 km, started in operation 1978
- Kosovo (SS Skopje 5 –SS Ferizaj), with length of 22.7 km, started in operation 1978
- Bulgaria (SS Stip 1 –SS Mogila), with length of 71.3 km, started in operation 2009

Additionally, there are 2 interconnectors at 100 kV, with Bulgaria:

- SS K. Palanka –SS Skakavitsa, with length of 12.8 km, started in operation 1994 and
- SS Susitsa –SS Petric, with length of 11.1 km, started in operation 1979

ii. Projections of interconnector expansion requirements (including for the year 2030)

The Republic of North Macedonia is connected to all neighboring countries except to Albania. For that purpose, MEPSO in February 2020 has signed an agreement for the construction of a 400 kV transmission line that will enable the connection of electricity transmission systems of Albania and Macedonia. This transmission line is of particular importance not only for the Republic of North Macedonia, but also for the entire region and it is part of the PECI list. It will enable connection between Bulgaria, Albania and through Montenegro with Italy.

4.5.2. Energy transmission infrastructure

i. Key characteristics of the existing transmission infrastructure for electricity and gas

The overall electricity transmission network consists of 577 km of 440 kV and 1,601 km of 110 kV lines. The Republic of North Macedonia's transmission system operator (MEPSO) manages the 2,122 km lines. The 400 kV lines form a ring and connect the largest producer of electricity, TPP Bitola, the direct consumers, as well as connect North Macedonia with neighbouring countries. The 110 kV is well developed and connects large hydro power plants, TPP Negotino, and other producers with all urban and industrial areas. The connection between 400 kV and 110 kV is realized through five transformation stations SS Skopje 4, SS Skopje 5, SS Bitola 2, SS Dubrovo and SS Stip.

Although the network is well maintained, strengthening of the grid and increasing its stability and reliability is required, especially in the circumstances of increased intermittent production from variable renewable energy sources (primarily solar and wind).

Regarding the gas transmission infrastructure, North Macedonia has only one interconnection gas pipeline, with the Republic of Bulgaria. Interconnectors with all neighbouring countries are being planned.

ii. Projections of network expansion requirements at least until 2040 (including for the year 2030)

Electricity transmission network projects in the period between 2025 and 2040 are listed in the following table.

Table 15 Electricity transmission network projects from 2025 to 2040

Period	Line	Length (km)
2025-2030	Sopotnica-Bitola	30,7
	Kicevo-Sopotnica	33,3
	Oslomej-Kicevo	15
	Oslomej-Gostivar	36,5
	Strumica 1-Strumica 2	1,9
	Valandovo-Strumica 2	15,6
	Miletkovo -Valandovo	39,3
2030-2035	Gostivar-Jegunovce	36,9
	Vrutok - Gostivar	8,3
	Vrutok-Spilje	45,6
	Globocica-Struga	32,4
	Vrutok-Polog	15,3
	Spilje-Globocica	13,5
	Gorce Petrov-Skopje 1	11,1
	Skopje3-Gorce Petrov	20,8
2035-2040	Stip1-Kocani	27,8
	Stip 1-Stip 2	5,4
	Radovis-Berovo	38,3
	Bucim-Radovis	10,5
	Kratovo-Probistip	17,5
	Kratovo-Kumanovo 1	33,5
	Stip 2- Bucim	21,8

4.5.3. Electricity and gas markets, energy prices

i. Current situation of electricity and gas markets including energy prices

The Republic of North Macedonia's **electricity market** consists of several key participants: electricity producers, the transmission system operator (TSO), distribution system operators (DSOs), electricity suppliers, and electricity consumers.

Electricity generation in North Macedonia is dominated by Elektrani na Severna Makedonija (ESM), the state-owned utility, which operates the majority of the country's power plants. ESM primarily produces electricity from thermal (coal) power plants, hydroelectric plants, and renewable sources such as wind and solar. Despite the heavy reliance on coal-fired generation, which presents environmental concerns, there has been an increasing push to diversify the energy mix by incorporating more renewable energy sources.

In addition to ESM, other private companies have been active in generating electricity from renewable sources. The government has been actively encouraging investment in renewable energy projects, especially in wind, solar, and biomass, through feed-in tariffs and other incentives. This shift is in line with North Macedonia's obligations under the EU's renewable energy targets.

The transmission of electricity in North Macedonia is managed by MEPSO (Macedonian Transmission System Operator), a state-owned company that operates the high-voltage transmission grid. MEPSO is responsible for maintaining grid stability, ensuring reliable electricity transmission, and facilitating the integration of renewable energy into the grid. The company also plays a key role in market operations, providing services related to balancing, ancillary services, and interconnection with neighbouring countries. The country is connected to all neighbouring countries except Albania, and MEPSO coordinates cross-border electricity trade.

Electricity distribution in North Macedonia is managed by EVN North Macedonia, a subsidiary of the Austrian utility company EVN Group. EVN North Macedonia operates the low- and medium-voltage distribution networks in the country, ensuring that electricity is delivered to end consumers. It is responsible for meter reading, billing, and customer service in the distribution network.

Electricity suppliers in North Macedonia are responsible for selling electricity to consumers. These suppliers purchase electricity from the wholesale market and then sell it to end-users at regulated or market-based prices. Since the market is in the process of liberalization, the government and the Energy Regulatory Commission have been working to open the retail electricity market to competition. As of now, large consumers are free to choose their electricity suppliers, while small consumers still receive electricity from the regulated electricity market.

There are several electricity suppliers in the market, and the competition among them is expected to grow in the coming years as the market continues to liberalize.

Electricity consumers in North Macedonia include households, businesses, and industrial consumers. Household consumers have been shielded from market volatility through regulated electricity tariffs, while larger consumers are increasingly exposed to market-based pricing. The government has implemented policies to protect vulnerable consumers from sudden price hikes. In the future, as the retail market opens up further, consumers will have more choice and flexibility regarding their electricity supplier, which is expected to lead to greater market efficiency.

The electricity market in North Macedonia is undergoing a gradual process of liberalization and restructuring. The market can be divided into several key segments: wholesale market, retail market, balancing market, capacity mechanisms and renewables.

The wholesale market is operated by the North Macedonian Electricity Market Operator (MEMO). It is still largely based on long-term bilateral contracts. The introduction of an intra-day market is underway, to improve price transparency, market efficiency, and the integration of renewable energy.

The retail market is still largely regulated, with electricity prices determined by the Universal Supplier and approved by the Energy Regulatory Commission. The retail market is becoming more competitive for large consumers, who can choose between different electricity suppliers. The government has committed to opening the retail market further, which will lead to more competitive pricing for consumers.

The balancing market is essential for maintaining the reliability and stability of the grid. It allows market participants to buy and sell electricity to correct imbalances between supply and demand. The balancing market in North Macedonia is still developing, but MEPSO plays a key role in ensuring that the market operates efficiently.

Given the intermittent nature of renewable energy, especially solar and wind, capacity mechanisms are being explored to ensure that sufficient backup generation is available when renewable output is low. These mechanisms are designed to incentivize the construction of flexible and reliable generation capacity.

Below, the average electricity prices for households (Table 16) and non-household consumers (Table 17) are shown.

