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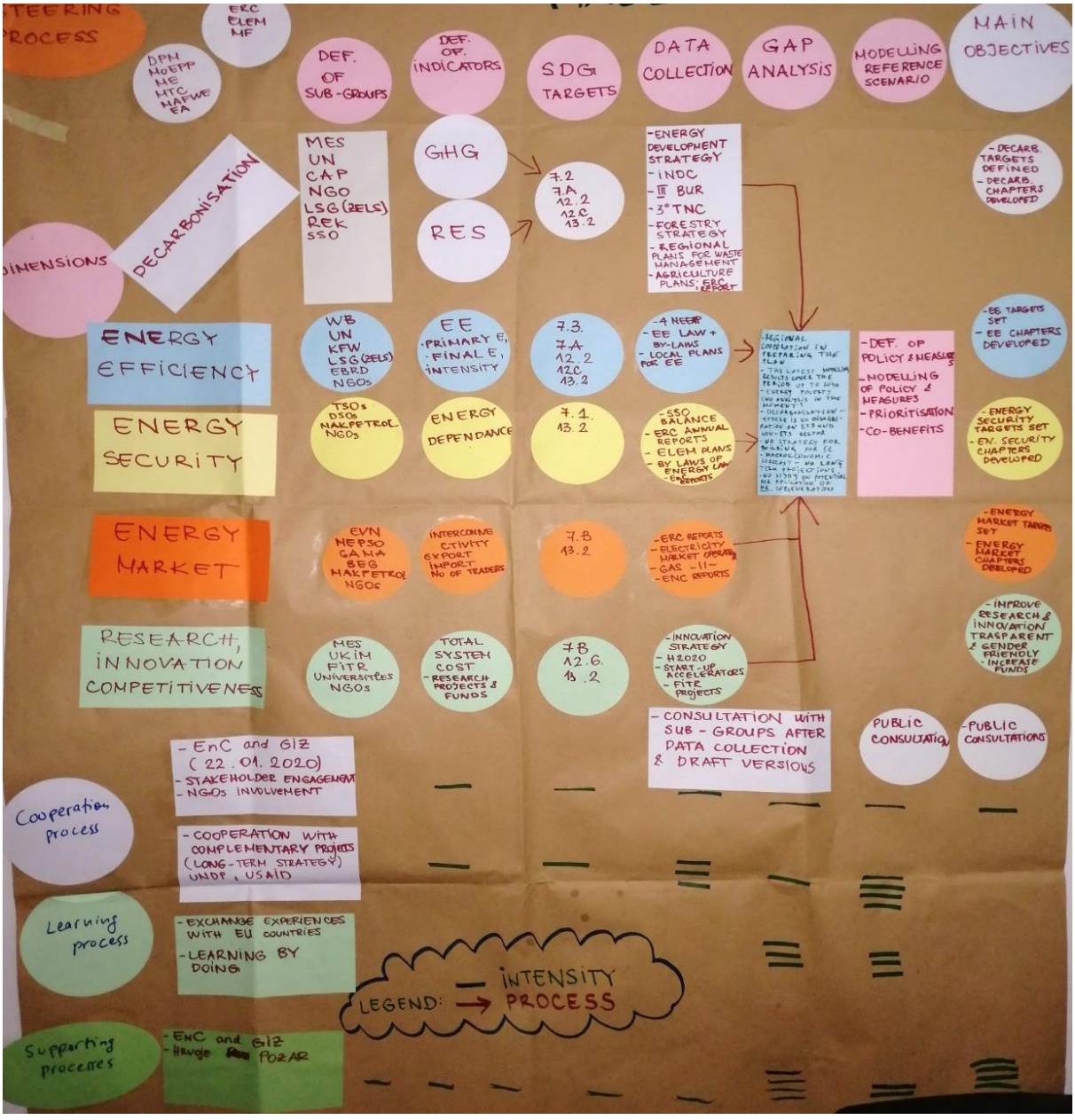

NATIONAL ENERGY AND CLIMATE PLAN OF THE REPUBLIC OF NORTH MACEDONIA

DRAFT

german cooperation
DEUTSCHE ZUSAMMENARBEIT

Implemented by
giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Republic of North Macedonia
Ministry of Economy

Published by the

Deutsche Gesellschaft für

Internationale Zusammenarbeit (GIZ) GmbH

Registered offices

Bonn and Eschborn, Germany

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As at

July 2020

Printed by

Name
City

Design

Name

Skopje

Photo credits

List of photographers in alphabetical order

Text

Author’s given name and family name

GIZ is responsible for the content of this publication.

On behalf of the
German Federal Ministry for Economic Cooperation and Development (BMZ)
Alternatively: German Federal Foreign Office

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ABBREVIATIONS AND ACRONYMS

ACER	Agency for the Cooperation of Energy Regulators
AFOLU	Agriculture, Forestry and Other Land Use
BEG	Balkan Energy Group
BUR	Biennial Update Report
CEE CAO	Central Eastern Europe Coordinated Auction Office
CHP	Combined heat and power
CNG	Compressed Natural Gas
CROPEX	Croatian Power Exchange
EBRD	European Bank for Reconstruction and Development
EE	Energy efficiency
EnC	Energy Community
EnC ISAC	Energy Community Information Sharing and Analysis Centre
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
FiP	Feed in Premium
FiT	Feed in Tariff
FOLU	Forestry and Other Land Use
GDP	Gross Domestic Product
GHG	Greenhouse Gases
H&C	Heating and Cooling
HFO	Heavy Fuel Oil
HGV	Heavy Goods Vehicle
HPP	Hydro Power Plant
HUPX	Hungarian Power Exchange
IEA	International Energy Agency
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product
LCV	Light Commercial Vehicles
LDV	Light Duty Vehicles
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MEPSO	Electricity Transmission System Operator of Republic of North Macedonia
MMR	Monitoring Mechanism Regulation
NGO	Non-governemental Organisation
PECI	Project of Energy Community Interest
PP	Power Plant
PV	Photovoltaic
R&D	Research and Development
R&I	Research and Innovation
RES	Renewable Energy Source
SDG	Sustainable Development Goals
SEEPEX	Serbian South East European Power Exchange
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
WB6	Western Balkans 6 Initiative
WEM	Scenario with Existing Measures
WEO	World Energy Outlook

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1. OVERVIEW AND PROCESS FOR ESTABLISHING THE PLAN

Tab 1

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EXECUTIVE SUMMARY

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

The National Energy and Climate Plan (NECP) was prepared against a backdrop of the country becoming **30th member of the NATO Alliance** and the formal approval of the EU leaders to **open EU accession negotiations**. The results from the past reforms including the solid macroeconomic fundamentals, job creation, and an open economy that has attracted foreign investment will help the country to capitalize on this renewed outlook. However, the weak state institutions, low and declining productivity of local firms, and deficiencies in competition and investment policy and business regulation continue to pose serious structural challenges to economic growth. A competitive business legal framework is missing, so the private sector is weak and incapable to fully exploit the country's location. Furthermore, there are risks to fiscal sustainability and the Government has limited fiscal space to stimulate the economy properly. Educational achievement is relatively poor and unequitable which limits labour market in terms of skills to meet the evolving demands of a modern economy, as well as creates inequality in access to economic opportunities. Finally, climate and environmental threats, including air pollution, require urgent attention or they may slow economic growth and reverse poverty reduction.

Following up on the national **Energy Strategy** adopted in December 2019 and in response to the **Recommendation of the Ministerial Council of the Energy Community (2018/1/MC-EnC)** on preparing for the development of integrated national energy and climate plans by the Contracting Parties of the Energy Community and the relevant **Policy Guidance by the Energy Community Secretariat (PG 03/2018),** the country prepared National Energy and Climate Plan (NECP), which covers the period from 2021 to 2030 prescribing the pathway to achieve the 2030 targets expected to be agreed in 2021. As the Energy strategy does, the NECP also takes a holistic approach and address the five main dimensions of the Energy Union in an integrated way recognizing the interactions between the different dimensions.

At national level, definitely the **Energy Law (Official Gazette 96/2018 and 96/2019)** which transposes the Third Energy Package in the electricity and natural gas sector, as well as the Renewable Energy Directive 2009/28/EC, have created the momentum for integrated energy and climate planning. Currently, the Energy Law is being amended to provide a legal basis for the development of NECPs, as well as for streamlined and harmonized national reporting against various energy and climate targets. Next is the **Energy Efficiency Law (Official Gazette 32/2020)**, which, with the relevant by-laws, warrants transposition of the Energy Efficiency Directive 2012/27/EU, Energy Performance of Buildings Directive 2010/31/EC and stipulates preparation of Energy Efficiency Action Plans (the **Fourth Energy Efficiency Action Plan until 2021** is under preparation).

The country as a non-Annex I party to the United Nations Framework Convention on Climate Change (UNFCCC) ratified Paris Agreement in November 2017, with the following contribution to the global efforts for GHG emissions reduction (**NDC**[1]): "To reduce the CO2 emissions from fossil fuels combustion for 30%, that is, for 36% at a higher level of ambition, by 2030 compared to the business as usual (BAU) scenario." In response to the call to the Paris Agreement parties for considerably enhanced NDCs, the country plans to submit **revised NDC** in October 2020, which will be based on this NECP and the TBUR. Furthermore, at national level, worth mentioning as contribution and entry point to the NECP is the ongoing project entitled "**Law and Strategy on Climate Change**," which has been programmed under the EU Instrument for Pre-Accession Assistance (IPA II) funding mechanism and is to deliver the Long-term Climate Action Strategy and a Law on Climate Action.

The country has so far submitted to the UNFCCC three **National Communications on Climate Change**[2] and two **Biennial Update Reports**[3]. In the period 2019-2021, the **Fourth National Communication and Third Biannual Update Report (TBUR)** to the UNFCCC are in the process of preparation. The **NECP** is

[1] http://unfccc.org.mk/Default.aspx?LCID=302
[2] https://klimatskipromeni.mk/article/32#/index/main
[3] https://klimatskipromeni.mk/article/28#/index/main

based on the **Enhanced Scenario with Additional Measures (e-WAM) from the TBUR**, or in other words, the **Green Scenario from Energy Strategy** augmented with the policies and measures from the Industry, Agriculture, Forestry and Other Land Use and Waste sectors."

All the mentioned strategic and planning documents are based on the **robust analytical work** and **consultations with the relevant ministries and other relevant stakeholders** aimed at identification and validation of possible mitigation policies and measures in the target sectors, prioritization of identified policies and measures and providing directions for development of mitigation scenarios, as well as, identification and validation of the assumptions used for the modelling of scenarios. The stakeholder consultation and communication have not been hindered by the COVID-19 crises since substantial buy-in from the stakeholders has been obtained through virtual meeting platforms. Therefore, it can be safely concluded that **the capacity, both analytical and institutional**, and **the participatory process**, which have been created even before the Macedonian NDC, and maintained and enhanced over the Energy strategy and the TBUR timelines, have been strong entry points for the NECP.

Although stipulated in the Energy Law, the **Program for realization of the Energy Strategy** was not adopted within six months after the adoption of Strategy due to political situation in the country (dissolution of the Parliament aimed at opening the way for the early parliamentary elections) and COVID-19 crises. However, the preparation of this document is planned to start mid-August with expected adoption in March 2021. As a part of this Program **a revision of the Energy Strategy and of this version of NECP is planned in order to reflect the changing reality with the COVID-19**.

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

The Integrated National Energy and Climate Plan of North Macedonia elaborates on all five dimensions of the Energy Union i.e. decarbonisation (addressing two segments: greenhouse gas emissions and renewable energy sources), energy efficiency, security of energy supply, internal energy market, and research, innovation and competitiveness.

The strategic policy under the **decarbonisation** dimension envisages the realization of all identified climate change mitigation actions that will further reduce GHG emissions, and at the same time will increase the share of renewable energy sources in the gross final energy consumption in a sustainable manner. Around 70% of the total GHG emissions in the country originate from fossil fuel combustion activities in the energy sector, particularly in the energy transformation, industry, and transport sub-sectors. Therefore, promoting the transition of the energy sector towards low-carbon technologies as a key objective includes a strong plan for gradual decommissioning of the coal power plants and accelerating the utilization of renewable sources in the electricity generation mix in conjunction with energy efficiency measures in all sectors. The introduction of a CO_2 tax will speed up the phasing-out of conventional fuels, and at the same time stimulate the investments in RES and implementation of energy efficiency measures. In the area of renewable energy, the country will continue its current support mechanisms for RES electricity generation via feed-in tariffs and feed-in premiums with auctions (granted in a tendering procedure). The country will promote further utilization of RES in the electricity sector (without incentives), but also in the other sectors through the introduction of the "prosumer" concept and by electrification of the heating and cooling sector using high efficient heat pumps and district heating fuelled by CHP biomass, as well as by increasing the biofuels consumption in the transport sector.

The **decarbonisation** dimension also foresees policies and measures for GHG emissions reduction in the non-energy sectors. The measures related to agriculture, forestry and land use include improvement of feeding and manure management practices in livestock breeding farms, land conversions that will reduce the soil erosion, and increase the soil organic matter and carbon sinks, as well as management of forest fires and afforestation of forestland that will contribute to additional absorption of GHG. The NECP also envisages the potential for GHG emission reduction from the waste sector, by improving waste management and treatment practices.

Concerning the **energy efficiency** dimension, North Macedonia will strive to maximise the savings in primary and final energy consumption. The projection with the current policies shows that the consumption of both, primary and final energy will increase by 38% and 55%, respectively, in 2040 relative to 2017, due to continuing economic growth. Having in mind that the country has the limited potential of lignite and biomass,

as the most dominant domestic resources that are currently used, the goal is to pay special attention to energy efficiency. Therefore, North Macedonia is planning to implement a number of policies and measures over the period 2020 – 2040, in order to reduce the energy consumption in buildings (households, commercial and public), industry sector, transport sector, and to reduce the losses the energy transformation, transmission, and distribution network. Considering that the secondary legislation that should deliver the targets and roadmaps for energy efficiency (as required by the new Energy Efficiency Law) is still not developed, the NECP provides some indicative savings that can be achieved in the future, when all the requirements from legislative acts will enter into force.

The polices and measures relevant for building sector will focus on improving the energy performance of buildings by refurbishing of the existing and construction of new buildings (including passive buildings), as well as through promotion and introduction of more advanced end-use technologies (if possible in combination with RES), utilization central heating systems, green procurements, etc. Regarding the industry sector, a priority is given to the improvement of the processes by using more efficient and advanced technologies, in combination with the energy management of the processes. Concerning transport, priority is given to policies for replacement of the road vehicle fleet (including the promotion of electric vehicles), promotion of advanced mobility (biking, walking, etc.) and using collective modes of transport, as well as a modal shift in freight transport from road to rail. The implementation of these measures in combination with the measures envisaged in the decarbonisation dimension will keep the primary energy consumption at the current level. This indicates notable energy savings relative to the BAU scenario (presented in the Energy Strategy), which is used to evaluate the indicative EE targets. In addition, all these policies and measures will have a direct effect on emission reductions, decrease import dependence, and stimulate the domestic economy with local job opportunities.

In terms of **energy security**, the country aims to become less dependent on energy imports by increasing the utilization of renewable sources and energy efficiency but, at the same time, plans to diversify its sources of supply through the use of natural gas (mainly in the industry sector). Analysing the current situation, the identified potential risks for the security of supply include limited use of domestic resources in energy production (mainly based on lignite, biomass and hydro), depleting coal resources, single interconnection point for natural gas supply, and high dependence on energy import (with nearly 60% of the total primary energy consumption). The policies and measures relevant to the security of energy supply are already addressed in the other dimensions. Thus, the measures for increasing the RES share envisaged in the decarbonisation dimension are highly pertinent for the diversification of domestic resources, but also for the reduction of energy import dependence when combined with the measures under the energy efficiency dimension. The flexibility of the system is expected to be increased by combining the utilization of RES with the electrification of the transport. The NECP also envisages diversification of the supply routes, through developing the gas transmission network, considering the significance of using the natural gas in the industry sector as a less carbon-intensive fuel that will reduce the GHG emission and improve the air quality resulting from this sector.

Regarding the **internal energy market** dimension, the NECP aims to establish an organized day-ahead market in North Macedonia, to enable coupling with the Bulgarian day-ahead market and to participate in initiatives for the establishment of regional market. In terms of the electricity interconnectivity, the country plans to improve the currently high level of connection, by finishing the new interconnection with Albania (as a project on the PECI List), thus enhancing the interconnectivity of the region. The country also plans to diversify the supply routes by realizing the planned natural gas interconnection with Greece (as a project on the Projects of Mutual Interest (PMI) list) and interconnections with Kosovo* and Serbia (as projects on the preliminary Projects of Energy Community Interest (PECI) list), that will ensure the security of the supply in the region. Also, the NECP includes continuous investments in the electricity transmission and distribution network, as well as the development of the gas transmission and distribution network in the country. Other plans for the development of the internal energy market that will increase the flexibility of the system for higher RES integration include improvement of the demand response level and introduction of real-time price signals that will encourage the consumers to have a pro-active role in balance services, thus increasing the capacity of energy storage. The NECP also envisages developing of an annual program for vulnerable consumers that will ensure their protection from the price shocks.

Concerning **research, innovation, and competitiveness** dimension, Macedonia will strive to include the energy transition technologies and measures in its research and innovation (R&I) priorities. In 2018, the country launched the process for developing a Strategy for Smart Specialization, which identified the energy sector as one of the priority areas that need innovation strategies, based on the objectives of the Energy Strategy for utilization of renewable energy sources and enhancement of energy efficiency. The NECP also identifies the need for frequent revision of the energy-related curricula at all educational levels to follow the innovative trends in science and technology, especially the energy transition trends.

In terms of funding the research and innovation activities related to energy and climate, the country plans to continue the national support via the mechanisms of the Fund for Innovation and Technology Development (like grants, loans, etc.) for support of innovation activities in micro, small and medium-sized enterprises (MSMEs). The FITD's programs, also include possibilities for new mechanisms targeted also to the public sector and large enterprises. These support mechanisms will enable knowledge and technology transfer between the scientific institutions and the industry, thus enhance the competitiveness of the business sector and at the same time support the industry-driven science. Also, the access to international support from the EU research and innovation programs (like Horizon Europe) and other donor funds should be further enhanced by establishing effective project management units in the responsible ministries (comprised of multidisciplinary officers involved in the planning, evaluation and monitoring procedures) and by increasing the competences of the institutions to effectively absorb such funds.

In terms of competitiveness, the NECP identifies that the SMEs should be encouraged and supported to diversify their portfolio of services and products in RES and EE, by providing suitable financial and technical mechanisms. The mechanisms included in the FITD programs (like co-financing grants, business accelerators, technology transfer offices, Science Technology Park, etc.) could be a good starting point towards improving the business environment and ensuring the competitiveness of companies.

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

In this NECP, 63 specific policies and measures (Table 1) are proposed for achieving the set target and objectives defined in Table 2 for each of the five dimensions. Some of the proposed policies and measures are related with more than one of the dimensions and their interaction is also presented in Table 1.

Table 1. Interactions between the policies and measures with Energy Union and EnC dimensions

		Policy/measure	Decarbonisation	Energy Efficiency	Energy Security	Internal Energy Market	R&I and competitiveness
Decarbonization	PM_D1	Introduction of CO2 tax	√		√		√
	PM_D2	Reduction of CH4 emissions from enteric fermentation in dairy cows by 3%	√				
	PM_D3	Reduction of N2O emissions from manure management in dairy cows by 20%	√				
	PM_D4	Reduction of NO2 emissions from manure management in swine farms by 13%	√				
	PM_D5	Reduction of N2O emissions from manure in dairy cows by 20% for farms below 50 Livestock Units	√				
	PM_D6	Establishing integrated management of forest fires	√		√		
	PM_D7	Afforestation	√		√		
	PM_D8	Conversion of land use of field crops above 15% inclination	√				
	PM_D9	Contour cultivation on areas under field crops on inclined terrains (5-15%)	√				
	PM_D10	Perennial grass in orchard and vineyards on inclined terrains (>5%)	√				

	PM_D11	Use of biochar for carbon sink on agricultural land	√				√
	PM_D12	Landfill gas flaring	√				√
	PM_D13	Mechanical and biological treatment (MBT) in new landfills with composting	√				
	PM_D14	Selection of waste - paper	√				
	PM_D15	Improved waste and materials management at industrial facilities	√				
	PM_D16	Program for just transition	√				√
	PM_D17	Identification of the proper location for solar and wind power plants	√				√
	PM_D18	Large hydro power plants	√		√	√	√
	PM_D19	RES without incentives	√		√	√	√
	PM_D20	Photovoltaic Irrigation	√		√	√	√
	PM_D21	Incentives feed-in tariff	√		√	√	
	PM_D22	Incentives feed-in premium	√		√	√	
	PM_D23	Solar rooftop power plants	√		√	√	√
	PM_D24	Solar thermal collectors	√		√	√	
	PM_D25	Biomass power plants (CHP optional)	√		√	√	
	PM_D26	Development of the biofuels market	√		√	√	√
Energy efficiency	PM_EE1	Energy efficiency obligation schemes	√	√	√		
	PM_EE2	Retrofitting of existing residential buildings	√	√	√		√
	PM_EE3	Retrofitting of existing central government buildings	√	√	√		√
	PM_EE4	Retrofitting of existing local self-government buildings	√	√	√		√
	PM_EE5	Retrofitting of existing commercial buildings	√	√	√		√
	PM_EE6	Construction of new buildings	√	√	√		√
	PM_EE7	Construction of passive buildings	√	√	√		√
	PM_EE8	Improvement of the street lighting in the municipalities	√	√	√		
	PM_EE9	Green procurements	√	√	√		√
	PM_EE10	Labeling of electric appliances and equipment	√	√	√		√
	PM_EE11	Increased use of heat pumps	√	√	√		√
	PM_EE12	Public awareness campaigns and network of energy efficiency (EE) info centers	√	√	√		
	PM_EE13	Phasing out of incandescent lights	√	√	√		
	PM_EE14	Energy management in manufacturing industries	√	√	√		√
	PM_EE15	Introduction of efficient electric motors	√	√	√		√
	PM_EE16	Introduction of more advanced technologies	√	√	√		√
	PM_EE17	Increased use of the railway	√	√	√		√
	PM_EE18	Renewing of the national car fleet	√	√	√		
	PM_EE19	Renewing of other national road fleet	√	√	√		√
	PM_EE20	Advanced mobility	√	√	√		√

	PM_EE21	Construction of the railway to Republic of Bulgaria	√	√	√		√
	PM_EE22	Electrification of the transport	√	√	√		√
	PM_EE23	Increased use of central heating systems	√	√	√		√
	PM_EE24	Smart communities	√	√			√
	PM_EE25	Reduction of network losses		√		√	√
INnernall energy market	PM_IEM1	Construction of 400 kV electricity transmission interconnection Macedonia-Albania (Bitola-Elbasan)			√	√	√
	PM_IEM2	Develop natural gas cross-border infrastructure to diversify supply routes and increase market competitiveness			√	√	√
	PM_IEM3	Develop gas transmission network			√	√	√
	PM_IEM4	Develop gas distribution network			√	√	√
	PM_IEM5	Pursue regional electricity market integration			√	√	√
	PM_IEM6	Develop further distribution system network to integrate more RES, including prosumers and more electric vehicles (EVs), as well as continuously improve network reliability	√	√	√	√	√
	PM_IEM7	Price signal demand response	√		√	√	√
	PM_IEM8	Adoption of annual program for vulnerable consumers			√	√	
Research, innovation and competitiveness	PM_RIC1	Participation in development of energy transition technologies and measures	√				√
	PM_RIC2	Increased level of education of sustainable energy needs	√	√			√
	PM_RIC3	Inter-sectoral and geographical mobility of researchers					√
	PM_RIC4	Increase the role of SME sector in energy transition	√	√	√	√	√

Table 2. Key targets and objectives

	Key objective/target (2030)
Decarbonization (GHG emissions and removals)	**82% GHG net emissions reduction relative to 1990 level**
	66% emissions reduction in Energy sector (mainly through decommissioning of coal fired TPP Oslomej in 2021 and TPP Bitola up to 2027)
	45% emissions increase in IPPU sector
	29% emissions reduction in Agriculture sector
	95% removals increase in FOLU sector
	21% emissions reduction in Waste sector
Decarbonization (Renewable energy)	**38% share in gross final energy consumption**
	66% share in gross electricity production
	45% share in gross final energy consumption for heating and cooling
	10% in final energy consumption in transport
Energy efficiency	**20.8% savings of final energy consumption relative to BAU scenario**
	34.5% savings of primary energy consumption relative to BAU scenario
	Establishment of Monitoring and Verification Platform by 2021
	Development of Building Renovation Strategy
	19% savings of final energy consumption in the transport sector relative to BAU
Energy Security	**Energy import dependency of 59%, mainly thought:** • Fulfilling the RES and EE targets • Continuous creation of a positive investment climate in RES • Continuous maintenance and improvement of the transmission and distribution networks • Increasing the number of prosumers • Creating a system of guarantees of origin that will increase the value of projects in RES
	Increase the diversification of energy sources and supply from third countries thought: • Fulfilling the RES target • Construction of additional interconnection pipelines with Greece, Kosovo* and Serbia
	Increase the flexibility of the national energy system thought: • Implementation of balancing market; • Construction of hydro- power plants (including pump storage) or gas fired power plants (including CHP); • Construction of biomass and biogas power plants; • Implementation of viable demand response options, including vehicle-to-grid, power-to-heat and battery storage.
Internal energy market	**Maintain the high interconnectivity level;**
	Maintain and upgrade the energy transmission infrastructure through: • finishing the already started project for electricity interconnector Bitola-Elbasan up to 2023 • implementation of the projects for construction of the natural gas pipelines to Greece, Kosovo* and Serbia • increasing the access to the natural gas transmission network, especially of the industrial consumers
	Increase market integration through: • establishing a day-ahead market as soon as possible • coupling with IBEX (Bulgarian day-ahead market) and participation in the initiative for establishing a regional electricity market • increasing the level of demand response • increasing the number of consumers that can provide balance services and aggregators • increasing the capacity of energy storage
	Decrease energy poverty level through: • ensuring the implementation of the provisions for protection of consumers (vulnerable consumers) by the suppliers • stimulating the installations of solar thermal collectors for hot water, especially for the vulnerable customers

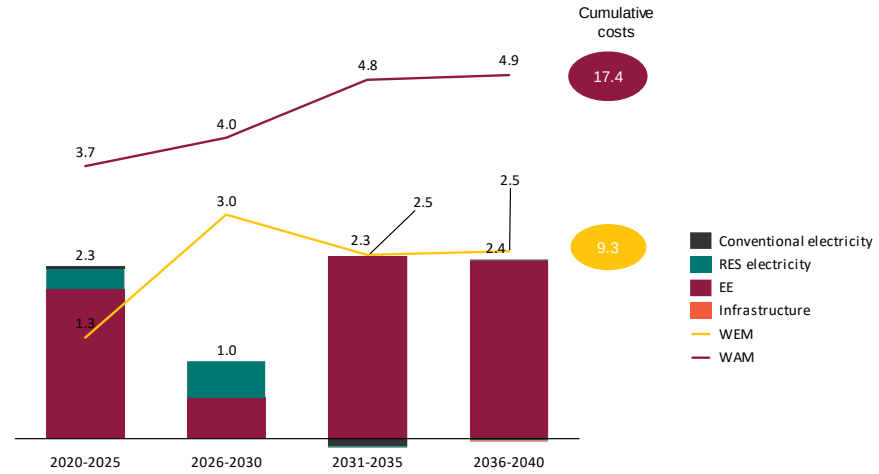
	• carrying out annual programs for vulnerable consumers, with an appropriate increase in the intensity of the measures, based on annual needs • introduction of energy poverty as a term in the relevant laws
R&D and competitiveness	**Increase funding for research and innovation, promote clean energy technologies and improve the competitiveness through:** • channelling more of the national funds into science • research and innovation (R&I) activities related to energy and climate • increasing the access to the EU funding programs for research and innovation (like Horizon Europe, the successor of Horizon 2020) and other international donors • adjusting the energy-related curricula at all educational levels to be responsive to energy transition trends • promote RES technologies and EE in the energy transformation and industry sector, in parallel with the electrification of heating and cooling sectors and transport • development and adoption of Strategy for Smart Specialization • encouraging and support of SMEs to diversify their portfolio of services and products in RES and EE by providing suitable financial and technical mechanisms

Each of the proposed measures and policies within this NECP is modeled individually in order to evaluate its individual effect (presented in the tables for each measure). However, in the scenario with existing measures (WEM) and the scenario with additional measures (WAM), all policies and measures are modeled together, in order to take into account the interaction between them and to avoid the risk of unnecessary investments and oversizing of the system. For example, in a scenario where no energy efficiency measures would be implemented, electricity consumption in 2030 could reach 9.2 TWh in Macedonia. In the scenario with existing measures it is reduced to 8.2 TWh, and in the scenario with additional measures it is 7.7 TWh. This means that if the electricity generation system aims to produce 9.2 TWh, and in the meantime energy efficiency measures have been implemented and the consumption does not exceed 7.7 TWh, and also at the regional level there are surpluses of electricity, the system is oversized and **unnecessary investments are made**. This emphasizes the importance of parallel implementation of all measures in a given scenario. Given that energy efficiency measures and policies are the most cost-effective, the model (MARKAL) automatically incorporates these measures and policies, **thus implementing the energy efficiency first principle**. But even in the Energy efficiency dimension, unnecessary investments can occur in certain measures, for example, if in a household that does not have insulation, first a heating system is installed and then it is insulated, the heating system may be oversized and again unnecessary investments may occur. By using the developed model (MARKAL-Macedonia), all measures are considered at the same time, so this kind of **stranded investments are avoided**.

Macroeconomic analyses for the Energy sector are based on the results for investments obtained from the MARKAL model. The results for the Energy sector show that the realization of the scenario with existing measures requires about 9.3 billion EUR, while the implementation of the scenario with additional measures requires 17.4 billion EUR (Figure 1). The largest investments in the WAM scenario are in the period from 2036-2040, and in the WEM scenario in the period 2026-2030. The main difference between the two scenarios is in the level of investments in energy efficiency measures. The investments in the Energy sector participate with more than 99% of the total investments (including the AFOLU and Waste sectors), which amount to 9.4 in WEM and 17.5 in WAM.

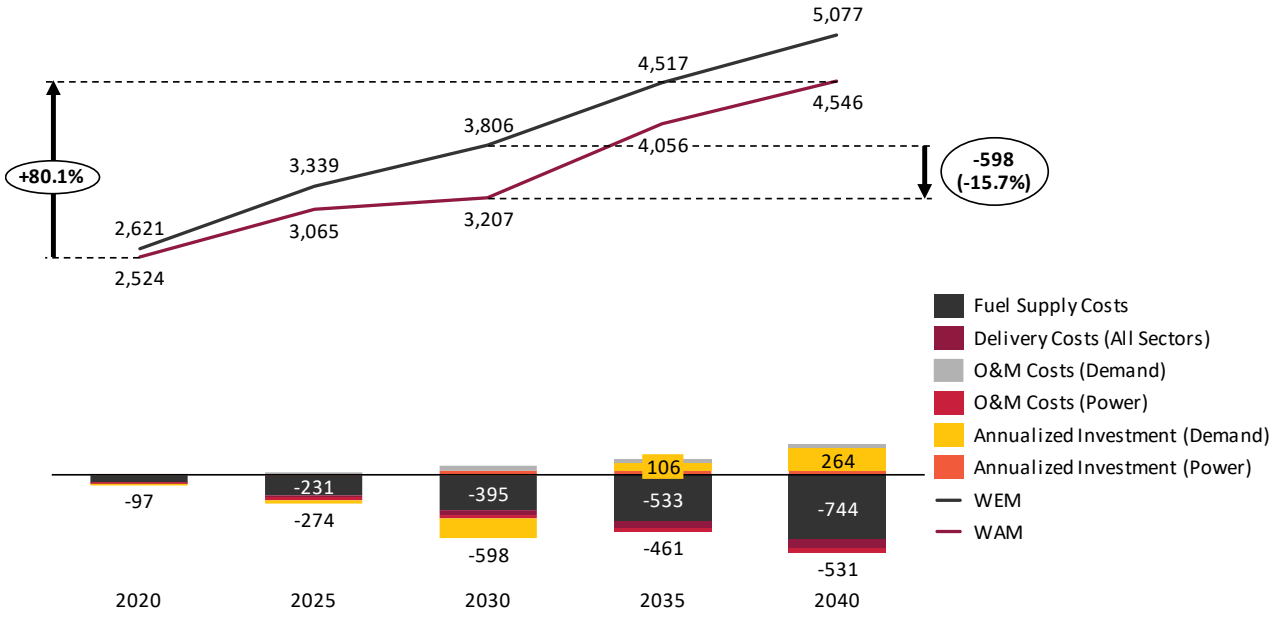
Although investments in the scenario with additional measures are greater, the total cost of the system is lower by 15.7% in 2030 compared to the scenario with existing measures (Figure 2). The biggest savings are in Fuel Supply Costs. Total system costs increase by about 80% in 2040, compared to 2020, in the scenario with additional measures and in 2030 they amount to 3,207 mil. EUR.

Figure 1. Investment costs by scenario (mil. EUR), and the difference between the scenarios by type of investment in the Energy sector



Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

Figure 2. Total energy system costs (mil. EUR) and the difference between the scenarios by type of cost

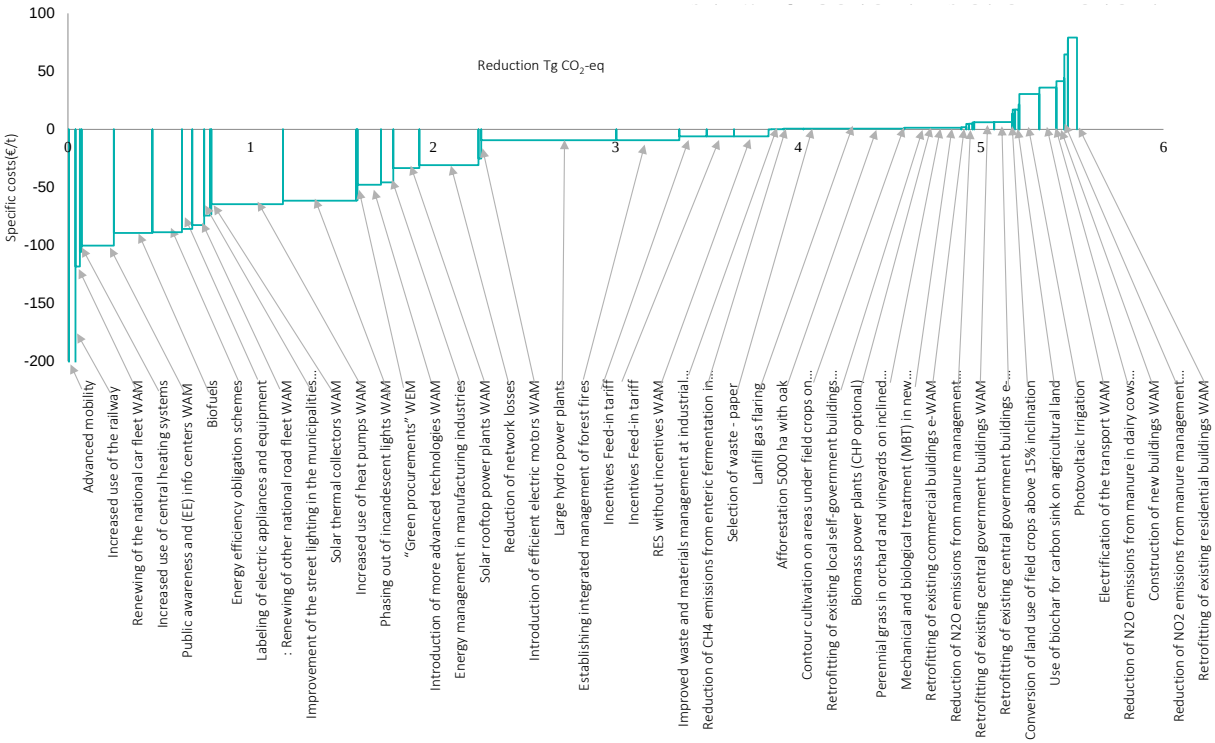


Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

Additionally, the proposed measures/policies are presented on a Marginal abatement cost curve (MAC curve), where the economic and environmental aspects are considered for each of them, in terms of their specific cost and the potential for CO_2-eq reduction (Figure 3). It is shown that around 70% of the proposed measures/policies reduce GHG emissions by negative specific costs (lower costs than in a scenario without measures), or they are called win-win options.

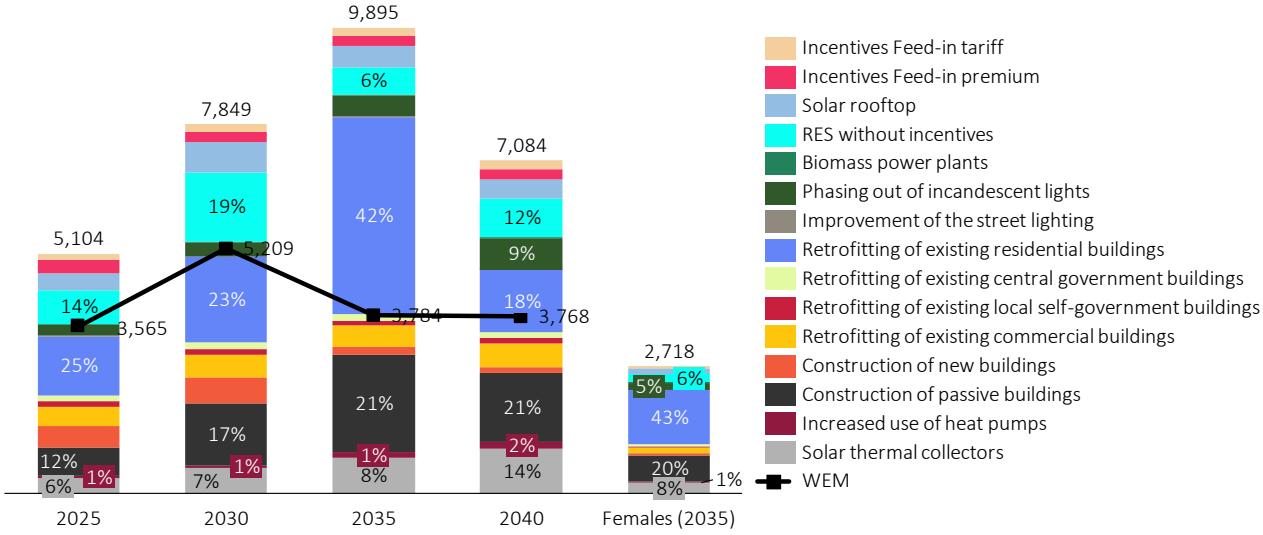
In addition to environmental and economic effectiveness, as part of the TBUR (mitigation report), the social benefits for some of the proposed measures/policies have been evaluated (Figure 4). With the implementation of the measures from the WAM scenario, 10,000 green jobs can be created in 2035, while in the WEM scenario, a maximum of 5,200 jobs can be created in 2030. Most of the jobs are in Retrofitting and construction of buildings.

Figure 3. Marginal abatement cost (MAC) curve



Source: National GHG Mitigation report under 3rd BUR

Figure 4. Number of green jobs



Source: National GHG Mitigation report under 3rd BUR

One of the major factors that affect the realization, not only of WAM, but also of the WEM scenario is the non-construction of:

- Chebren and the other planned large hydropower plants that significantly improve the flexibility of the system and enable greater inclusion of variable RES in the system. Additionally, in conditions of reduced production or decommission of TPP Bitola, this measure is crucial for increasing the security of supply, and also contributes to increasing the RES share. The sensitivity analyses were done and they show that if Chebren and other hydro PP are not built, the construction of gas power plant should be considered. This will increase the flexibility of the system, but in comparison with hydro power plants option, it is not going to contribute as much to improving the overall RES share and to decreasing import dependence. Construction of new gas PP is conditioned on construction of new interconnection gas pipeline. The last, most unfavorable option is increase the import of electricity.

- natural gas pipelines to Greece and Serbia, which enable energy sources diversification, increase the capacity for natural gas import, that enable increased use of this fuel by the industry, as a step in the transition towards low carbon industry.
- access to gas transmission network, especially to the industry entities

The implementation of the policies and measures usually involves more institutions. Therefore, of critical importance for the realization of the set targets and objectives is the higher level of cooperation between the instructions, as well as improvement of their capacities. This is also important for speeding up and facilitation of the processes and procedures for the investors.

Government policies should be aimed at meeting the set goal, but also to represent an example for private companies and investors. In addition, it is necessary to continuously monitor the provision of funds and, if there is a problem in certain sectors, the Government should intervene by finding additional sources of funds.

The realization of the scenario with additional measures leads to an increase in energy prices. In order to reduce the risk of energy poverty, it is necessary to constantly monitor the vulnerable categories and to adequately adjust the level of subsidies for this category of citizens.

OVERVIEW OF CURRENT POLICY SITUATION

I. National circumstances and energy system

The national circumstances relevant for the process of development of the National Energy and Climate Plan and identifying the its most appropriate policies and measures are mainly represented by the available resources, financial potentials, national commitment for greening the economy, size of the state, etc. Making social, economic and environmentally responsive assessment of those parameters should strengthen the quality of the proposed set of measures but also mitigate the challenges for achieving the expected results and enable easier process of in-practice implementation. Building upon the lessons learned and experience in the region, this document makes sure that the current situation is well analysed, hence enabling environment for identification of proactive policies and measures that meet the criteria for achieving strengthened results while avoiding simple replication of best practices that are considered as not applicable to the country at this stage of its development.

This section provides a brief overview of the situation in the country, with a particular view of the energy sector. In addition, a comparison has been made with the remaining 5 Western Balkans 6 countries (Albania, Bosnia and Herzegovina, Kosovo*[4], Montenegro, Serbia), the European Union countries that are close to Macedonia such as Greece, Bulgaria, Croatia and Slovenia, but also other European Union countries such as Hungary and Austria. This comparison allows the reader to det a sense of Macedonia's position in relation to other countries.

According to the World Bank 2018 data[5], Republic of North Macedonia (Macedonia) has a population of about 2.08 million and represents the forth smallest country in the list of 12 countries that are subject to comparison in this analysis (Figure 5). Real GDP growth in 2018 was 2.7%, which is higher compared to the GDP growth in Greece, Croatia and Austria, although it should be taken into account that these EU Member States have quite developed economies already (Figure 6). On the other hand, compared to the WB6, the country is lacking behind, mainly due to the unrealized capital investments. The investments proposed with the set of policies and measures listed in the NECP should be also considered as an opportunity for placing additional value to the GDP, hence supporting the national process for economic growth.

Each citizen in Macedonia earns about 6.100 USD (GDP/capita) which is around 6 times lower compared to EU (Figure 7). Compared to the WB6, Macedonia is ahead of Albania, Kosovo* and BiH, and behind Serbia and Montenegro – the latter has the highest GDP/capita of the WB6.

However, this does not mean that in Macedonia the living standard is 6 times lower than EU, because the cost of living is different. For this purpose, a comparison is made with the PPP GDP/capita indicator, which also takes into account the different purchasing power, with for example, 1 USD in Macedonia and in EU. According to this indicator, Macedonia has 16,359 USD/capita, which is about 2.7 times smaller than EU (Figure 8).

When it comes to GDP, it is important to note that export of goods and services of Macedonia in 2018 account for 60% of the GDP and have increased by about 20 percentage points compared to 2010 (Figure 9). This indicates that Macedonian companies are primarily export oriented and are competitive in the foreign markets. Compared to the WB6 countries, Macedonia has the largest share of export in GDP.

[4] The designation is without prejudice to position on status, and is in line with UNSRC 1244/99 and the ICJ Opinion on the Kosovo Declaration of Independence

[5] The World Bank data, North Macedonia, https://data.worldbank.org/country/north-macedonia?view=chart

Figure 5. Population in '000, 2018

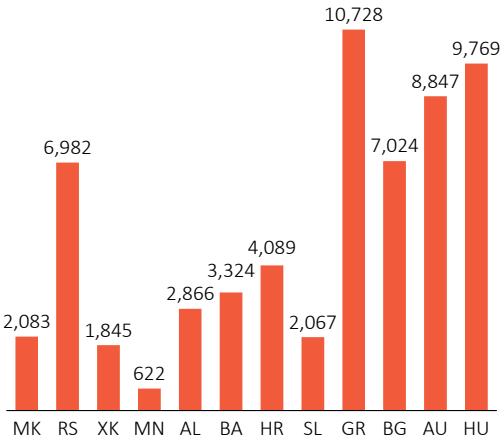
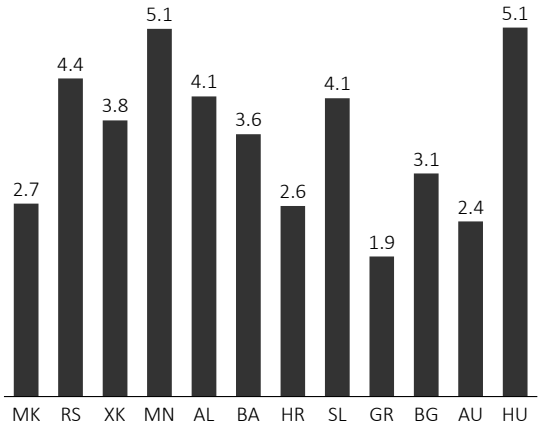


Figure 6. Real GDP growth rate (%), 2018



Source: World Bank; Project team analysis

Figure 7. Real GDP/capita (USD), 2018

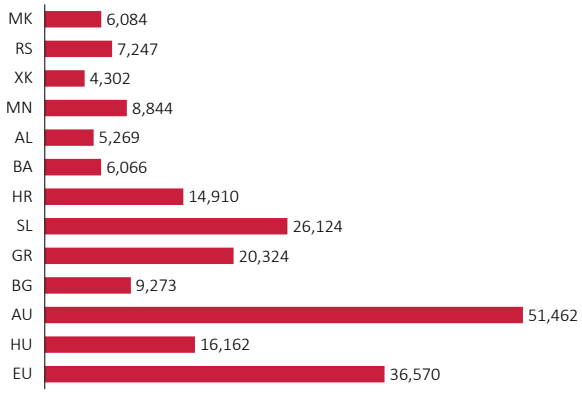
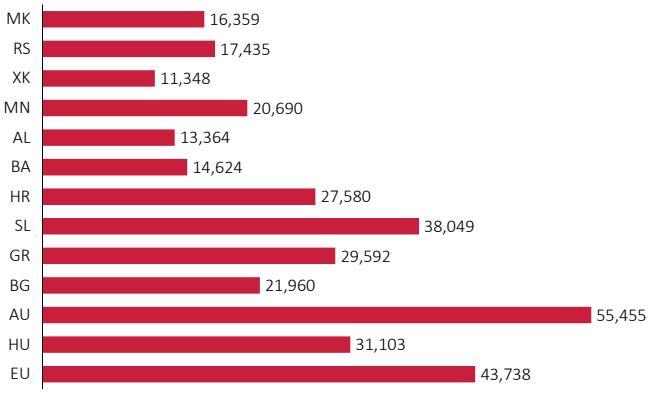
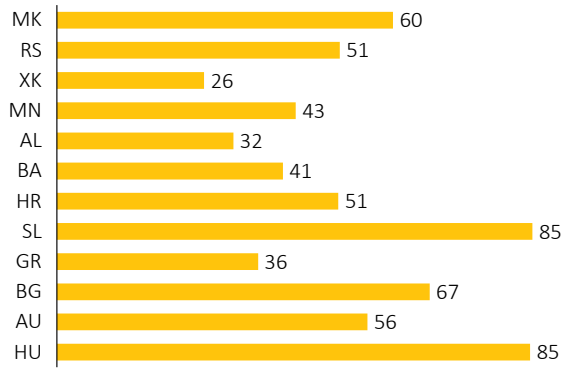


Figure 8. PPP GDP/ capita (USD), 2018



Source: World Bank; Project team analysis

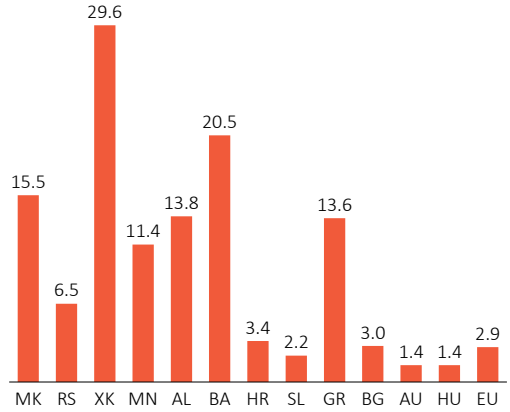
Figure 9. Share of export of goods and services in GDP (%), 2018



Source: World Bank; Project team analysis

The long-term unemployment rate in Macedonia is continuously decreasing. It has declined by more than 40% over a nine-year period, but it is still quite high and in 2018 it was 15.5% (Figure 10). Among EU countries, Greece has the highest long-term unemployment rate of 13.6% while all other countries are below 3.5%. Implementation of the NECP policies and measures will enable creation of new jobs, primarily green jobs or at least replacement of existing jobs with new ones that will have higher value in the economy.

Figure 10. Long-term unemployment rate (%), 2018



Source: Eurostat (SDG Long-term unemployment rate); for Kosovo Agency of statistic of Kosovo (unemployment rate); Albania and BiH Statista (unemployment rate) ; Project team analysis

When defining the policies and measures the gender perspectives should be considered very carefully. The processes of increased gender mainstreaming should be based on the baseline information such as:

- the gender gap remains significant, with about 78% of men participating in the labour market, compared to 52 % of women[6];
- women own 29.4% and manage 26.3% of surveyed businesses;
- the largest energy companies in North Macedonia employ a significantly lower number of women compared to men. In EVN Macedonia, the country's power utility, women account for 19.6% of total workforce (about 1000 employees), 21.1% of engineers, and only 3.4% of technical field operations staff, which account for almost half of the total workforce (430 employees)[7];
- sector Electricity, gas, steam and air conditioning supply – 14,5% women and 85,5% men, and Sector Transportation and storage – 12,8 % women and 87,2% men
- women face specific and greater vulnerabilities due to their different social status and the roles traditionally attributed to them within societies[8];

In terms of energy consumption, each citizen in Macedonia consumes, on average, about 1.2 toe (13.9 MWh) of primary energy, which is 1.8 times lower than the EU 28 average (Figure 11). Only citizens in Albania consume less primary energy than Macedonia, 0.8 toe, but this is mainly due to the fact that the total electricity production in Albania comes from hydropower plants, unlike North Macedonia where 60% of the electricity is produced by lignite power plants, which requires three times more primary energy compared to the hydro power plants.

On the other hand, by comparing how much energy is needed to produce 1 EUR, it turns out that North Macedonia is one of the most inefficient countries in the observed region. It is about 60% less efficient than the EU28 average (Figure 12). Only Serbia, Kosovo, BiH and Bulgaria are less efficient than North Macedonia. In fact, North Macedonia needs to spend 0.24 toe (2.8 MWh) of energy to make 1 EUR, unlike EU28 where only 0.1 toe (1.2MWh) is needed. Proposed measures, especially in the area of energy efficiency, will increase the productivity without increasing energy consumption, bringing North Macedonia closer to the EU 28 average.

[6] State Statistical Office
[7] USAID study titled Engendering Utilities: "Improving Gender Diversity in Power Sector Utilities"
[8] GIZ ORF SEE Energy Efficiency – "Gender Analysis"

Figure 11. Primary energy consumption per capita (toe/capita), 2018

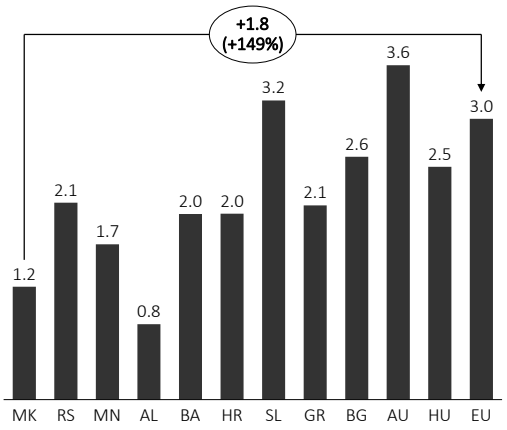
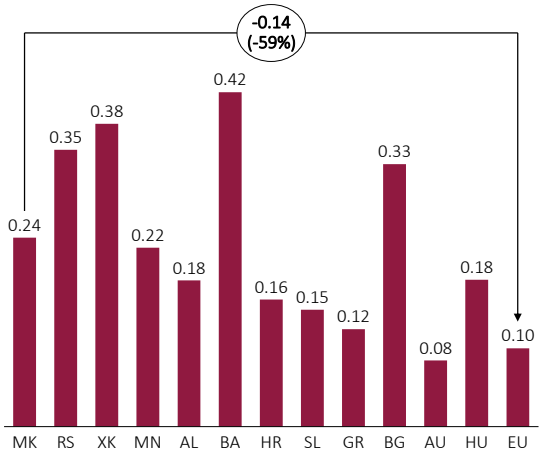


Figure 12. Primary energy consumption per GDP (toe/EUR), 2018



Source: Eurostat and World Bank; Project team analysis
Note: BA data are for 2017 (in the absence of data for 2018), while there is no data for XK for primary energy consumption per capita

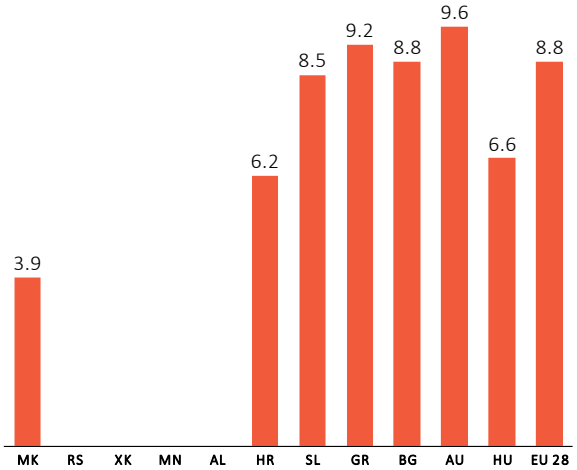
One of the basic principles in the process of selection of appropriate policies and measures that will be part of the NECP is their capacities to be adequately measures. Measures that are difficult or impossible to be quantified may also be proposed, but in that case the fulfilment of the targets may be questionable. Monitoring the implementation of the proposed policies and measures is one of the main tasks in the period upon the adoption of the NECP. A mechanism is needed to determine how appropriate policies or measures are implemented. In addition, indicators need to be established in order to monitor the achievement of the NECP targets. To this end, SDG Goals (1-No poverty, 7-Affordable and clean energy, 9-Industry, innovation and infrastructure, 12-Responsible production and consumption, 13-Climate action) indicators have been linked to the appropriate NECP dimension. In the following part of this section, the current situation in Macedonia in terms of these indicators is presented, as well as the situation in the countries from the observed region.

Monitoring the level of implementation of the NECP implies introducing indicators for each dimension separately (Decarbonisation, Energy efficiency, Energy Security, Internal energy market and Research, innovation and competitiveness). To this end, the existing Sustainable Development Indicators of the SDG Goal 7 (Affordable and clean energy), 9 (Industry, innovation and infrastructure) and 13 (Climate action) have been used, broken down into different pillars.

Dimension - Decarbonisation

Each citizen in Macedonia is responsible for 3.9 t CO_2-eq (Figure 13). Compared to the EU countries, Macedonia has more than twice lower value compared to EU 28 average.

Figure 13. CO_2-eq emissions per capita



Source: Eurostat and Macedonian State statistical office, Project team analysis

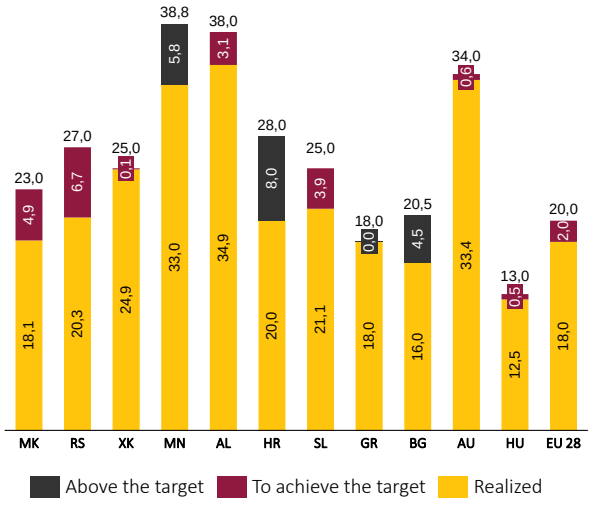
Renewable energy sources

Renewable energy sources (RES) in Macedonia in 2018 accounted for 18.1% of gross final energy consumption, which is almost identical to the level of RES share in EU 28 (Figure 14). Compared to WB6, Macedonia has the smallest share of renewable energy sources, while in the wider considered region only Hungary is behind with 12.5%. According to 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[9], the RES target for Macedonia for 2020 is 23%. Macedonia lacks 5% to achieve this target. From the considered countries, Bulgaria, Croatia, Montenegro and Greece have already achieved their 2020 targets as of February 2020.

Biofuels are the main reason why Macedonia will not meet the RES target in 2020. Namely, the target for RES in transport sector for 2020 is 10%, but the achieved share of RES in this sector in 2018 is about 0.1% (Figure 15). However, verification of the biofuels in line with sustainability criteria as required by Directive 2009/28/EC is needed. Failure to meet this target also causes failure to meet the RES target in gross final consumption. The situation is almost the same within all countries in the WB6 group. Montenegro and Serbia show best performance within the WB6 group with RES share in the final energy consumption in transport of 0.9% and 1.2%, respectively. Austria has almost achieved the RES target in the transport with a 9.8% share, while the other countries are in range from around 4% (Greece) to 8% (Bulgaria).

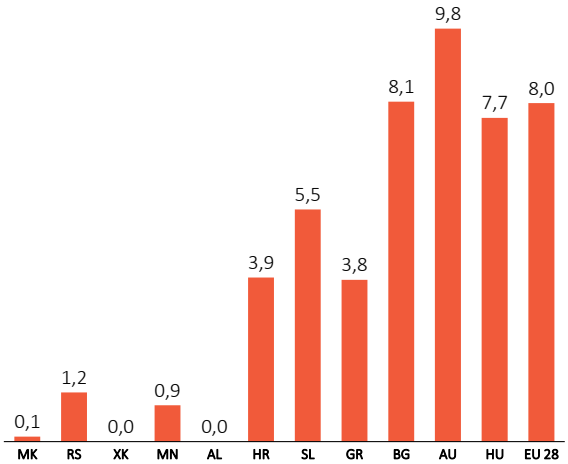
The RES share in Macedonia's electricity production has been steadily increasing; from 16% in 2010 to almost 25% in 2018 (Figure 16). Macedonia has very limited (24.8%) share of RES in electricity generation, that compare to other WB6 countries shows better performance only from Kosovo* (4.2%). As for the heating and cooling sector, the share of RES in Macedonia is 32% (Figure 17), primarily due to the consumption of biomass (firewood) for heating. The RES share in heating and cooling in Macedonia is close to the average percentage in the analyzed region. It should be emphasized that in this percentage, as well as in the share of RES in gross final energy consumption, the heat pumps and solar thermal collectors are not taken into account (because of the lack of detailed statistical data for heat pumps and solar thermal collectors), which can significantly contribute to increasing the share. However, in the new Household survey of the State Statistical Office, which started in June 2020, questions regarding heat pumps are added. These questions are a good basis for calculating the contribution of the heat pumps.

Figure 14. RES share in gross final energy consumption (%), 2018



Source: Eurostat; Project team analysis

Figure 15. RES share in final energy consumption in transport (%), 2018



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

Figure 16. RES share in electricity production (%), 2018

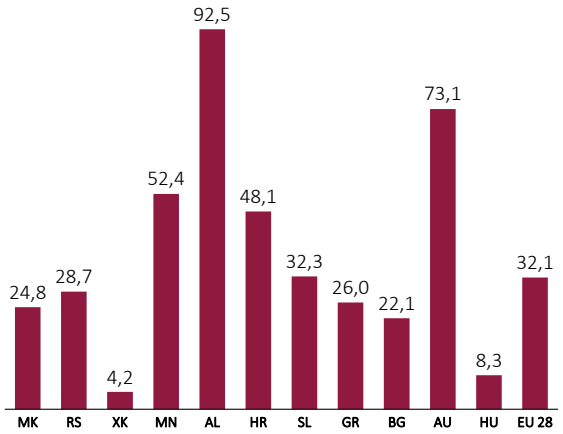
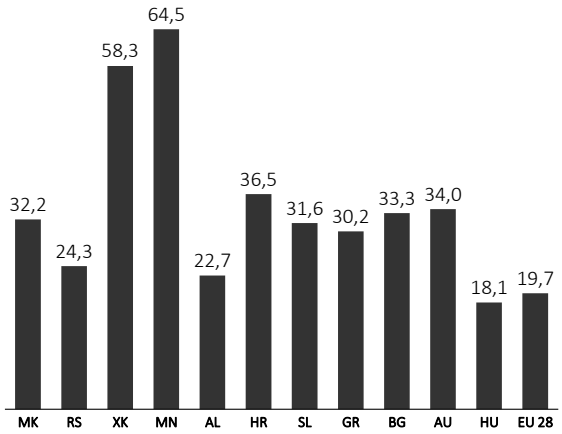


Figure 17. RES share in heating and cooling (%), 2018



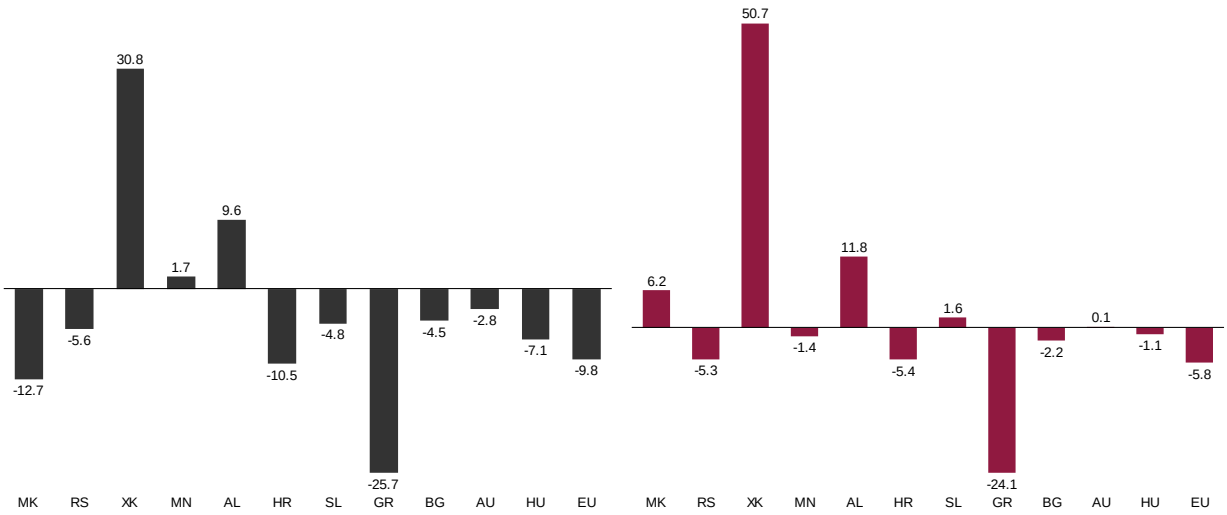
Source: Eurostat; Project team analysis

Dimension - Energy efficiency

Primary energy consumption (SDG:7_10) and final energy consumption (SDG:7_11) indicators from SDG Goal 7 are incorporated into the energy efficiency dimension. Relative to the primary energy consumption in 2005, in 2018, Macedonia has decreased its consumption for 12.7% and after Greece is on the second place comparing with all other countries (Figure 18). The reduction is results on lower electricity production from lignite. On the other hand, the final energy consumption in 2018 relative to 2005 level is increased for 6.2% (Figure 19). Apart from Macedonia, Kosovo, Albania, Slovenia and Austria also have a positive trend in the final energy consumption. All other countries have a negative trend.

Figure 18. Primary energy consumption relative to 2005 (%)

Figure 19. Final energy consumption relative to 2005 (%)

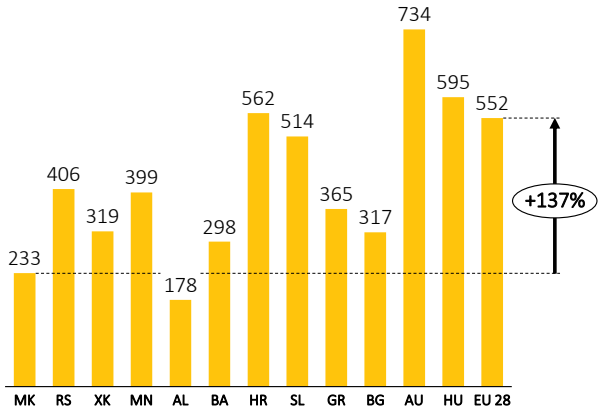


Source: Eurostat; Project team analysis

According to State Statistical Office publication “Energy consumption in households, 2014”, only 18% of the households have some insulation, while according to UNDP study “Analysis of household heating practices in the Skopje Valley”, 50.8% of the buildings in Skopje Valley do not have any insulation, 42% have thermal insulation bellow the requirements, and only 7.2% of the surveyed households live in buildings with thermal insulation according to the requirements of Rulebook regulating the construction of new buildings, adopted in 2013. On the other hand, around 25% of the households in Macedonia use inefficient electricity stove for heating and 60% inefficient biomass technologies. Having in mind the situation in the household sector and the fact that it participates with almost 28% in the final energy consumption, most of the proposed policies and measures in this NECP are for the household sector as a sector with high potential for energy savings, which can be seen from the results presented in Chapter 4 and 5. For this purpose, the SDG indicator Final energy consumption in households per capita (SDG:7_20) is used in the section on energy efficiency. This indicator

shows, on average, how much electricity and heat are spent by the households. In 2018, an average household in Macedonia consumed 233 kgoe (2710 kWh), which is 2.4 times lower compared to EU 28, which may be a result of energy poverty giving the fact that - 25% of the population in Macedonia and 7% of the population of the EU28 are unable to keep their homes adequately warm (Figure 25). However, final energy consumption in households per capita in Macedonia is smaller than all WB6 with the exception of Albania, where an average household consumed 178 kgoe (2070 kWh). Electrification of the heating and cooling sector, as well as increasing the heat consumption, which are the main priorities in the National Strategy for Energy Development up to 2040 (Energy Strategy), will contribute to improving the Macedonian situation concerning this indicator.

Figure 20. Final energy consumption in households per capita (kgoe), 2018



Source: Eurostat; Project team analysis

Apart of the Final energy consumption in households per capita indicator (SDG:7_20), which reflect the energy consumption of households, the implementation of energy efficiency measures in other sectors can be monitored using the Energy productivity indicator (SDG:7_30). This indicator represents the economic output that is produced per unit of gross available energy. The gross available energy represents the quantity of energy products necessary to meet all the demand of entities in Macedonia. According to this indicator, among the WB6, Macedonia is ahead of Serbia and Kosovo*, but is over 2.5 times lower than the average of the EU 28 (Figure 21). However, if we take the Purchasing Power Standard as an indicator, it turns out that Macedonia is almost at the level of the EU 28 (Figure 22). Far ahead of the all observed countries is Montenegro with around 1000 PPP/kgoe.

Figure 21. Energy productivity (EUR/kgoe), 2018

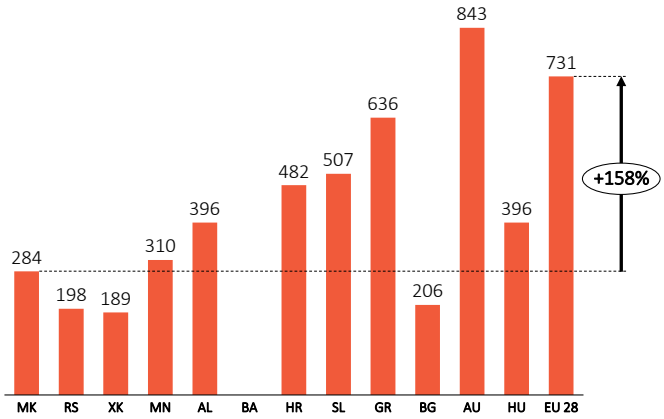
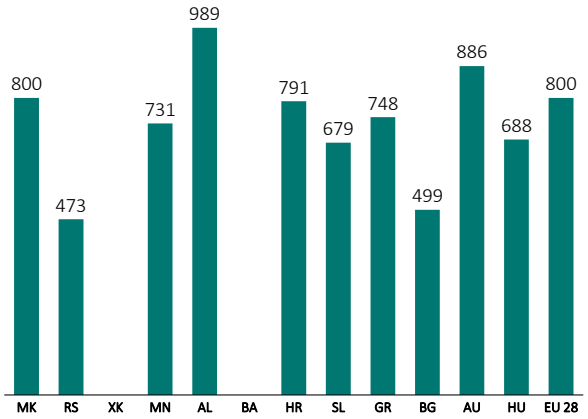


Figure 22. Energy productivity (PPPEUR/kgoe), 2018



Source: Eurostat; Project team analysis

Dimension - Energy security

Security in energy supply is one of the top priorities of both the Energy Law[10] and the Energy Strategy, as well as the NECP. To ensure security of supply, the energy imports need to be below or at about the current level. This is the main objective that the Energy Strategy is focusing on. Achievement of this objective could be

[10] http://www.economy.gov.mk/Upload/Documents/Zakon%20za%20energetika%20MK.pdf

trailed by close monitoring of the Energy import dependence indicator (SDG:7_50). In this area Macedonia shows very disappointing performance due to the high energy import dependence (56%) that is a way beyond other WB6 see Figure 23. But it must be noted that Austria, for example, imports 64% of its needs, or Greece imports over 70% of its needs. Macedonia imports total quantities of natural gas and petroleum products, and in 2018, 9% of solid fuels such as coal (Figure 24). In addition, about 30% of the electricity needs are met thought import of electricity.

Figure 23. Import dependence (%), 2018

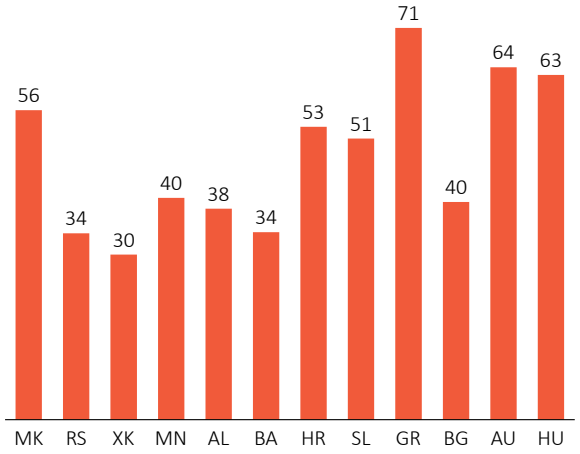
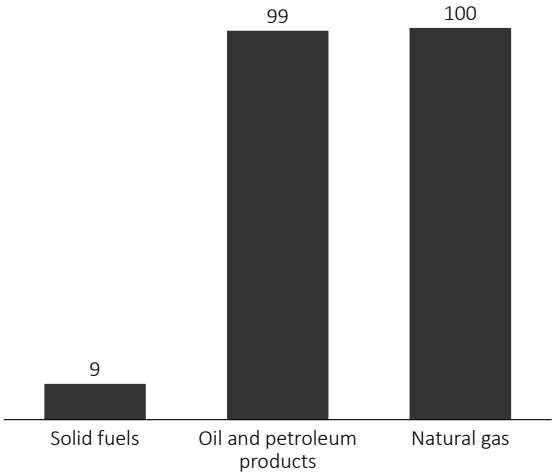


Figure 24. Macedonia import dependence by fuels (%), 2018

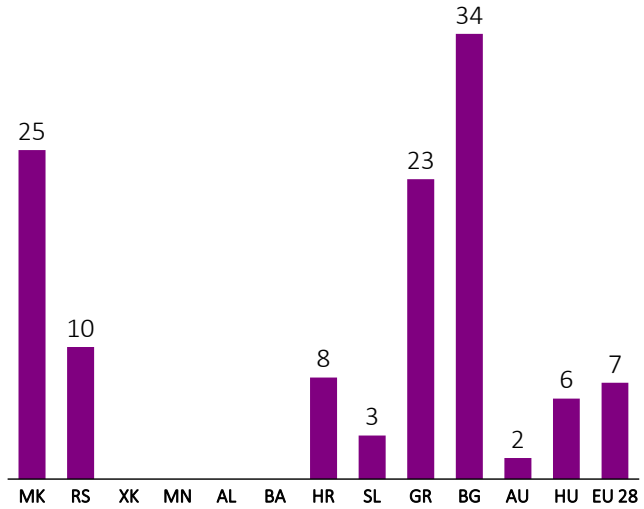


Source: Eurostat; Project team analysis

Dimension - Internal energy market

The ability of people to secure energy for heating their home reflecting the level of energy poverty in the country, but also reflects the development of energy market in the country. For this purpose, the indicator, Population unable to keep home adequately warm by poverty status (SDG:7_60), was used. According to this indicator, 25% of the population in Macedonia are unable to keep their homes adequately warm (Figure 25). Statistics in this area are not sufficiently harmonized yet, so there is no data for Kosovo*, Albania, Montenegro and BiH. At EU MSs level, this indicator is showing lower performance only in Bulgaria where 34% of the population are unable to keep their homes adequately warm, and in Greece it is approximately the same as in Macedonia. At EU 28 level, the situation is far better, only 7% of the population are unable to keep their homes adequately warm. The implementation of the program for vulnerable consumers, as well as the implementation of energy efficiency measures, are expected to significantly improve this indicator.

Figure 25. Population unable to keep home adequately warm (%), 2018

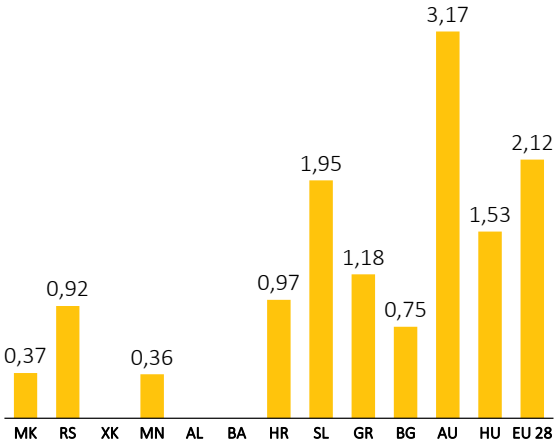


Source: Eurostat; Project team analysis
Note: Still there is no official data for XK, MN, AL and BA

Dimension - research, innovation and competitiveness

Research and Development (R&D) contributes to increased productivity, adds new high value added to the economy, and enables higher competitiveness. One of the key indicators of whether Macedonia is doing something in this field is the allocation of funds for R&D. Macedonia has a modest 0.37% of GDP for R&D, which is at the same level of Montenegro but almost 3 times less compared to Serbia and Croatia. The EU 28 average is 2.12% for 2018.

Figure 26. Gross domestic expenditure on R&D (%), 2018



Source: Eurostat; Project team analysis

II. Policy context of the national plan

The main cornerstone of the ***energy related policy context*** is the **Energy Law (Official Gazette 96/2018 and 96/2019)**, adopted in 2018, which transposes the Third Energy Package in the electricity and natural gas sector, as well as the Renewable Energy Directive 2009/28/EC. Currently, the Energy Law is being amended to provide a legal basis for the development of the NECP, as well as for streamlined and harmonized national reporting against various energy and climate targets. In February 2020, the **Energy Efficiency Law (Official Gazette 32/2020)**[11] has been adopted, which, with the relevant by-laws, warrants 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 introduces 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

As a requirement from the Energy Law, an **Energy Strategy** was adopted in December 2019. The Energy Strategy depicts three scenarios - Reference, Moderate Transition and Green, which reflect different dynamics of energy transition and enable flexibility into the country's response to relevant EU policies and governance for modern, competitive and climate-neutral economy by 2050. The Strategy defines five energy pillars with six strategic goals, closely interlinked with the five dimensions of the EU Energy Union Strategy. The Strategy is based on robust analytical work, conducted using two software tools - MARKAL and Power2Sim. The objective of the MARKAL model is to define the optimal development of the overall energy system in North Macedonia based on least cost principle, while the Power2Sim model is used to deep-dive and to confirm the electricity market results of the more comprehensive energy market model MARKAL. The Strategy provides a roadmap, which for each strategic measure and policy specifies the level of priority per scenario, the estimated time frame for implementation and the responsible administrative level for implementation. Each scenario has different set of policies and strategic measures how to achieve the strategic goals. Developed policies and strategic measures are categorized along five energy pillars and provide answers how to tackle current specific challenges and leverage on new opportunities. In addition, they are also in line with the priorities stipulated from the Energy Law in order to emphasize their relevance and contribution. Although stipulated in the Energy Law, the **Program for realization of the Energy Strategy** was not adopted within six months after the adoption of Strategy due to political situation in the country (dissolution of the Parliament

[11] https://www.pravdiko.mk/wp-content/uploads/2020/03/Zakon-za-energetska-efikasnost-10-02-2020.pdf

aimed at opening the way for the early parliamentary elections) and COVID-19 crises. However, the preparation of this document is planned to start mid-August with expected adoption in March 2021. As a part of this Program a **revision of the Energy Strategy and of this version of NECP is planned in order to reflect the changing reality with the COVID-19**.