Table 16 Average electricity prices for households (source: ERC)

End-user consumer bands	Annual electricity consumption in KWh		Prices including VAT, in denars /KWh	Prices in denars/KWh					Indices for prices including VAT
				energy and supply	network costs		VAT excluded	VAT included	
					transmission	distribution			
	lowest	highest	VII-XII 2023	I-VI 2024					I-VI 2024 / VII-XII 2023
D1	< 1 000		7,178	9,221	0,294	2,010	11,524	12,676	176.6
D2	1 000	< 2 500	7,145	4,115	0,294	2,010	6,418	7,060	98.8
D3	2 500	< 5 000	7,129	3,501	0,294	2,010	5,804	6,384	89.6
D4	5 000	< 15 000	7,202	3,416	0,294	2,010	5,719	6,291	87.3
D5	>= 15 000		8,366	4,795	0,294	2,010	7,098	7,808	93.3
average			7,289	3,719	0,294	2,010	6,023	6,625	90.9

Table 17 Average electricity prices for non-households (source: ERC)

End-user consumer bands	Annual electricity consumption in MWh		Prices including VAT, in denars /KWh	Prices in denars/KWh					Indices for prices including VAT
				energy and supply	network costs		VAT excluded	VAT included	
					transmission	distribution			
	lowest	highest	VII-XII 2023	I-VI 2024					I-VI 2024 / VII-XII 2023
I1	< 20		12,393	8,899	0,297	1,813	11,010	12,992	88.8
I2	20	8,106	8,106	6,467	0,309	0,342	7,119	8,400	87.8
I3	500	7,185	7,185	5,723	0,314	0,153	6,190	7,304	86.2
I4	2 000	7,159	7,159	5,624	0,313	0,100	6,037	7,124	84.3
I5	20 000	7,212	7,212	4,749	0,309	0,005	5,064	5,975	70.2
I6	70 000	6,756	6,756	4,791	0,301	0,000	5,092	6,009	75.4
I7	>= 150 000		6,796	4,312	0,300	0,249	4,860	5,735	71.5

The **natural gas market** in North Macedonia is still in the early stages of development. The majority of natural gas in North Macedonia is supplied by Makpetrol, a state-owned company that operates in the wholesale gas supply market. It imports natural gas from Russia via the Trans-Balkan pipeline and distributes it to large industrial consumers and the distribution network. There are also smaller gas suppliers that import and distribute natural gas to specific areas.

NOMAGAS is a Joint stock company for performing energy activity natural gas transmission. It plays a key role in the development and operation of the national gas infrastructure. NOMAGAS is responsible for building and maintaining the gas network, as well as ensuring that the infrastructure is safe, efficient, and sustainable. The company operates under the regulatory framework established by the Energy Regulatory Commission of North Macedonia, which governs energy markets and ensures the reliable and fair supply of energy resources.

The average electricity prices for households (Table 18Table 16) and non-household consumers (Table 19) are shown below.

Table 18 Average gas prices for household consumers (source: ERC)

End-user consumer bands	Annual gas consumption in GJ		Prices in denars/GJ				
			energy and supply	network costs		VAT excluded	VAT included
				transmission	distribution		
	lowest	highest	I-VI 2024				
D1	< 20		1332,961	10,343	102,581	1445,885	1706,144
D2	20	1295,679	15,567	105,091	1400,770	1652,909	1295,679
D3	≥ 200		-	-	-	-	-

Table 19 Average gas prices for non-household consumers (source: ERC)

End-user consumer bands	Annual gas consumption in GJ		Prices including VAT, in denars /GJ	Prices in denars/KWh					Indices for prices including VAT
				energy and supply	network costs		VAT excluded	VAT included	
					transmission	distribution			
	lowest	highest	VII-XII 2023	I-VI 2024					I-VI 2024 ---------- VII-XII 2023
I1	< 1000		1237,803	1118,598	40,583	49,452	1208,634	1426,188	97,6
I2	1000	< 10 000	1018,462	902,145	39,806	18,226	960,176	1133,008	94,3
I3	10 000	< 100 000	994,227	780,294	39,222	1,353	820,870	968,627	82,6
I4	100 000	< 1 000 000	944,583	747,309	38,889	-	786,198	927,714	83,2
I5	1 000 000	< 4 000 000	-	-	-	-	-	-	-

4.6. Dimension: Research, innovation and competitiveness

i. Current situation in the low-carbon-technologies sector and, to the extent possible, its position on the global market (that analysis has to be carried out at Union or global level)

The main pillar of the energy union's 5th pillar on research, innovation and competitiveness is the European Strategic Energy Technology Plan (SET Plan). SET Plan coordinates research and innovation efforts across member states and helps finance projects. The SET Plan focuses on improving new technologies and reducing their costs through coordinated national research.

- The SET Plan activities are clustered into 10 actions for research and innovation:
- Integrating renewable technologies in the energy systems
- Reducing costs of technologies
- New technologies and services for consumers
- Resilience and security of energy systems
- New materials and technologies for buildings
- Energy efficiency for the industry
- Competitiveness in the global battery sector and e-mobility
- Renewable fuels and bioenergy
- Carbon capture and storage
- Nuclear safety

Following the Communication on the revision of the SET Plan[29], 5 temporary task forces have been established. They will operate between 2025 – 2027, and will provide recommendations to the SET Plan community to better integrate several topics into their work, namely:

- Circularity and materials substitution
- R&I for societal needs
- Digitalisation
- Skills
- Access to market.

The Republic of North Macedonia has not yet joined the EU, it is therefore not a member of SET Plan and the energy union priority technologies they haven't been streamlined into national research and innovation policies.

Smart Specialization Strategy 2024-2027 adopted in 2023 stipulates "Energy for future" as a horizontal domain, due to its strong cross-sectoral relations with other proposed priority areas and in line with the process of greening the industry and protecting the environment.

The S3 strategy identifies the following existing capacities, that can be aligned with energy union priority technologies:

- Batteries[30] (currently only starting lead batteries)
- Innovative tailor-made construction products[31]

The following opportunities aligned with energy union priority technologies have been identified in the EDP:

[29] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023DC0634

[30] S3: "Electro-Mechanical Industry"; Energy Union: "Sustainable transport"

[31] S3: „Sustainable Materials and Smart Buildings"; Energy Union: „Thermal performance of building"

- Bio-economy and energy from biological waste[32]
- Production of thermal solar panels, photovoltaic panels and pellet stoves[33]
- Energy efficiency and renewable energy solutions integrated in buildings[31, 34]
- IoT devices and solutions for smart buildings and smart cities[35]
- Smart building technologies[35].

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

Current level of public funding for research and development is low, around 0,4% of GDP[36]. The Smart Specialization Strategy sets the target value of 1% in 2027, but no specific target related to low carbon technologies has been specified.

iii. Breakdown of current price elements that make up the main three prices components (energy, network and taxes/levies)

Electricity price consists of the price of electricity purchased in the liberalised market, of the network tariffs and of the taxes and levies imposed. In 2023, these shares were[37]:

- Electricity price: 51.09%,
- Network tariffs (transmission & distribution): 37.6%,
- Taxes and levies: 11.31%.

iv. Description of energy subsidies including fossil fuels

As electricity generation from coal and lignite makes up a significant share of electricity production in the Energy Community, the Energy Community Secretariat publishes bi-annual reports on direct subsidies provided to coal and lignite electricity generation in the Energy Community. The subsidies are classified into fiscal support subsidies, public finance support subsidies and state-owned enterprises investment subsidies.