Furthermore, in line with the Law on Energy Efficiency, the **Fourth Energy Efficiency Action Plan until 2021**, as an integral part of this NECP, is under preparation, in line with the reporting requirements of the Energy Efficiency Directive 2012/27/EU.

As to the ***climate change related policy context***, the country as a non-Annex I party to the United Nations Framework Convention on Climate Change (UNFCCC) ratified Paris Agreement in November 2017, with the following contribution to the global efforts for GHG emissions reduction (**NDC**[12]): "To reduce the CO2 emissions from fossil fuels combustion for 30%, that is, for 36% at a higher level of ambition, by 2030 compared to the business as usual (BAU) scenario." The focus of the NDC is put on climate change mitigation, that is, on policies and measures which lead to GHG emissions reduction, and particularly to CO2 emissions from fossil fuels combustion which covers almost 80% of the total GHG emissions in the country. The following sectors are of dominant share: energy supply, buildings and transport. Vulnerable sectors and climate change adaptation shall be subject to a more detailed analysis in the **revised NDC** submission (to be submitted by October 2020), which will be based on this NECP and the TBUR. The process for determining the NDC was led by the Ministry of Environment and Physical Planning (MOEPP). The National Climate Change Committee (NCCC) and the Technical Working Group at the National Sustainable Development Council were also part of this process, as well as other key stakeholders – the Ministry of Economy and the Ministry of Transport and Communication as institutions which are responsible for policies in the target sectors, representatives of the business community, civil society organizations and the academic community. Also, the international institutions and donors in the country had important role, primarily UNDP and GIZ which provided technical and financial support for this process. The analysis and the technical component of the process were carried out by an expert team which included the team of the Research Center for Energy and Sustainable Development of the Macedonian Academy of Sciences and Arts, one national expert and one international expert.

The country has so far submitted to the UNFCCC three **National Communications on Climate Change**[13] and two **Biennial Update Reports**[14]. In the period 2019-2021, the **Fourth National Communication and Third Biannual Update Report (TBUR)** to the UNFCCC are in the process of preparation. The scenarios of the Energy Strategy are based on years of research in the areas of strategic energy planning and climate change not only within the energy strategies, EE and RES plans, but also within the National Communications and Biennial Update Reports, particularly the climate change mitigation analyses conducted as a part of the **Second Biannual Update Report**[15].

The country is in the process of development of a **Long-term Strategy** and a **Law on Climate Action** with a goal to establish a strong and sustainable framework for coordinating climate action in the country by development the national strategic and legal framework for coordinated climate action aligned with the EU one to the extent possible, supported by the EU Instrument for Pre-Accession Assistance (IPA II) funding mechanism. The drafting of the Law on Climate Action (including transposition of EU Monitoring Mechanism Regulation 525/2013) has started, and the draft was prepared in April 2020. Work on the Long-term Climate Action Strategy started in March 2019, and a first draft is expected by August 2020. The 2050 outlook of this document will be included in the second phase of the NECP developmet process.

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

[12] http://unfccc.org.mk/Default.aspx?LCID=302
[13] https://klimatskipromeni.mk/article/32#/index/main
[14] https://klimatskipromeni.mk/article/28#/index/main
[15] http://unfccc.org.mk/content/Documents/SBUR/2%20Your%20Guide%20to%20the%20Macedonian%20SBUR.pdf

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 EnC 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)**[16] 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)**[17]. 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. 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)**[18] while the latest strategic and planning documents include **National Waste Management Strategy 2008-2020**[19] and **National Waste Management Plan 2009-2015 (Official Gazette 77/09)**[20]**.** 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 **Climate Change Health Adaptation Strategy and Action Plan**[21], which defines 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**[22].

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, and cooperation and communication among relevant sectors should be further enhanced or established

[16] http://www.moepp.gov.mk/?page_id=16546
[17] http://www.moepp.gov.mk/?page_id=16550
[18] http://www.moepp.gov.mk/?page_id=16555
[19] http://www.moepp.gov.mk/wp-content/uploads/2014/12/Waste-Management-Strategy-of-the-RM-2008-2020.pdf
[20] http://www.moepp.gov.mk/wp-content/uploads/2014/12/NWMP_2009-2015_-of-RM_finaL.pdf
[21] https://www.euro.who.int/__data/assets/pdf_file/0018/144171/e95094.pdf
[22] http://mrk.mk/wp-content/uploads/2018/10/Strategija-za-obrazovanie-ENG-WEB-1.pdf

in order to build synergies, reduce trade-offs, increase efficiency and improvie 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 Macedonia are:

- The **Energy Strategy** (from 2019) and
- The Second Biennial Update Report (SBUR) for Climate Change (from 2018)

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

- **Utilization of the RES potential and their promotion via financial support mechanisms,** like feed-in tariffs for small hydro, wind, PV, biomass and biogas power plants for which the Government issued a Decision (Official Gazette of the Republic of Macedonia 100/11 and 12/12) that determines the total installed capacity for application of feed-in tariffs for each RES. Another mechanism the feed-in premiums for which legal framework have been set up recently;
- **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 (biofuels) 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.

Other policies and measures relevant for the dimension **decarbonisation** are related to other sectors and include:

- **Improvement of waste management practices** via promotion of composting and waste selection, all in line with the regional waste management plans.
- **Promoting modification of manure management and feeding practices of livestock in agriculture sector** via new practices for modified farm design and construction, that will enable GHG emissions reduction.
- **Decreasing the number and extent of forest fires and improvement of forest quality** through integrated management of forest fires and afforestation of transitive forestland with higher quality tree species.
- **Promotion of land use conversion in agricultural or other land use types,** that will help to reduce erosion, protect organic matter in soil, and reduce carbon emissions from soil.

The measures that are relevant for dimensions **energy security** and **internal energy market** include:

- **Revitalization and improvement of the transmission system network** in line with Strategic Development Plans of MEPSO including starting the construction of new interconnection point towards Albania (400 kV).
- **Development of the natural gas transmission network** in line with the plan for gasification of Macedonia.

Considering the dimension **research, innovation and competitiveness**, the following policies and measures are relevant:

- **Establishment of the Fund for innovation and technology development**, as a national public fund for SMEs that provides technical assistance via tech accelerators, offers 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.
- **Eligibility to international donors' funds** such as EBRD, EIB, EU funds, UNDP, KfW, UNIDO, USAID, World Bank, which continually support the energy and climate activities in the country, either with specific investment projects or with enabling support for research analysis.

More details on current policies and measures are provided in Chapter 3.

IV. Key issues of cross-border relevance

The regional cooperation is crucial for 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 well as market coupling with Bulgaria and participation in 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. 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.

The Energy Community also prepares annual implementation reports on Contracting Parties' progress on compliance with the adapted EU Directives and Regulations. Although much of the EU legislation through EnC has been transposed in the contracting parties to the EnC Treaty, introduction of a carbon price mechanism is still pending. The introduction of this mechanism can significantly affect the situation in the region, and especially in the electricity market. To that end, the Energy Community, at the beginning of February 2020, has launched a project that will show whether, when and how to introduce a CO_2 tax or a cap-and-trade system, and at what price. During the preparation of this study, relevant experts from Energy Community countries will be involved in the whole process.

Meeting the goals outlined in the Energy Strategy, which are properly incorporated in this plan, means building large capacities of renewable energy sources. Renewables will mean introducing uncertainty into the system and balancing that requires cross-border cooperation (already addressed in the EnC study - Development of

a roadmap towards a regional balancing cooperation[23]). The Energy Community has prepared a study on the adequacy of the electricity systems of the WB6. The purpose of this report is to perform a forward-looking analysis of the resource adequacy of electricity systems of WB6 in their transition to EU regulation - that is, to assess whether sufficient capacity will be available to guarantee the security of supplies. In addition, this study investigates the extent to which the transition to the EU target electricity market model as well as the implementation of attainable EU environmental requirements and the transition to CO_2 pricing may make existing plants unprofitable to operate and cause their decommissioning, which could in turn create adequacy issues.

Energy Community included cybersecurity in its support to energy and network security. The Study[24] on cybersecurity in the energy sector is published in January 2020. It provides a comprehensive overview of the responsible bodies and transposed legislation in cybersecurity applicable to energy, threat analysis and risk assessment, and a set of recommendations (on local and regional level) for increased resilience and security of energy infrastructures. The Energy Community initiated the establishment of cooperation mechanisms to facilitate cybersecurity measures including designation of energy critical infrastructures, application of cybersecurity technical standards in energy, establishment of Energy Community Information Sharing and Analysis Centre (EnC ISAC) and a broad platform for education and training in cybersecurity under the umbrella of a Cybersecurity Academy. It also aims to set tangible cooperation with the EU cybersecurity agency ENISA, the European Energy ISAC (EE-ISAC) and other cybersecurity bodies and associations active in the energy sector in Europe and beyond.

Macedonia participates in several regional initiatives. MEPSO, the Electricity Transmission System Operator (TSO) of North Macedonia, is one of the founders of SEE CAO (Coordinated Auction Office in South East Europe) which was established in 2014 by the South East European Power System Operators (Croatian HOPS, NOSBiH, Montenegrin CGES, Albanian OST, Kosovar KOSTT, Greek IPTO, Turkish TEIAS, and additionally, MEPSO) - with the objective to perform the explicit allocation of cross-border transmission capacity in both directions between TSO's Controlled Areas, through NTC-based Auction Processes in accordance with the requirements of Regulation (EC) 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions to access the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003. Today, apart from providing services to its shareholders, SEE CAO also manages allocations on the Italy-Montenegro border and qualifies Italian TERNA as a non-shareholding Service User.

MEPSO is also a full member of the European Network of Transmission System Operators for Electricity - ENTSO-E), and it is actively participating and contributing to realization of the tasks of the working groups. On the other hand, GAMA is observer in the European Network of Transmission System Operators for Gas - ENTSO-G. ENTSO-E and ENTSO-G were established and given legal mandates by the EU's Third Legislative Package for the Internal Energy Market in 2009, aimed at further liberalizing gas and electricity markets in the EU.

MEPSO is also a service user of Security Coordination Centre SCC Ltd. Belgrade, which is the first Regional Security Coordinator in the Southeast Europe, established as a company whose objective is to develop necessary services defined by ENTSO-E's Policy Paper „Core strategy for TSO Coordination" and „Future TSO Coordination for Europe" in order to fulfill operational planning standards which will be defined by the European NC/GL.

Concerning the regional cooperation, it is also important to note that the National Electricity Market Operator (MEMO) is in constant communication and coordination with the operator of the organized electricity market in Bulgaria. Immediately after the establishment of an organized market in Macedonia, market coupling with the organized market in Bulgaria will be made.

The Energy Regulatory Commission of Macedonia is a member of the Energy Community Regulatory Board (ECRB) and from 2019 the president of the Regulatory Commission of Macedonia is elected as a president of ECRB, with a mandate of 2 years. The ECRB is the coordinating institution of the national regulators of the

[23] https://www.energy-community.org/dam/jcr:2dd693b9-61f4-44cf-a398-bd72b85ebf83/EKC_IMP_task5report_032019.pdf
[24] https://www.energy-community.org/dam/jcr:db8e479d-b423-40c9-9ff9-998c7d9045ef/Blueprint_cyber_122019.pdf

Energy Community for the development of harmonized regulatory rules, composed of representatives of the regulatory bodies of signatory countries as contracting parties.

At the beginning of 2020, the Energy Regulatory Commission of Macedonia has applied and has been given a positive recommendation from the Energy Community to be granted an observer status in the Agency for Cooperation of Energy Regulators (ACER).

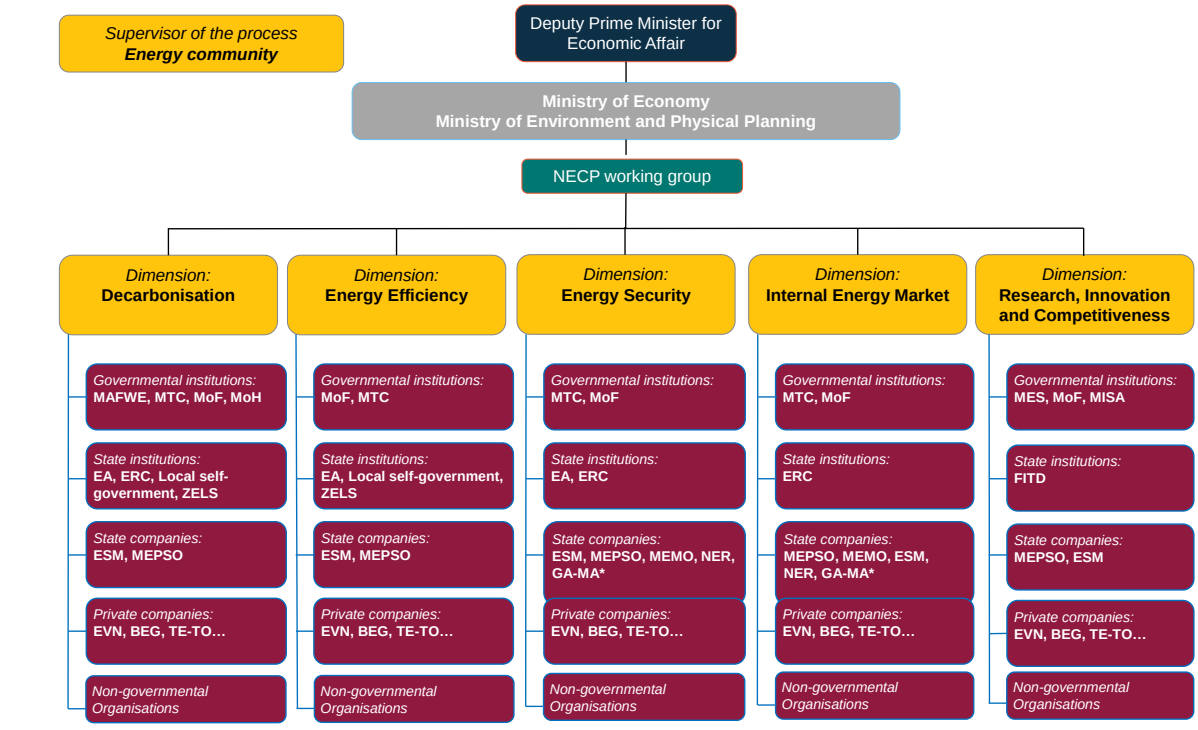
The Energy Regulatory Commission of Macedonia also participates, as an observer, in the work of the Council of European Energy Regulators (CEER). By joining this Council, the Energy Regulatory Commission gains experience in implementing the Third Package of Legislation and the challenges that EU Member States face in creating a single, competitive, efficient and sustainable internal energy market in the European Union, as well as with new packages of the European legislation.

The Energy Regulatory Commission is also full member of the Energy Regulators Regional Association (ERRA) since 2004. The purpose of this Association is to promote cooperation, exchange experiences and strengthen the capacity of regulatory bodies.

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, for each dimension the relevant institutions have been identified. The work of all dimensions will be coordinated by the Deputy Prime Minister in Charge of Economic Affairs, as well as the Ministry of Economy and the Ministry of Environment and Physical Planning, as institutions with the ultimate responsibility for implementing the NECP. Figure 27 shows the grouping of the responsible institutions for each dimension. The Energy Community will observe and support the whole process.

Figure 27. Implementing bodies



MAFWE – Ministry of Agriculture, Forestry and Water Economy; MTC – Mistry for Transport and Communication; MoF – Ministry of Finance, MoH – Ministry of Health; MES – Ministry of Education and Science; MISA – Ministry of Information Society and Administration; EA – Energy Agency; ERC – Energy Regulatory Commission; FITD – Fund for Innovation and Development; ESM – Power plants of North Macedonia, MEPSO – Electricity Transmission System Operator of the Republic of North Macedonia; MEMO – National Electricity Market Operator, NER – National Energy Resources; GA-MA - Gas Transmission Company; EVN – Electricity Distribution Company, BEG – Balkan Energy Group District Heating Company; TE-TO - Cogeneration Power Plant; ZELS – Association od Local Self-governments

**Note: GA-MA is a joint-stock company with 50% of the shares owned by the Government, and at 50% owned by the private company AD Makpetrol. A settlement is made in 2019 between both parties, and the Government agreed to purchase Makpetrol's share in GA-MA, but the implementation of this settlement is still not accomplished.*

CONSULTATIONS AND INVOLVEMENT OF NATIONAL ENTITIES AND THEIR OUTCOME

I. Involvement of the national parliament

The NECP was prepared against a backdrop of dissolution of the Parliament aimed at opening the way for the early parliamentary elections scheduled for April 12, 2020, which have been postponed to 15 July due to the coronavirus. Therefore, the Parliament could not have been involved in the NECP preparation phase. The technical analyses and consultations for the NECP are expected to be finalized before the forthcoming parliamentary elections, so that the draft version can be introduced and discussed at technical sessions with the relevant parliamentarian groups once the new Parliament is established, in particular with the Green Parliamentarian Group. The perspectives and views of the parliamentarians taken at the technical sessions will be incorporated in the NECP and that version will be submitted to the Government for adoption. The experience gathered from the GIZ project involving parliamentarians across the Western Balkan will be utilized in order to ensure effective communication and substantial buy-in from the parliamentarians.

II. Involvement of local and regional authorities

The NECP is built on the understanding that the realisation of the energy and climate goals cannot be achieved only through top-down activities from a national government, but bottom-up support is also needed through active participation of regional and local governance levels. This is reflected in the composition of the working groups having the Association of the Units of Local Self-Government (ZELS) represented in two out of five working groups (Decarbonisation and Energy Efficiency), as well as one civil organization dealing with local development represented in Energy Efficiency working group. Also, the findings of the studies conducted at local level, like UNDP supported Heating Study of the City of Skopje (STUGRES) and Transport Study of the City of Skopje, will be integrated in the NECP. Stakeholders at regional level, like Regional Development Centres will be invited to participate in the public debate. Also, presentations and technical sessions can be organized at regional and municipal level ether as webinars or seminars in order to bring the NECP closer to regional and local stakeholders, encouraging thus engagement for a local action.

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

The NECP planning process started in the beginning of 2019 with a couple of meetings aimed at creation of a common understanding of NECP process design, exchanging about requirements and possible setup of the National Coordination Process, discussing thematic working groups, their tasks and steering structure, as well as identifying the first steps, activities and responsibilities. At the fifth meeting, the final structural design of the NECP process was formalized as presented in Figure 28.Specifically, five working groups were established along the five NECP dimensions - Decarbonisation, Energy Efficiency, Energy Security, Energy Market and Research and Innovation (R&I) and Competiveness, each with a national coordinator (from one of the leading ministries) and a technical coordinator (from academic sector). Technical Working Group, composed of technical coordinators, is responsible for analytical work and drafting the NECP and is supported by an international mentor. The overall process is coordinated by a NECP national coordinator (from the leading ministry) and NECP technical coordinator (from academic sector) supported by representatives of two leading ministries. In the working groups, total 21 national stakeholders are involved - 8 governmental institutions (6 Ministries, Sector for EU integration and Cabinet of the Vice Prime Minister for economic Affairs), 3 agencies, regulators and statistical offices, 5 energy companies, 1 regional/local stakeholder (umbrella institution of all local self-governments), 3 non-governmental organizations and 1 academic institution. This structure has remained operational during coronavirus crisis, mainly through online meetings (virtual skype meetings) for presentation and discussions of the work in progress and electronic communication for reviewing and providing inputs to drafted texts. In total, 8 NECP working groups meetings were conducted, while the 9th

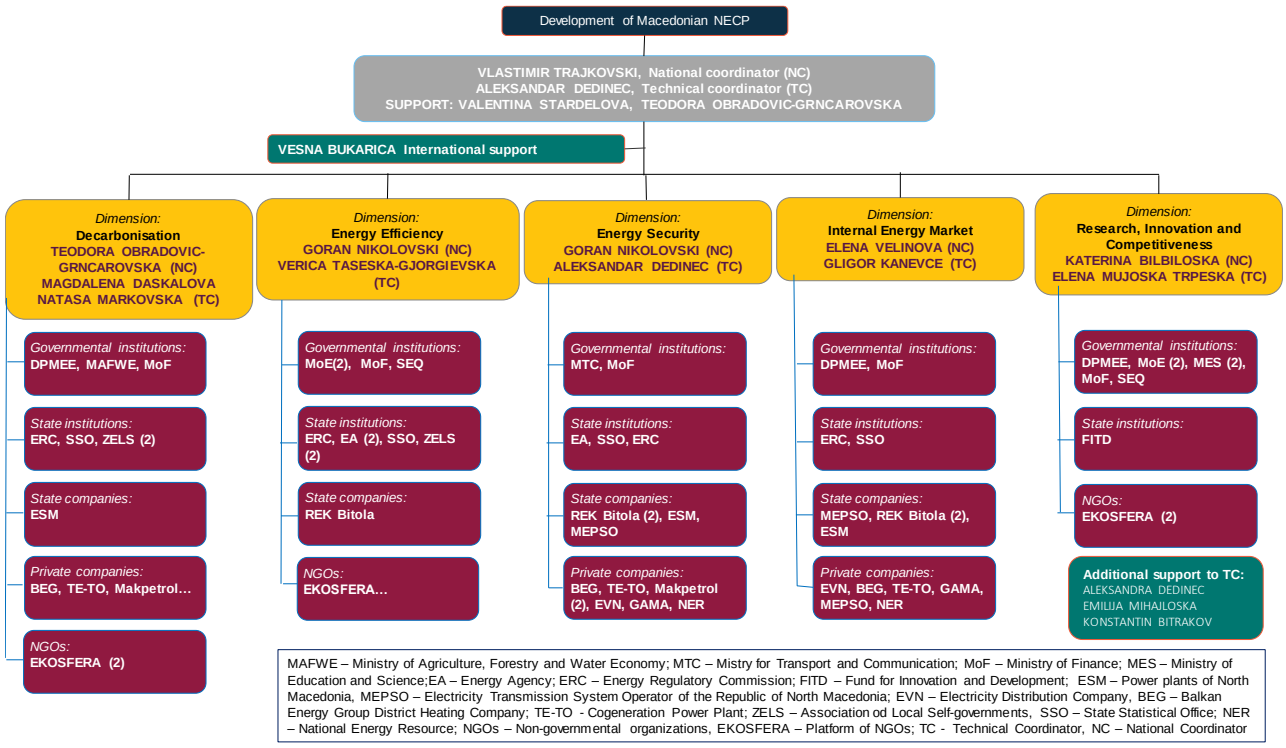
meeting was organized through 5 separate meetings dedicated to each of the five dimensions in order to present and discuss in details the NECP content and results for the respective dimension.

It is worth noting that the NECP capitalizes on the institutional and analytical capacities, participatory practice, experience, tools and knowledge base that have been already created in the country, and maintained and enhanced over the SBUR, Energy Strategy and the TBUR timelines. Like all these documents, NECP is based on the robust analytical work and consultations with the relevant ministries and other relevant stakeholders aimed at:

- Identification and validation of possible mitigation policies and measures in the target sectors in agreement with the sector policies and planning documents, as well as with the European Policy on Climate and Energy.
- Identification and validation of the assumptions used for the modelling of the identified policies and measures in line with the sector policies and planning documents, as well as with the European Policy on Climate and Energy.
- Prioritization of identified policies and measures and providing directions for development of mitigation scenarios and setting of targets.

Admittedly, there might be same gaps in the representation of stakeholders in the working groups, like for example, not full coverage of the main energy companies in the country or underrepresentation of regional and local stakeholders. Also, some additional institutions could have a significant role as shown in the respective analyses, like for example Chambers of Commerce for Decarbonisation and Energy Efficiency working groups, or Fund for Innovation and Technological Development as found by the analyses under R&I and Competitiveness dimension. These gaps are mitigated to some extent, as the NECP is conceived as widely inclusive and transparent process and the stakeholders are encouraged to enter and contribute at any phase of its timeline. Particularly important in this regard will be the public debate which is planned to be opened in the second phase of NECP development process. All available communication methods will be used to gather inputs from wide spectrum of stakeholder groups in order to improve the NECP document and, at the same time, to create over-all ownership over the NECP document and over-all willingness to implement the stipulated policies and measures.

Figure 28. Persons and entities involved in the process of NECP preparation



IV. Consultations of other Contracting Parties

The NECP consultations with the other Contracting Parties are realized through the already established bodies and mechanisms for regional cooperation which are detailed in the next section (Regional cooperation in preparing the plan, subsection II). Herein, a mention is made of

- Western Balkan 6, Central and South Eastern Europe energy connectivity (CESEC),
- Ministerial Council of the Energy Community,
- Energy and Climate Committee,
- Energy and Climate Technical Working Group,
- Renewable Energy Coordination Group,
- Energy Efficiency Working Group,
- Environmental Task Force,
- EnC Permanent High Level Group and
- Platforms for Gas and Electricity.
- Furthermore, the country participates and contributes to Regional Meetings and Workshops, as well as Regional Exchange events organized by GIZ Open Regional Fund - Energy Efficiency (ORF-EE) in order to facilitate a discussion of modelling approaches, data availability and quality, challenges, best practices, cross-sectoral and regional issues.

In addition, if any NECP policy or measure entails a cross border issue with any of the neighboring EU member states (Greece or Bulgaria), this issue will be jointly addressed with the respective member state.

V. Interactive process with the Energy Community Secretariat

The Energy Community (EnC) Secretariat closely follows the NECP developments and provides support as needed. Formally, this involvement of the EnC Secretariat is realized through the work of Ministerial Council of the EnC, Energy and Climate Committee, Energy and Climate Technical Working Group, Renewable Energy Coordination Group, Energy Efficiency Coordination Group, Environmental Task Force, EnC Permanent High Level Group and Platforms for Gas and Electricity, as well as regional platforms and fora (e.g. Sustainability Forum, Law Forum, Athens Forum, etc.).

EnC Secretariat is also involved at technical level, through participation at the NECP Working Group Meetings and regular written exchange. Hence, at 4th NECP Working Group Meeting EnC experts together with technical coordinators and Working Group Members went through the first two chapters of NECP template and discussed their content in Macedonian context. The result of this interactive and brainstorming discussion was a guidance for the chapter developers taking into account the requirements of the NECP regulation and the Macedonian context brought by the technical coordinators and Working Group Members. Furthermore, the EnC experts reviewed the drafted text and provided their informal comments. This iterative mode of communication with the EnC, and also with the Working Group, has proved highly effective, and ensured following the right NECP development pathway since all the issues are detected early and adequate response action is jointly devised.

Lastly, a substantial buy-in form EnC comes through Regional Meetings and Workshops and Regional Exchange events organized by GIZ ORF-EE (total 4), where the EnC experts as well as national experts make presentations and discuss many topics which are of high relevance for the NECPs. Macedonian experts made presentations on the following topics: NECP of Macedonia – current stage, Sensitivity analyses in the energy planning, Bottom-up demand modeling for the heat sector and Modeling of the transport sector and Emission factor on the imported electricity. Worth mentioning here are the series of webinars hosted by EnC Secretariat covering a number of NECP relevant topics, such as Electricity Market and Trading with market development outlook for the EnC, Regulation on Wholesale Energy Market Integrity and Transparency, Energy Poverty, Electricity Storage Investment and others, as well as a number of online meetings dedicated to Carbon pricing regional study.

REGIONAL COOPERATION IN PREPARING THE PLAN

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

The previous chapter, Overview of the current policy situation, explains the need for regional cooperation, as well as where Macedonia or certain institutions from Macedonia have participated. Elements that are or could be subject to regional cooperation are presented below by dimension.

1 Decarbonisation

- introduction of carbon pricing,
- splitting ETS and non-ETS sectors,
- RES quota exchange,
- guarantees of origins exchange, as well as knowledge sharing,
- participation to the EnC Renewable Energy Coordination Group,
- participation to the EnC Environmental Task Force,
- participation to the EnC Energy and Climate Committee.

2 Energy efficiency

- Bilateral and regional energy efficiency projects (e.g. REEP Plus, GIZ ORF EE – e.g. Monitoring and Verification Platform, EU BUILD UP Skills, CESEC, CBC IPA projects etc.)
- participation to the EnC Energy Efficiency Coordination Group,

3 Security of supply

- regional balancing mechanism-SMM block ,
- electricity interconnection with Albania,
- gas transmission network with Greece, Kosovo* and Serbia.
- participation to the EnC SoS Coordination Group,
- participation to CESEC Initiative meetings

4 Internal energy market

- market coupling with Bulgaria,
- regional electricity market,
- participation in SEE CAO,
- participation in ENTSO-E and ENTSO-G,
- participation in the CEER.

5 Research, innovation and competitiveness

- Bilateral or multilateral research projects (IPA, Interreg Balkan-Mediterranean),
- Horizon 2020 and its successor,
- Other regional and international funds for research, innovation and competitiveness.

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

Being a vital element of stabilization and association – the process guiding the Western Balkans towards EU membership and helping the region to address shared challenges such as energy shortages, pollution,

transport infrastructure, cross-border issues and others -, regional cooperation, also within the NECP, is seen as a crucial building block and an important tool for the realization of a number of activities.

The NECP encompasses activities which follow **the Western Balkan 6 Initiative** (Berlin Process) which aims to support the six Contracting Parties of the Energy Community in Southeast Europe in strengthening regional cooperation and driving sustainable growth and jobs. It will also integrate national activities within **Central and South Eastern Europe energy connectivity (CESEC)** cooperation in facilitating the swift completion of cross-border and trans-European projects that 1) diversify gas supplies to the region, 2) develop regional gas markets and 3) implement harmonised EU rules to ensure the optimal functioning of infrastructure, as well as in (4) adopting a joint approach on electricity markets, energy efficiency and renewable development, (5) devising a list of priority projects to build an interconnected regional electricity market and (6) undertaking specific actions to boost renewables and investment in energy efficiency in a region with vast growth potential in these areas.

The regional cooperation will also be realized in the form of **knowledge and experience exchange within the Energy Community Energy and Climate Committee** and its Technical Working Group, which serve as a platform for cooperation between representatives of ministries and agencies in charge of energy, climate change and environment from the Energy Community Contracting Parties and Observers in the following areas:

- Implementation and alignment of Contracting Parties legislation to the Monitoring Mechanism Regulation (MMR). This includes: establishing GHG emission inventories, developing low-carbon development strategies and improving national systems for reporting on policies and measures and for reporting on projections of anthropogenic greenhouse gas emissions,
- Preparation of integrated national energy and climate plans, implementation of the Energy Community Policy Guidance and Governance Regulation – exchanging best practices and lessons learned.
- Streamlining climate change considerations in other sectoral policies - exchanging best practices and lessons learned.
- Establishing energy efficiency, renewables and greenhouse gas emission reduction targets for 2030.

Regional cooperation at Energy Community level will also be pivotal for

i) establishing the most appropriate mechanism for carbon pricing, also taking into account a possible carbon border tax, as emerging from the EU Green Deal;

ii) ensuring active participation as well as rigorous, streamlined and inclusive discussions of Contracting Parties on energy efficiency, renewables, environment, electricity, gas etc. - assisted by the Energy Efficiency Coordination Group, the Renewable Energy Coordination Group, the Environmental Task Force, the ECRB Electricity Working Group and Gas Working Group and Customers and Retail Markets Working Group).

NECP may also benefit from the work of the **Regional Cooperation Council**, contributing to realization of the following two objectives of its Connectivity area: (1) The Paris Agreement on Climate Change to keep temperature growth well below 2℃ implemented and (2) 2030 energy and climate framework policy targets defined and successfully achieved.

The section “IV. Key issues of cross-border relevance” provides more information on the regional cooperation.

2. NATIONAL OBJECTIVES AND TARGETS

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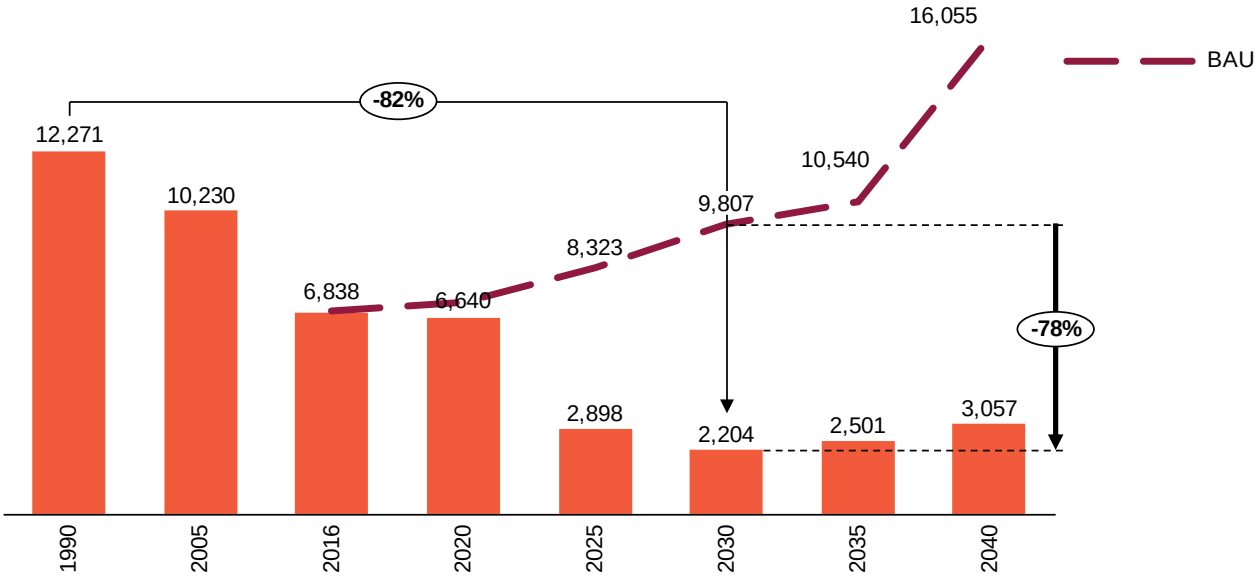
DIMENSION DECARBONISATION

1. GHG emissions and removals

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

The economy wide GHG emission reduction **target** for Macedonia is 82% in 2030 compared to 1990 (Figure 29), or 78% compared to BAU scenario (defined in the Energy Strategy). The indicative trajectory shows that by 2020, Macedonia will reach a reference point of 56% of the total GHG reduction target (which means that more than half of the emission reductions will be achieved by 2020), and 93% in 2025. After 2030, there is increase of the GHG emissions that are mainly result of the transport sector (increase in the transport of goods).

Figure 29. Indicative targets and trajectory for GHG emissions reduction



Source: Results from the Strategy for energy development up to 2040 and TBUR, project team analyses

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

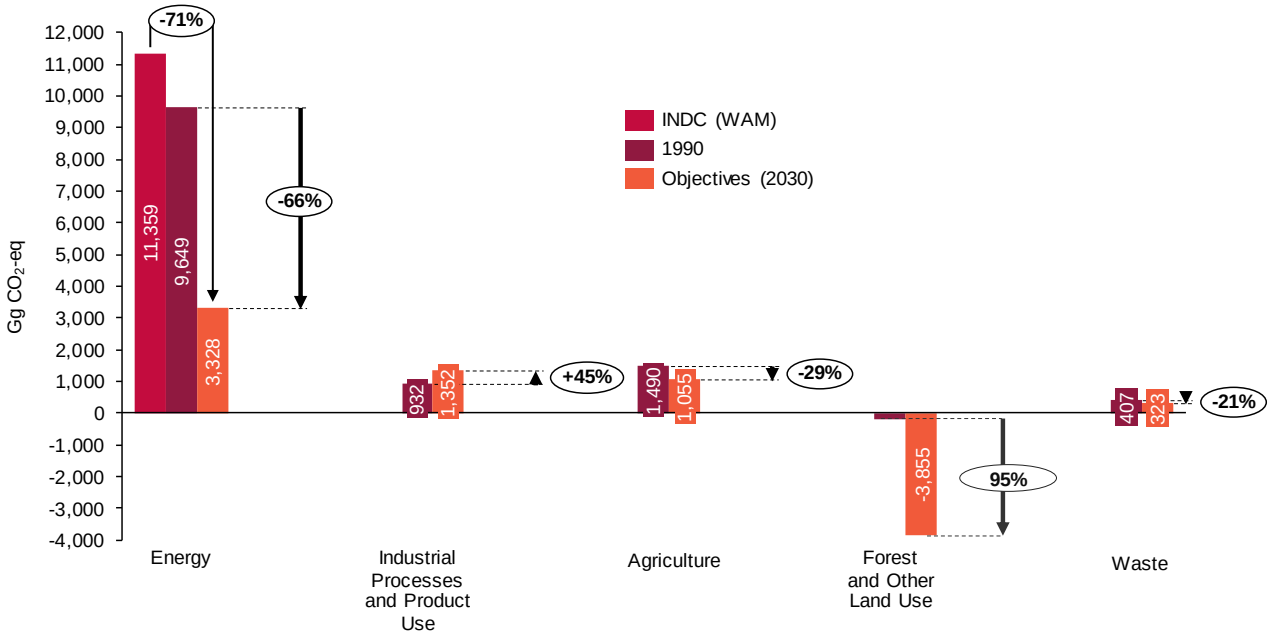
In order to achieve the target for GHG emissions reduction, sectoral **objectives** are set for 2030 relative to 1990 level (Figure 30):

- Energy sector – 66% (6,321 Gg CO_2-eq) GHG emission reduction (mainly through decommissioning of coal fired TPP Oslomej in 2021 and TPP Bitola up to 2027)
- Industrial Processes and Product Use – 45% (420 Gg CO_2-eq) GHG emissions increase
- Agriculture – 29% (435 Gg CO_2-eq) GHG emissions reduction
- Forest and Other Land Use – 95% (2,647 Gg CO_2-eq) GHG removals increase
- Waste – 21% (84 Gg CO_2-eq) GHG emissions reduction

Furthermore, there is a need for revision of the Macedonian Intended Nationally Determined Contribution (INDC), where only the CO_2 emissions from the Energy sector were considered. The target in INDC is set compared to BAU scenario – maximum 36% reductions by 2030 (scenario with additional measures-WAM).