The most recent report covers the period of 2021 and 2022[38]. In North Macedonia, the only subsidy to the coal fired generation offered in this period was public finance support, in the form of two state loan guarantees for the modernization of TPP Bitola.

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[32] S3: "Smart agriculture and food with higher added value"; Energy Union: "No 1 in Renewables" (Bioenergy, Advanced biofuels, Sustainable biofuels), "Sustainable transport" (Advanced biofuels)

[33] S3: Electro-Mechanical Industry"; Energy Union: "No 1 in Renewables" (Photovoltaics)

[34] S3: „Sustainable Materials and Smart Buildings"; Energy Union: „Energy efficiency" (Integration of renewables in buildings

[35] S3: „Sustainable Materials and Smart Buildings"; Energy Union: „Smart Systems" (Building/home energy management systems)

[36] https://enlargement.ec.europa.eu/document/download/5f0c9185-ce46-46fc-bf44-82318ab47e88_en?filename=North%20Macedonia%20Report%202024.pdf

[37] Source: Annual Report of the Energy and Water Services Regulatory Commission of the Republic of North Macedonia for 2023, https://erc.org.mk/odluki/ANNUAL%20REPORT%20for%202023%20-ERC.pdf

[38]https://www.energy-community.org/dam/jcr:1a15066f-1c55-44ae-8ca0-34ef37ff6999/Final%20report%20Dijana%20Ristovic-28.09.2023.pdf

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 year 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)

Projections of the most important energy and climate indicators, according to WAM scenario, are presented below:

- The expected overall reduction in greenhouse gas emissions is from 37% by 2030, compared to 1990 levels.
- Final energy consumption of 78.3 PJ and primary energy consumption of 100.5 PJ in 2030 is expected.
- The rate of building renovation increases from 1.1% to 3% until 2030.
- The penetration of electric and plug-in hybrid vehicles, whose share in vehicle sales reaches 30% in 2030, is expected (includes newly acquired and first-time registered second-hand vehicles).
- Increase in the share of renewable energy sources in gross final energy consumption to 31.6% by 2030.
- Decarbonisation of electricity production by increasing the share of renewable energy sources to 51.2% by 2030.

Increasing energy efficiency is strongly present in all consumption sectors, with the most substantial effects expected in the building sector and transport.

In the WAM scenario, primary energy consumption is reduced by 22% compared to the WEM scenario in 2030. Notably, coal drops to below 1% of the energy mix by that year (Figure 52), indicating an almost complete phase-out. At the same time, natural gas and RES increase their shares.

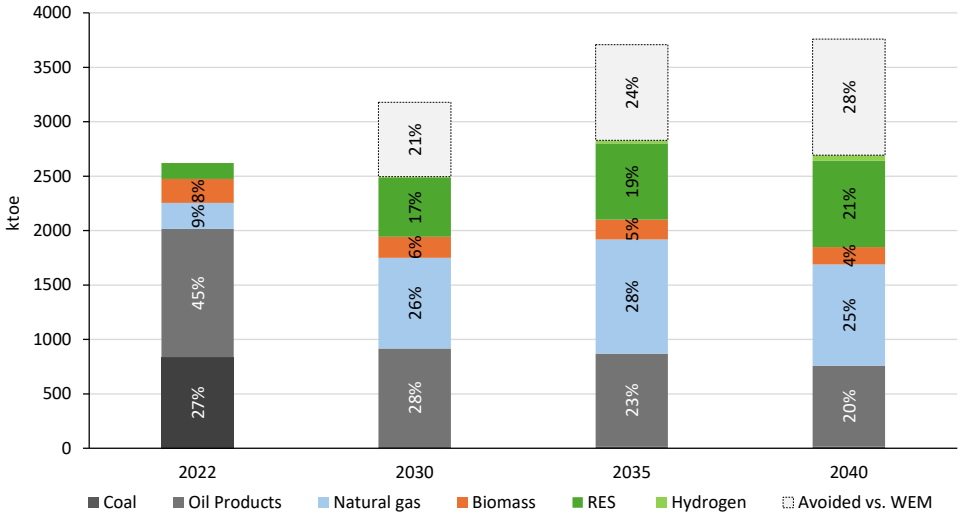

Figure 52 Projection of primary energy consumption (WAM and WEM comparison)

In the WAM scenario, final energy consumption in 2030 is 10% lower compared to the same year under the WEM scenario (Figure 53) and the difference is expected to reach 25% by 2040.

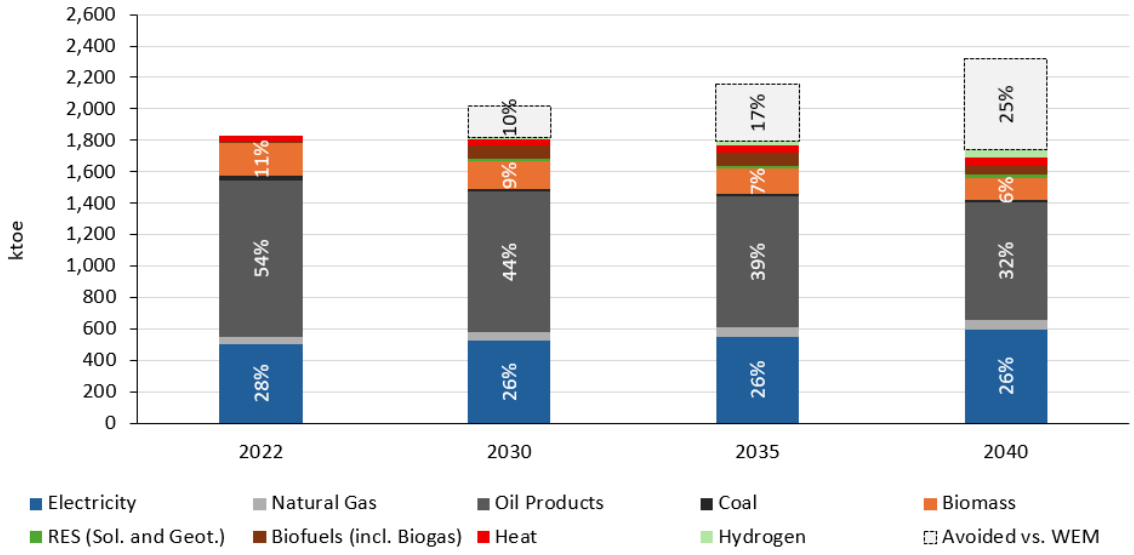

Figure 53 Projections of final energy consumption by fuels (WAM and WEM comparison)

From a sectoral perspective, the transport sector and the public and commercial sector (service sector) show a decrease in their share in 2030 compared to the WEM scenario.

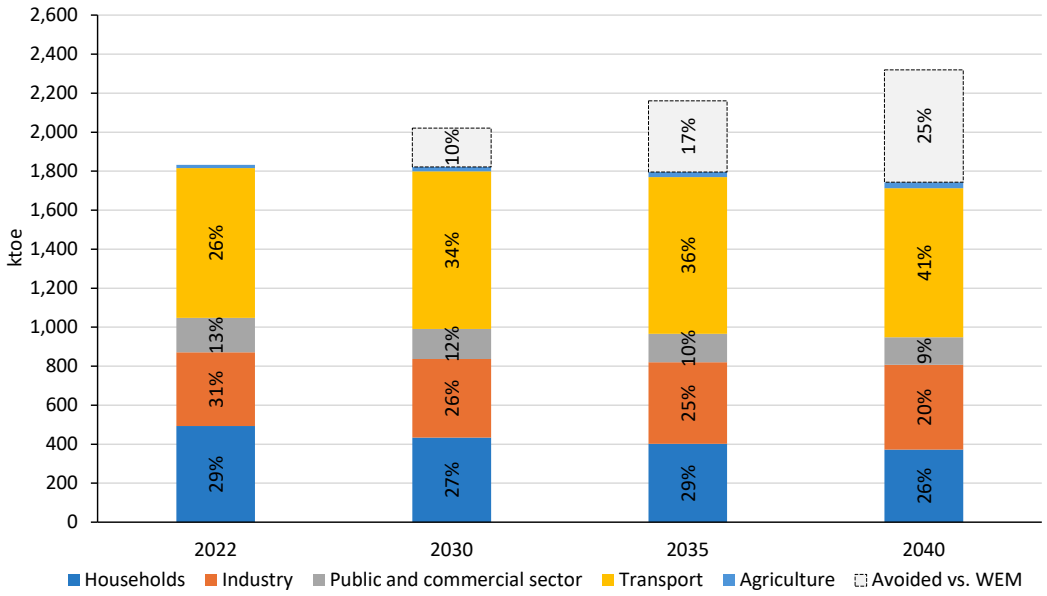

Figure 54 Projections of final energy consumption by sectors (WAM and WEM comparison)

When individual sectors are observed, the industry sector records a 13% lower final energy consumption in 2030 compared to the WEM scenario.

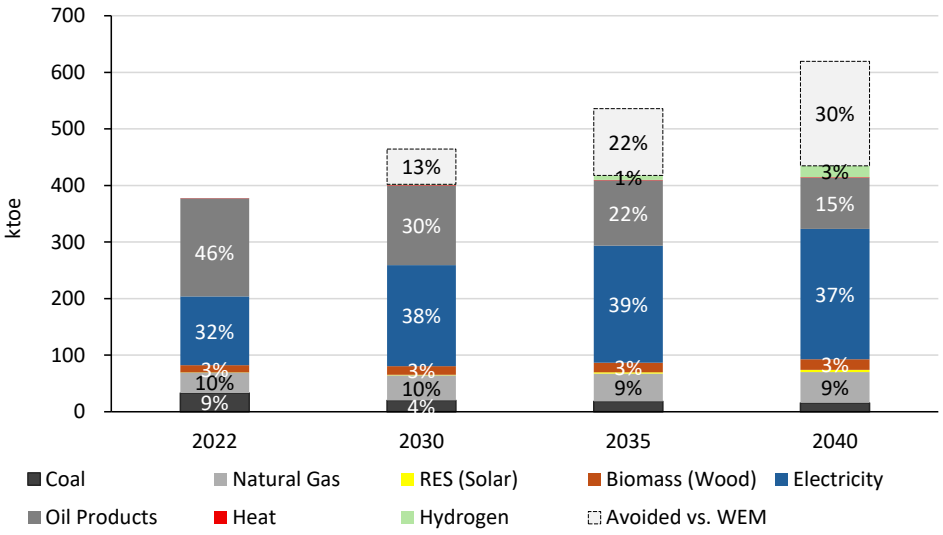

Figure 55 Projections of energy consumption in industry (WAM and WEM comparison)

In the transport sector, final energy consumption in 2030 is 4% lower compared to the WEM scenario. This is also the sector with the smallest reduction in consumption relative to the WEM projections.

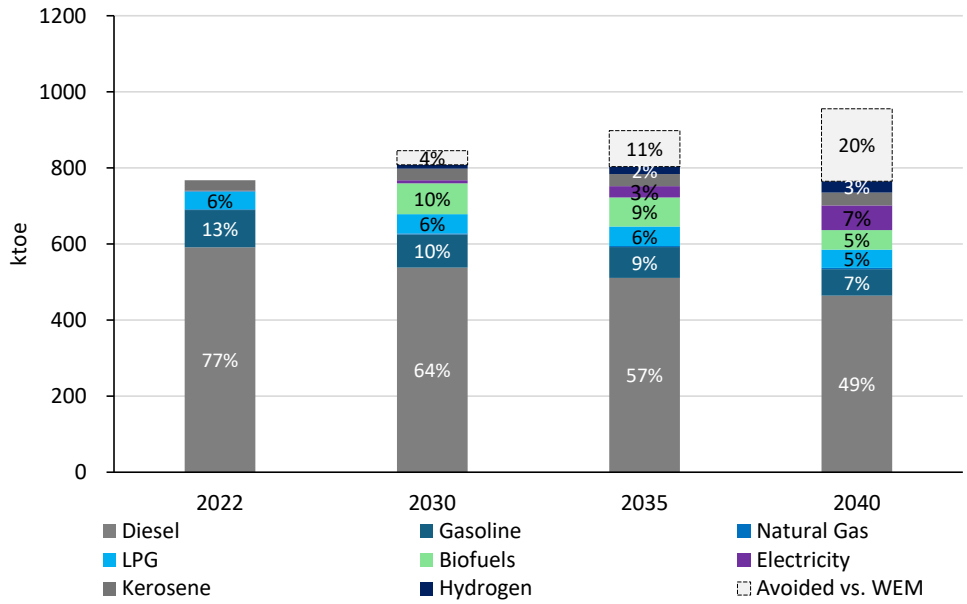

Figure 56 Projections of energy consumption in transport sector (WAM and WEM comparison)

In the public and commercial sector (service sector), final energy consumption is 18% lower, making it the sector with the highest reduction in consumption compared to the WEM projections.