The absolute value of the GHG emissions of the target set in this NECP for the Energy sector (including CO_2, CH_4 and N_2O emissions) is 71% lower, even compared to the most ambitious scenario in the INDC. However, this means that the target set in the INDC will be met by fulfilling the objective set for the Energy sector in this NECP.

Figure 30. Sectoral objectives for 2030 relative to 1990 level, and comparison with INDC target



Source: Results from the Strategy for energy development up to 2040 and TBUR, project team analyses

III. Outlook up to 2050

The analyses of the latest documents cover the period up to 2040. Therefore, the **objective** is to achieve the 2040 level for GHG emissions defined in the TBUR (e-WAM – extended mitigation scenario)[25]. If the analysis from the Long-term Climate Action Strategy until 2050 become available during the preparation of this document, targets for 2050 will be included.

2. Renewable energy[26]

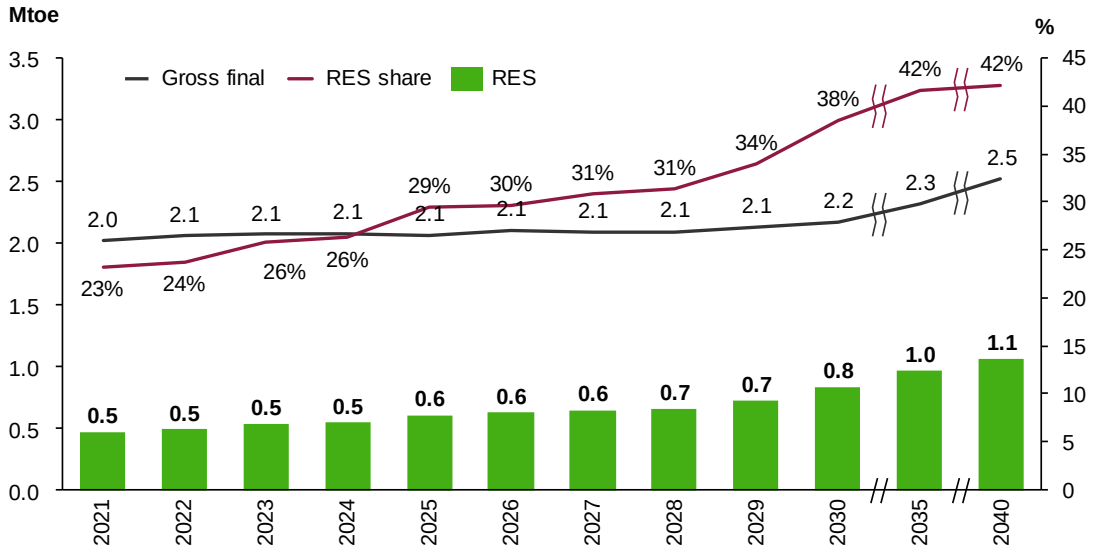
I. The elements set out in point (a)(2) of Article 4;

The Macedonian **target** for the share of energy from renewable sources in gross final consumption of energy in 2030 is 38% (Figure 31). The indicative trajectory shows that by 2022, it will reach a reference point of 9% of the total increase in the share of energy from renewable sources between Macedonian binding 2020 national target, and its contribution to the 2030 target. By 2025 and 2027, the indicative trajectory reaches a reference point of 44% and 53%, correspondingly, of the total increase in the share of energy from renewable sources between Macedonian binding 2020 national target and its contribution to the 2030 target. It is projected that the target will reach 42% in 2040. The most important thing regarding the biofuels is that verification in line with sustainability criteria as required by RES Directive 2018/2001 is needed.

25 https://klimatskipromeni.mk/data/rest/file/download/1fde7ae390526eab08df8490ae199a7f0597b28f358721a252f2b23f316b3208.pdf

26 Renewable energy is listed under Decarbonisation in the Governance Regulation; however, several Contracting Parties already have set up alone standing working groups on the topic.

Figure 31. Share of energy from renewable sources in gross final consumption of energy, with an indicative trajectory



Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

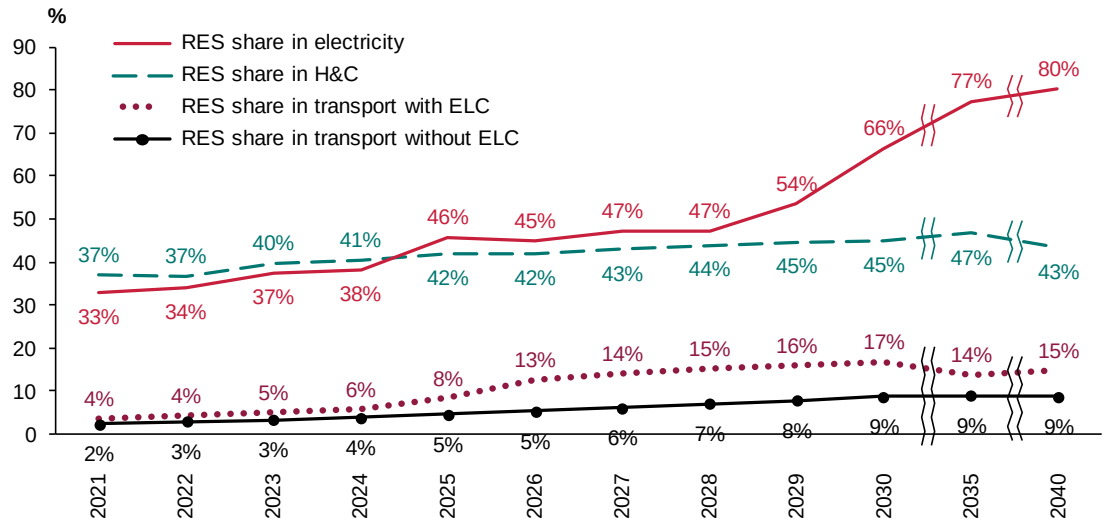
II. Estimated trajectories for the sectoral share of renewable energy in final energy consumption from 2021 to 2030 in the electricity, heating and cooling, and transport sector;

The Macedonian goal for the share of renewable energy in final energy consumption in the electricity sector is 66% in 2030 (Figure 32). The **indicative trajectory** shows that by 2025, the RES share in electricity will reach a reference point of 43% of the total increase in the share of RES in electricity between Macedonian binding 2020 national target, and its contribution to the 2030 target.

The estimated **target** for the share of renewable energy in final energy consumption in the heating and cooling sector is 45% in 2030. The indicative trajectory shows that by 2025, the RES share in heating and cooling will reach a reference point of 57% of the total increase in the share of RES in heating and cooling between Macedonian binding 2020 national target, and its contribution to the 2030 target.

The **target** for RES share in the final energy consumption in the transport sector is defined as 10% in 2030, which is achieved only by using biofuels. In the total energy consumption in transport, biofuels will participate with 9% (Figure 32). However, it's not just biofuels that contribute to the increase of RES in transport, since electric vehicles can also have a significant role. According to the Energy Strategy, electric vehicles can contribute to an increase of RES share in transport by 8 percentage points, reaching 17% RES share in transport in 2030. The indicative trajectory shows that by 2025, the RES share in transport (without electricity) will reach a reference point of 46% of the total increase in the share of RES in transport (without electricity) between Macedonian binding 2020 national target, and its contribution to the 2030 target.

Figure 32. Estimated trajectories for the share of renewable energy in final energy consumption in the electricity, heating and cooling and transport sector

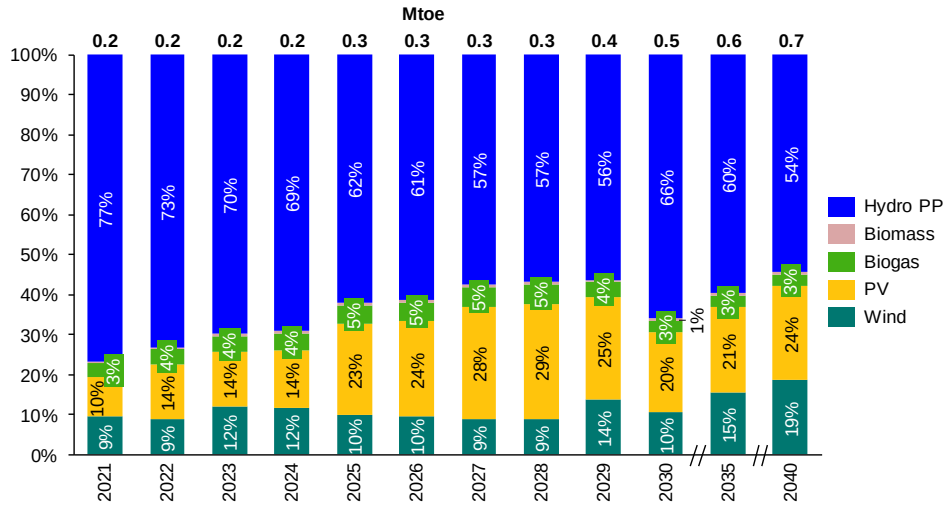


Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

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 Macedonian RES share target in the electricity sector is planned to be fulfilled by having 66% hydro, 20% PV, 10% wind, 3% biogas and 1% biomass production in the final energy consumption in the electricity sector in 2030 (Figure 33).The technology with highest increase is the PV, which reaches almost 30% in 2028.

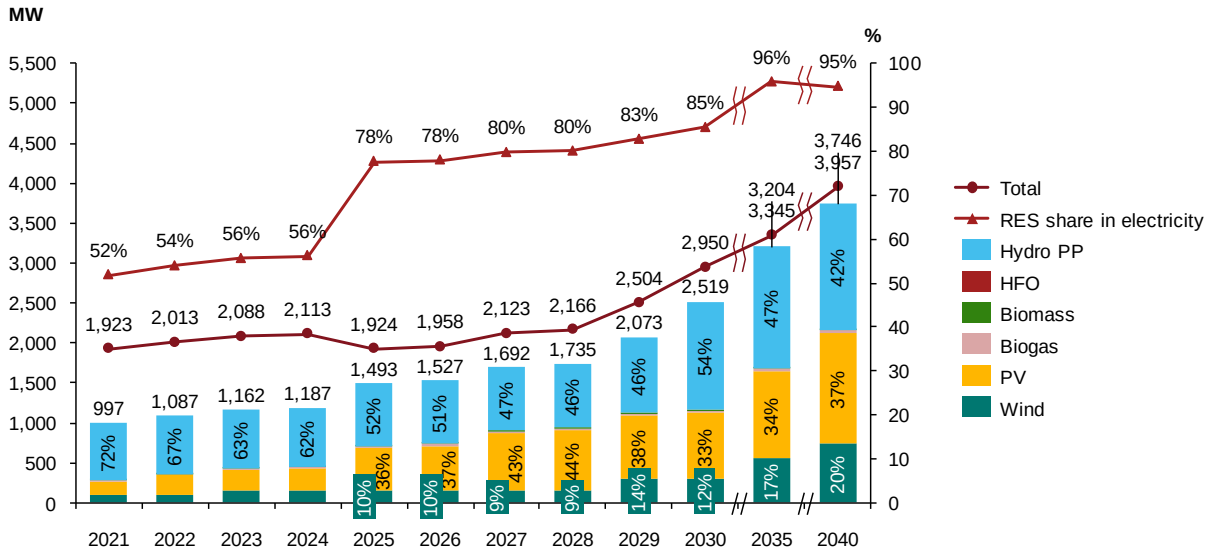
Figure 33. Estimated trajectory by RES technology in gross final energy consumption, electricity sector



Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

It is projected that the share of RES in the installed capacity for electricity production in 2030 should reach over 85%. From these, the highest percentage is installed capacity of hydropower plants (54%), 33% are PV, 12% are wind and the remaining 1% is biogas and biomass power plants (Figure 34).

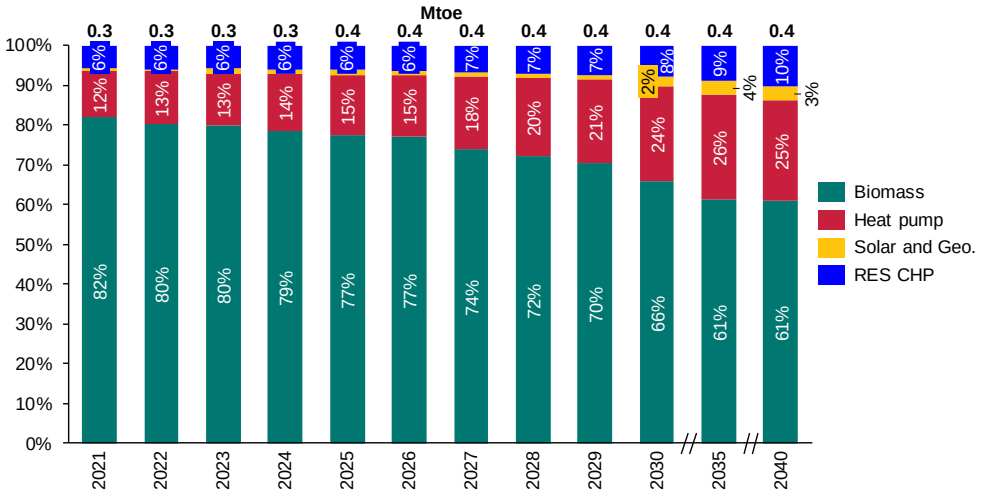
Figure 34. Trajectory of the installed capacity from RES for electricity production, by technology



Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

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 35). Because the decrease of usage of biomass can in turn reduce the RES share, it is advised to replace these biomass stoves with high energy efficient heat pumps that are considered renewable energy sources. Therefore, in 2030, 66% of the final energy consumption will be from biomass, 24% from heat pumps, 8% from RES in combined heat and power plants, 2% from solar and geothermal sources.

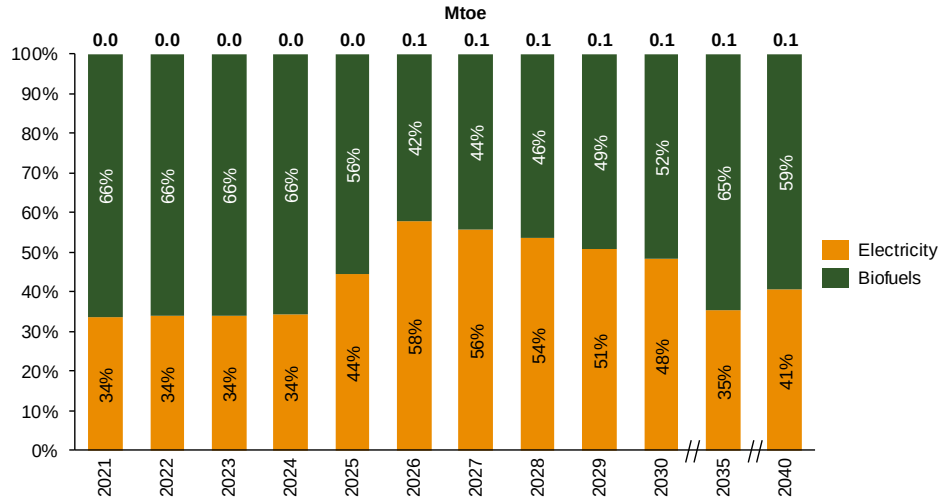
Figure 35. Estimated trajectory by RES technology in gross final energy consumption, heating and cooling sector



Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

As stated in the previous chapter, the estimated trajectory in the transport sector is planned to be achieved using biofuels. Additionally, if the electric vehicles are included, which significantly improves the RES share in the transport, 52% of the share is from biofuels and 48% from electricity in the transport in 2030 (Figure 36).

Figure 36. Estimated trajectory by RES technology in final energy consumption, transport sector



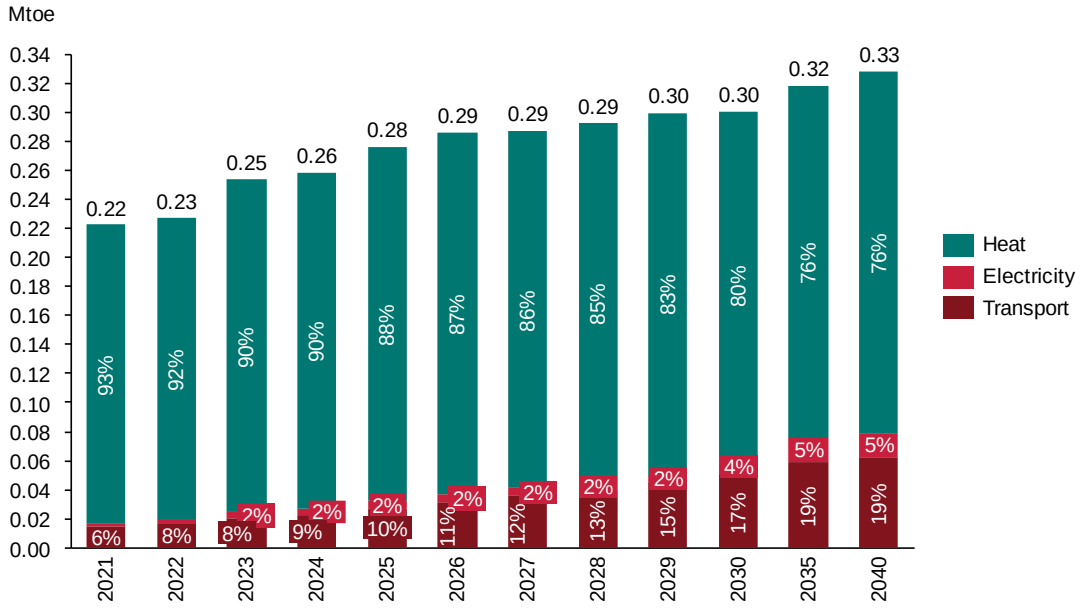
Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

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 0.3 Mtoe, of which 80% is for heat, 17% for biofuels in the transport sector and the remaining 4% for electricity production (Figure 37). There is an increase in 2030 by 35% compared to 2020. The demand in the heat and electricity sector is from domestic production, while for the transport sector detailed study for domestic of biofuels is needed.

Although, the biomass consumption is envisioned to increase, the estimated trajectory is within the framework of its sustainable development. This is in accordance to the detailed study for Macedonia[27], where the maximum usage of biomass for energy purposes is analyzed, considering its sustainability.

Figure 37. Estimated trajectory on biomass demand, disaggregated between heat and electricity



Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

[27] Optimal usage of biomass for energy purposes toward sustainable development - a case of Macedonia, 2016, http://thermalscience.vinca.rs/2016/supplement/8

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).

During the preparation of this document, there is no assessment of the potential for application of high-efficiency cogeneration and efficient district heating and cooling, nor is there a study that can determine that. According to the EE Law, this type of study is planned to be developed during the development of the Program for the realization of the Energy Strategy. The **objective** is, within this study the potential for renewable energy use in district heating to be analyzed in detail, although construction of 15 MW CHP on biomass is already considered as part of the RES target for electricity generation in this NECP.

In the building sector, the Energy Efficiency Law stipulates that in the phase of project preparation for construction of new or significant reconstruction of an existing building it is obligatory to conduct an analysis by an energy auditor of buildings for possible use of the following highly efficient alternative systems:

1. decentralized energy supply systems that use renewable energy sources;
2. systems for combined energy production;
3. systems that use heat pumps; or
4. central heating or cooling systems, especially those that use renewable energy sources and are supplied with energy from a centralized energy source

The **objective** is to monitor the energy audits process.

As stated in the Dimension Internal energy market, Market integration part, the Macedonian **objective** for 2030 is to have 250 MW PV roof-top systems – either prosumers or systems from which the overall produced electricity will be used for own purposes or will be stored. One of the possibilities for increasing the installed capacity of solar roof-top systems is through renewable energy communities. The **objective** is to make favourable conditions for this communities along with raising public awareness.

According to the recast of Renewable Energy Directive, there are obligations for implementation of sustainability criteria for biofuels. Having in mind that Macedonia does not have Law on bioenergy, nor an action plan, the **objective** is during the preparation of both documents, the sustainability criteria, as well as other requirements from the recast to be included.

DIMENSION ENERGY EFFICIENCY

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

Having in mind that Macedonia has limited potential of lignite and biomass, as the most dominant domestic resources that are currently used, the goal is to pay special attention on energy efficiency. Although, it is projected that the needs for heating, cooling, cooking, lighting etc., will increase, the implementation of more efficient technologies, as well as improvement of building performances will contribute in saving large amount of energy. The **indicative targets for EE** in relation to the primary energy consumption are 34.5% and 51.8%, while for the final energy consumption are 20.8% and 27.5%, in 2030 and 2040, respectively, relative to the BAU scenario (presented in the Energy Strategy), Figure 38. In absolute terms, the target for EE in relation to the primary energy consumption is 2.3 Mtoe and for the final is 2 Mtoe in 2030 (Figure 39). These target for final energy consumption in absolute terms is in line with the indicative 2030 Energy Community target set in their study (although during the preparation of this document these targets have not been formally adopted). On the other hand, the target for the primary energy consumption in absolute terms is even higher for 0.5 Mtoe, compared to the indicative 2030 Energy Community target. The difference is mainly because of the decommissioning of TPP Bitola in NECP.

Figure 38. EE targets - primary and final energy savings, relative to BAU scenario, 2021-2040, in relative terms

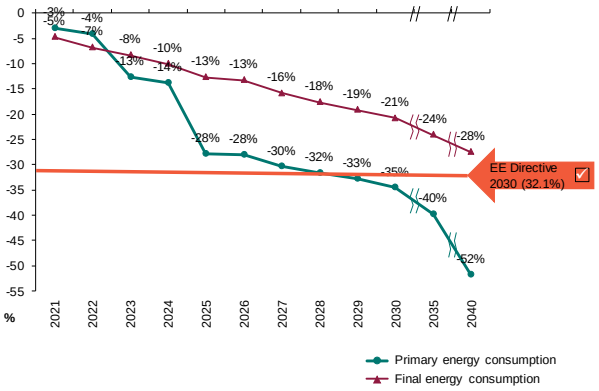
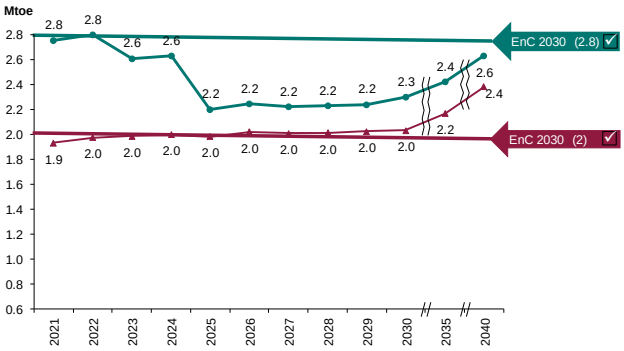


Figure 39. EE targets - primary and final energy consumption, 2021-2040, in absolute terms



Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

The Energy Efficiency Law stipulates that a Decree should be adopted which will set the national EE targets for savings in primary and final energy consumption, for at least 10 years.

For each of the proposed measures (including the EE measures) in Chapter 3, progress indicators are defined in order to monitor the level of their realization. In addition, for the purpose of monitoring the overall EE target, the objective is to use the primary and final energy consumption. As stated above, Figure 39 shows the targets and trajectories of these indicators. In addition, of crucial importance is to implement the already developed Monitoring and Verification Platform (MVP) defined in the Energy Efficiency Law. The MVP rulebook is in the phase of preparation, the bottom-up methodology is renewed, the municipalities are been trained, the tool is translated in English and the Albanian translation is in the process of preparation, so the **objective** is this system to be operational by the end of 2021.

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

The Law on Energy Efficiency stipulates that a Decree for establishing an energy efficiency obligation scheme should be adopted by the Government (by the end of 2020), that will set up targets for end-use energy savings, which distribution system operators and / or suppliers energy markets are obliged to apply it (to be in

compliance with Article 7, Directive 2012/27/EU). The drafting and adopting the necessary secondary legislation will be supported via the REEP Plus' Policy Dialogue Window 1[28] of EBRD.

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;

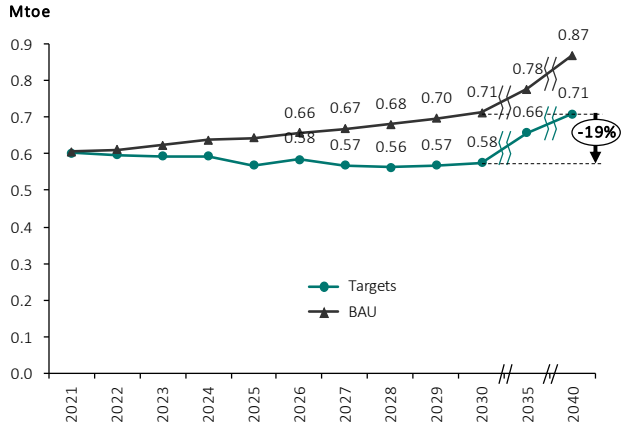
The Energy Efficiency Law also stipulates that the Ministry of Economy by February 2022, should develop a Building Renovation Strategy for the residential, public and commercial building for at least a 10-years period. Another obligation of the Ministry of Economy under the Energy Efficiency Law is preparation of a draft plan for annual reconstruction of at least 1% of the total useful floor area of buildings, published in the list of buildings with a total useful floor area of over 250 m^2 that do not meet the minimum energy performance requirements, owned and occupied by public sector entities at the state level. The building reconstruction plan should be for a period of three years and should take into consideration the objectives and measures provided in the NAPEE and the Building Renovation Strategy.

Since the secondary legislation that will deliver all these targets and roadmaps is still not developed, the NECP provides some indicative savings based on the Green scenario of the Energy Strategy that can be achieved in future, when all the requirements from legislative acts will enter into force. The polices and measures relevant for achievement of the requirements, and the assumptions used are presented in Chapter 3.

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

In order to achieve the target for EE, sectoral **objective** for the transport sector of 19% energy savings is set for 2030 relative to BAU scenario (Figure 40), or in absolute terms the final energy consumption in 2030 should be around 0.6 Mtoe

Figure 40. Final energy consumption and energy saving objective in transport sector,



Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

As it is stated in Chapter 4 Energy Efficiency part, there is no assessment of the potential for application of high-efficiency cogeneration and efficient district heating and cooling, nor is there a study that can determine that. According to the EE Law, this type of study is planned to be developed during the development of the Program for the realization of the Energy Strategy (by March 2021).

[28] Regional Energy Efficiency Programme (REEP) for the Western Balkans: http://www.wb-reep.org/eng/about

DIMENSION ENERGY SECURITY

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

Security of supply is one of Macedonia's top priorities, which is also defined in the Energy Law. In fact, the main goal of the Energy Law is to provide an efficient, competitive and financially sustainable energy sector based on the principles of non-discrimination, objectivity and transparency, which ensures a high level of security of energy supply. Additionally, the Law encourages the use of renewable energy through appropriate and effective financial and other support measures, in order to achieve the objectives of the renewable energy policy and ensure security of energy supply.

Particularly, in order to achieve this goal, the Energy Law stipulates that the Government may impose a public service obligation on all suppliers in the Republic of Macedonia to procure electricity from production capacities using domestic sources of energy, whereby the share of the purchased electricity must not exceed 15% of the total primary energy used for production of electricity consumed in Macedonia during one year.

Additionally, when constructing new energy facilities, if the given authorisations for the construction of new and reconstruction of existing electricity generation facilities or electricity and heat energy cogeneration are insufficient for ensuring security of electricity supplies, the Government, upon proposal of the Ministry, may adopt a decision on tendering procedure by means of an open call, for the construction of electricity generation facilities and facilities for electricity and heating energy cogeneration.

Concerning electricity generation, according to the Energy Law, the Government, may adopt a decision imposing obligation to the electricity producer to provide a public service, at any point of time, to have operational primary fuel reserves in quantity which is required for at least 15 days of operation at maximum capacity.

In the situations when the security of electricity supply is endangered (or there are other major accidents or major deviations in electricity consumptions from the envisaged quantities), the Energy Law stipulates that it is a duty of the Electricity Transmission System Operator, within the technical possibilities for electricity transmission, to establish the necessary changes in the timetable and the time window for engagement of generation capacities in the Republic of Macedonia and the purchase of electricity, whereby the costs for the purchased electricity, by applying the balance mechanism, will be compensated by the participants on the electricity market that caused deviation.

The electricity from RES has a priority access to the systems and/or priority dispatching, but in the Energy Law it is stipulated that in order to ensure the security of supply or security of the relevant system, the electricity transmission operator and the electricity distribution system operator may undertake measures that significantly limit the priority access to the systems and/or priority when dispatching electricity after noting the Energy Regulatory Commission of these measures, as well as for the operative market-oriented measures that they will undertake for the purpose of eliminating or reducing the restrictions and the pace of taking such measures.

If a certain license holder obtains a prohibition on performing the energy activity for a certain period of time, in order to ensure security in the supply and continuous operation of the energy system, the Government, at a request of the Energy Regulatory Commission, may adopt a decision imposing an obligation on another energy activity provider to provide public or universal service for a period of which the license holder has been imposed a prohibition to perform the activity.

If during the monitoring of the conditions and functioning of the energy markets, the Energy Regulatory Commission determines irregularity, according to the Energy Law it may adopt a decision imposing undertaking of appropriate mandatory measures, including prohibition of the particular behaviour of the entity performing energy activity in order to provide security in the supply, efficient, competitive and non-discriminatory functioning of the energy markets, as well as consumers of energy systems rights protection.

The Energy Law also defines the duties of the gas transmission system operator, among which is the one to contribute to the security of natural gas supplies by providing secure, safe, economically cost-effective and quality transmission and dispatch of natural gas through the transmission system.

By analysing the current situation, explained in detail in Chapter 4, the risks for the security of supply of the Macedonian system are noticed. First, the domestic energy production is mainly based on only three energy resources (lignite, biomass and hydro). Furthermore, there is a risk of depletion of coal, which on one hand will lower the diversification of the energy sources, but on the other hand, will increase the import dependence. Beside the lack of coal, the decommission of the thermal power plants may be caused by the introduction of high CO_2 tax. Additionally, for the realization of the GHG target, the natural gas plays an important role, especially in the industry sector. As currently there is only one gas interconnection (with Bulgaria) this also represents a risk for the security of supply. Even more, there is no interconnector agreement between Macedonian and Bulgarian TSOs. In Macedonia still there is no organized day-ahead market.

The security of supply is one of the top priorities of ENTSO-e, which is also incorporated in their Ten Year Network Development Plan (TYNDP). In this regard one of the main criteria for assessing the cross-border electricity interconnections is their contribution to the security of supply. Security of supply is evaluated in terms of Flexibility and Stability of the transmission system. MEPSO defines the scenarios for planning the transmission system in accordance with the reference ENTSO-E methodology defined in TYNDP.

By the end of 2020 new Grid code of MEPSO should be adopted, which are in line with ENTSO-e. This code pays a special attention on the transmission system security. In the draft version of the code it is stipulated that one of the criteria that should be satisfied by the system is the fulfilment of the security criteria N-1. Additionally, in the rules it is stipulated how the operational security, frequency quality and efficient use of interconnected transmission systems and resources, should be ensured. Specifically, detailed instructions are set for:

- requirements and principles regarding operational security,
- rules and responsibilities for coordination and exchange of data in operational planning and close to real time,
- rules for training and certification of MEPSO employees,
- requirements for coordination of disconnections of the elements of the transmission system,
- requirements between the control areas of the transmission system operators,
- rules for providing system services.

I order to increase the trust among Energy Community Contracting parties and EU member states it is necessary to enable stronger cooperation which is also the main objective of the Risk Preparedness Regulation[29] (soon to become mandatory acquis). In article 18 of this regulation it is stipulated that the EU Member States and the Energy Community Contracting Parties are invited to closely cooperate in the process of the identification of electricity crisis scenarios and the establishment of risk-preparedness plans so that no measures are taken that endanger the security of supply of Member States, Contracting Parties or the Union. In this respect, Energy Community Contracting Parties may participate in the Electricity Coordination Group upon invitation by the Commission with regard to all matters by which they are concerned.

As the role of information technologies in the energy sector is becoming more important, so is the need for cybersecurity becoming necessary in order to obtain safe energy production, distribution, transmission and storage. In this context, the Energy Community has adopted Procedural Act and has completed a Study on cybersecurity in the energy sector of the Energy Community[30] in December 2019 with the aim of emphasizing the importance of this topic, increasing the strategic cooperation and building energy-specific cybersecurity capabilities. Within this study an overview of the current situation in each Contracting Party concerning cybersecurity is presented. Assessment of gaps in cybersecurity related institutional and legal frameworks is performed, and accordingly a set of recommendations are presented for each country.

The Energy Community facilitates implementation of the EU cybersecurity framework by the Contracting Parties and building coherent mechanisms for resilience and security of critical energy infrastructure. The

[29] https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A52016PC0862

[30] https://www.energy-community.org/dam/jcr:db8e479d-b423-40c9-9ff9-998c7d9045ef/Blueprint_cyber_122019.pdf

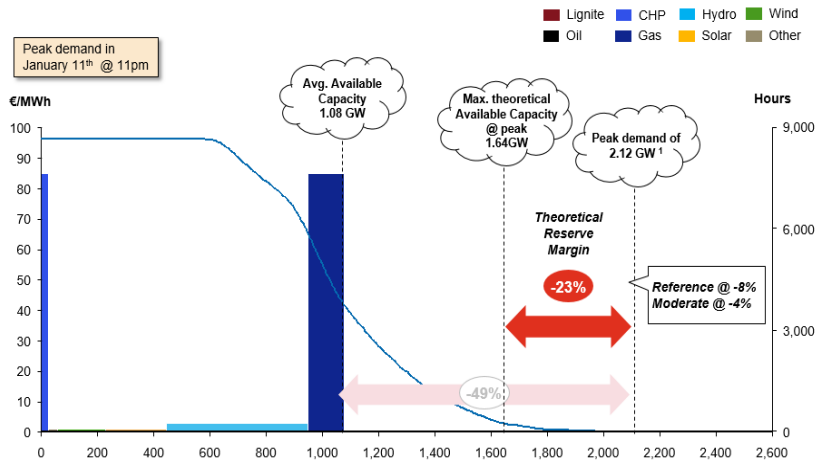
objective is to actively engage and build up adequate environment for cybersecurity in the energy sector. Activities would include local measures in the legislation (transposition of EU cybersecurity acquis relevant to energy), designation of critical infrastructures and essential services in energy, application of methodologies for risk assessment and security plans, technical standards, and regulatory rules in support of cybersecurity in energy. Sustainability perspective would also require development of mechanisms for coordination and cross-border cooperation in cyber incident response within the interconnected energy networks, coherent mechanisms for certification of technologies and authorization of services, a common platform for capacity building, education and training in cybersecurity.

Macedonia has completed several basic steps in cybersecurity by adoption of its Cybersecurity Strategy[31] and establishment of a national Computer Incident Response Centre[32] (MKD-CIRT) however the EU primary legislation (acquis) on cybersecurity has not been transposed yet. Additionally, the energy sector requires special considerations, which in the current environment are either missing or insufficient. A number of energy-specific steps pursuant to the EU cybersecurity policy, standards, practices and legal framework need to be implemented, with effects both in the domestic energy sector and within the regional interconnected networks.

II. National objectives with regard to increasing: the diversification of energy sources and supply from third countries for the purpose of increasing the resilience of regional and national energy systems;

The Macedonian **objective** is to fulfil the RES target in 2030, which will contribute to diversification of the energy sources. However, generation of electricity from renewable sources such as wind and sun introduce great uncertainty into the system primarily due to their unstable nature of electricity generation, which requires balancing the system. In 2040 the theoretical margin is -23% (Figure 41). This means that 23% of the electricity should be imported in order to ensure system adequacy. However, the level of interconnectivity of the electricity transmission system (as elaborated in Chapter 2, Electricity interconnectivity) in 2040 is around 45%, so the security of supply in this regard is ensured. Still, continuous maintenance of the electricity transmission network is needed, and more importantly maintenance and improvement of the distribution network, since most of the RES are planned to be connected to the distribution network.

Figure 41 Macedonia merit order curve in 2040 – Green scenario (MW)



Source: Strategy for energy development up to 2040

Furthermore, concerning the natural gas supply, the **objective** is to construct additional interconnection pipelines with Greece, Kosovo* and Serbia (as explained in Chapter 2, Energy transmission infrastructure), which will diversify the supply routes.

[31] http://mioa.gov.mk/sites/default/files/pbl_files/documents/strategies/cyber_security_strategy_macedonia_2018-2022_-_eng.pdf

[32] https://mkd-cirt.mk/?lang=en

III. National objectives with regard to reducing energy import dependency

The main strategic goal is to maintain the energy dependence in 2040 at the same level as today (54% net import), while improving the overall integration in European markets. The **target** for 2030 is 59% of import dependence.

Macedonia does not have many options to reduce its import dependency, because except for domestic production of electricity and use of biomass primarily for heating, it imports all other fuels. Therefore, in order to reduce import dependency, it is necessary to electrify the heating and cooling sector as well as the transport sector while investing in RES.

In order to have continuity in investing in energy sources that will reduce Macedonia's import dependency, the **objectives** are:

- Increase energy efficiency – primarily in buildings, heating and cooling;
- Continue to create a positive investment climate in renewable energy sources;
- Continuous maintenance and improvement of the transmission and distribution network;
- Increasing the number of prosumers (the term prosumers is defined in the Rulebook on Renewable Energy Sources);
- Creating a system of guarantees of origin that will increase the value of projects in RES.

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

The **objective** for improving the system flexibility are:

1. The next short-term steps are to implement a balancing mechanism (including system services for secondary and fast tertiary regulation) and to establish a regional market coupling (both day-ahead and intraday) as one of the crucial measures for integration of RES. In this direction, 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;
2. The mid and long-term steps include use of existing and construction of new power plants from which the most important one for increasing the flexibility of the system is the hydro-pumped storage power plants (Cebren), but also the storage hydro power plants (Gradec, Veles, Globocica 2 and tunnel Tenovo - Kozjak), or gas fired power plants (including CHP);
3. Increasing the number of prosumers should be implemented together with smart technologies that will enable demand response;
4. Construction of 15 MW of biomass and 23 MW of additional biogas plants;
5. Implementation of viable demand response options, including vehicle-to-grid, power-to-heat and battery storage, as well as.