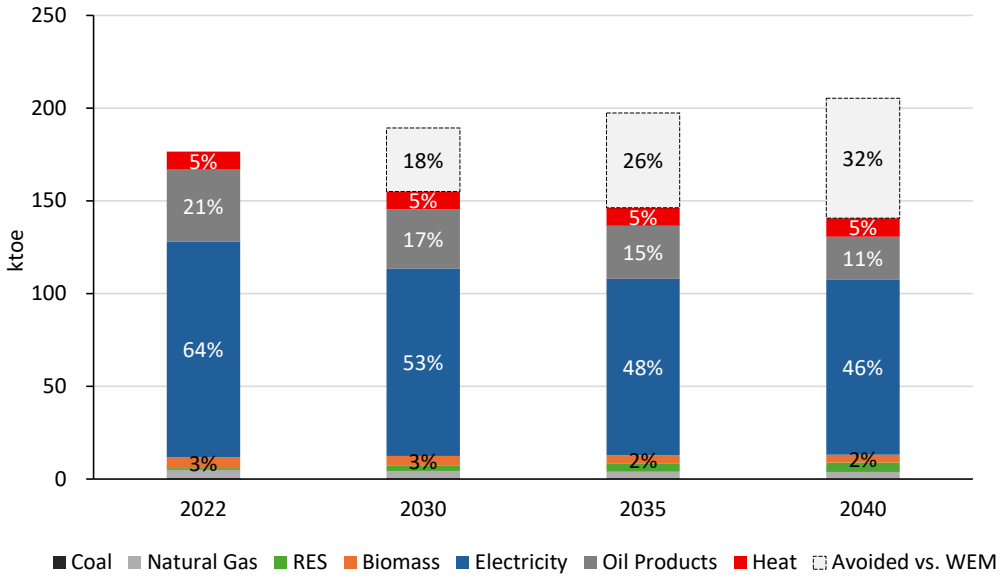

Figure 57 Projections of energy consumption in service sector (WAM and WEM comparison)

Like all other sectors, the residential sector also records lower final energy consumption in the WAM scenario. In this case, consumption is 13% lower compared to the WEM scenario in 2030.

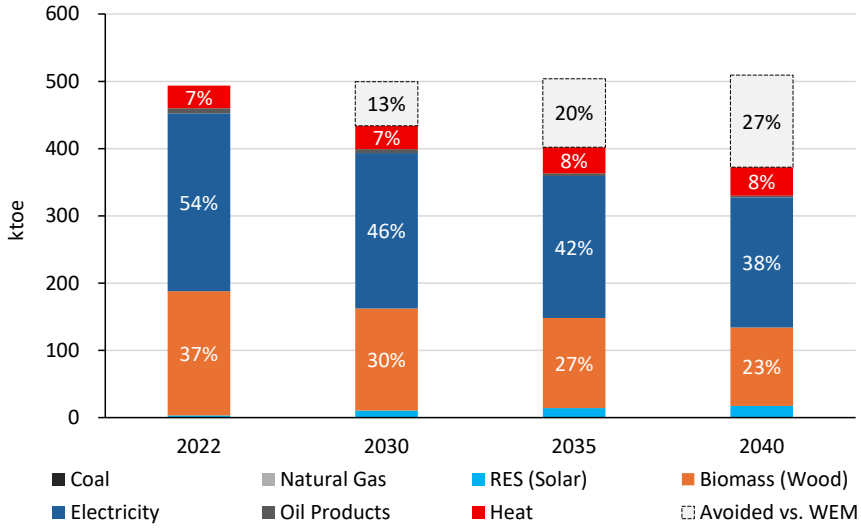

Figure 58 Projections of energy consumption in residential sector (WAM and WEM comparison)

The expected structure of power plant capacities is shown in Figure 59 (capacities are indicative, and some variation among individual RES technologies is anticipated). The development of individual technologies will depend on the state of the market at a particular moment, and it is possible that certain RES technologies will develop more rapidly than projected during one period, and more slowly in another period. However, it is necessary that the capacities of all RES technologies be developed sufficiently to achieve the target share of renewable energy in the gross final consumption of electricity. Bearing this goal in mind, with regard to the locations and capacity of electricity production, it is crucial to take into account the capacities of the distribution and transmission power network, that is, the significantly increased amounts of investment in the construction of the necessary reinforcements of the network and the possibilities of their timely realization. Therefore, it is necessary to maximally encourage the use of already existing electricity infrastructure, and the production of electricity integrated within built-up areas, in capacities appropriate to the energy needs near the location of production.

According to the WAM scenario, the total installed capacity is expected to increase by almost 2,000 MW by 2030, with the largest increase expected for solar power plants.

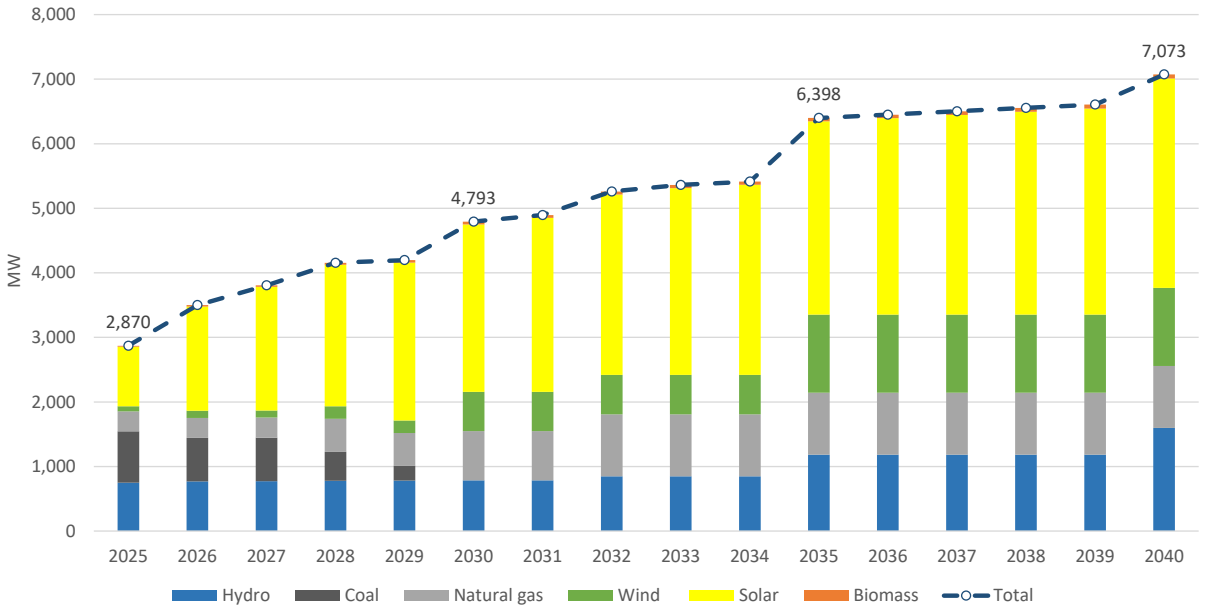

Figure 59 Estimated power plants capacities, by technology (WAM scenario)

In accordance with the increase in installed power capacity, electricity production will increase to almost 11 TWh by 2030, whereby the share of energy produced from renewable sources will increase significantly.

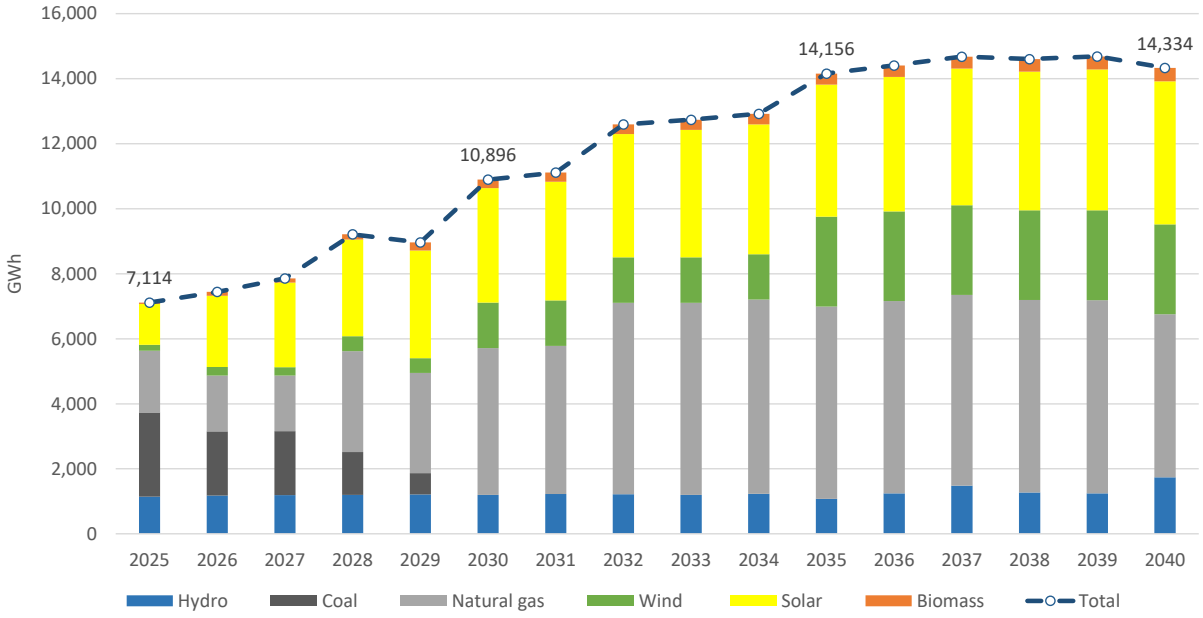

Figure 60 Projection of electricity production, by technology (WAM scenario)

Projections of greenhouse gas emissions from mobile and stationary energy sources are presented in Figure 61

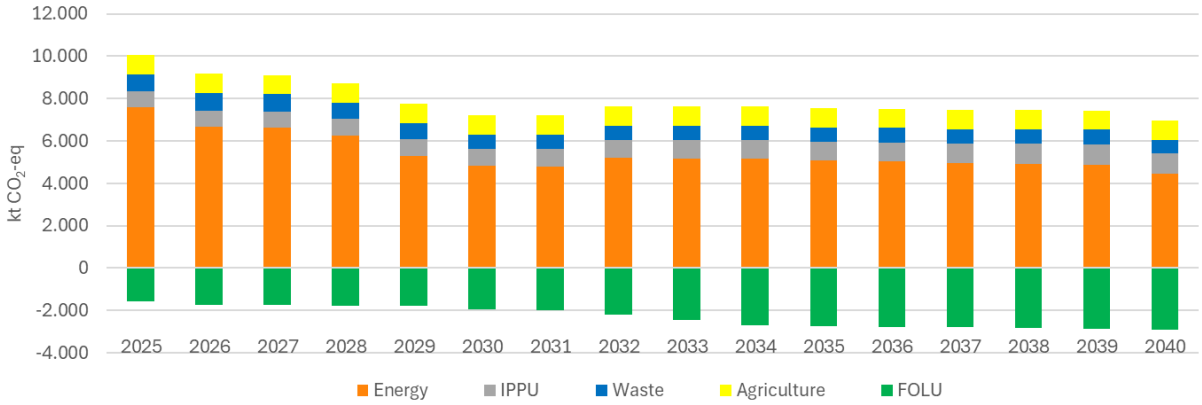

Figure 61 GHG emission sectoral breakdown, WAM scenario 2025 - 2040

The scenario with existing measures (WEM) and the scenario with additional measures (WAM) are shown in Figure 62

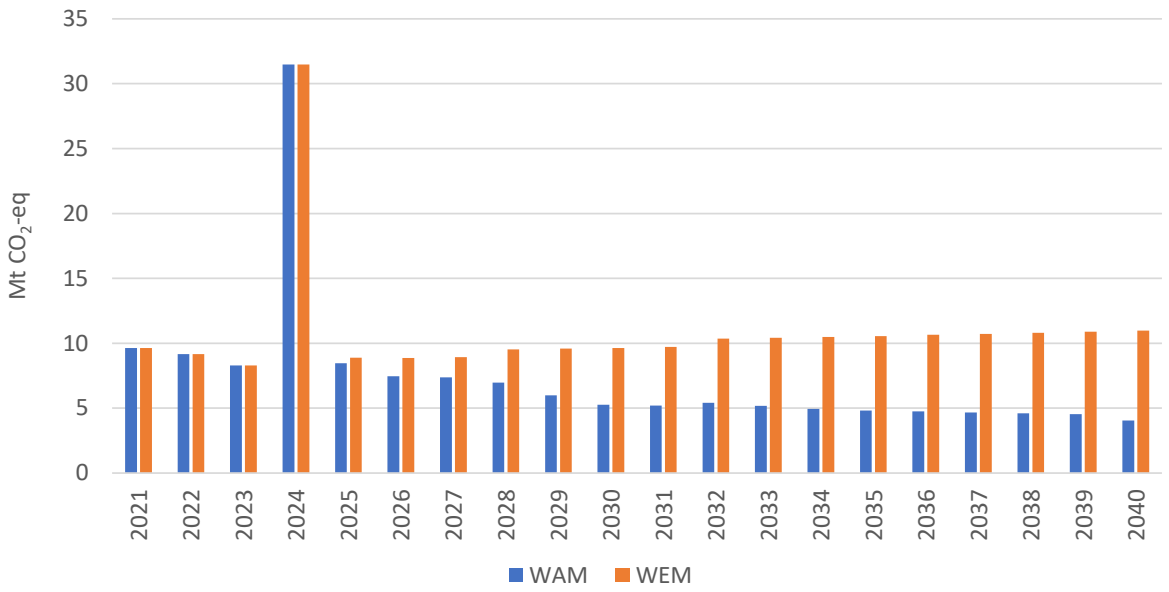

Figure 62 Greenhouse gas emissions projections for WEM and WAM scenario, Mt CO_{2eq}

Table 20 shows the impact of the planned policies and measures on GHG emissions, e.g. the difference in emissions between WAM and WEM scenario in 2030, 2035 and 2040, for all GHG emission sectors. It must be noted that due to the specifics of the IPPU sector (GHG emissions are resulting from chemical and physical processes and relying on production data and process-specific emission factors and are therefore highly technology- and material-specific) only one scenario has been developed, with no differences between the WEM and WAM scenarios. This simplification will have no consequences for setting and achieving the 2030 target, however until preparing the NECP for the period beyond 2030 a new national industrial strategy will be necessary to be able to model future GHG emissions from the IPPU sector. For this reason, the table below does not contain impacts of planned policies and measures on GHG emissions from the IPPU sector.