DIMENSION INTERNAL ENERGY MARKET

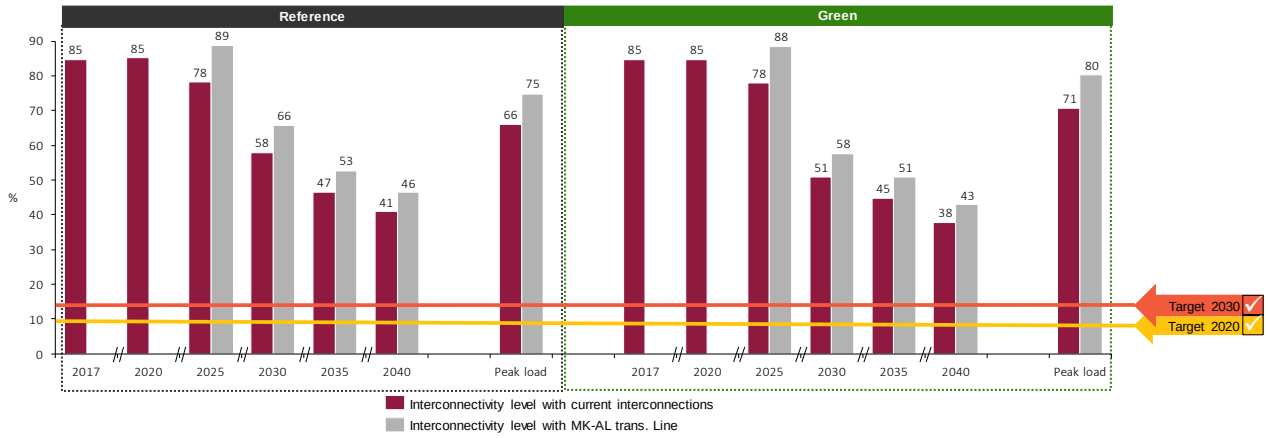
1. Electricity interconnectivity

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. Each new interconnector shall be subject to a socioeconomic and environmental cost-benefit analysis and implemented only if the potential benefits outweigh the costs.

The **objective** of Macedonia is to maintain the high level of interconnectivity during the overall period up to 2040. The analyses conducted for this purpose show that there is no need to define a certain target for 2030, because in 2017 Macedonia has interconnectivity level of 85%, which is more than 8 times higher than the 2020 target at EU level (Figure 42). Even the target at EU level for 2030 with the current interconnections is reached in both reference and green scenario from the Energy Strategy, although the installed capacity for electricity generation is increased as a result of huge investments in RES. With the construction of the interconnection with Albania, the interconnectivity level will increase for at least 8% in the reference scenario (or 7% in the green scenario).

If we analyze the interconnectivity levels against peak load, again they have high values even with the current interconnections in both scenarios. In the green scenario the interconnectivity level relative to the peak load has higher value compared to the reference scenario, as there is lower peak consumption, which is a result of the higher level of implementation of the energy efficiency measures.

Figure 42. Interconnectivity level of Macedonian transmission system



Source: MARKAL results from the Strategy for energy development up to 2040, ENTSO-E Winter outlook 2017, project team analyses

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

As it is explained in the part "Electricity interconnectivity", the Macedonian interconnectivity level of the transmission system is almost five times above the targets defined for the EU countries for 2020 (10%) and 2030 (15%). In addition, Macedonian transmission system operator, based on the scenarios defined in the Energy strategy, conveyed very detailed study on the influence of these scenarios on the transmission network. In the study it is concluded that, in general, the future transmission system of Macedonia, regardless of the growth rate of electricity consumption and the construction of new power plants, should not have an endangered adequacy. This is primarily due to the good interconnectivity with the neighboring systems at 400 kV voltage level, which enable high import of electricity/power.

In order to additionally improve the interconnectivity level of Macedonia, but also of the region (as currently there is no connection between Macedonia and Albania), the Macedonia **objective** is to finish the already started project for construction of electricity interconnector Bitola-Elbasan up to 2023. Furthermore, this project is the last segment of the Corridor 8 for transmission of electricity between Bulgaria, Macedonia, Albania and Italy. The project is included in the List of Projects of Energy Community Interest (PECI). In addition, the possibility for another 400kV electricity interconnection with Bulgaria should be reconsidered.

As currently there is one cross-border gas pipeline (with Bulgaria) and in order to fulfil especially the Macedonian GHG and EE targets, and improve the security of supply under competitive prices, the objective is to implement the projects for construction of the natural gas pipelines to Greece, Kosovo* and Serbia. Through the pipeline to Greece, Macedonia can access the Trans Adriatic Pipeline via the Greek transmission system (DESFA) which brings natural gas from the Caspian region to Europe, but will also enable accessing the world LNG markets via Greece. It is expected that this project will grant access to liquid markets and stimulate entrance of natural gas traders into the Macedonian market. This will grant higher competition and market-based setting of gas price securing sustainability of the gas sector at a competitive price. Currently the project is in the process of finalization of the mutual Feasibility Study after which the applying for funding and the commencement of construction should follow. The pipeline to Serbia could provide additional alternative source and transit opportunity to the Macedonian system, while the connection with Kosovo* could provide transit opportunity, as the feasibility study for Kosovo* shows high gas demand that could reach 1 mill. Nm^3. Both can increase the utilization rate of the system, thus have the potential to decrease tariffs and help the gasification efforts in Macedonia. The projects for gas pipelines to Kosovo* and Serbia are on the preliminary PECI 2020 list that should be adopted by the Ministerial council at the end on 2020, while the gas project to Greece is already included in the PMI list.

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

Beside the projects for interconnectivity, MEPSO as a Transmission system operator, and responsible company for maintaining the reliability of the network, in 2019 has developed a Strategy for reconstruction/revitalization of the transmission network[33]. This strategy will contribute to achieving the targets especially for RES, so the **objective** is to implement the projects with the proposed timeline in the period 2020-2040. This list of projects, together with timeline and investment costs are given in Table 3 (Chapter 4, Energy transmission infrastructure).

33 http://mepso.com.mk/CMS/Content_Data/Dokumenti/%D0%A1%D1%82%D1%83%D0%B4%D0%B8%D0%B8%20%D0%B8%20%D0%B0%D0%BD%D0%B0%D0%BB%D0%B8%D0%B7%D0%B8/2019/Rekonstrukcija-izvestaj-FINAL-revised%20(1).pdf

Additionally, Macedonia has an ambitious gasification plan and a detailed list of planned infrastructure project of the gas network in Macedonia with timeline is given in Chapter 4, Energy transmission infrastructure. The **objective** is to increase the access to the transmission network, especially of the industrial consumers (which are most affected by the green scenario), as natural gas is one of the fuels that will significantly contribute to the energy transition in the industry sector in the period up to 2040.

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 Energy Strategy envisages the energy development by integrating the countries in a regional and finally in the European market. Given that an organized electricity market has not yet been established in Macedonia, the first **goal** is to establish a day-ahead market as soon as possible (by the end of 2020), and thus increase the energy that would be traded on the open market. In parallel, the **objective** is to work on market coupling with IBEX (Bulgarian day-ahead market) and participation in the initiative to establish a regional electricity market.

In addition, in order to achieve the targets, especially for RES, it is necessary to further develop the balance and intraday markets. Although in Macedonia the demand response is at the basic level (there are big industrial companies that offer their capacity for balancing services) the **objective** is to increase the level of demand response (in different sectors) as one of the measures that can enable higher integration of RES. According to the new balancing rules adopted by MEPSO in August 2019, it is possible for consumers to appear in the role of balance service provider. Thus, Macedonia's **goal** is to increase the number of consumers that can provide balance services.

The Energy Strategy envisages introduction of a significant share of electric vehicles in the system, as a way of increasing the RES share in the transport. Therefore, the **goal** is to increase the capacity of energy storage using these electric vehicles, an in order to efficiently integrate them in the system, this process has to be accompanied by improved demand response capabilities, the introduction of real-time price signals and smart grids. In this regard, MEPSO has seriously considered these opportunities and has already made analyzes within two projects concerning the integration of electric vehicles and demand response.

Furthermore, in order to increase the energy storage and system flexibility, among **top priorities** is the construction of pumped-storage hydro power plant Chebren. The objective is up to 2028 this power plant to be commissioned.

The natural gas market in Macedonia is liberalized starting from 2015. However, during this period there are only five participants at the wholesale market. In order to increase the number of participants in the wholesale market, the **goal** is to meet the following conditions:

1. Adoption of a law by which the state will purchase the share of Makpetrol in GAMA, by the end of 2020;
2. Certification of natural gas TSO, by the end of 2021;
3. Establishment of organized natural gas market, by the end of 2022;
4. Signing of Interconnector agreement between Macedonian and Bulgarian TSOs and implementation of cross border capacity auctions, by the end of 2020.

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;

The basis for non-discriminatory participation of renewable energy is already defined in the Energy Law. It is stipulated that the electricity transmission operator and the electricity distribution system operator are obliged, in an objective, transparent and non-discriminatory manner, to ensure priority access to the systems and priority in the dispatching of the electricity produced from renewable energy sources or from highly efficient combined plants in a manner and under conditions determined in the network rules, taking into account the limitations arising from the operational possibilities of the power system. The **objective** is to follow the process of implementation of this provision.

In order to increase the non-discriminatory level of participation of RES, within the Energy Law, the feed-in premium is introduced, and is conveyed through tendering procedures finishing with negative auctions. The premiums mechanism has already been applied for PV in two tendering procedures (on private and state-owned land). The **goal** is to further use this mechanism to construct 200 MW PV in 2025 and to introduce it for wind power plants. Although, the feed-in mechanism still exists for small hydro power plants, the potential investors are also selected in a tendering procedure.

Aggregator, as a term is introduced for the first time in Macedonia in the Energy Efficiency Law in 2020. The aggregators represent a new way of providing balancing services, so the **objective** is to promote and introduce them in the market, in order to shave the peak load, increase the security of supply and balancing of the RES.

III. Where applicable, national objectives with regard to ensuring that consumers participate in the energy system and benefit from self-generation and new technologies, including smart meters;

The Macedonian **objective** is to have 250 MW PV roof-top systems – either prosumers or systems from which the overall produced electricity will be used for own purposes or will be stored. The Rulebook on RES defines ("Official Gazette of the Republic of North Macedonia" No. 96/2018) prosumer as a household, small consumer or budget user who may build a facility for electricity generation from RES, where the generated electricity is used for its own consumption and the surplus electricity produced is transferred to the grid.

A prosumer may transfer the surplus of electricity produced to the grid in the following cases:

1) is not supplied with electricity from the universal supplier,
2) installs a photovoltaic system or a small wind power plant as a unit for generation of electricity from renewable energy source (hereinafter: electricity generation unit), on a construction for which it has and ownership rights or right to use,
3) the installed capacity of the electricity generation unit does not exceed 4 kW, for household,
4) the installed capacity of the electricity generation unit does not exceed 20 kW, for a small consumer, a budget user and a user unit and
5) transfer the surplus electricity produced at the same grid connection point where the supplier delivers the electricity.

The energy is exchanged through net billing, designed to stimulate prosumers to return as little energy as possible to the grid and use most of it for their own consumption with the introduction of smart devices that will operate at the moments when there is electricity production.

The **goal** is to enable development of the market, to attract more suppliers and to encourage the households to be supplied by them (and not by the universal supplier). In fact, the idea of liberalized market is to have as much as possible suppliers that will sell electricity to households.

In addition, the **objective** is to continue with the stimulation for installations of solar thermal collectors for hot water, especially for the vulnerable customers.

IV. National objectives with regard to ensuring electricity system adequacy, as well as for the flexibility of the energy system with regard to renewable energy production, including a timeframe for when the objectives are to be met;

The system adequacy is calculated for the scenario using which the Macedonian targets and objectives are set within this document (the green scenario from the Energy Strategy) by MEPSO in their study - Long-term forecast for the needs of electricity and power – 2019. In certain years, the import of electricity will increase up to 50% of the total electricity needs. However, the conclusion in this study is that the system adequacy will be ensured even in these circumstances because the good interconnection level with the neighbouring countries. The **objective** is to further maintain the regional cooperation and thus the system adequacy.

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

Following the guidelines of the Energy Law, the Energy Regulatory Commission has adopted supply rules that place particular emphasis on the protection of consumers, most notably the protection of vulnerable consumers of electricity, natural gas and heat. Supply rules define that the supplier is obliged to provide the following to the vulnerable customer:

1) information on their right to use one or several protection measures.
2) Information on the planned disconnection due to unpaid invoice at least 40 days prior to the disconnection,
3) delivering on natural gas to vulnerable consumers during December, January and February, in spite of unpaid invoices for delivered natural gas.
4) delivering on natural gas to vulnerable consumers, in spite of unpaid invoice for delivered energy, if no more than 60 days have passed from the day of maturity of the invoice and
5) possibility for delayed payment or instalment payment of the matured debt, while the payment of the debt shall be made in at least six equal instalments, for which a settlement is concluded with the vulnerable consumer.

The **objective** is Energy regulatory commission to ensure the implementation of this provision by the suppliers.

The competitiveness of the retail market in North Macedonia can be seen from the ERC reports, namely using two indicators: supplier switch and the number of market participants. In 2018, supplier switching was made for 4,344 metering points, which represents 20.13% of the total number of metering points supplied to consumers on the free electricity market and an increase of 31.68% compared to metering changes made in 2017 (3,299). Furthermore, the number of realized procedures for supplier switch in 2019 is 7,231, which is an increase of 66.46% relative to 2018. It is important to note, that for the first time in 2019, there is a supplier switch in the household category (59 of the total 7,231). According to the latest CEER data (2018) Macedonia is at the same level as Austria, Denmark and Finland in terms of annual switching rates.

Additionally, the total percentage of gross electricity consumption provided by the open electricity market in 2019 was 49.13%, an increase of 47.48% compared to 2018. In the regulated supplier (EVN Macedonia AD Skopje and EVN HOME DOO Skopje) in 2019 there is a continuous reduction of the total purchased quantities of electricity, which is correlated with the process of full liberalization of the electricity market. These indicators are a confirmation of the continuous trend of development and correct functioning of the free electricity market segment in the Republic of Macedonia, especially when compared to other Energy Community Contracting Parties.

In terms of improving the competitiveness in the retail electricity market, the Macedonian **objective** is to continue to increase the number of supplier switching, the number of market participants and the percentage of gross electricity consumption provided by the open electricity market.

4. Energy poverty

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

The term “Energy poverty” is not defined in the legislation in Macedonia, so the first **objective** is to be defined in the adequate Laws and bylaws.

As presented on Figure 25, 25% of the population in Macedonia are unable to keep their homes adequately warm. With the aim to improve the situation, in the Energy Law an adoption annual program for vulnerable consumers is introduced. This program defines:

- the consumers belonging to the category of vulnerable consumers;
- the measures to be taken to protect vulnerable energy consumers, including energy consumption subsidies intended for households not provided for in the energy subsidy programme in accordance with the social security regulations;
- the measures for energy saving and energy efficiency improvement;
- the manner of implementation of the measures and the competent authorities responsible for their implementation;
- the measures taken by the energy distribution systems operators;
- the measures to be undertaken by the supplier with the obligation to provide a public service i.e. a universal service in the energy supply and
- the necessary funds and financing sources.

The program defines **Vulnerable consumer** as a household:

1. that uses the guaranteed minimum assistance and makes a monetary allowance to cover part of the costs of energy consumption in the household in accordance with the Law on Social Protection;
2. in which a person lives in a state of social risk (motherhood, illness, old age, injury and disability) to which the power supply and/or the right to use the network are granted under special conditions and in the manner specified in a separate supply rules for the type of energy.

Additionally, this program defines three different categories of vulnerable consumers: Vulnerable electricity consumer, Vulnerable natural gas consumer and Vulnerable heat consumer.

Vulnerable electricity consumer is a household that meets the requirements for vulnerable consumer and also:

1. is supplied by a supplier with an obligation to provide universal service in the supply of electricity;
2. electricity consumption annually does not exceed 3600 kWh,
3. electricity consumption is measured by a single-phase meter with a rated current on fuse or connection line of 25 A or a three-phase meter with a rated current on fuse or connection line of 16 (A)

Vulnerable natural gas consumer is a household that meets the requirements for vulnerable consumer and also:

1. is supplied by a supplier with an obligation to provide public service in the supply of natural gas; and
2. natural gas consumption for the months of October to March annually does not exceed 70 normal cubic meters.

Vulnerable heat consumer is a household that meets the requirements for vulnerable consumer.

In addition, in 2020, solar thermal collectors, heat pumps and windows will be subsidized for these categories for the first time.

Up to 2020 there is no information about the number of vulnerable costumers, so the **objective** is up to end of 2021, to develop a plan for indicators through which the number of households and the energy poverty will be monitored.

In the future, it is expected to actively implement the measures of the program that is carried out for the first time in 2020 and the **objective** is once the indicators are set, an impact of the existing program against them to be assessed and, if needed, the program to be adjusted accordingly at annual level.

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;

There are no separate targets set in the country for funding public or private research and innovation related to energy and climate. The total expenditure for research and development (R&D) as a percentage of the GDP remains significantly low, i.e. 0.4% R&D expense from total GDP. The **objectives** that are in the focus of this plan are: to channel more of the national funds into science, research and innovation (R&I) activities related to energy and climate; 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; and to adjust energy-related curricula at all educational levels to be responsive to energy transition trends.

The Ministry of Education and Science in its two-year strategic plans[34] recognizes all objectives as key priorities under the *Program 2.4 Investment in science, research and innovation*. The development of consciousness for sustainable energy needs to be addressed in the earliest education stages, so the curricula at all educational levels (primary, secondary and tertiary) should be frequently revised to follow the innovative trends in science and technology. The increased national financing of scientific research and innovation will enable establishment of mechanisms for transfer of knowledge between science - education, science - economy, science - public and state administration, and science - non-governmental organizations. Therefore, the development of sectoral strategies and plans for science and R&I should be realized in cooperation between the Ministry of Education and Science and relevant energy stakeholders. This will also improve the process of identification and prioritization of technologies and measures relevant to the energy transition of the country. At the same time, it will help in mobilization of the existing and building of new research capacities, as well as better integration into energy and climate-related themes of the European Research Area (ERA).

The programs of the Fund for Innovations and Technological Development (FITD) are also crucial for streamlining the energy transition technologies and measures in the national R&I priorities. Besides continuation of the ongoing mechanisms for support of innovation activities in micro, small and medium-sized enterprises (MSMEs), the FITD's programs[35] also include possibilities for new mechanisms targeted also to the public sector and large enterprises. These support mechanisms will enable knowledge and technology transfer between the scientific institutions and the industry, thus enhance the competitiveness of the business sector and at the same time support the industry-driven science.

The increased participation in the international programs for science and research, as well as in the regional and bilateral initiatives (also recognised by the Ministry of Education and Science and the FITD), besides finances, will enable knowledge sharing and access to more innovative concepts and technologies. However, the competence of the national institutions and companies (both, public and private) to pull such funds in the country need to be further enhanced.

I. 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 goal of EU's R&D activities is to pursue the decarbonisation agenda in a cost-effective manner and to strengthen its leadership in the manufacturing industry of low-carbon and energy-efficient technologies.

[34] Ministry of Education and Science, Strategic Plan (2020-2022), (available only in Macedonian)
[35] Fund for Innovation and Technology Development, Mid-term Work Program (2018 -2020) and Annual Work Program for 2020 (available only in Macedonian)

The Energy Strategy identifies the importance of decarbonisation with the Green scenario, which in the long-term is shown to be the most cost-effective option (i.e. with the highest energy savings and emission reductions at the lowest total system costs) even though it requires significant investments in new and more advanced technologies. Therefore, the **objective** is to promote RES technologies and EE in the energy transformation and industry sector, in parallel with the electrification of heating and cooling sectors and transport. The RES and EE measures considered in this plan are presented in Chapter 3.

The utilization of RES and enhancement of energy efficiency have been also accepted as one of the main priorities and strategic objectives in the other national documents adopted by the Government, like the Innovation Strategy 2012-2020[36], the Industry Strategy 2018 – 2027[37], as well as in the Economic Reform Programme 2020 – 2022[38]. The priorities from all three documents are incorporated in the FITD's programs to provide support and encourage innovation activities in micro, small and medium-sized enterprises (MSMEs) in order to achieve more dynamic technological development based on knowledge transfer, development research and innovations. These programs also envisage developing of National Technological Transfer Office and Science Technology Park (in line with the pillar 3 of the Economic Growth Plan of the Government), that will provide infrastructural and professional services to the subjects of the innovation activity, in terms of networking, as well as development, designing and fast utilization of new technologies. This could provide an opportunity to boost the competitiveness of the low-carbon technologies via technology transfer centers and scientific parks, which could enable networking and knowledge sharing between science, academia, and the business sector.

In 2018, Macedonia launched the process for development of Strategy for Smart Specialization (S3), as a comprehensive model for sustainable economic growth based on capacities of the endogenous industry, science and society. S3 should be linked to and add value to the Industrial Policy, Competitiveness Strategy, Innovation Strategy, R&D Strategy, etc. The process of developing the Strategy is jointly coordinated by the Ministry of Education and Science (MES) and the Ministry of Economy (ME) and a working group has been established consisting of representatives from the Cabinet of the Prime Minister (PM), Cabinet of the Deputy PM, FITD, as well other competent ministries, institutions, business representatives, academics and non-governmental sector. The process is performed in collaboration and systematic assistance by the European Commission's Joint Research Center (JRC) as part of the action for supporting an Innovation Agenda for the Western Balkans in cooperation with the Directorate-General for Neighborhood and Enlargement Negotiations (DG NEAR). The first phase of the process included quantitative mapping of the economic, innovative, and research capacities in the country, and the second phase should include qualitative analysis, focusing on six potential S3 priority areas that need innovation strategies. The sixth priority domain is energy, taking into consideration the objectives of the new Energy Development Strategy for utilization of renewable energy sources (RES) and enhancement of energy efficiency, as well as the potentials of this sector at the domestic and global market.

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

The Ministry of Finance in 2016 have developed a Competitiveness Strategy and Action Plan of the Republic of North Macedonia for 2016-2020[39]. The aim of the strategy was to initiate the transformation of the country into a competitive economy able to harness entrepreneurial talent, increase the number of start-ups and gradually grow, add value, increase the productivity and export of its enterprises. The Action plan for 2016 - 2020 of this Strategy sets seven strategic objectives, namely to create:

- A simpler and more stable business environment;
- A more entrepreneurial and productive SME sector;
- A more vibrant export sector;

[36] http://www.fitr.mk/wp-content/uploads/2015/02/InnovationStrategy-EN-version.pdf
[37] http://economy.gov.mk/Upload/Documents/Finalna%20Industriska%20Strategija.pdf (available only in Macedonian)
[38] https://www.finance.gov.mk/files/ERP%20MKD%202020-2022%20en.pdf
[39] http://www.pintoconsulting.de/Images/References/Competitiveness%20Strategy%20Action%20Plan%202016-2020%20Macedonia.pdf

- A more attractive environment for inward investors;
- A more skilled and entrepreneurial labour force;
- A reinvigorated industrial policy;
- A higher volume of finance for the enterprise sector.

However, all these strategic objectives cover a much broader scope than the NECP. 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. Therefore, **the objective** is to encourage and support SMEs to diversify their portfolio of services and products in RES and EE by providing suitable financial and technical mechanisms. The mechanisms included in the FITD programs (like co-financing grants, business accelerators, technology transfer offices, Science Technology Park, etc.) could be a good starting point towards improving the business environment and ensuring the competitiveness of companies.

3. POLICIES AND MEASURES

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3. POLICIES AND MEASURES

The proposed polices and measures in this section are developed based on the Strategy for energy development up to 2040 and TBUR-Mitigation Analyses Report. The lessons learned from NECP development of the EU countries were also considered. The "Budget" information given in the tables refers to the cumulative investment cost.

DIMENSION DECARBONISATION

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

For the achievement of the GHG emissions and removals target set in this NECP 16 policies and measures (2 in Energy sector, 4 in Agriculture, 2 in Forestry, 4 in Land use changes and 4 in Waste) are defined. The following tables present details for each of them (for some of the measures more details are given in the TBUR-Mitigation Analyses Report).

PM_D1: Introduction of CO_2 tax		
Main objective: Incentivize lowering CO2 emissions **Description:** Introduction of CO_2 tax in order to stimulate the investments in RES and to increase the penetration of energy efficiency measures		
Timeframe		2020– 2040
Type		Regulatory
Sector		Energy
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on Energy • Bylaws for renewable energy • Law on Climate Change
Assumptions		Gradual introduction of CO_2 tax (2027 in WEM, 2023 in WAM) based on the projected prices from WEO 2017.
Status of implementation		• Draft version of the Law on Climate Change • Strategy for Energy Development of the Republic of Macedonia up to 2040
Finance	Budget	n/a
	Source of finance	n/a
Implementing entity		• Government of the Republic of North Macedonia • Energy Regulatory Commission • Ministry of Economy, Energy Agency • JSC Macedonian Power Plants (ESM AD) • Private investors
Monitoring entity		Ministry of environment and physical planning
Progress indicators		/
Relation with other dimensions		Energy security, Research, innovation and competitiveness (competitiveness)

PM_D2: Reduction of CH_4 emissions from enteric fermentation in dairy cows by 3%

Main objective: Decrease level of CH_4 emission from enteric fermentation in highly productive dairy cows

Description: By modification of the feed composition and nutrition practice in dairy cows, the emission of CH_4 due to enteric fermentation can be reduced by 20%. It is foreseen that the number of dairy cows under intensive farming system will be increased form present 1% to 30% in 2040. Because of highly productive cows involved the CH_4 emission will also increase. But, with modification of feed content (adding carbohydrates, high quality forages and tannins) into TMR, the CH_4 emission will be decreased by 20%. The mitigation measure can be easily applied on dairy farms, by nutrition management. It is also cost effective; do not require additional subsidies or incentives. Practical training and demonstration for farmers will be sufficient.

Timeframe		2020– 2040
Type		Education, Technical
Sector		AFLOU-Livestock
Relevant planning documents, legal and regulatory acts		• Strategy for Agriculture Development • IPARD program
Assumptions		• Increased number of highly productive dairy cows under intensive farming, • Introduced modified TMR and nutrition management. • Expected to be on organized in farms with more than 50 heads
Status of implementation		TMR with partly modified feed composition in already used on two intensive farms that account about 1% of the dairy cow population
Results to be achieved		GHG savings: • 3.2 Gg CO2-eq in 2020 • 35.0 Gg CO2-eq in 2030 • 63.6 Gg CO2-eq in 2040
Finance	Budget	0.2 mil. EUR
	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 farms (dairy cows as a percentage of the total population) used TMR modified feed and nutrition management on biannual base. • Emissions reduction (Gg CO2-eq)
Relation with other dimensions		/

PM_D3: Reduction of N_2O emissions from manure management in dairy cows by 20%

Main objective: Decrease level of N_2O emission from manure management in highly productive dairy cows

Description: By modification of the manure management in dairy cows, the emission of N_2O can be reduced up to 20%. It is foreseen that the number of dairy cows under intensive farming system with more than 50 heads will be increased form present 1% to 30% in 2040. All those farms will need to apply improved manure management in order to reduce N loss, and N_xO emissions. Therefore, on farm manure management system needs to modify. The mitigation measure, consider on farm adaption on existing farms and moderate investments on newly established farms. It will require subsidies for adapting and incentives in farm design and construction.

Timeframe	2020– 2040
Type	Education, Technical
Sector	AFLOU-Livestock
Relevant planning documents, legal and regulatory acts	• Law for Nature Protection • IPARD program, • Agro-ecology measures in national program
Assumptions	• Target group are the farms with more than 50 heads. The manure management practice is expected to be change from solid fraction (N loss factor 40), to below animal (N loss factor 28). It can be applied to 10% of the population and shift toward practice is expected to be done in 15% of the farms by 2025. The proportion of the high productive dairy cows is expected to reach 25% in 2040. In such action the reduction of the N_2O emissions in manure management on dairy cows will be up to 25% by 2040. • Increased number of highly productive dairy cows under intensive farming,

		• On farm modified manure management.
Status of implementation		None
Results to be achieved		GHG savings • 0.2 Gg CO2-eq in 2020 • 2.1 Gg CO2-eq in 2030 • 3.9 Gg CO2-eq in 2040
Finance	Budget	1 mil. EUR
	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 farms (dairy cows as a percentage of the total population) used modified manure management on 2-5 years base. • Emissions reduction (Gg CO2-eq)
Relation with other dimensions		/

PM_D4: Reduction of NO_2 emissions from manure management in swine farms by 13%

Main objective: Decrease level of NO_2 emission from manure management in highly productive swine farms **Description:** By modification of the manure management in swine farms, the emission of N_2O can be reduced up to 50%. It is foreseen that number of fatteners and number of fatteners per sow will increase, while the total number of sows will remain stable over period. Number of swine farms with more than 1000 fatteners and/or 350 sows will also increase and they need to adapt improved manure management system, in order to reduce N loss. In 2040 is expected that 90% of fatteners will be produced on those farms, accounting for 75% of sow in the country. The mitigation measure, consider on farm adaption on existing farms and moderate investments on newly established farms. It will require subsidies for adapting and incentives in farm design and construction.

Timeframe		2020– 2040
Type		Education, Technical
Sector		AFLOU-Livestock
Relevant planning documents, legal and regulatory acts		• Law for Nature Protection • IPARD program, • Agro-ecology measures in national program
Assumptions		• Swine production system is expected to shift towards intensification that will bring modification of the swine farms. The management practice is supposed to shift form solid manure towards below animal (practice that already exists on large swine farms). Then the fraction of N loss will be reduced by 50%. The implementation of shift will be slightly over years in category sows and finishing pigs (e.g. sows from 55% in 2020 to 75% in 2040; finishing pigs from 70% in 2020 to 92% in 2040 • Increased number of highly productive swine farms with more than 1000 fatteners and/or 350 sows, • On farm modified manure management.
Status of implementation		Existing swine farms with more than 1000 fatteners and/or 350 sows are working on modification in manure management system
Results to be achieved		GHG savings: • 0 Gg CO2-eq in 2020 • 0.4 Gg CO2-eq in 2030 • 0.7 Gg CO2-eq in 2040
Finance	Budget	1 mil. EUR
	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 farms (fatteners and sows as a percentage of the total population) used modified manure management on 2-5 years base. • Emissions reduction (Gg CO2-eq)

Relation with other dimensions	/

PM_D5: Reduction of N_2O emissions from manure in dairy cows by 20% for farms below 50 Livestock Units

Main objective: Decrease level of N_2O emission from manure management in dairy cows on farm farms below 50 Livestock Units

Description: By modification of the manure management in dairy cows, the emission of N_2O can be reduced up to 30%. In discussion with farmers, the most common system is dry manure management, where manure together with bedding (mostly wheat or barley straw) are taken out of the barn daily or within week. The manure than is composting on pile near the farm. Farmers do not use any cover of manure nor tanks for collecting liquid drainage of the pile. Fermentation is usually mixed where in bottom parts is anaerobic, but on the surface, due to aeration it is aerobic. Manure is used as fertilizer mostly within 2-3 months (depending on storage capacity on the farm and field availability). Depending on manure fermentation the loss of N can be up to 60%. The N loss and reduction of the N_2O emissions can be reached by prolonging fermentation period up to 6 months, and covering the pile. Hence the measure is to support farmers with less than 50 cows to provide proper manure storage places for longer period.

Timeframe		2020– 2040
Type		Education, Technical
Sector		AFLOU-Livestock
Relevant planning documents, legal and regulatory acts		• IPARD program, • Agro-ecology measures in national program
Assumptions		• Replaced low productive with high productive dairy cows, • On farm modified manure management for farms with 10 to 50 cows. • Dairy cow produce manure about 7% of the life weight per day. Milking cows are weighted between 500 and 650 kg, depending on breed and conditions. Heifers 1-2 year, calves 3-12 months and young calves 0-3 months are transformed into adult cow by coefficient 2, 4 and 10, respectively. For simplicity, animal units (AU) should be used as a base (1 AU = 500 kg). Based on usual feed consumption, bedding material (annual average use of 8% wheat/barley straw) it can be expected about 0.04 m^3 manure per AU/day. • The manure has about 40% moisture and during the storage reduce volume for 40%. For the period of 6 months total volume of 5 m^3 per AU should be expected. For pile composting, a trench with clay or concreate floor with inclination of 4% is required. The pile needs to be protected from rainfall (either by roof or covered by plastic foil. Aeration is occurring when fresh manure is adding, taking care that old and already fermented one should be always on top. By prolonging manure storage and covering period the reduction of N_2O emission will be for 30% is expected.
Status of implementation		None
Results to be achieved		GHG savings: • 0.1 Gg CO2-eq in 2020 • 0.7 Gg CO2-eq in 2030 • 1.2 Gg CO2-eq in 2040
Finance	Budget	1 mil. EUR
	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 farms (dairy cows as a percentage of the total population) used modified manure management in 7 years. • Emissions reduction (Gg CO2-eq)
Relation with other dimensions		/

PM_D6: Establishing integrated management of forest fires

Main objective: Reducing the average annual burned area for 6000 ha

Description: Forest fires are already detected as a very significant problem of forest loss and source of GHG emissions. In the period from 1999 to 2019 year the average annual number of forest fires is 229 fires, average annual burned area is 10,985 ha and average annual damage is estimated on 6,9 million Euro. The total burned forest area in the same period is around 219,163 ha with the total damage of around 138 million. This measure includes the protection of the forest area by preventing the forest fires and the damages resulting from forest fires.

Timeframe		2020– 2040
Type		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"
Assumptions		• Up to 3000 ha will be burned annually on average
Status of implementation		The location for building and establishment of a forest fire training center in the frame of the PE "National forests" is already chosen, the plan prepared and 8 vehicles are purchased.
Results to be achieved		GHG savings: • 345.0 Gg CO2-eq in 2020 • 345.0 Gg CO2-eq in 2030 • 345.0 Gg CO2-eq in 2040
Finance	Budget	1.45 M€
	Source of finance	PE “National forests”, other forest enterprises
Implementing entity		Ministry of Agriculture Forestry and Water Economy, through PE "National forests"
Monitoring entity		Ministry of Agriculture Forestry and Water Economy, through PE "National forests"
Progress indicators		Forest area (ha)
Relation with other dimensions		Security of supply

PM_D7: Afforestation

Main objective: Afforestation of 5000 ha of barren land with Oak (Quercus spp.)

Description: Afforestation and reforestation may change landscapes and may have an impact on the provision of landscape-related goods and services. The supply with goods and services benefiting people and societies and the conservation of traditional cultural landscapes, as well as landscape ecology, need to be taken into account. According to the many strategic documents there are about 1,500,000 ha barren land aimed for afforestation or reforestation.

Timeframe		2020– 2040
Type		Technical
Sector		AFLOU-Forestry
Relevant planning documents, legal and regulatory acts		• Law on forests
Assumptions		• The oak is species resistant on high air temperature and small amount of precipitations-dry conditions (conditions that are expected in agreement with the official national scenarios on climate change for Macedonia) and lees sensitive to forest fires, as well. Besides, the economic and technical value of the timber mass is high. The afforestation could be done on one location (all 5,000 ha) or distributed but not to more than five location. • Minimum 80 % of the seedlings have to be alive after third year of the afforestation and with good health and morphological condition should be maintained
Status of implementation		There are already existed nurseries for production of more than 8.000.000 seedlings annually
Results to be achieved		GHG savings: • 0 Gg CO2-eq in 2020 • 312.5 Gg CO2-eq in 2030 • 312.5 Gg CO2-eq in 2040
Finance	Budget	7.8 M€
	Source of finance	PE “National forests”, other forest enterprises
Implementing entity		Ministry of Agriculture Forestry and Water Economy

Monitoring entity	Ministry of Agriculture Forestry and Water Economy
Progress indicators	• Forest area (ha) • Forest planted/covered with new seedlings (ha) • Number of seedlings planted and alive
Relation with other dimensions	Security of supply

PM_D8: Conversion of land use of field crops above 15% inclination

Main objective: To reduce the intensity of soil erosion and loss of soil organic matter

Description: Cultivation of land on inclined terrain causes intensive processes of soil erosion and mineralization of sol organic matter. These processes lead to intensive decomposition of soil organic matter and emission of soil carbon into atmosphere. Conversion of such areas into perennial grassland (pastures, meadows) will significantly decrease intensity of soil organic matter depletion and emission of soil carbon, and will lead to carbon sink. Areas above 15% inclination by law should not be cultivated and are not considered as agricultural land. This conversion supposes land use change and change of the production system, which might influence the net annual income of primary producers. Due to this, its implementation should be supported with incentives, especially in the first years of conversion, in order to bridge possible loss of incomes in farm holds.

Timeframe		2020– 2040
Type		Education, Technical
Sector		AFLOU-Land
Relevant planning documents, legal and regulatory acts		• Law on agricultural land • Rulebook on GAP • Rulebook on cross compliance for minimum requirements of GAP and environmental protection
Assumptions		• The total area of almost 3000ha is intensively cultivated which leads to decreasing of SOM as a result of its intensive decomposition and intensive soil erosion processes. If conversion to grass land is implemented, the estimated SOM increase is for more than 2% which for the total converted area of 2975 ha. The conversion of land use, should: • Stop the intensive process of erosion of the top soil layer which leads to loss of soil organic matter and its intensive ex-city mineralization, • Stop on site mineralization of soil organic matter due to intensive processes of cultivation, • Intensify carbon sink through accumulation of soil organic matter,
Status of implementation		• The effects of conversion of crop land to grass land has been monitored on two experimental fields in the past four years, • Land Parcel Identification System has been established and will serve as a tool for control of the process of conversion
Results to be achieved		GHG savings: • 1.0 Gg CO2-eq in 2020 • 3.7 Gg CO2-eq in 2030 • 5.3 Gg CO2-eq in 2040
Finance	Budget	1.5 M€
	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		► Area converted on yearly base (ha/year), ► Percentage of soil organic matter increase and carbon sink per ha.
Relation with other dimensions		/

PM_D9: Contour cultivation on areas under field crops on inclined terrains (5-15%)

Main objective: To reduce erosion of top soil and conservation of soil organic mater

Description: Regular cultivation in crop production means a massive disturbance of top soil layer, which cause intensive mineralization of soil organic matter (SOM) and CO_2 emissions. Downslope cultivation of cropland usually causes intensive processes

of soil erosion. Field experiments showed that the quantity of eroded sediment is multiply higher if compared to contour cultivation. This eroded sediment is reach with SOM which in such circumstances is rapidly mineralized, due to what significant quantity of soil carbon is released into atmosphere.

Contour cultivation means that all agro-technical operations should be across the slope. This measure is easy to be implemented, since it does not require a special technical capacities and know-how. In practice, farmers usually are not aware of its importance and influence of the overall soil fertility. With a systematic campaign for increasing the awareness of the farmers this measure can be widely adopted.

Timeframe		2020– 2040
Type		Education, Technical
Sector		AFLOU-Land
Relevant planning documents, legal and regulatory acts		• Law on agricultural land • Law on water • Rulebook on Good Agricultural Practices • Rulebook on cross compliance for minimum requirements of GAP and environmental protection
Assumptions		• 14,000 ha (30%) of the total 47,090 ha of no-irrigated land on inclined terrines (above 5%) are planned for this measure • Decreasing of soil erosion processes of the top soil layer and SOM loss with contour ploughing of inclined cropland, • Increasing of soil carbon with preservation of SOM in the top soil layer
Status of implementation		• Contour cultivation tested in practice of two experimental sites, • Contour cultivation promoted among farmers within several national and international Projects
Results to be achieved		GHG savings: • 5.0 Gg CO2-eq in 2020 • 28.0 Gg CO2-eq in 2030 • 39.7 Gg CO2-eq in 2040
Finance	Budget	1.0 M€
	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		• Area in ha with contour cultivation, • Percentage of soil organic matter increase and carbon sink per ha • Quantity of reduced soil sediment loss in t/ha
Relation with other dimensions		/

PM_D10: Perennial grass in orchard and vineyards on inclined terrains (>5%)

Main objective: Reducing of soil erosion and increasing of SOM in vineyards and orchards on inclined terrains (5-15% slope)

Description: In vineyards and orchard on locations where rows are oriented downslope, as a result of intensive classical system of cultivation, an intensive processes of soil erosion and depletion of SOM occurs, which lead to intensive emissions of soil carbon. Simple change of cultivation system with establishment of perennial grass can significantly mitigate the process of SOM loss and emissions of soil carbon. The measure is easy to be implemented with low initial cost.

Timeframe	2020– 2040
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

Assumptions		• Decreasing of soil erosion processes of the top soil layer and SOM loss when classical type of cultivation system with deep plowing is replaced with perennial grass and no-tillage system • Increasing of soil carbon with accumulation of SOM in the top soil layer due to mulching of moved biomass and accumulation of biomaterial in the root zone of the perennial grass.
Status of implementation		• Perennial grass in vineyards and orchards as a cover crop tested in practice in two regions, • Perennial grass in vineyards and orchards as an agro-ecological measure promoted among farmers within several national and international Projects
Results to be achieved		GHG savings: • 1.6 Gg CO2-eq in 2020 • 8.9 Gg CO2-eq in 2030 • 12.6 Gg CO2-eq in 2040
Finance	Budget	1 M€
	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		• Area of vineyards and orchards under perennial grass (ha), • Percentage of soil organic matter increase and carbon sink per ha • Quantity of reduced soil sediment loss (t/ha)
Relation with other dimensions		/

PM_D11: Use of biochar for carbon sink on agricultural land

Main objective: Carbon sink by negative emission technology

Description: The agricultural soils in the country are characterized as soils with relatively low carbon content and with average to low fertility. The application of biochar can improve soil water holding capacity, nutrients storage into the soil, and increase yield. Biochar can capture even 3 times more CO_2 compared to its weight, because of its high carbon concentration. Biochar was included for the first time as a promising negative emission technology in the new IPCC special report “An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty” published in 2018. The process of application of biochar should go through several steps: i) research, ii) development the suitable technology for various soil/crop combination iii) experimental/demonstrative sites iv) development the measure for support from national programs for support of agriculture v) promotion of measure. This is new measure, need some research, therefore, in period 2017 – 2040 we predict only 15 years of active use of the measure.

Timeframe		2026– 2040
Type		Research, Education, Technical
Sector		AFLOU-Land/Agriculture
Relevant planning documents, legal and regulatory acts		• Biochar is not present in any strategic document in the country
Assumptions		• Sinking the amount of 330.3 Gg-eq CO_2-eq and removing that amount from the atmosphere • Increasing of soil carbon content with adding of biochar as persistent carbon source. Most of the biochar will remain in the in the top soil layer due to available application technology incorporation biochar by plow on the plowing depth. • The positive effects on the soil fertility and soil health • Local production of the biochar by using residual biomass that is usually burnt in open fires.
Status of implementation		• None
Results to be achieved		GHG savings: • 0 Gg CO2-eq in 2020 • 110.0 Gg CO2-eq in 2030 • 330.3 Gg CO2-eq in 2040
Finance	Budget	30 M€

	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	• Area in ha of agricultural arable land with applied biochar (ha), • Amount of carbon sink per ha and total
	Relation with other dimensions	Research, innovation and competitiveness (research)

PM_D12: Landfill gas flaring

Main objective: Environmental protection and meeting the highest European standards

Description: Rehabilitation of the existing landfills and illegal ("wild") dumpsites with very high, high and medium risk in each of the five waste management regions, as well as opening of regional landfields. The rehabilitation includes covering on the existing non-compliant landfills, supplemented by gas extraction and flaring.

	Timeframe	2020– 2040
	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 Macedonia • Regional Waste Management Plans (Northeast, Southeast, Pelagonia, Polog and Skopje region) – final and draft versions
	Assumptions	Closing of existing and opening of new landfills by waste management regions in the following order: • Skopje – 2023 • East and Northeast – 2025 • Polog – 2026 • Southeast – 2029 • Pelagonia and Southeast – 2029
	Status of implementation	• Regional waste management plans developed • EU funds provided for construction of a regional landfill for the East and Northeast planning region provided, construction of six transfer stations and closing of all non-compliant landfills.
	Results to be achieved	GHG savings: • 0 Gg CO2-eq in 2020 • 489.7 Gg CO2-eq in 2030 • 552.3 Gg CO2-eq in 2040 Annual burned emissions of CH4 • 0 kt CH4 in 2020 • 22.0 kt CH4 in 2030 • 24.8 kt CH4 in 2040
	Finance – Budget	20.5 M€
	Finance – 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 • State Environmental Inspectorate • Inter-Municipal Waste Management Board • Authorized Inspectors of Environment (Municipalities)
	Monitoring entity	Ministry of Environment and Physical Planning
	Progress indicators	• Amount of CH4 burned (kt) • Emissions reduction (Gg CO2-eq)
	Relation with other dimensions	Research, innovation and competitiveness (innovation)

PM_D13: Mechanical and biological treatment (MBT) in new landfills with composting

Main objective: Environmental protection and meeting the highest European standards

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

Timeframe	2020– 2035
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 Macedonia • Regional Waste Management Plans (Northeast, Southeast, Pelagonia, Polog and Skopje region) – final and draft versions
Assumptions	Opening of the regional landfills in the following order: • Skopje – 2023 • East and Northeast – 2025 • Polog – 2026 • Southeast – 2029 • Pelagonia and Southeast – 2029
Status of implementation	• Regional waste management plans developed • EU funds provided for construction of a regional landfill for the East and Northeast planning region provided, construction of six transfer stations and closing of all non-compliant landfills.
Results to be achieved	GHG savings: • 0 Gg CO2-eq in 2020 • -12.2 Gg CO2-eq in 2030 (108 Gg CO2-eq in 2030**) • 23.8 Gg CO2-eq in 2040 (109.3 Gg CO2-eq in 2030**) Amount of compost: • 0 kt in 2020 • 78 kt in 2030 • 80 kt in 2040
Finance – Budget	36.1 M€
Finance – 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 • State Environmental Inspectorate • Inter-Municipal Waste Management Board • Authorized Inspectors of Environment (Municipalities)
Monitoring entity	Ministry of Environment and Physical Planning
Progress indicators	• Amount of compost (kt) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions	/

** Total reduction when including the emissions realized after 2040

PM_D14: Selection of waste - paper

Main objective: Environmental protection and meeting the highest European standards
Description: Installation of containers for collection of selected waste, mainly paper.

Timeframe	2020– 2035
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 Macedonia • Regional Waste Management Plans (Northeast, Southeast, Pelagonia, Polog and Skopje region) – final and draft versions
Assumptions	• Gradual increase of paper selection compared to WOM, starting from 2% upto 50% in 2040.
Status of implementation	• Regional waste management plans developed

		• Containers for waste selection installed in several cities in Macedonia, mostly in Skopje. • Private companies – digitalization of information (bills) realized
Results to be achieved		GHG savings: • 0 Gg CO2-eq in 2020 • 10.1 Gg CO2-eq in 2030 (62.5 Gg CO2-eq in 2030*) • 36.2 Gg CO2-eq in 2040 (109.5 Gg CO2-eq in 2030*) Expected annual amount of paper waste: • 2 kt in 2020 • 22 kt in 2030 • 40 kt in 2040
Finance	Budget	2 M€
	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 • State Environmental Inspectorate • Inter-Municipal Waste Management Board • Authorized Inspectors of Environment (Municipalities)
Monitoring entity		Ministry of Environment and Physical Planning
Progress indicators		• Amount of paper waste (kt) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions		/

* Total reduction when including the emissions realized after 2040

PM_D15: Improved waste and materials management at industrial facilities

Main objective: Set targets for reduction of generation, selection, reuse, recycling and treatment of waste at industrial installations

Description: On an individual assessment, each IPPC installation operator shall submit proposals for 1) waste generation, 2) waste selection, 3) waste reuse, 4) waste recycling, 5) waste treatment. Goals are set in integrated environmental permits.

Goals are set for a 5 year framework (progressive goals for each year) that will be updated as appropriate after the deadline.

Two levels of goals: mandatory and higher incentives (through tax or financial incentives).

Timeframe		• 1 year preparation, • 2 years to implement permit changes, and • 5 years for implementation of goals 2020– 2035
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 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
Assumptions		• Conducted substantive analysis, international experiences analyzed. The percentage of industrial waste treatment will increase from 5% in 2024 up to 30% in 2040.
Status of implementation		
Results to be achieved		GHG savings: • 0 Gg CO2-eq in 2020 • 3.3 Gg CO2-eq in 2030 • 17.5 Gg CO2-eq in 2040 Expected annual amount of industrial waste: • 0 kt in 2020 • 302 kt in 2030 • 892 kt in 2040
Finance	Budget	n/a
	Source of finance	Ministry of Environment and Physical Planning, Municipalities and city of Skopje, Industrial facilities, EU funds
Implementing entity		• Ministry of Environment and Physical Planning • Municipalities and city of Skopje • State Environmental Inspectorate • Inter-Municipal Waste Management Board

		• Authorized Inspectors of Environment (Municipalities)
	Monitoring entity	Ministry of Environment and Physical Planning
	Progress indicators	• Industrial waste collected (kt) • Emissions reduction (Gg CO2-eq)
	Relation with other dimensions	/

PM_D16: Program for just transition		
Main objective: Developing programs for socially responsible and just transition **Description:** Depending on selected level of transition from conventional energy, it is important to develop programs for socially responsible and just transition to mitigate negative effects of associated job losses. Such programs should provide an answer how to redeploy employees to other jobs and stimulate new job opportunities by investing in low carbon technologies and services.		
	Timeframe	2020– 2030
	Type	Regulatory
	Sector	Energy
	Relevant planning documents, legal and regulatory acts	• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on Energy • Documents from project which are working in this area
	Assumptions	Oslomej is decommissioned in 2021 Bitola is decommissioned in the period 2025-2027
	Status of implementation	• EBRD project of just transition in Oslomej region • NGO project of just transition in Oslomej region • 100 MW PV power plant in Oslomej • 20 MW PV power plant in Oslomej • 20 MW PV power plant in Bitola
	Finance – Budget	n/a
	Finance – Source of finance	n/a
	Implementing entity	• Government of the Republic of North Macedonia • Ministry of Economy • JSC Macedonian Power Plants (ESM AD) • Ministry of labor and social policy
	Monitoring entity	• Ministry of Economy
	Progress indicators	Program adopted and project realized
	Relation with other dimensions	Research, innovation and competitiveness (research)

II. Where relevant, regional cooperation in this area;

Regional cooperation within the EnC is the most important for the introduction of CO_2 tax and just transition process.

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

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)

For the achievement of the RES target set in this NECP 4 policies and measures are defined in this part. The following tables present details for each of them (more details are given in the TBUR).

PM_D17: Identification of the proper location for solar and wind power plants	
Main objective: Development of methodology for selection of the most appropriate location foe solar and wind power plants **Description:** Avoid excessive damage to nature, Government, energy companies and NGOs can prioritize land areas that have already been disturbed by industrial activity such as mines or quarries. In territories that have been historically dependent on coal production, depleted coal and other mines can be used for this purpose. In addition, for the wind warms it is important to find appropriate locations, not environmentally sensitive (e.g habitats of birds and bats).	
Timeframe	2020– 2023
Type	Technical
Sector	Energy
Relevant planning documents, legal and regulatory acts	• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on Energy • Law on environmental protection • Documents from project which are working in this area
Assumptions	Oslomej is decommissioned in 2021 Bitola is decommissioned in the period 2025-2027
Status of implementation	• 100 MW PV power plant in Oslomej • 20 MW PV power plant in Oslomej • 20 MW PV power plant in Bitola
Finance – Budget	n/a
Finance – Source of finance	n/a
Implementing entity	• Government of the Republic of North Macedonia • Ministry of Economy • JSC Macedonian Power Plants (ESM AD) • Ministry of labor and social policy • Donors
Monitoring entity	• Ministry of Economy
Progress indicators	Methodology developed
Relation with other dimensions	Research, innovation and competitiveness (research)

PM_D18: Large hydro power plants	
Main objective: Increase of the domestic generation capacity from renewable energy sources **Description:** Construction of new large hydro power plants taking into account environmental and social impacts	
Timeframe	2020– 2040
Type	Technical
Sector	Electricity producers
Relevant planning documents, legal and regulatory acts	• Strategy for Energy Development of the Macedonia up to 2040 • Strategy for utilization of renewable energy sources in the Republic of Macedonia • Development plan of ESM AD (JSC Macedonian Power Plants).

Assumptions		It is envisaged construction of large hydro power plants according to the following dynamics: • Vardar valley – 2025-2030 • Chebren – 2029 • Tunnel Vardar – Kozjak, Veles and Gradec • Globochica II – 2035
Status of implementation		• Feasibility/pre-feasibility studies developed • Chebren feasibility study • Prequalification tender for Chebren published
Results to be achieved		Primary energy savings: • 0 ktoe in 2020 • 28.8 ktoe in 2030 • 932.6 ktoe in 2040 Additional benefit - decrease of net import: • 0 ktoe in 2020 • 220.5 ktoe in 2030 • 1156.0 ktoe in 2040 GHG savings: • 0 Gg CO2-eq in 2020 • 740.7 Gg CO2-eq in 2030 • 1868.2 Gg CO2-eq in 2040
Finance	Budget	1716.2 M€
	Source of finance	Public private partnership, ESM
Implementing entity		• ESM AD (JSC Macedonian Power Plants). • Ministry of Environment and Physical Planning • Energy Agency, Ministry of Economy
Monitoring entity		Energy Agency, Ministry of Economy
Progress indicators		• Increase in installed capacity (MW) • Increase in electricity generation (GWh) • Emissions reductions (Gg CO2-eq)
Relation with other dimensions		Energy security, Internal energy market, Research, innovation and competitiveness (competitiveness)

PM_D19: RES without incentives

Main objective: Increase of the domestic generation capacity from renewable energy sources

Description: Construction of wind, solar and biogas power plants on different location in Macedonia carefully selected in order to avoid the impact on environment compared to benefits of generated electricity

Timeframe		2020– 2040
Type		Technical, regulatory
Sector		Electricity producers
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on Energy • Bylaws for renewable energy
Assumptions		The following capacities by scenario without incentives are envisioned to be constructed by 2040: • Wind – 600 MW • Solar – 750 MW • Biogas – 10 MW
Status of implementation		• Decree on the measures for support of electricity generation from renewable energy sources adopted (5.04.2019). • Decision on the total installed capacity for preferential producers of electricity adopted (5.04.2019). • Electricity grid code adopted • Construction of 10MW Oslomej PV started • Tender for Public Private Partnership for PV Oslomej of at least 80 MW
Results to be achieved		Primary energy savings: • 0 ktoe in 2020 • 29.4 ktoe in 2030 • 846.4 ktoe in 2040 Additional benefit - decrease of net import: • 0 ktoe in 2020 • 70.5 ktoe in 2030 • 1039.4ktoe in 2040 GHG savings: • 0 Gg CO2-eq in 2020 • 202.8 Gg CO2-eq in 2030 2040.2 Gg CO2-eq in 2040

Finance	Budget	1325.4 M€
	Source of finance	Private, ESM
Implementing entity		• Government of the Republic of North Macedonia • Energy Regulatory Commission • Ministry of Economy, Energy Agency • JSC Macedonian Power Plants (ESM AD) • Private investors
Monitoring entity		Ministry of Economy, Energy Agency
Progress indicators		• Increase in installed capacity (MW) • Increase in electricity generation (GWh) • Emissions reductions (Gg CO2-eq)
Relation with other dimensions		Energy security, Internal energy market, Research, innovation and competitiveness (competitiveness)

PM_D20: Photovoltaic Irrigation

Main objective: Mitigation by replacing the non-renewable energy sources for water pumping with renewable, thus reducing the CO_2 emission

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".

Timeframe		2021– 2040
Type		Technical
Sector		AFLOU-Land/Agriculture
Relevant planning documents, legal and regulatory acts		• Law on Agriculture and Rural Development • National strategy on Agriculture and Rural Development • IPARD2
Assumptions		• About 1000 installations annually in the period of 20 years, reaching about than 20 000 hectares irrigated by photovoltaic as energy source.
Status of implementation		• There is possibility for getting support from IPARD2 funds. The measure provides up to 65% of co-financing and promoting of photovoltaic irrigation if the frame of this measure is feasible
Results to be achieved		GHG savings: • 0 Gg CO2-eq in 2020 • 93.3 Gg CO2-eq in 2030 • 186.6 Gg CO2-eq in 2040
Finance	Budget	47 M€
	Source of finance	Private sector, IPARD programme
Implementing entity		• Ministry of Agriculture Forestry and Water Economy
Monitoring entity		Ministry of Economy, Energy Agency
Progress indicators		• Increase in installed capacity (MW) • Increase in electricity generation (GWh) • Emissions reductions (Gg CO2-eq)
Relation with other dimensions		Energy security, Internal energy market, Research, innovation and competitiveness (innovation)

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

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

For the achievement of the RES target set in this NECP 2 policies and measures are defined in this part. The following tables present details for each of them (more details are given in the TBUR).

PM_D21: Incentives feed-in tariff		
Main objective: Incentives feed-in tariff **Description:** Construction of new small hydro power plants, wind and biogas with feed-in tariffs that will stimulate the construction		
Timeframe		2020– 2040
Type		Technical, regulatory
Sector		Electricity producers
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of Macedonia • Strategy for Utilization of Renewable Energy Sources in the Republic of Macedonia • Renewable Energy Action Plan • Law on Energy • Bylaws for renewable energy
Assumptions		Through stimulation with feed-in tariffs, it is envisaged that by 2040 additional capacity of: • 86 MW wind power plants • 13 MW biogas power plants • 92.5 MW small hydro power plants will be constructed.
Status of implementation		Regulation on feed-in tariffs adopted (17.04.2013)
Results to be achieved		Primary energy savings: • 1.8 ktoe in 2020 • 24.5 ktoe in 2030 • 169.6 ktoe in 2040 Additional benefit - decrease of net import: • 5.7 ktoe in 2020 • 56.4 ktoe in 2030 • 211.4 ktoe in 2040 GHG savings: • 11.75 Gg CO2-eq in 2020 • 149.5 Gg CO2-eq in 2030 • 431.6 Gg CO2-eq in 2040
Finance	Budget	356.9 M€
	Source of finance	Private, incentives through consumer bills
Implementing entity		• Government of the Republic of North Macedonia • Energy Regulatory Commission • Ministry of Environment and Physical Planning • Ministry of Economy, Energy Agency • Private investors
Monitoring entity		Energy Regulatory Commission
Progress indicators		• Increase in installed capacity (MW) • Increase in electricity generation (GWh) • Emissions reductions (Gg CO2-eq)
Relation with other dimensions		Energy security, Internal energy market

PM_D22: Incentives feed-in premium
Main objective: Increase of the domestic generation capacity from renewable energy sources **Description:** Construction of solar and wind power plants with feed-in premium tariffs to stimulate the construction

Timeframe		2020– 2040
Type		Technical, regulatory
Sector		Electricity producers
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on Energy • Bylaws for renewable energy
Assumptions		Through stimulation with feed-in premium, it is envisaged that by 2040 additional capacity will be constructed: • 200 MW solar power plants • 64 MW wind power plants
Status of implementation		• Decree on the measures for support of electricity generation from renewable energy sources as well as decision on the total installed capacity for preferential producers of electricity adopted (5.04.2019). • Public call on awarding an agreement for right to use premium for electric power produced from photovoltaic power plant constructed on land owned by the Republic of North Macedonia (21.07.2019) • Public call on awarding the right to use a premium for electricity generated and sold from photovoltaic power plants built on land not owned by the Republic of North Macedonia or on land owned by the Republic of North Macedonia on which right to use has been established (2.10.2019) • Electronic auction for both tenders • Public call on awarding an agreement for right to use premium for electric power produced from photovoltaic power plant constructed on land owned by the Republic of North Macedonia • Public call on awarding the right to use a premium for electricity generated and sold from photovoltaic power plants built on land not owned by the Republic of North Macedonia or on land owned by the Republic of North Macedonia on which right to use has been established
Results to be achieved		Primary energy savings: • 0.0 ktoe in 2020 • 21.5 ktoe in 2030 • 175.7 ktoe in 2040 Additional benefit - decrease of net import: • 0.0 ktoe in 2020 • 53.3 ktoe in 2030 • 209.5 ktoe in 2040 GHG savings: • 0 Gg CO2-eq in 2020 • 162.6 Gg CO2-eq in 2030 • 377.4 Gg CO2-eq in 2040
Finance	Budget	240.6 M€
	Source of finance	Private, incentives from the central government budget
Implementing entity		• Government of the Republic of North Macedonia • Energy Regulatory Commission • Ministry of Economy • Private investors
Monitoring entity		Ministry of Economy
Progress indicators		• Increase in installed capacity (MW) • Increase in electricity generation (GWh) • Emissions reductions (Gg CO2-eq)
Relation with other dimensions		Energy security, Internal energy market

For the heating and cooling sector, financial support is planned as part of the measures for solar thermal collectors (PM_D24) and heat pumps (PM_EE11). For the transport sector, the measure for electrification of the transport (PM_EE22) also includes a financial support.

IV. Where applicable, the assessment of the support for electricity from renewable sources that Member States are to carry out pursuant to Article 6(4) of Directive (EU) 2018/2001

The measures PM_D21 and PM_D22, are measures for support of the electricity production from RES.

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

For the achievement of the RES target set in this NECP 2 policies and measures are defined in this part. The following tables present details for each of them (more details are given in the TBUR).

PM_D23: Solar rooftop power plants		
Main objective: Increase of the domestic generation capacity from renewable energy sources **Description:** Construction of solar rooftop power plants, on private as well as public buildings, either prosumers or systems from which the overall produced electricity will be used for own purposes or will be stored. One of the possibilities for increasing the installed capacity of solar roof-top systems is through renewable energy communities.		
Timeframe		2020– 2040
Type		Technical, regulatory
Sector		Household, commercial and industry sector
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of Macedonia up to 2040 • Law on Energy • Bylaws on renewable energy
Assumptions		400 MW solar capacities are envisioned to be constructed by 2040.
Status of implementation		• Rulebook on renewable energy sources adopted. • Distribution grid code
Results to be achieved		Primary energy savings: • 0.0 ktoe in 2020 • 29.9 ktoe in 2030 • 311.1 ktoe in 2040 Additional benefit - decrease of net import: • 0.0 ktoe in 2020 • 57.7 ktoe in 2030 • 356.8 ktoe in 2040 GHG savings: • 3.2 Gg CO2-eq in 2020 • 164.3 Gg CO2-eq in 2030 • 627.2 Gg CO2-eq in 2040
Finance	Budget	263.4 M€
	Source of finance	Private, donors, subsidies from national and local budget, EE fund
Implementing entity		• Government of the Republic of North Macedonia • Energy Regulatory Commission • Ministry of Economy, Energy Agency • Elektrodustribucija Skopje • Suppliers of electricity • End-users of electricity
Monitoring entity		Ministry of Economy, Energy Agency
Progress indicators		• Increase in installed capacity (MW) • Increase in electricity generation (GWh) • Emissions reductions (Gg CO2-eq)
Relation with other dimensions		Energy security, Internal energy market, Research, innovation and competitiveness (research)

PM_D24: Solar thermal collectors	
Main objective: Reduction of the energy costs and improvement of the efficiency **Description:** Hot water electric heaters are one of the biggest energy consumers with a major impact on bills. On the other hand, the reduced investment cost for purchasing and installation of solar thermal collectors is of great importance because it can drop consumer bills for hot water. In addition, these systems serve for energy savings and are able to satisfy at least 50% at annul level, depending on the hot water needs. Furthermore, solar thermal collectors can be used in combination with electricity and district heating systems.	
Timeframe	2020– 2040

Type		Technical
Sector		Households and commercial sector
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on Energy • Law on Energy Efficiency • Bylaws for renewable energy • Program for promotion of renewable energy
Assumptions		45%/30% share of solar thermal collector in hot water useful demand in household/commercial sector correspondingly by 2040.
Status of implementation		• Program for promotion of RES for 2020 adopted
Results to be achieved		Final energy savings: • 1.5 ktoe in 2020 • 7.5 ktoe in 2030 • 16.0 ktoe in 2040 Final energy savings: • 1.4 ktoe in 2020 • 10.7 ktoe in 2030 • 98.1 ktoe in 2040 GHG savings: • 0.7 Gg CO2-eq in 2020 • 21.5 Gg CO2-eq in 2030 • 165.4 Gg CO2-eq in 2040
Finance	Budget	70.0 M€
	Source of finance	Private, EE fund, incentives from the central government budget, donors
Implementing entity		• Ministry of Economy, Energy Agency • End-users
Monitoring entity		Ministry of Economy, Energy Agency
Progress indicators		• Energy savings (ktoe/GWh) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions		Energy security, Internal energy market

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

For the achievement of the RES target set in this NECP one measure is defined in this part. The following table presents details of it (more details are given in the TBUR).

PM_D25: Biomass power plants (CHP optional)	
Main objective: Increase of the domestic generation capacity from renewable energy sources **Description:** This measure considers construction of distributed small sized biomass power plants (CHP optional) with stimulation through feed-in tariffs. Beside increasing the RES share with this CHPs, they should also contribute in increasing the flexibility of the electricity system and ensuring the security of supply. It is envisioned that waste biomass will be used, taking into account the sustainability of the biomass at national level.	
Timeframe	2020– 2040
Type	Technical, regulatory
Sector	Electricity producers
Relevant planning documents, legal and regulatory acts	• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on Energy • Bylaws for renewable energy
Assumptions	Through stimulation with feed-in tariffs, it is envisaged that by 2040 biomass power plants with capacity of 15 MW will be constructed
Status of implementation	• Decree on the measures for support of electricity generation from renewable energy sources adopted (5.04.2019). • Decision on the total installed capacity for preferential producers of electricity adopted (5.04.2019).
Results to be achieved	Primary energy savings: • 0.0 ktoe in 2020 GHG savings: • 0 Gg CO2-eq in 2020

		• 3.0 ktoe in 2030 • 18.4 ktoe in 2040 • 21 Gg CO2-eq in 2030 • 91.1 Gg CO2-eq in 2040
Finance	Budget	24.3 M€
	Source of finance	Private, incentives through consumer bills
Implementing entity		• Government of the Republic of North Macedonia • Energy Regulatory Commission • Ministry of Environment and Physical Planning • Ministry of Economy, Energy Agency • Private investors
Monitoring entity		Ministry of Economy, Energy Agency
Progress indicators		• Increase in installed capacity (MW) • Increase in electricity generation (GWh) • Increase in heat production (TJ) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions		Energy security, Internal energy market

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

The measures that are related to the sustainable use of biomass are PM_D19(biogas), PM_D21 (biogas), PM_D25. In addition, the implementation of PM_EE12 assumes that new modern technology for heating on biomass will be introduced.

PM_D26: Development of the biofuels market		
Main objective: the RES share in the transport sector is almost zero and it is the main reason for not achieving the country 2020 target. In order to fulfil the 2030 RES target in the transport sector, but also the overall RES target it is necessary to have a functional biofuels market. **Description:** Increase the share of biofuels in line with the requirement of the recast on the RES Directive (2018/2001).		
Timeframe		2020 – 2040
Type		Regulatory, policy
Sector		Transport
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Biennial report on the progress of increased utilization of renewable energy sources
Assumptions		• Law on biofuels as well as action plan will be adopted in line with the requirements of the RES Directive (2018/2001). • The share of biofuels in 2030 will be 10%
Status of implementation		• Draft version of the Action Plan for Biofuels developed • Draft version of the Law on Biofuels developed
Finance	Budget	/
	Source of finance	Central government budget
Implementing entity		• Government of the Republic of North Macedonia • Ministry of economy • Companies that sell oil products
Monitoring entity		• Ministry of economy
Progress indicators		• Share of the biofuels in the total final energy consumption in transport (%)

	• Emissions reduction (Gg CO2-eq)
Relation with other dimensions	Energy security, Internal energy market, Research, innovation and competitiveness (innovation)

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

Measures PM_D6, PM_D7 and PM_D13 can contribute to sustainable production of biomass.

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

For the achievement of the EE target set in this NECP one measure is defined in this part. The following table presents details of it (more details are given in the TBUR). As a part of the REEP Plus, in which the EE Law was prepared, it is planned to develop a detailed methodology for the setting the Energy efficiency obligation schemes.

PM_EE1: Energy efficiency obligation schemes		
Main objective: Fulfilment of the obligation under Article 7 of the EE Directive **Description:** To set up the scheme the average annual final consumption for the period 2014 – 2016 is used. The measure implements the possibilities from the Article 7 of the EE Directive to exclude the transport sector consumption (paragraph 1) from the sum of the average annual consumption and reduce the consumption in the industry sector (paragraph 2).		
Timeframe		2020 – 2040
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		• Law on energy efficiency • Directive for EE
Assumptions		1. Final energy savings targets of: • 0.5% in 2017 • 0.7% in 2018 – 2020 • 0.35% in 2021 – 2030 • 0.2% in 2031 – 2040 of the average annual energy sales to final customers in the period 2014 – 2016 excluding the customers in the transport sector as well as industries of the Annex I of the Directive 2003/87/EC 2. Up to 30% of the costs will be covered through subsidies by the distribution companies or suppliers.
Status of implementation		• Law on Energy Efficiency adopted
Results to be achieved		Final energy savings: • 13.2 ktoe in 2020 • 44.4 ktoe in 2030 • 87.6 ktoe in 2040 Primary energy savings: • 10.8 ktoe in 2020 • 67.8 ktoe in 2030 • 306.6 ktoe in 2040 GHG savings: • 0 Gg CO2-eq in 2020 • 162.8 Gg CO2-eq in 2030 • 592.5 Gg CO2-eq in 2040
Finance	Budget	182 M€
	Source of finance	Consumers through their bills
Implementing entity		• Ministry of economy • Distribution system operators • Suppliers and traders of electricity and gas
Monitoring entity		Ministry of economy
Progress indicators		• Energy savings (ktoe/GWh)
Relation with other dimensions		Energy security, Decarbonisation

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

Although, one of the objectives is to develop a Strategy for building renovation, in the NECP, in order to achieve the EE target 6 policies and measures are defined in this part. The following tables present details for each of them (more details, such as GHG emission reductions, final and primary energy savings for 2020, 2030 and 2040 of each individual policy/measure are given in the TBUR).

PM_EE2: Retrofitting of existing residential buildings		
Main objective: Retrofitting of existing residential buildings with aim to meet the requirements under the Energy Efficiency Law **Description:** The measure considers reconstructions of residential buildings including windows replacement, initiated by the owners and/or supported by commercial banks and funds. This measure will provide issuing of certificates for energy performance of buildings, as a prerequisite for putting the reconstructions into operation.		
Timeframe		2020 – 2040
Type		Technical, regulatory
Sector		Households
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on energy efficiency
Assumptions		The existing residential buildings, while meet the standard for at least C class (90 kWh/m^2). 2% annual renovation rate is considered.
Status of implementation		• 31 buildings for collective housing were renovated (EE measures implemented) under the USAID/Habitat Project for residential energy efficiency. • Financial support for rehabilitation of buildings for collective housing with implementation of EE measures provided by some municipalities • Call for applications for reimbursement of 50% of the costs for windows replacement and installation of PVC and aluminum windows, but not more than 500 €, provided by the Ministry of Economy • Law on Energy Efficiency adopted
Results to be achieved		Final energy savings: • 8.1 ktoe in 2020 • 42.0 ktoe in 2030 • 107.2 ktoe in 2040 Primary energy savings: • 8.3 ktoe in 2020 • 50.4 ktoe in 2030 • 255.0 ktoe in 2040 GHG savings: • 7.1 Gg CO2-eq in 2020 • 73.0 Gg CO2-eq in 2030 • 352.5 Gg CO2-eq in 2040
Finance	Budget	1708.2 M€
	Source of finance	Private, donors through commercial EE loans, EE fund
Implementing entity		• Ministry of Economy, Energy Agency • Donors and financial institutions • Households
Monitoring entity		Ministry of Economy, Energy Agency
Progress indicators		• Energy savings (ktoe/GWh) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions		Energy security, Decarbonisation, Research, innovation and competitiveness (research)

PM_EE3: Retrofitting of existing central government buildings
Main objective: Retrofitting of existing public buildings with aim to meet the objectives of the EE Directive and the Energy Efficiency Law **Description:** Having in mind the situation with the energy performance of the public buildings at central level and the role that they should play, it is essential to boost their renovation. Article 5 of the EE Directive is of great importance because it can be a starting point for the retrofit expansion. 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, centers for social affairs, as well as state administrative sector – Ministry of Economy, Ministry of Education and Science, Ministry of Environment and Physical Planning and Ministry of Transport and Communications). In addition, the specific consumption given in the same document is used (average 214 kWh/m^2).

This measure considers reconstruction including windows replacement of existing public buildings under jurisdiction of the central government. The measure will provide issuing of certificates for energy performance of buildings, as a prerequisite for putting the reconstructions into operation.

Timeframe	2020 – 2040
Type	Technical, regulatory
Sector	Central government buildings
Relevant planning documents, legal and regulatory acts	• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on energy efficiency
Assumptions	Annual renovation rate of the existing central government buildings of 3% is assumed.
Status of implementation	• Draft National Program for energy efficiency in public buildings in the Republic of Macedonia (Phase I) was developed under the GEF Sustainable Energy Project • "Resilient Skopje" – Climate Change Strategy for the City of Skopje developed. • Ongoing project financed by the World Bank for Energy Efficiency in Public Sector (as an IBRD loan) that will enable reduction of the energy consumption in the public sector and will support the establishment and operationalization of a sustainable financing mechanism for the public sector (the proposed Energy Efficiency Fund).
Results to be achieved	Final energy savings: • 0.4 ktoe in 2020 • 4.8 ktoe in 2030 • 10.1 ktoe in 2040 Primary energy savings: • 0.4 ktoe in 2020 • 6.6 ktoe in 2030 • 32.2 ktoe in 2040 GHG savings: • 1.1 Gg CO_2-eq in 2020 • 19.2 Gg CO_2-eq in 2030 • 66.8 Gg CO_2-eq in 2040
Finance – Budget	170 M€
Finance – Source of finance	Central government budget, donors
Implementing entity	• Ministry of Economy, Energy Agency • Ministry of Finance • Local self-government • Municipal public enterprises • Donors and financial institutions
Monitoring entity	Ministry of Economy, Energy Agency
Progress indicators	• Energy savings (ktoe/GWh) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions	Energy security, Decarbonisation, Research, innovation and competitiveness (research)

PM_EE4: Retrofitting of existing local self-government buildings

Main objective: Retrofitting of existing public buildings with aim to meet the objectives of the EE Directive and the Energy Efficiency Law

Description: Local self-government should be encouraged by the central government renovation strategy, so they can put special attention on buildings under their competence.

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/m^2).

This measure considers reconstruction including windows replacement of existing public buildings under jurisdiction of the local self-government. The measure will provide issuing of certificates for energy performance of buildings, as a prerequisite for putting the reconstructions into operation

Timeframe	2020 – 2040
Type	Technical, regulatory
Sector	Local self-government buildings
Relevant planning documents, legal and regulatory acts	• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on energy efficiency
Assumptions	Annual renovation rate of the existing local self-government buildings of 1.5% of assumed.

Status of implementation		• Draft National Program for energy efficiency in public buildings in the Republic of Macedonia (Phase I) was developed under the GEF Sustainable Energy Project • "Resilient Skopje" – Climate Change Strategy for the City of Skopje developed • Law on Energy Efficiency adopted
Results to be achieved		Final energy savings: • 0.4 ktoe in 2020 • 4.7 ktoe in 2030 • 10.1 ktoe in 2040 Primary energy savings: • 0.4 ktoe in 2020 • 6.7 ktoe in 2030 • 39.5 ktoe in 2040 GHG savings: • 1.1 Gg CO_2-eq in 2020 • 19.8 Gg CO_2-eq in 2030 • 78.3 Gg CO_2-eq in 2040
Finance	Budget	150 M€
	Source of finance	Local self-government budget, donors
Implementing entity		• Ministry of Economy, Energy Agency • Ministry of Finance • Local self-government • Municipal public enterprises • Donors and financial institutions
Monitoring entity		Ministry of Economy, Energy Agency
Progress indicators		• Energy savings (ktoe/GWh) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions		Energy security, Decarbonisation, Research, innovation and competitiveness (research)

PM_EE5: Retrofitting of existing commercial buildings

Main objective: Retrofitting of existing commercial buildings with aim to meet the objectives of the EE Directive and the Energy Efficiency Law

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. The measure will provide issuing of certificates for energy performance of buildings, as a prerequisite for putting the reconstructions into operation.