Table 20 The impact of planned policies and measures on GHG emissions

CO_2 e emission reductions (kt)	2030	2035	2040
Energy	3,935	4,503	5,447
Agriculture (excl. FOLU)	200	252	357
FOLU	19	36	36
Waste	224	947	1,102
Total emission reduction	**4,378**	**5,739**	**6,943**

The energy sector is expected to remain the primary source of GHG emissions, but it also shows the most significant reduction potential. By 2030, emissions are projected to decline to 4,817 kt CO_2-eq, driven by a comprehensive coal phase-out strategy. This includes the decommissioning of TPP Oslomej and TPP Bitola by 2030. Replacement capacities are expected to be installed in gas fired CHP plants, solar PV and wind power plants. Grid modernization and the introduction of stationary battery storage further support renewable integration. Additionally, the electrification of transport, expansion of biofuels, and enhanced energy efficiency in buildings and industries are crucial contributors. By 2040, energy sector emissions are expected to decline further to 4,459 kt CO_2-eq.

IPPU emissions are projected to increase to 821 kt by 2030, reaching 967 kt by 2040, reflecting industrial growth. In the future, key mitigation measures will include the deployment of Carbon Capture and Utilization (CCU) technologies in cement and steel industries, development of green hydrogen applications, and enhanced circular economy practices.

Pilot projects and feasibility studies are planned in the period 2025–2030, laying the foundation for broader adoption post-2030.

The waste sector is projected to reduce emissions to 663 kt by 2030 and further to 633 kt by 2040. This is driven by the establishment of regional landfills with Mechanical-Biological Treatment (MBT) and composting units in Pelagonija and Southwest regions by 2030. Landfill methane capture systems, waste diversion targets, and the introduction of Extended Producer Responsibility (EPR) schemes for packaging and electronic waste are integral to this progress. Public awareness campaigns and "pay-as-you-throw" systems aim to reduce municipal waste generation by 5% per capita by 2030.

Agricultural emissions are projected to reduce to 911 kt CO_2-eq by 2030, and are projected to stay at this level until 2040. Key mitigation actions include improved manure management on small farms, increased biogas production on large farms, and adoption of soil conservation practices on sloped lands. The sector will benefit from sustainable land management measures aimed at reducing soil erosion and enhancing soil organic matter.

The FOLU sector plays a pivotal role as a carbon sink, with net removals projected at -1,954 kt CO_2-eq by 2030 and -2,929 kt by 2040. Key measures include large-scale afforestation, sustainable forest management, and forest fire prevention initiatives. By 2030, the country aims to develop 15 climate-resilient forest management plans, engage 30 local community groups in forest stewardship, and certify 30% of annual timber production under sustainable standards. Afforestation efforts target degraded and marginal lands, contributing significantly to increased carbon sequestration.

Considering FOLU removals, net GHG emissions are projected at 5,258 kt CO_2-eq in 2030, decreasing further to 4,041 kt by 2040. The FOLU sector alone accounts for 27% of net emissions mitigation in 2030 and more than 40% by 2040, highlighting its critical role in achieving national climate targets.

North Macedonia's climate strategy is underpinned by robust cross-sectoral integration, including the establishment of a national carbon pricing mechanism and MRVA system by 2029 as a preparatory step for EU ETS participation. Institutional strengthening is ongoing, with a draft Climate Action Law expected in 2025. This will be further reinforced through the implementation of measure PM_D1: Strengthening institutional and governance framework for effective NECP implementation. Financial mechanisms involve a mix of national funding, EU IPA/IPARD support, and international financing from EIB, EBRD, and others. Regional cooperation through the Energy Community and bilateral agreements further reinforce policy alignment with EU climate objectives.

ii. 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

The description of each measure indicates the dimensions to which the measure in question has an effect.

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 and measures

The description of each measure indicates the dimensions to which the measure in question has an effect.

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

Based on the defined NECP targets, the measures necessary to achieve these targets have been defined. It must be noted that, while policies and measures in the waste sector and the agriculture, forestry, and other land use (AFOLU) sector have been fully incorporated into the GHG emissions projections, these sectors have been excluded from the quantitative macroeconomic impact assessment focusing on GDP and employment effects, due to their distinct policy frameworks and limited short-term macroeconomic visibility, which make them poorly suited to standard macroeconomic modelling of NECP impacts that prioritizes direct, medium-term energy transition effects.

The necessary investments for the period up to 2030, from 2031 to 2040 and from 2041 to 2050 have been assessed. The macroeconomic effects were analysed based on the assessment of total investments from 2025 to 2050. Total investments are estimated at EUR 39.4 billion (including investments in construction of new buildings). The total investment between 2025 and 2030 is assessed at EUR 10.1 billion, while in the period from 2031 until 2050 and from 2041 to 2050 the remaining 29.3 billion is foreseen. The analysis assumes that the investments are linearly distributed over the years; an average of EUR 1.7 billion is invested annually in the first period and EUR 1.5 billion in the second period.

Macroeconomic effects are calculated by input-output analysis based on the input-output table for the North Macedonia. The analysis considers the direct and indirect multiplicative effects of investments that are disaggregated by different estimates into individual activities, which are in the symmetric input-output table, given the specificity of each investment. Direct effects include additional employment in the sectors producing goods and services to meet the additional final demand. Indirect effects include indirect employment in other sectors that increase production levels to deliver the intermediate inputs required for production in the sector that directly supplies output for final demand.

The results of the analysis are divided into three periods: 2025-2030, 2031-2040 and 2041-2050.

In the first analysed period from 2025 to 2030, with an estimated annual investment of EUR 1.7 billion, employment would increase by about 18,600 employees, added value by 0.49 billion EUR/year, and GDP by 0.62 billion EUR/year.

Between 2031 and 2040, with an estimated annual investment of EUR 1.6 billion, employment would increase by about 19,400, added value by 0.51 billion EUR/year, and GDP by 0.63 billion EUR/year.

Between 2041 and 2050, with an estimated annual investment of EUR 1.3 billion, employment would increase by about 19,500, added value by 0.52 billion EUR/year, and GDP by 0.63 billion EUR/year.

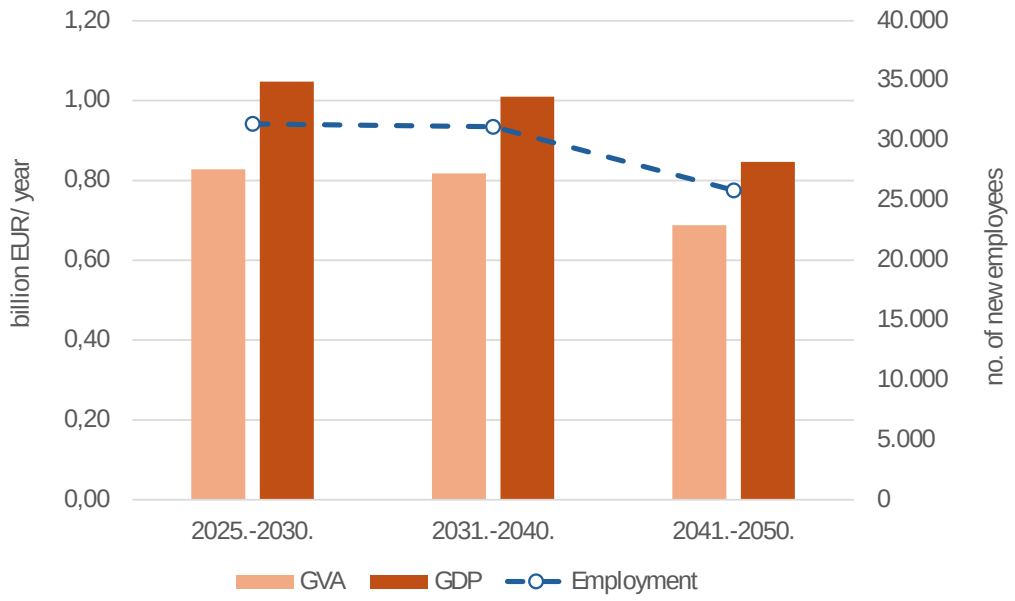

Figure 63 Absolute annual effects of investments by periods

It must be noted that the current evaluation represents an initial, high-level analysis, and as such requires subsequent in-depth elaboration to ensure comprehensive operationalization of the proposed measures. In particular, measure PM_D1: Strengthening the Institutional and Governance Framework for Effective Implementation of the NECP envisages a detailed financial assessment of all NECP-aligned measures.