Timeframe		2020 – 2040
Type		Technical, regulatory
Sector		Commercial sector
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on energy efficiency
Assumptions		Annual renovation rate of 1.5% of the existing commercial buildings.
Status of implementation		• Law on Energy Efficiency adopted
Results to be achieved		Final energy savings: • 11.2 ktoe in 2020 • 26.5 ktoe in 2030 • 48.1 ktoe in 2040 Primary energy savings: • 10.8 ktoe in 2020 • 35.7 ktoe in 2030 • 179.4 ktoe in 2040 GHG savings: • 30.6 Gg CO_2-eq in 2020 • 98.2 Gg CO_2-eq in 2030 • 359.2 Gg CO_2-eq in 2040
Finance	Budget	530 M€
	Source of finance	Private, donors through commercial EE loans, EE fund
Implementing entity		• Ministry of Economy, Energy Agency • Ministry of Finance • Commercial building owners
Monitoring entity		Ministry of Economy, Energy Agency
Progress indicators		• Energy savings (ktoe/GWh) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions		Energy security, Decarbonisation, Research, innovation and competitiveness (research)

PM_EE6: Construction of new buildings

Main objective: Construction of new buildings that will meet the minimum criteria set in the Rulebook of energy performance in buildings

Description: An energy efficient building reduces maintenance and utility costs, but, in many cases, improves durability, lessens noise, increases comfort and creates a healthy and safe indoor environment. A further goal of energy efficient construction is to limit damage to the ecosystem and reduce the use of natural resources like energy, land, water, and raw materials. This measure will provide issuing of certificates for energy performance of buildings, as a prerequisite for putting the building into operation

Timeframe		2020 – 2040
Type		Technical, regulatory
Sector		Households
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on energy efficiency
Assumptions		Construction of new residential buildings, while meeting the standard for at least C class (90 kWh/m^2)
Status of implementation		• Financial support for construction of new buildings at municipality level for vulnerable categories • Law on Energy Efficiency adopted
Results to be achieved		Final energy savings: • 2.0 ktoe in 2020 • 12.0 ktoe in 2030 • 15.6 ktoe in 2040 Primary energy savings: • 2.1 ktoe in 2020 • 14.3 ktoe in 2030 • 26.9 ktoe in 2040 GHG savings: • 1.8 Gg CO_2-eq in 2020 • 19.8 Gg CO_2-eq in 2030 • 40.4 Gg CO_2-eq in 2040
Finance	Budget	282.7 M€
	Source of finance	Private, donors through commercial EE loans, EE fund
Implementing entity		• Ministry of Economy, Energy Agency • Donors and financial institutions • Investors (households)
Monitoring entity		Ministry of Economy, Energy Agency
Progress indicators		• Energy savings (ktoe/GWh) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions		Energy security, Decarbonisation, Research, innovation and competitiveness (research)

PM_EE7: Construction of passive buildings

Main objective: After 31.12.2020 all new building should be nearly zero-energy buildings

Description: The measure considers construction of new passive residential buildings in compliance with the EU Directive 2010/31/EU. This measure will provide issuing of certificates for energy performance of buildings, as a prerequisite for putting the building into operation

Timeframe		2020 – 2040
Type		Technical, regulatory
Sector		Households
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on energy efficiency
Assumptions		Construction of new passive buildings, while meeting the standard for at least A+ class (15 kWh/m^2) starting from 2020 and continuously increasing their number so that in 2040, 85% of new buildings are assumed to be passive.
Status of implementation		• Law on Energy Efficiency adopted
Results to be achieved		Final energy savings: • 0.0 ktoe in 2020 • 8.5 ktoe in 2030 • 30.0 ktoe in 2040 Primary energy savings: • 0.0 ktoe in 2020 • 10.5 ktoe in 2030 • 86.9 ktoe in 2040 GHG savings: • 0.3 Gg CO_2-eq in 2020 • 17.0 Gg CO_2-eq in 2030 • 123.2 Gg CO_2-eq in 2040

Finance	Budget	1068.0 M€
	Source of finance	Private, donors through commercial EE loans, EE fund, Financial support at municipality level for vulnerable categories
Implementing entity		• Ministry of Economy, Energy Agency • Donors and financial institutions • Investors (households)
Monitoring entity		Ministry of Economy, Energy Agency
Progress indicators		• Energy savings (ktoe/GWh) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions		Energy security, Decarbonisation, Research, innovation and competitiveness (research)

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)

For the achievement of the EE target set in this NECP one measure is defined in this part. The following table presents details for it (more details are given in the TBUR).

PM_EE8: Improvement of the street lighting in the municipalities		
Main objective: Reduce the costs and increase the quality of the street lighting. **Description:** The cost of street lighting, including electricity and maintenance, can have a huge impact on the budget of the municipalities. In addition, having in mind that a lot of manufactories work on daily bases on improvement of the light bulbs, new opportunities are being opened for the municipalities. The inefficient light bulbs should be replaced, purchasing new ones that comply with criteria of belonging to the highest EE class possible (LED).		
Timeframe		2020 – 2040
Type		Technical
Sector		Local self-government
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on energy efficiency
Assumptions		Improvement rate of 100% of street lighting by 2040.
Status of implementation		• Street lighting at some location replaced • Promotional activities for the implementation of public-private partnership (PPP) taken
Results to be achieved		Final energy savings: • 3.2 ktoe in 2020 • 7.8 ktoe in 2030 • 9.6 ktoe in 2040 Primary energy savings: • 2.7 ktoe in 2020 • 14.2 ktoe in 2030 • 57.7 ktoe in 2040 GHG savings: • 8.9 Gg CO_2-eq in 2020 • 37.9 Gg CO_2-eq in 2030 • 117.1 Gg CO_2-eq in 2040
Finance	Budget	25.3 M€
	Source of finance	Central and local government budget, ESCO
Implementing entity		• Government of the Republic of North Macedonia • Ministry of Environment and Physical Planning • Ministry of Economy, Energy Agency • Local self-government
Monitoring entity		Ministry of Economy, Energy Agency
Progress indicators		• Energy savings (ktoe/GWh) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions		Energy security, Decarbonisation

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))

For the achievement of the EE target set in this NECP 15 policies and measures are defined in this part. The following tables present details for each of them (more details are given in the TBUR).

PM_EE9: Green procurements		
Main objective: Application of energy efficiency criteria ("greening") in public procurement procedures **Description:** According to Article 6 from the EE Directive, central governments can purchase only products, services and buildings with high energy-efficiency performance. Intensified activities should take place to ensure legal and technical knowledge and skills of public sector entities for inclusion and evaluation of requirements for energy efficiency in public procurement procedures by applying the criteria of most economically advantageous tender.		
Timeframe		2020 – 2040
Type		Regulatory
Sector		Public bodies
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on energy efficiency
Assumptions		Increased rate of advanced energy efficiency technologies due to public procurement of 7%.
Status of implementation		• Law on Energy Efficiency adopted • Law on Public procurements
Results to be achieved		Final energy savings: • 0.3 ktoe in 2020 • 2.5 ktoe in 2030 • 5.9 ktoe in 2040 Primary energy savings: • 0.3 ktoe in 2020 • 3.4 ktoe in 2030 • 20.3 ktoe in 2040 GHG savings: • 0.8 Gg CO_2-eq in 2020 • 9.4 Gg CO_2-eq in 2030 • 32.7 Gg CO_2-eq in 2040
Finance	Budget	24 M€
	Source of finance	Central and local government budget
Implementing entity		• Ministry of Economy, Energy Agency • Public Procurement Bureau • Local self-government
Monitoring entity		Ministry of Economy, Energy Agency
Progress indicators		• Energy savings (ktoe/GWh) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions		Energy security, Decarbonisation, Research, innovation and competitiveness (competitiveness)

PM_EE10: Labelling of electric appliances and equipment	
Main objective: Penetration of appliances with higher efficiency (class A++, A+, A, B) **Description:** Labelling of electric appliances and equipment to provide relevant information on the energy consumption of the products. The application of the labelling and eco-design of the products is necessary to ensure that the products sold in Macedonia are in compliance with the EU regulations.	
Timeframe	2020 – 2040
Type	Regulatory
Sector	Households and commercial sector
Relevant planning documents, legal and regulatory acts	• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on energy efficiency

		• Third Energy Efficiency Action Plan • Rulebook on labelling consumption of energy and other resources on devices using energy. • Regulation on eco-design of products
Assumptions		• As a result of this measure it is expected that by 2040 the share of energy efficient technologies will be 6% in the overall stock.
Status of implementation		New Rulebook on labelling consumption of energy and other resources on devices using energy adopted in September 2016 by the Ministry of Economy Draft version of the new Regulation on eco-design of products developed
Results to be achieved		Final energy savings: • 4.6 ktoe in 2020 • 19.0 ktoe in 2030 • 40.0 ktoe in 2040 Primary energy savings: • 4.1 ktoe in 2020 • 28.1 ktoe in 2030 • 137.9 ktoe in 2040 GHG savings: • 13.1 Gg CO_2-eq in 2020 • 56.3 Gg CO_2-eq in 2030 • 236.7 Gg CO_2-eq in 2040
Finance	Budget	71 M€
	Source of finance	Private, EE fund
Implementing entity		• Ministry of Economy, Energy Agency • Producers and suppliers of electrical equipment and household appliances • End-users
Monitoring entity		Ministry of Economy, Energy Agency
Progress indicators		• Energy savings (ktoe/GWh) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions		Energy security, Decarbonisation, Research, innovation and competitiveness (competitiveness)

PM_EE11: Increased use of heat pumps

Main objective: More efficient use of electricity
Description: Phasing out heating devices with resistive heaters, as well as inefficient biomass stoves and their replacement with heat pumps.

Timeframe		2020 – 2040
Type		Regulatory, policy
Sector		Households and commercial sector
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on energy efficiency • Third Energy Efficiency Action Plan • EU Climate and Energy Policy
Assumptions		It is assumed that heating devices with resistive heaters will be gradually replaced with heat pumps. The share of heat pumps in useful heat demand is 55% in 2040.
Status of implementation		/
Results to be achieved		Final energy savings: • 48.0 ktoe in 2020 • 139.3 ktoe in 2030 • 256.1 ktoe in 2040 Primary energy savings: • 46.5 ktoe in 2020 • 186.1 ktoe in 2030 • 519.2 ktoe in 2040 GHG savings: • 725.4 Gg CO_2-eq in 2020 • 584.6 Gg CO_2-eq in 2030 • 623.5 Gg CO_2-eq in 2040
Finance	Budget	474.4 M€
	Source of finance	Private, EE fund, incentives from the central and local government budget, donors
Implementing entity		• Ministry of Economy, Energy Agency • End-users
Monitoring entity		Ministry of Economy, Energy Agency
Progress indicators		• Energy savings (ktoe/GWh)

	• Emissions reduction (Gg CO2-eq)
Relation with other dimensions	Energy security, Decarbonisation, Research, innovation and competitiveness (all)

PM_EE12: Public awareness campaigns and network of energy efficiency (EE) info centers

Main objective: Implement information campaigns that will raise public awareness about the importance, effects and benefits from energy efficiency

Description: Although a large number of campaigns for promotion of energy efficiency by different stakeholders are provided, still there is a lack of knowledge about the benefits from the EE. Article 12 of the EE Directive stipulates that the country should takes appropriate measures to promote and facilitate an efficient use of energy by small energy customers, including domestic customer. This can be done using different mechanisms. One of them is establishment of EE info centers in the local self-governments. Following the examples from the EU, beside this measure several other should be implemented such as:

- Education, starting from the kindergarten,
- Training of the employees in the public institutions at central and local level,
- Creation of calculation tool that will show the financial and environmental effects from implementation of certain measure.

Timeframe		2020 – 2040
Type		Information, Education
Sector		Households and commercial consumers
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on energy efficiency
Assumptions		Investment in public awareness rising campaigns that will increase the share of more efficient appliances (with higher class of efficiency) by 2040 to 40%.
Status of implementation		• Platform for energy efficiency, for education of the population and journalists and experience sharing of the private sector for successfully implemented EE measures implemented. • Info Center for Energy of the City of Skopje opened. • Free advices to the customers for reasonable consumption of electricity enabled by EVN's Customer Service Centre
Results to be achieved		Final energy savings: • 24.3 ktoe in 2020 • 67.8 ktoe in 2030 • 110.4 ktoe in 2040 Primary energy savings: • 20.2 ktoe in 2020 • 99.7 ktoe in 2030 • 416.3 ktoe in 2040 GHG savings: • 56.6 Gg CO_2-eq in 2020 • 201.5 Gg CO_2-eq in 2030 • 716.4 Gg CO_2-eq in 2040
Finance	Budget	704 M€
	Source of finance	Private sector, donors, central and local governments
Implementing entity		• Ministry of Economy, Energy Agency • Energy suppliers • End-users
Monitoring entity		Ministry of Economy, Energy Agency
Progress indicators		• Energy savings (ktoe/GWh) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions		Energy security, Decarbonisation

PM_EE13: Phasing out of incandescent lights

Main objective: Improve the efficiency of lighting following the EU policies.

Description: Governments around the world have passed measures to phase out incandescent light bulbs for general lighting in favour of more energy-efficient lighting alternatives. The goal is to improve energy efficiency, rather than forbid the use of incandescent technology. This measure includes replacing conventional incandescent light bulbs with LED.

Timeframe	2020 – 2040
Type	Regulatory, policy
Sector	Households and commercial sector

Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on energy efficiency • Commision Regulation(EC) No 244/2009 implementing Directive 2005/32/EC of the European Parlament and of the Council with regard to ecodesign requirements for non-directional household lamps
Assumptions		It is assumed that a Regulation will be adopted on prohibiting sales of incandescent light bulbs, its implementation will start in 2020, and it is assumed that there will be 2-3 years of transition period.
Results to be achieved		Final energy savings: • 3.2 ktoe in 2020 • 7.8 ktoe in 2030 • 9.6 ktoe in 2040 Primary energy savings: • 2.7 ktoe in 2020 • 14.2 ktoe in 2030 • 57.7 ktoe in 2040 GHG savings: • 8.9 Gg CO_2-eq in 2020 • 37.9 Gg CO_2-eq in 2030 • 117.1 Gg CO_2-eq in 2040
Status of implementation		/
Finance	Budget	558.0 M€
	Source of finance	Central government budget, private
Implementing entity		• Government of the Republic of North Macedonia • Ministry of Economy, Energy Agency • End-users
Monitoring entity		Ministry of Economy, Energy Agency
Progress indicators		• Energy savings (ktoe/GWh) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions		Energy security, Decarbonisation

PM_EE14: Energy management in manufacturing industries

Main objective: Efficient management of manufacturing processes in industry aiming to increase production using the same energy consumption.

Description: This measure considers implementation of obligatory energy audits of large companies and implementation of ISO 50001 standard, as well as advanced measurement and introduction of new IT technologies. This will enable prevention of defects, better process control and quicker response times in manufacturing using advanced data analysis and predictive technologies.

Timeframe		2020 – 2040
Type		Regulatory, technical
Sector		Industry
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on energy efficiency
Assumptions		Improvement of the systems efficiency in manufacturing industries at annual rate of 0.15%.
Status of implementation		• Promotion of ISO 50001 standards completed • Training on implementation of energy management in industry organized • Certificates for energy auditors issued • USAID project for energy management in industry realized in 17 companies • UNIDO/GEF Project in which one of the activities is Program for energy management in industrial companies according to ISO 50001 standard and the UNIDO Methodology. Initial results achieved in 12 companies and additionally Program for replications of the energy management systems realized in 5 companies.
Results to be achieved		Final energy savings: • 0.9 ktoe in 2020 • 15.7 ktoe in 2030 • 43.4 ktoe in 2040 Primary energy savings: • 0.9 ktoe in 2020 • 18.8 ktoe in 2030 • 103.7 ktoe in 2040 GHG savings: • 2.9 Gg CO_2-eq in 2020 • 67.8 Gg CO_2-eq in 2030 • 259.3 Gg CO_2-eq in 2040
Finance	Budget	Negligible
	Source of finance	Private, donors through commercial EE loans

Implementing entity	• Ministry of Economy, Energy Agency • Private companies
Monitoring entity	Ministry of Economy, Energy Agency
Progress indicators	• Energy savings (ktoe/GWh) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions	Energy security, Decarbonisation, Research, innovation and competitiveness (competitiveness)

PM_EE15: Introduction of efficient electric motors

Main objective: Increase the competitiveness of the industrial products through improvement of the efficiency in the production process and reducing the resources.

Description: Electric motors are responsible for a high share of the total electricity consumption in industries. This measure considers replacement of the obsolete machines currently in use, with new more efficient motors. .

Timeframe		2020 – 2040
Type		Technical
Sector		Industry
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on energy efficiency
Assumptions		It is envisaged that the share of efficient electric motors by 2040 will be 60%.
Status of implementation		New efficient electric motors installed in a number of companies
Results to be achieved		Final energy savings: • 0.3 ktoe in 2020 • 5.0 ktoe in 2030 • 7.9 ktoe in 2040 Primary energy savings: • 0.3 ktoe in 2020 • 7.8 ktoe in 2030 • 39.9 ktoe in 2040 GHG savings: • 0.7 Gg CO_2-eq in 2020 • 28.8 Gg CO_2-eq in 2030 • 83.8 Gg CO_2-eq in 2040
Finance	Budget	113.0 M€
	Source of finance	Private, donors through commercial EE loans
Implementing entity		• Ministry of Economy, Energy Agency • Private companies
Monitoring entity		Ministry of Economy, Energy Agency
Progress indicators		• Energy savings (ktoe/GWh) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions		Energy security, Decarbonisation, Research, innovation and competitiveness (competitiveness)

PM_EE16: Introduction of more advanced technologies

Main objective: Introduction of more advanced technologies in the industrial processes that will also enable use of more environmental friendly fuels.

Description: Advanced industrial technologies present major opportunities for further reduction of the energy consumption and potentially lower costs as well as environmental benefits. In addition, they can help various industries to progress at a much faster rate

Timeframe	2020 – 2040
Type	Technical
Sector	Industry
Relevant planning documents, legal and regulatory acts	• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on energy efficiency
Assumptions	The share of more advanced technologies by 2040 is 60% from all technologies.

Status of implementation		Construction of gas network in Macedonia
Results to be achieved		Final energy savings: • 6.7 ktoe in 2020 • 59.4 ktoe in 2030 • 119.2 ktoe in 2040 Primary energy savings: • 6.7 ktoe in 2020 • 62.5 ktoe in 2030 • 186.1 ktoe in 2040 GHG savings: • 20.0 Gg CO_2-eq in 2020 • 206.0 Gg CO_2-eq in 2030 • 474.4 Gg CO_2-eq in 2040
Finance	Budget	438.6 M€
	Source of finance	Private, donors through commercial EE loans, EE fund
Implementing entity		• Government of the Republic of North Macedonia • Ministry of Environment and Physical Planning • Ministry of Economy, Energy Agency • Private investors
Monitoring entity		Ministry of Economy, Energy Agency
Progress indicators		• Energy savings (ktoe/GWh) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions		Energy security, Decarbonisation, Research, innovation and competitiveness (all)

PM_EE17: Increased use of the railway

Main objective: Improve the energy efficiency in the transport sector using cheap and efficient railway transport.

Description: Although the rail transport is cheap, official statistical data show that in the last three years there is a downward trend. Using this mode of transport as one of the most efficient can also improve the competitiveness of the companies. Therefore, at least several listed measures should be implemented, aiming to return the utilization level of this transport as of three years ago, and further increase it. The measure includes:

- implement raising awareness campaigns
- invest in stations and improve the “access to the stations”
- increase the network security and expand the network coverage

Timeframe		2020 – 2040
Type		Technical, information
Sector		Transport
Relevant planning documents, legal and regulatory acts		• National Transport Strategy • Strategy for Energy Development of the Republic of Macedonia up to 2040
Assumptions		By 2040, 3% of the passenger kilometers of cars, 1% of passenger kilometers of busses and 6.6% of tonnes kilometers of heavy duty vehicles will be realized by railway transport.
Status of implementation		• 150 freight cars and six compositions consisting of a locomotive and passenger cars ordered by the Government as part of a project with the European Bank for Reconstruction and Development (EBRD). Some of these have already been received and put into use. • Campaigns for cheaper/free driving of certain categories of passengers (young people, pensioners, etc.) carried out
Results to be achieved		Final energy savings: • 7.9 ktoe in 2020 • 14.8 ktoe in 2030 • 23.2 ktoe in 2040 Primary energy savings: • 7.9 ktoe in 2020 • 12.3 ktoe in 2030 • 4.3 ktoe in 2040 GHG savings: • 25.7 Gg CO_2-eq in 2020 • 37.2 Gg CO_2-eq in 2030 • 24.3 Gg CO_2-eq in 2040
Finance	Budget	180.6 M€
	Source of finance	Central government budget
Implementing entity		• Government of the Republic of North Macedonia • Ministry of Transport and Communications • Ministry of Economy, Energy Agency • JSC Macedonian Railway Transport • End-users • Private companies

Monitoring entity	Ministry of Economy, Energy Agency
Progress indicators	• Energy savings (ktoe/GWh) • Increase of passenger km in railway transport (pkm) • Increase of tonnes km in railway transport (tkm) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions	Energy security, Decarbonisation, Research, innovation and competitiveness (competitiveness)

PM_EE18: Renewing of the national car fleet

Main objective: Use of more advanced technologies in order to slow down the growing energy consumption in the transport sector, which is complex and with limited capabilities of energy use reduction.

Description: The measures recommended in the Study on the transport sector analysis of policies and measures should be implemented: Reduction of VAT from 18% to 5% for hybrid and electric vehicles; Direct subsidizing of hybrid vehicles, Excise duties of diesel fuel and petrol need to be gradually equaled.

Obligations of public institutions to purchase vehicles with low CO_2 emissions (up to 90 gCO_2/km by 2020 and 50 gCO_2/km by 2025). The quantified effects of this measure should also be analytically modelled and mitigation costs assessed

Timeframe		2020 – 2040
Type		Regulatory, policy, information
Sector		Transport
Relevant planning documents, legal and regulatory acts		• National Transport Strategy • Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on vehicles • Law on vehicle tax
Assumptions		It is assumed that only new vehicles and vehicles not older than eight years will be sold, i.e. vehicles that meet EU standards such as CO_2 emissions in 2020 of 95 g CO_2/km, and 70 g CO_2/km by 2025. In addition, advanced technologies such as diesel and gasoline HEV will be used with a share of 35% in the total passenger km from cars by 2040.
Status of implementation		• Law on vehicles adopted (August 2019) • Law on vehicle tax bylaws to be adopted
Results to be achieved		Final energy savings: • 10.2 ktoe in 2020 • 13.9 ktoe in 2030 • 31.1 ktoe in 2040 Primary energy savings: • 10.2 ktoe in 2020 • 13.9 ktoe in 2030 • 47.3 ktoe in 2040 GHG savings: • 33.3 Gg CO_2-eq in 2020 • 43.1 Gg CO_2-eq in 2030 • 98.6 Gg CO_2-eq in 2040
Finance	Budget	2167.7 M€
	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, Energy Agency • End-users
Monitoring entity		• Ministry of Economy, Energy Agency • Ministry of interior
Progress indicators		• Energy savings (ktoe/GWh) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions		Energy security, Decarbonisation

PM_EE19: Renewing of other national road fleet

Main objective: Reduction of the local air pollution.

Description: This measure anticipates introduction of a regulation that will enable renewal of the vehicle fleet of light duty and heavy goods vehicles and buses.

Timeframe		2020 – 2040
Type		Regulatory, policy
Sector		Transport
Relevant planning documents, legal and regulatory acts		• National Transport Strategy • Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on vehicles • Law on vehicle tax
Assumptions		It is assumed that only new advanced vehicles such as HEVs that meet EU standards for exhaust fumes will be sold. :
Status of implementation		/
Results to be achieved		Final energy savings: • 0.2 ktoe in 2020 • 20.8 ktoe in 2030 • 47.9 ktoe in 2040 Primary energy savings: • 0.2 ktoe in 2020 • 20.8 ktoe in 2030 • 44.9 ktoe in 2040 GHG savings: • 1.2 Gg CO_2-eq in 2020 • 66.4 Gg CO_2-eq in 2030 • 147.3 Gg CO_2-eq in 2040
Finance	Budget	~2300 M€
	Source of finance	Private
Implementing entity		• Government of the Republic of North Macedonia • Ministry of Transport and Communications • Ministry of Economy, Energy Agency • Private companies
Monitoring entity		• Ministry of Transport and Communications • Ministry of Economy, Energy Agency
Progress indicators		• Energy savings (ktoe/GWh) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions		Energy security, Decarbonisation, Research, innovation and competitiveness (competitiveness)

PM_EE20: Advanced mobility

Main objective: Reduction of the local air pollution.
Description: The measure includes conducting campaigns/providing subsidies and systems for use of new or rented bicycles, electric scooters, promoting walking, and introduction of parking policies that would reduce the use of cars in the city area. People, especially in smaller towns where a lot of them use cars for short distances, would increase the use of bicycles/electric scooters or walking.

Timeframe	2020 – 2040
Type	Regulatory, technical, information
Sector	Transport
Relevant planning documents, legal and regulatory acts	• National Transport Strategy • Strategy for Energy Development of the Republic of Macedonia up to 2040 • Decisions made by municipalities to subsidize buying of new bicycles
Assumptions	By 2040, 3% of short distance passenger kilometres will be replaced by walking, using bicycles or electric scooters
Status of implementation	• Subsidies and campaigns for buying new bicycles/electric scooters implemented • Systems for bicycles renting implemented • Bicycles tracks constructed • Zonal parking implemented • New multi-level car parks constructed
Results to be achieved	Final energy savings: • 0.7 ktoe in 2020 • 1.2 ktoe in 2030 Primary energy savings: • 0.7 ktoe in 2020 • 1.2 ktoe in 2030 GHG savings: • 2.1 Gg CO_2-eq in 2020 • 3.6 Gg CO_2-eq in 2030

		• 2.0 ktoe in 2040 • 2.0 ktoe in 2040 • 6.4 Gg CO_2-eq in 2040
Finance	Budget	/
	Source of finance	Private, EE fund, incentives from the central and local government budget, donors
Implementing entity		• Ministry of Economy, Energy Agency • Local self-government • End-users
Monitoring entity		• Ministry of Economy, Energy Agency • Local self-government
Progress indicators		• Energy savings (ktoe/GWh) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions		Energy security, Decarbonisation, Research, innovation and competitiveness (research, innovation)

PM_EE21: Construction of the railway to Republic of Bulgaria

Main objective: Connecting the Republic of Macedonia with the Republic of Bulgaria and extending the export to external markets, not just in the neighboring countries but in the Southeast Europe and Turkey region, using the railway transport.
Description: Construction of the railway to Republic of Bulgaria.

Timeframe		2023 – 2040
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
Assumptions		By 2040 up to 5% of the tonne kilometers (to the Republic of Bulgaria) of the heavy goods vehicles will be replaced by the railroad transport.
Status of implementation		First phase (Kumanovo - Beljakovce) is under construction, 67% constructed at the end of 2019 Tender for the second phase is announced.
Results to be achieved		Final energy savings: • 5.1 ktoe in 2020 • 10.2 ktoe in 2030 • 14.4 ktoe in 2040 Primary energy savings: • 5.0 ktoe in 2020 • 8.2 ktoe in 2030 • 4.7 ktoe in 2040 GHG savings: • 16.7 Gg CO_2-eq in 2020 • 24.6 Gg CO_2-eq in 2030 • 32.3 Gg CO_2-eq in 2040
Finance	Budget	720 M€ (infrastructure+trains)
	Source of finance	Central government budget
Implementing entity		• Government of the Republic of North Macedonia • Ministry of Transport and Communications • Ministry of Economy, Energy Agency
Monitoring entity		• Ministry of Transport and Communications • Ministry of Economy, Energy Agenc
Progress indicators		• Energy savings (ktoe/GWh) • Increase of the tonnes km in the railway transport (tkm) • Emissions reduction (Gg CO2-eq)
Relation with other dimensions		Energy security, Decarbonisation, Research, innovation and competitiveness (competitiveness)

PM_EE22: Electrification of the transport

Main objective: Transition from society based on fossil fuels to low carbon society, where the renewable energy and electrification of the transport will play the most important role.
Description: At least the following measures recommended in the "Study on the transport sector, analysis of policies and measures" should be implemented:

- Based the methodologies for calculation of environmental taxes as well as the excise duty on CO_2

		• Exemption from paying excise duty for electric vehicles • Direct subsidizing of electric vehicles, 5000 EUR in the period 2020-2023 • Reserve green parking in all public parking lots • Obligation to place fast chargers at all gas stations on motorways (at every 100 km by 2020)
	Timeframe	2020 – 2040
	Type	Regulatory, policy, information
	Sector	Transport
	Relevant planning documents, legal and regulatory acts	• National Transport Strategy • Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on vehicles • Law on vehicle tax
	Assumptions	It is envisaged that by 2040 the share of electric vehicles and "plug-in" hybrid electric vehicles in the total passenger km from cars will be 45%.
	Status of implementation	• Chargers installed at specific locations in the City of Skopje • Law on vehicles adopted (August 2019) • Law on vehicle tax and bylaws adopted
	Results to be achieved	Final energy savings: • 3.4 ktoe in 2020 • 30.5 ktoe in 2030 • 61.3 ktoe in 2040 Primary energy savings: • 3.4 ktoe in 2020 • 20.9 ktoe in 2030 • 75.1 ktoe in 2040 GHG savings: • 11.3 Gg CO_2-eq in 2020 • 61.6 Gg CO_2-eq in 2030 • 78.8 Gg CO_2-eq in 2040
	Finance – Budget	8292.3 M€
	Finance – 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, Energy Agency
	Monitoring entity	• Ministry of Economy, Energy Agency • Ministry of interior
	Progress indicators	• Energy savings (ktoe/GWh) • Emissions reduction (Gg CO2-eq)
	Relation with other dimensions	Energy security, Decarbonisation, Research, innovation and competitiveness (all)

PM_EE23: Increased use of central heating systems	
Main objective: Reduction of the local air pollution, as household heating is one of the main sources for local pollution. **Description:** Increased use of the existing central heating systems through implementation of information campaigns for connecting new consumers, including those who have been disconnected from the system in the past.	
Timeframe	2020 – 2040
Type	Technical, information
Sector	Households and commercial
Relevant planning documents, legal and regulatory acts	• Strategy for Energy Development of the Republic of Macedonia up to 2040 • Law on energy efficiency • Study for determining the techno-economic optimal and environmentally sustainable structure of heating and implementation of the central supply of sanitary hot water in the City of Skopje
Assumptions	Information campaigns will contribute to maximize the utilization of the existing network as well as to enable construction of new network.
Status of implementation	• Studies for analysis of the central heating system and implementation of central supply of sanitary hot water developed • Information campaigns for re-connection of the previously disconnected consumers and attraction of new consumers implemented • Reduced the VAT from 18% to 5%

Results to be achieved	Final energy savings: • 0.4 ktoe in 2020 • 1.3 ktoe in 2030 • 13.3 ktoe in 2040	Primary energy savings: • 0.7 ktoe in 2020 • 2.1 ktoe in 2030 • 26.3 ktoe in 2040	GHG savings: • 4 Gg CO_2-eq in 2020 • 9.3 Gg CO_2-eq in 2030 • 560 Gg CO_2-eq in 2040
Finance – Budget	3.2 M€		
Finance – Source of finance	Private, EE fund, incentives from the central and local government budget		
Implementing entity	• Ministry of Economy, Energy Agency • Balkan energy Dooel Skopje • JSC Skopje Sever • "Energetika" –Skopje, subsidiary to JSC Macedonian Power Plants (ESM AD) • Private investors		
Monitoring entity	• Energy Regulatory Commission • Ministry of Economy, Energy Agency		
Progress indicators	• Increase of heat consumption (form central heating systems) (GWh) • Increase in the number of consumers connected to the central heating system • Emissions reduction (Gg CO2-eq)		
Relation with other dimensions	Energy security, Decarbonisation, Research, innovation and competitiveness (research and innovation)		

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

PM_EE24: Smart communities	
Main objective: Develop pilots for smart communities **Description:** Smart academic campuses could have an exemplary role where all advanced concepts and principles from smart energy systems can be tested with the goal for roll-out on larger scale**.**	
Timeframe	2020-2030
Type	Education, Technical
Sector	Education, Energy
Relevant planning documents, legal and regulatory acts	/
Assumptions	/
Status of implementation	PV power plants are installed at the Faculty of Electrical Engineering and Information Technologies
Finance – Budget	Depends on the type of smart community
Finance – Source of finance	• Donors • Horizon 2020 and other research programs
Implementing entity	Universities (or high schools)
Monitoring entity	• Ministry of Education and Science • Ministry of Economy
Progress indicators	Number of smart communities
Relation with other dimensions	Decarbonisation, Research Innovation and Competitiveness (all)

VI. Description of measures to develop measures to utilise energy efficiency potentials of gas and electricity infrastructure (5);

For the achievement of the EE target set in this NECP one measure is defined in this part. The following table presents details for it (more details are given in the TBUR).

PM_EE25: Reduction of network losses		
Main objective: Reduction of losses in electricity and heat networks **Description:** Technical measures for reducing distribution electricity losses comprise of overhead lines replacement with underground (where possible), transition to 20 kV voltage level, installation of new transformation stations to shorten the low voltage lines, as well as automation and remote network management. All these improvements will contribute to better SAIDI and SAIFI indicators. For the heating sector, technical measures include continuous replacement of existing heat pipelines with pre-insulated ones and optimization of the substation operations through automatic control.		
Timeframe		2020– 2040
Type		Technical
Sector		Electricity and heat distribution operators
Relevant planning documents, legal and regulatory acts		• Strategy for Energy Development up to 2040 • Development plan of EVN Macedonia, AD • Development plan of Balkan Energy Group (BEG)
Assumptions		Technical interventions will reduce the electricity transmission and distribution losses from 12% to 8%, while the district heating system losses will be reduced from 12% to at least 7%.
Status of implementation		• A General investment plan in electricity distribution network is developed for the next 20 years. • Implementing measures for operation improvement and losses reduction in the heat distribution system
Results to be achieved		Primary energy savings: • 11.0 ktoe in 2020 • 28.9 ktoe in 2030 • 263.7 ktoe in 2040 Additional benefit - decrease of net import: • 41.8 ktoe in 2020 • 86.6 ktoe in 2030 • 332.3 ktoe in 2040 GHG savings: • 201.8 Gg CO_2-eq in 2020 • 323.4 Gg CO_2-eq in 2030 • 701.8 Gg CO_2-eq in 2040
Finance	Budget	170 M€
	Source of finance	Electricity and neat distribution companies
Implementing entity		• Electricity distribution companies • Heat distribution companies
Monitoring entity		Energy Agency, Ministry of Economy
Progress indicators		• Energy savings (ktoe/GWh) • Emissions reductions (Gg CO2-eq)
Relation with other dimensions		Internal energy market, Research, innovation and competitiveness (innovation)

VII. Regional cooperation in this area, where applicable;

Regional cooperation within the EnC is important for the implementation of the measures in this section.

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

The budget and source of finance for each of the proposed policy and measure, where available are included in the tables. 'Budget' is actually the total estimated cost of the measures. From the State point of view, some measures will have no cost (like appliance labelling), but private persons will endure costs of purchase of more efficient appliances.

DIMENSION ENERGY SECURITY

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

For the Energy security dimension, four objectives were defined in Chapter 2. Some of the measures defined in other dimensions already fulfil these objectives:

- **Objective 1** – diversification of domestic energy sources – fulfilled with the measures **PM_D18 - PM_D25**, defined in Renewable Energy part
- **Objective 2** – diversify supply routes – fulfilled with the measure **PM_IEM3, PM_IEM4**, defined in Internal Energy Market Part
- **Objective 3** – reduce energy import dependence – fulfilled with the measures **PM_D18 - PM_D25**, defined in Renewable Energy part, as well as the measures **PM_EE1 - PM_EE25** defined in Energy Efficiency dimension
- **Objective 4** – increase system flexibility – fulfilled with the measures **PM_D18, PM_D25, PM_EE22**.

II. Regional cooperation in this area;

The regional cooperation between Serbia, Macedonia and Montenegro (SMM) is realized with the share and exchange of auxiliary services (power control reserves and balancing energy).

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, where available are included in the tables.

DIMENSION INTERNAL ENERGY MARKET

1. Electricity infrastructure

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

For the achievement of the Internal energy market objectives, one measure is defined in the electricity infrastructure part. The following table presents details for it.

PM_IEM1: Construction of 400 kV electricity transmission interconnection Macedonia-Albania (Bitola-Elbasan)		
Main objective: Improve the interconnectivity level **Description:** this project is the last segment of the Corridor 8 for transmission of electricity between Bulgaria, Macedonia, Albania and Italy. The project is included in the List of Projects of Energy Community Interest (PECI).		
Timeframe		2020-2023
Type		Technical
Sector		Energy
Relevant planning documents, legal and regulatory acts		• PECI list • Plan for development of the transmission system, 2020-2029, MEPSO • Infrastructure Capacity Project, Technical Assistance Window (IPA) Western Balkans
Assumptions		Interconnectivity level will be increased for at least 7%
Status of implementation		an agreement for construction signed
Finance	Budget	34 Mil. €
	Source of finance	EBRD (17.2 Mil. €), Grand from Western Balkan Investment Fund (16.9 Mil. €)
Implementing entity		MEPSO
Monitoring entity		/
Progress indicators		Interconnectivity level
Relation with other dimensions		Energy secturity, Research, innovation and competitiveness (competitiveness)

II. Regional cooperation in this area;

MEPSO will cooperate with Albanian transmission system operator during the realization of the PM_IEM1.

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 of the proposed measure, where available are included in the tables.

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;

For the achievement of the Internal energy market objectives, two measures are defined in the Energy transmission infrastructure. The following tables present details for them.