To ensure transparency and accountability, a dedicated NECP Budget Report will be compiled and updated annually, providing a consolidated overview of financial planning, expenditures, and funding gaps.

5.3. Overview of investment needs

i. Existing investment flows and forward investment assumptions with regard to the planned policies and measures

Table 21 shows a preliminary estimate of total investments for the period 2025-2050, organized into three intervals: from 2025 to 2030, from 2031 to 2040 and from 2041 to 2050. The total estimated investments until 2030, including the necessary investments in constructing new buildings (nZEB new construction), amount to about EUR 10.14 billion.

Table 21 Investment needs until 2050

Million EUR	until 2030	2031–2040	2041-2050
Construction of new buildings	5,350	7,013	6,730
Energy renovation of buildings	1,827	2,316	2, 493
Transport sector	1,150	1,500	1,000
Construction of new power plants	1,000	3,200	900
Electricity networks	370	1.000	800
Gas networks	350	500	800
District heating system	90	500	500
Total	**10.137**	**16.029**	**13.223**

The most substantial capital expenditures will be concentrated in two primary domains:

- Construction of new high-efficiency building infrastructure
- Transformation of electricity generation capacity, particularly utility-scale solar PV installations, wind farms, hydropower and progressive phase-out of carbon-intensive generation assets.

Critical Areas Requiring Policy Support Mechanisms are:

- Transport sector decarbonization, in particular development of EV charging infrastructure, fleet modernization incentives and public transport electrification programs
  Building stock energy modernization, primarily renovation incentives for existing residential and commercial structures and deep energy retrofit programs targeting worst-performing buildings

ii. Sector or market risk factors or barriers in the national and regional context

Risks and barriers have been grouped into two categories:

- Delays in implementation of regulatory measures, due to capacity constraints within responsible institutions and coordination challenges between multiple stakeholders
- Financial implementation constraints, due to insufficient budgetary allocations for planned measures, limited access to international climate finance and challenges in mobilizing private sector investments

To address these challenges, the Government will implement a comprehensive monitoring system, regular reporting and other actions as specified by the measure "PM_D1: Strengthening institutional and governance framework for effective NECP implementation".

iii. Analysis of additional public finance support or resources to fill identified gaps identified under point ii

Within the measure "PM_D1: Strengthening institutional and governance framework for effective NECP implementation", total investments necessary for all decarbonisation actions envisaged by NECP will be thoroughly assessed, together with confirmed and potential funding sources. Should gaps be identified, they will be disclosed in in annual NECP progress reports and appropriate strategy will be implemented, focusing either on domestic resources optimization, international climate finance activation or private capital catalysation.

5.4. Impacts of planned policies and measures described in section 3 on other Member States and the Energy Community Contracting Parties 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

The cross-border and regional integration of energy markets is anticipated to reduce the prices of energy and energy-generating products. Simultaneously, the increased integration of variable renewable energy sources into national electricity systems will lead to greater fluctuations in cross-border electricity flows. This will necessitate the development of more resilient transmission grids and potentially new interconnectors, which could impact the quality

of electricity supplied to consumers and pose risks to system stability due to lower inertia and faster frequency changes. These challenges, including quality issues and reduced system inertia, are expected to be addressed at the European level.

ii. Impacts on energy prices, utilities and energy market integration

The anticipated changes in the energy sector are economically sustainable and will not lead to higher overall costs. However, the cost structure will shift—investment costs will rise, while operating and energy expenses will decrease.

In the long run, energy markets will become fully integrated both geographically, encompassing the European Union and neighbouring countries, and sectorally, connecting the electricity, heat, gas, and transport sectors.

iii. Where relevant impacts on regional cooperation

Enhancing cross-border and regional cooperation across all aspects of the Energy Union will be essential.

6. List of figures

7. List of tables

8. Abbreviations

AAAC	All-Aluminum Alloy
ACER	Agency for the Cooperation of Energy Regulators
AFOLU	Agriculture, Forestry and Other Land Use
AMI	Advanced Metering Infrastructure
BUR	Biennial Update Report
CHP	Combined heat and power
CIF	Connectivity Investment Facility
CNG	Compressed Natural Gas
DHS	District heating system
DSM	Demand-Side Management
EBRD	European Bank for Reconstruction and Development
EE	Energy efficiency
EIB	European Investment Bank
ENTSO - E	European Network of Transmission System Operators for Electricity
ENTSO – G	European Network of Transmission System Operators for Gas
ERC	Energy and Water Services Regulatory Commission of the Republic of North Macedonia
ESCO	Energy Service Company
ESM	Power Plants of North Macedonia
ETS	Emission Trading System
EU	European Union
FOLU	Forestry and Other Land Use
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GoNM	Government of North Macedonia
H&C	Heating and Cooling
HPP	Hydro Power Plant
IEA	International Energy Agency
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product
JETIP	Just Energy Transition Investment Platform

KfW	German investment and development bank
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MAFWE	Ministry of Agriculture, Forestry and Water Management
MEMMR	Ministry of Energy, Mining and Mineral Resources
MEMO	National Electricity Market Operator of North Macedonia
MEPSO	Electricity Transmission System Operator of Republic of North Macedonia
MEUR	Million Euro
MMR	Monitoring Mechanism Regulation
MoEPP	Ministry of Environment and Physical Planning
MoTC	Ministry of Transport and Communications
NECP	National Energy and Climate Plan
NGO	Non-governmental Organisation
PECI	Project of Energy Community Interest
PMI	Project of Mutual Interest
PMU	Phasor Measurement Unit
PP	Power Plant
PV	Photovoltaic
R&D	Research and Development
R&I	Research and Innovation
RES	Renewable Energy Source
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
S3	Smart Specialization Strategy
SDG	Sustainable Development Goals
SME	Small and Medium Enterprises
SMM	Serbia, North Macedonia, Montenegro control block
SS	Substation
TPP	Thermal Power Plant
TSO	Transmission System Operator
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
WAM	Scenario with Additional Measures
WBIF	Western Balkans Investment Framework

WB6	Western Balkans 6 Initiative
WEM	Scenario with Existing Measures
WEO	World Energy Outlook