PM_IEM2: Develop natural gas cross-border infrastructure to diversify supply routes and increase market competitiveness	
Main objective: **Description:** On 10 July 2015 the Republic of North Macedonia became a signatory to the Memorandum of understanding on a common approach to address the natural gas diversification and the challenges of security of supply within the Central and Southeastern Europe Gas Connectivity Initiative (CESEC). NER JSC Skopje has started implementing the obligations under this Initiative aimed at promoting the diversification of natural gas supply and ensuring security in the supply of the region, which should take place by improving the regional infrastructure and integration of markets through the joint engagement of all EU Member States and Contracting Parties of the Energy Community. This initiative should provide the supply of the necessary quantities of natural gas to all consumers in the region of Central and South-Eastern Europe (CESEC), including the Republic of North Macedonia. In addition, there are two other initiatives - pipelines to Kosovo* and Serbia. The pipeline to Serbia could provide additional alternative source and transit opportunity to the Macedonian system, while the connection with Kosovo* could provide transit opportunity. Both can increase the utilization rate of the system, thus have the potential to decrease tariffs and help the gasification efforts in Macedonia. The projects for gas pipelines to Kosovo* and Serbia are on the preliminary PECI 2020 list that should be adopted by the Ministerial council at the end on 2020, while the gas project to Greece is already included on the PMI list, verified on 14 October 2016 by the Ministerial council of the Energy Community. Furthermore, Macedonia and Albania have signed a Memorandum of understanding and a working group is established and it is expected that by the end of 2020 more concrete activities will start.	
Timeframe	2025
Type	Technical, Regulatory
Sector	Energy
Relevant planning documents, legal and regulatory acts	• List of Projects of Mutual Interest • List of Project of Energy Community Interest
Assumptions	
Status of implementation	Macedonia – Greece pipeline • Project application after the fourth open call for co-financing of infrastructure projects within the IPA instrument Investment Framework of the Western Balkans, November 2018 and update of the same in April 2019. The investment grant application has a positive screening status and the final decision was made in December 2019; • A letter was submitted with a request for expression of interest for financing the Project submitted to the European Investment Bank (EIB), October 2018. The EIB submitted a positive response to this request in November 2018. Intensive negotiations have started for the financing procedure. • Mutual Feasibility Study is prepared by DESFA and NER in January 2019 and it is submitted and accepted by EIB • A request for technical assistance (100% grant) has been submitted for the preparation of an Environmental Impact Assessment Study and a general design project to Connect (Technical Assistance for Connectivity in the Western Balkans). The application was approved in January 2019. The study and the general design project are being prepared by Konnekta. According to the plans, the Study (EIA) has already been prepared and submitted to the EIB for comments, while the project documentation should be completed by the middle of 2020. • A request for technical assistance (100% grant) for preparation of tender documentation for construction and construction supervision has been submitted. The same has been approved, but due to the coronavirus situation it is postponed. Macedonia – Kosovo* pipeline • Memorandum of Understanding is signed, February 2019 • A letter with a request for expression of interest for financing the Project was submitted to the EBRD. At the beginning of 2019, the EBRD submitted a positive

		response to this request and the bank supported the implementation of this project; • A project application was submitted after the 21st open call for technical assistance for preparation of a Feasibility Study and Environmental Impact Assessment Study within the IPA Instrument Investment Framework of the Western Balkans, November 2018 and update of the same in April 2019. The technical assistance application was approved in July 2019; The TOR (Terms of Reference) has been developed. A Feasibility Study and an Environmental Impact Assessment Study are expected to be completed by the middle of 2020. Macedonia – Serbia pipeline: • Activities for signing a Memorandum of Understanding.
Finance	Budget	/
	Source of finance	Grant – 10 Mil. €, Central government budget
Implementing entity		National Energy Resources of Macedonia
Monitoring entity		Ministry of Economy
Progress indicators		Natural gas interconnection capacity
Relation with other dimensions		Energy Security, Research, innovation and competitiveness (competitiveness)

PM_IEM3: Develop gas transmission network

Main objective: Increase the access to the transmission network

Description: Macedonia has an ambitious gasification plan and a detailed list of planned infrastructure project of the gas network in Macedonia with timeline is given in Chapter 4, Energy transmission infrastructure. The increased level of transmission network access is especially aimed at the industrial consumers (which are most affected by the green scenario), as natural gas is one of the fuels that will significantly contribute to the energy transition in the industry sector. In addition, with the implementation of this measure the air quality will be significantly improved.

Timeframe		2025
Type		Technical
Sector		Energy
Relevant planning documents, legal and regulatory acts		• Gasification plan of Macedonia
Assumptions		Described in detail in chapter 4, Energy transmission infrastructure
Status of implementation		Described in detail in chapter 4, Energy transmission infrastructure
Finance	Budget	~ 200 Mil. €
	Source of finance	
Implementing entity		National Energy Resources of Macedonia
Monitoring entity		Ministry of Economy
Progress indicators		Number of natural gas consumers
Relation with other dimensions		Energy Security, Research, innovation and competitiveness (competitiveness)

PM_IEM4: Develop a gas distribution network

Main objective: Diversification of the energy resources

Description: 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	2020-2025
Type	Technical
Sector	Energy

Relevant planning documents, legal and regulatory acts		• Gasification plan of Macedonia • Feasibility study about gasification (revised version in 2020)
Assumptions		Development of a cost benefit analyses for each city
Status of implementation		• Tender announced • EBRD support for procurement and installation of household equipment (50 mill. EUR) • Tender for technical and legal support for preparation and implementation of a tender procedure is announced in June 2020 by EBRD
Finance	Budget	/
	Source of finance	Grant, Central governmental budget, Local self-government budgets
Implementing entity		Ministry of economy, National Energy Resources of Macedonia, Local self-government
Monitoring entity		Ministry of Economy
Progress indicators		• Number of natural gas consumers • Natural gas consumption
Relation with other dimensions		Energy Security, Research, innovation and competitiveness (competitiveness)

II. Regional cooperation in this area;

Cooperation with the relevant entities from Greece was established and for the purpose of realization of the project for construction of the gas interconnection for transmission of natural gas between the Republic of North Macedonia and Greece, NER JSC Skopje and DESFA S.A. - the operator of the natural gas transmission system in Greece, signed a Memorandum of Understanding on 14 October 2016. In addition, there is a need for further cooperation with Bulgaria in order the interconnection agreement to be signed. Regarding the other gas interconnection pipelines, there is a regional cooperation with Serbia, Kosovo* and Albania.

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, where available are included in the tables.

3. Market integration

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

For the achievement of the Internal energy market objectives, one measure is defined in this part. The following table presents details for it.

PM_IEM5: Pursue regional electricity market integration	
Main objective: Increase the electricity price competitiveness and affordability **Description:** It is anticipated that day ahead market coupling, and development of power exchange is playing an important role in the future for North Macedonia and EnC market integration initiatives (WB6). Future potential domestic capacities for electricity generation are considered in the context of integrated regional and European market. In addition, a well-integrated regional market will serve as a control indicator for price competitiveness and steer future capital investment decisions. In order to have competitive natural gas market in Macedonia, the interconnection agreement between Macedonian and Bulgarian TSOs is of crucial importance.	
Timeframe	2020-2023
Type	Regulatory
Sector	Energy

Relevant planning documents, legal and regulatory acts		• Energy Law and bylaws
Assumptions		/
Status of implementation		The decree for the operation of the organized electricity market and the necessary technical, staff and financial conditions that should be fulfilled, should be adopted by the Government
Finance	Budget	/
	Source of finance	/
Implementing entity		Electricity Market Operator
Monitoring entity		Energy Regulatory Commission
Progress indicators		/
Relation with other dimensions		Energy security, Research, innovation and competitiveness (competitiveness)

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;

For the achievement of the Internal energy market objectives, one measure is defined in this part. The following table presents details for it.

PM_IEM6: Develop further distribution system network to integrate more RES, including prosumers and more electric vehicles (EVs), as well as continuously improve network reliability		
Main objective: Develop further distribution system network to integrate more RES, as well as continuously improve network reliability. **Description:** The RES policies and measures envisage a huge number of solar PVs up to 1,400 MW, out of which 250 – 400 MW being rooftop PVs. Such trend indicates an important role of the distribution network system to service growing decentralised systems. In addition, European practice shows that regulators are imposing additional pressure and incentive to improve the operational performance and results of distribution system operators. The key changes that should be considered in the future are related in introducing new quality indicators in the tariff methodology (voltage quality, quality of supply, customer relationship quality etc.), as well as additional revisions on investment decisions (CAPEX and regulated asset base), operating efficiency and expected returns for distribution system operators. These changes in the regulatory framework will indirectly contribute to improvements in asset management, workforce management, automation and roll out of “behind the meter” services in the future.		
Timeframe		2020-2040
Type		Technical and regulatory
Sector		Energy
Relevant planning documents, legal and regulatory acts		• Plan for development of the distribution network
Assumptions		The potential for distributed RES, prosumers and electric vehicles will be increased.
Status of implementation		Chargers for Electric vehicles are being installed Old meters are being replaced with smart meters
Finance	Budget	/
	Source of finance	EVN, consumers through their electricity bills
Implementing entity		• EVN • Energy Regulatory Commission
Monitoring entity		Energy Regulatory Commission
Progress indicators		• Number of prosumers • Capacity of distributed PV • Number of electric vehicles

Relation with other dimensions	Energy Security, Energy efficiency, Decarbonisation, Research, innovation and competitiveness (competitiveness)

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 already defined measures PM_D19 and PM_D23 in Decarbonisation part will contribute to the improvement of non-discriminatory participation of renewable energy and storage.

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;

The measure PM_IEM8 defined in the Energy poverty section will contribute to protect consumers, especially vulnerable and energy poor consumers.

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

For the achievement of the Internal energy market objectives, one measure is defined in this part. The following table presents details for it.

PM_IEM7: Price signal demand response		
Main objective: Introduce price signals to consumers in order to implement demand response **Description:** Demand response is one of the main methods that are used in order to reduce the maximum electricity consumption in the system, and thus reduce its peak load and integrate higher level of RES in the system. Price signalling provided by the electricity suppliers can significantly contribute towards achieving these goals. By implementing the new Energy Law, and by the liberalized market it is envisioned that the role of the universal supplier will be reduced, and that the concurrency of the suppliers will be increased. Therefore, each of them may introduce different pricing signals for different type of consumers.		
Timeframe		2020-2040
Type		Regulatory
Sector		Energy
Relevant planning documents, legal and regulatory acts		• Energy Law • Study on automated demand response, MEPSO
Assumptions		Price signal demand response will reduce the peak load and enable higher integration of RES
Status of implementation		/
Finance	Budget	/
	Source of finance	/
Implementing entity		• Electricity suppliers/traders • Consumers
Monitoring entity		Energy Regulatory Commission
Progress indicators		Number of suppliers on the market with price signals
Relation with other dimensions		Energy security, Decarbonisation, Research, innovation and competitiveness (competitiveness)

Another measure that will contribute toward demand response is the measure PM_EE22 defined in Energy Efficiency part.

4. Energy poverty

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

For the achievement of the Energy poverty objectives, one measure is defined in this part. The following table presents details for it.

PM_IEM8: Adoption of annual program for vulnerable consumers		
Main objective: Protect vulnerable customers **Description:** The Implementation of the GHG and RES targets will increase the price of electricity as it is described in Chapter 4 Internal energy market. Having this in mind a program for vulnerable costumers is needed that will protect them from the price shocks.		
Timeframe		2020-2040
Type		Regulatory
Sector		Energy
Relevant planning documents, legal and regulatory acts		• Energy law • Separate rules for electricity, gas and heat supply • Program for vulnerable consumers for 2020
Assumptions		This early program should define the categories of vulnerable costumers and associated measures, including financial supports and responsible institutions for realization of the program.
Status of implementation		The first program is adopted by the Government
Finance	Budget	Different for each year
	Source of finance	Budget and potential donors
Implementing entity		• Ministry of economy • Suppliers of electricity, gas and heat
Monitoring entity		Energy regulatory commission
Progress indicators		Number of supported vulnerable consumers
Relation with other dimensions		Energy security

DIMENSION RESEARCH, INNOVATION AND COMPETITIVENESS

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

For the achievement of the Research, Innovation and Competitiveness objectives, four measures are defined in this part. The following tables presents their details.

PM_RIC1: Participation in development of energy transition technologies and measures		
Main objective: Streamline energy transition technologies and measures into national R&I priorities **Description:** The development of sectoral strategies and plans for science and R&I should be realized in cooperation between Ministry of Education and Science and relevant energy stakeholders, in order to prioritize energy transition technologies and measures. Same is needed for the programmes in the Fund for Innovation and Technology Development.		
Timeframe		2020-2040
Type		Research
Sector		Energy, Research, Economy
Relevant planning documents, legal and regulatory acts		• Innovation Strategy, 2012-2020 • Law on Innovation Activity • Annual programs of the Fund for Innovation and Technology Development
Assumptions		/
Status of implementation		The Fund for Innovation and Technology Development has already announced two public calls for research in climate change and local pollution
Finance	Budget	/
	Source of finance	• Fund for Innovation and Technology Development • Horizon 2020 • Donors
Implementing entity		• Ministry of Education and Science • Fund for Innovation and Technology Development • Chamber of Commerce
Monitoring entity		Ministry of Education and Science
Progress indicators		Number of research projects development of energy transition technologies and measures
Relation with other dimensions		Decarbonisation

PM_RIC2: Increased level of education of sustainable energy needs		
Main objective: Adjust energy related curricula at all educational levels to make them responsive to energy transition trends **Description:** The development of consciousness for sustainable energy needs to be addressed from the earliest education levels and incorporated in the curricula of all primary, secondary and tertiary educational levels. Moreover, stimulating science and education in energy transition will help mobilization of the existing and building of new research capacities, as well as better integration into European Research Area (ERA) in energy themes.		
Timeframe		2020-2040
Type		Education, Regulatory
Sector		Education
Relevant planning documents, legal and regulatory acts		• Law on primary education • Law on secondary education • Law on higher education

Assumptions		/
Status of implementation		/
Finance	Budget	/
	Source of finance	/
Implementing entity		Universities, High and Primary schools
Monitoring entity		Ministry of Education and Science
Progress indicators		Number of curricula for sustainable energy needs
Relation with other dimensions		Energy Efficiency, Decarbonisation

PM_RIC3: Inter-sectoral and geographical mobility of researchers

Main objective: Encourage inter-sectoral and geographical mobility of researchers

Description: Knowledge and experience transfer among researchers from industry and academia, as well as incoming and outgoing mobility is needed to build internal capacities. For example, at highest educational level, industrial doctorates can be promoted as a tool to support industry driven science.

Timeframe		2020-2040
Type		Research, Education
Sector		Education, Energy
Relevant planning documents, legal and regulatory acts		/
Assumptions		/
Status of implementation		Faculty of Electrical Engineering and Information Technologies has established INNOFEIT, which is a place where the faculty staff, students and company representatives can interact, network and transfer technologies and innovations. The goal of INNOFEIT is to improve, strengthen and stimulate the transfer of knowledge.
Finance	Budget	/
	Source of finance	• Industry companies • Donors
Implementing entity		• Universities • Industry companies
Monitoring entity		• Ministry of Education and Science • Ministry of Economy
Progress indicators		Number of industrial doctorates
Relation with other dimensions		/

PM_RIC4: Increase the role of SME sector in energy transition

Main objective: Encourage SME sector to diversify their portfolio of services and products in RES and EE

Description: To support greater involvement of local SME in energy transition, it is necessary to promote further expansion of RES projects and EE measures overall, especially via financial mechanisms, as well as green public procurement for innovative products. Private investments in RES and EE will be encouraged by structuring financing instruments with grant components to lower the risk of private investments in untested but promising clean energy technologies or business models. In addition, provision of technical assistance for SMEs in order to facilitate the access of enterprises to external services is needed. This covers the areas of external research and development, testing, design, instruction and training, market research, business consulting, etc.

Timeframe	2020-2040
Type	Research, Technical, Voluntary

Sector		Energy
Relevant planning documents, legal and regulatory acts		/
Assumptions		/
Status of implementation		/
Finance	Budget	/
	Source of finance	• Grants • Private investments
Implementing entity		• SMEs
Monitoring entity		Ministry of Economy
Progress indicators		• Energy savings (ktoe/GWh) • Emissions reduction (Gg CO2-eq) • Number of innovations/patents in the field of clean energy
Relation with other dimensions		All other sectors

II. Where applicable, cooperation with other Member States in this area, including, where appropriate, information on how the SET Plan objectives and policies are being translated to a national context;

Macedonia is not member of the steering group of the European Strategic Energy Technology Plan (SET-Plan).

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

The source of finance for each of the proposed policy and measure are included in the tables. The national support via the mechanisms of the Fund for Innovation and Technology Development (grants, loans, etc.) should continue. Also, the access to international support from the EU research and innovation programs and other donor funds should be further enhanced by establishing effective project management units in the responsible ministries (comprised of multidisciplinary officers involved in the planning, evaluation and monitoring procedures) and by increasing the competences of the institutions to effectively absorb such funds.

4. CURRENT SITUATION AND PROJECTIONS

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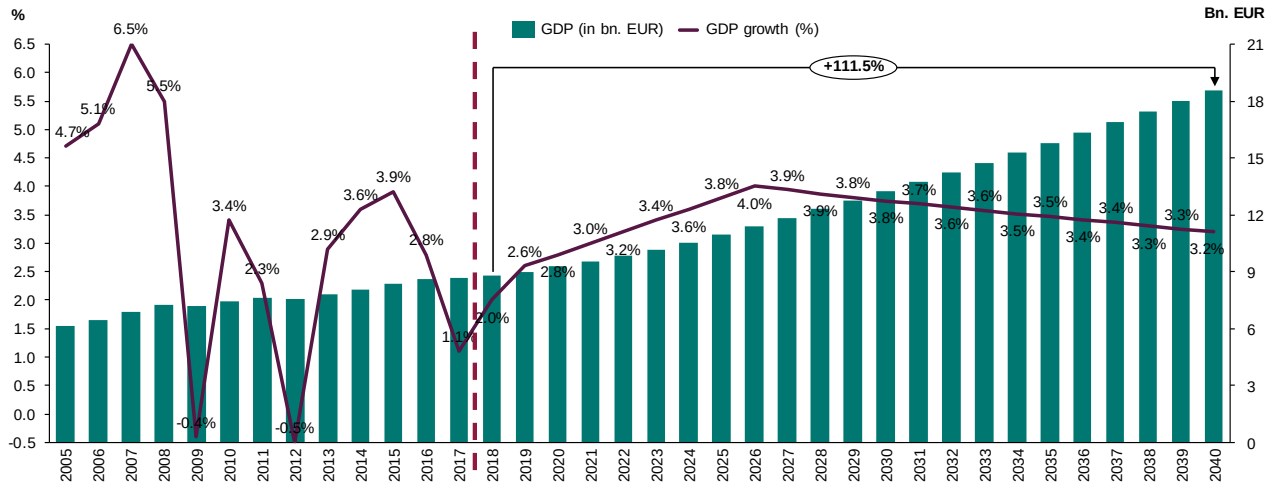
4. CURRENT SITUATION AND PROJECTIONS WITH EXISTING POLICIES AND MEASURES

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

i. Macroeconomic forecasts (GDP and population growth)

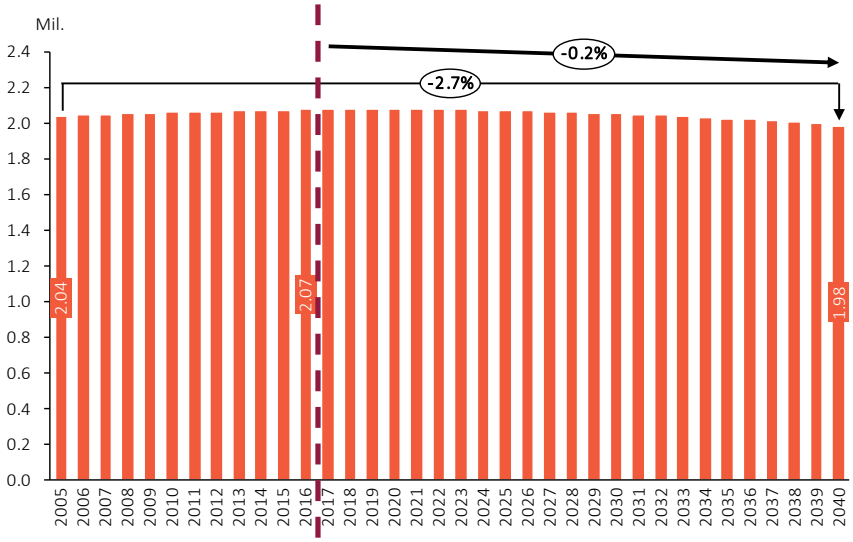
Using the macroeconomic drivers from the Energy Strategy, an average GDP growth rate of 3.3% is forecasted during the period 2018-2040 (Figure 43). The population is expected to decline by 0.2% in 2040 compared to 2017 (Figure 44).

Figure 43. GDP and GDP growth - historical and projected values up to 2040 in Macedonia



Source: SSO, Strategy for energy development up to 2040, project team analyses

Figure 44. Population in Macedonia – historical and projected values

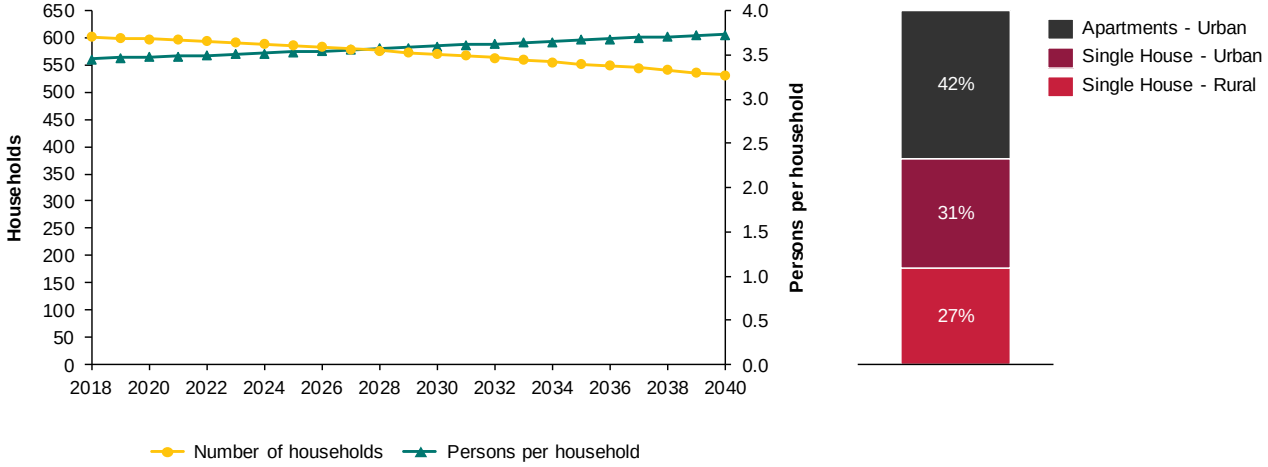


Source: SSO, Strategy for energy development up to 2040, project team analyses

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

Besides the population and GDP, for the household sector there are a lot of other parameters that are important for useful energy projection. One of the parameters is the number of persons per household, which is decreasing from around 3.7 persons per household in 2018 to 3.3 in 2040 (Figure 45). At the same time, based population and the number of persons per household, the number of households is calculated. The households are divided in three different groups (urban apartment, urban and rural single houses) (Figure 45).

Figure 45. Number of households, person per households and split of households by type



Source: SSO Energy consumption in households 2014, MARKAL input data for the Strategy for energy development up to 2040, project team analyses

It is projected that the size of urban and rural houses will increase to 100 m^2, while the size of apartments will achieve around 80 m^2, in the analyzed period (Figure 46). From the current 32% and 40% of the rural and urban houses, it is projected that in 2040 the heated area will be increased to around 40% and 50%. respectively (Figure 51).

Figure 46. Size of dwelling by type

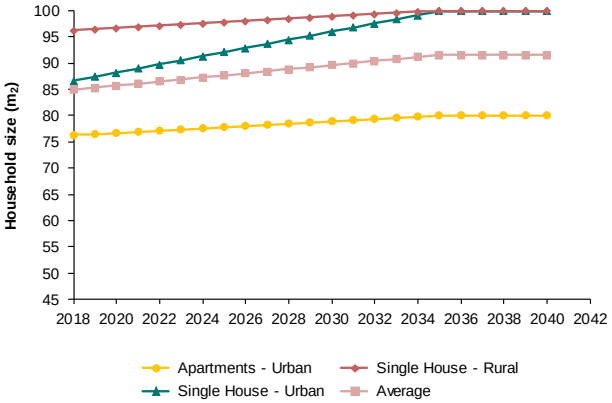
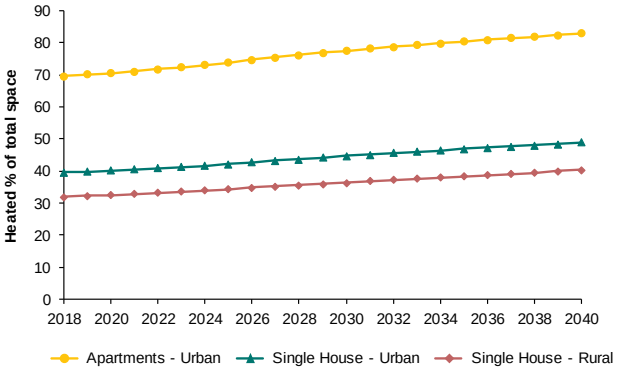


Figure 47. Heated area by type of dwelling

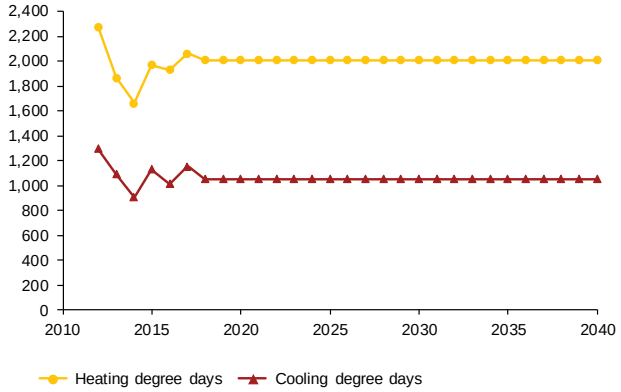


Source: SSO Energy consumption in households 2014, MARKAL input data for the Strategy for energy development up to 2040, project team analyses

For the projection of the useful energy demand in both sectors, households and commercial, the number of heating and cooling degree days have an important role. The model is calibrated taking into account the heating and cooling degree days for the period 2012 -2017, while for the period after 2017 the average number of degree days is used (the average is calculated taking into account the period 2000-2017) (Figure 48).

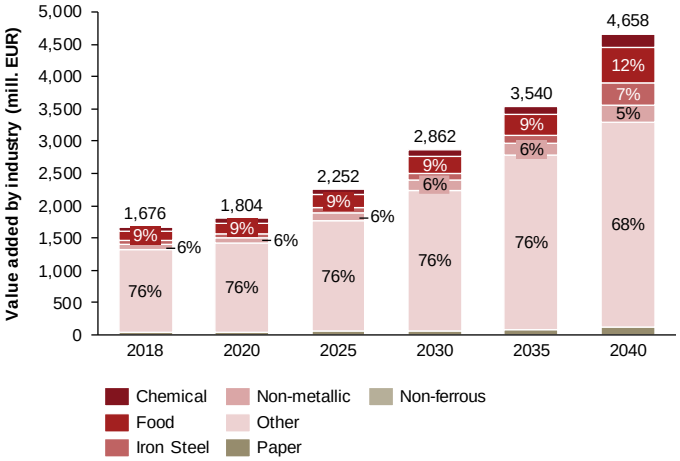
For the industry sector, most important parameter is the value added per industry type. During the overall planning period the Other industry subsector is the most dominant one. In 2040 76% from the total value added in the industry sector is camming from the Other industries (Figure 49). The next most contributing industry is the food industry with 12%, while the third one is the Iron and steel industry (7%).

Figure 48. Heating and cooling degree days



Source: Wheather Undergraund (2000-2107), MARKAL input data for the Strategy for energy development up to 2040, project team analyses

Figure 49. Value added by industries

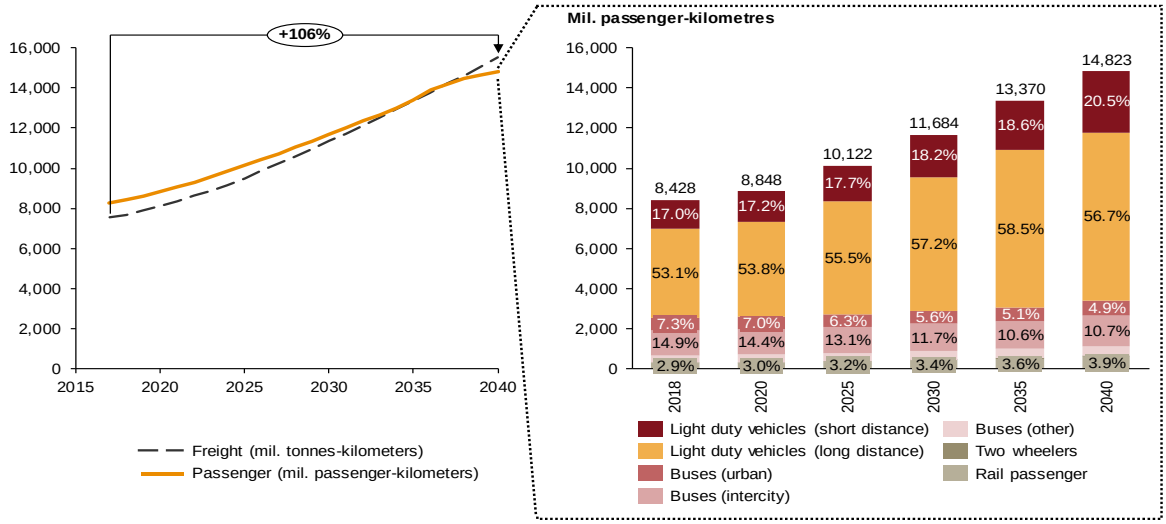


Source: SSO - GDP components by sectors, MARKAL input data for the Strategy for energy development up to 2040, project team analyses

Based on the GDP and population growth the passenger and freight km are calculated and it is projected that each of them will be doubled during the planning period Figure 50). The most dominant in the passenger km are the light duty vehicles (around 77% in 2040). This is the situation when no measures are implemented. It should be noted that in WEM and WAM scenario, as a result of implementation of the proposed measures in the transport sector, the share of buses, rail and advanced mobility (walking, cycling and electric scooters) is increased.

Figure 50. Transport (passenger + freight) evolution

Figure 51. Passenger transport evolution



Source: MARKAL input data for the Strategy for energy development up to 2040, project team analyses

Regarding the Waste sector the same key drivers as for the Energy sector, i.e. GDP and population are used. In order to calculate the GHG emissions from Municipal Solid Waste Disposal, one of the key parameters, besides population, is the amount of waste per capita. For that purpose, the comparison of the amount of waste per capita in Macedonia with the countries in the nearby region as well as with the European Union 28 (EU28) was made. At the EU 28 level there is a downward trend, while in Macedonia, if 2017 is excluded, there is a trend of growth. It was assumed that these trends will continue and in 2035 Macedonia will have the same level of waste per capita as the EU28. Additionally, it is assumed that in the period after 2035, the amount per capita will start to decline.

For the IPPU sector, the fundamental assumption used to plan the GHG emissions is that they are mainly dependent on the increase of the added value in the specific industry. Based on this assumption, an analysis of the correlation between the emissions and the added value in each industry category is made. However, this assumption does not apply to the category Product Uses as Substitutes for ODS, where the main source of emissions is from imported appliances (such as refrigerators and air conditioners). For this category it is assumed that the import of appliances depends on GDP.

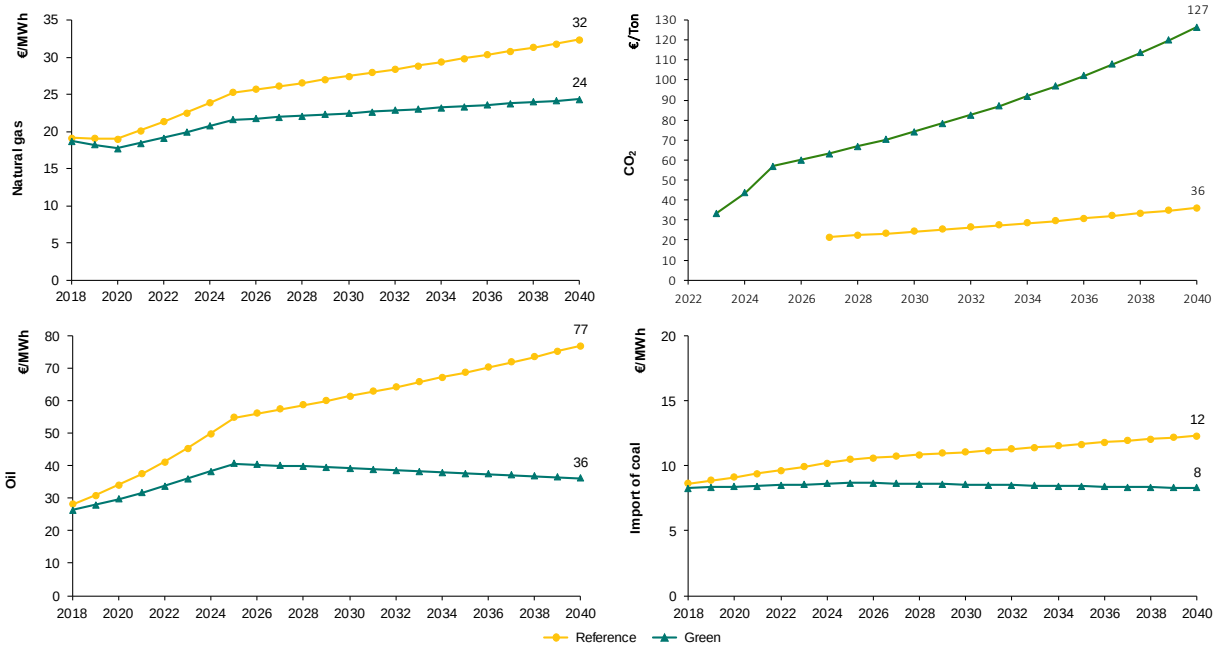
The major drivers of GHG emissions in the AFOLU sector explained by IPCC (increased livestock numbers, increased area under agriculture, increased use of fertilizer, increased area under irrigation, increased human and animal populations etc.) are not noticed in the country, quite the opposite, the official data show that the livestock number decreased, as well as utilized agricultural area and irrigated area. In addition, there is no evidence on increasing in fertilizer use. The prediction of the GHG emission from the AFOLU sector are based on the present situation of decreasing trends. The other assumption regarding AFOLU sector are given in the table for each policy and measure in Chapter 3, part Decarbonisation.

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

The global trends that are used within this project in order to calculate the projections with existing policies and measures (Reference scenario from the Energy Strategy) show increase of 70% of the gas price, 174% of oil price and 43% of import coal price in 2040 compared to 2018 (Figure 52). On the other hand, the prices used to calculate the national objectives and targets (Green scenario from the Energy Strategy) show increase of 27% of the gas price and 29% of oil price, while the price of imported coal is remaining at the same level during the whole period.

Additionally, for the projections with existing policies and measures, the CO_2 tax is planned to be introduced in 2027 in Macedonia, with a moderate increase of 68% in 2040 compared to 2027. For the calculations of the national objectives and targets, it is envisioned that the CO_2 tax will be introduced much earlier, i.e. in 2023, with aggressive increase of four times in 2040 compared to 2023.

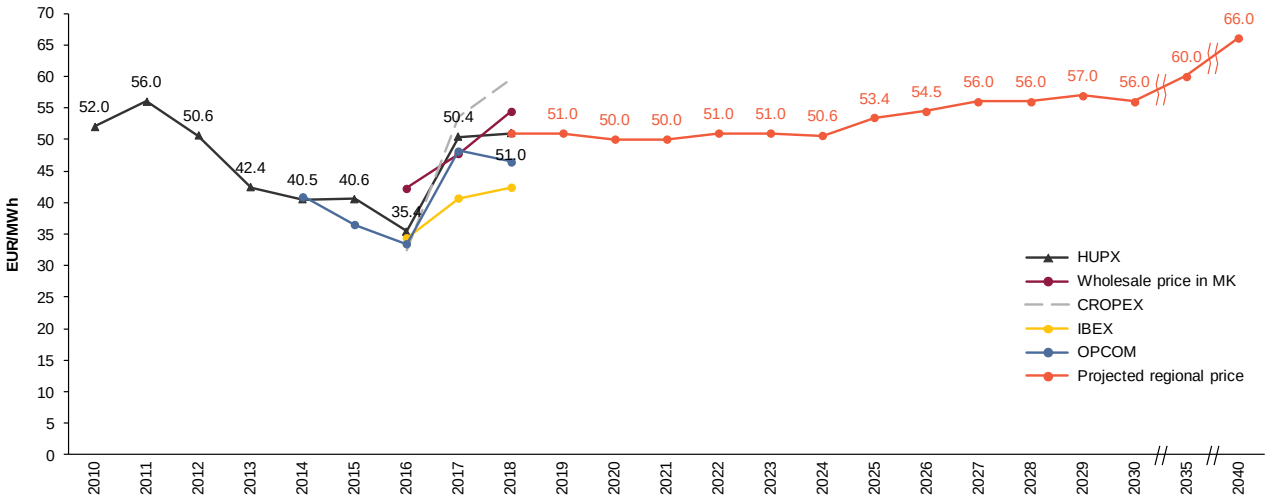
Figure 52. Global energy trends of fuel prices, 2018-2040



Source: Strategy for energy development up to 2040 (Reference scenario refers to the current policies scenarios, while the Green scenario applies the Sustainable development policies of WEO 2017)

Regarding the price of electricity, HUPX is considered as a reference market in the region, as one of the oldest and with the highest level of quantities traded. The average annual price of electricity on this market is in the range from 35 EUR/MWh to 56 EUR/MWh in the period 2010-2018 (Figure 53). Starting from 2016, three additional day-ahead markets were opened in the region (CROPEX in Croatia, SEEPEX in Serbia and IBEX in Bulgaria). It can be noted that the wholesale electricity price in Macedonia follows the price in the HUPX day-ahead market. For calculating the projections with existing policies and measures, the regional price will increase especially in the period after 2027, when the CO_2 tax in this scenario is introduced.

Figure 53. Comparison of the average annual electricity price on the day-ahead markets in the region with the wholesale electricity price in Macedonia



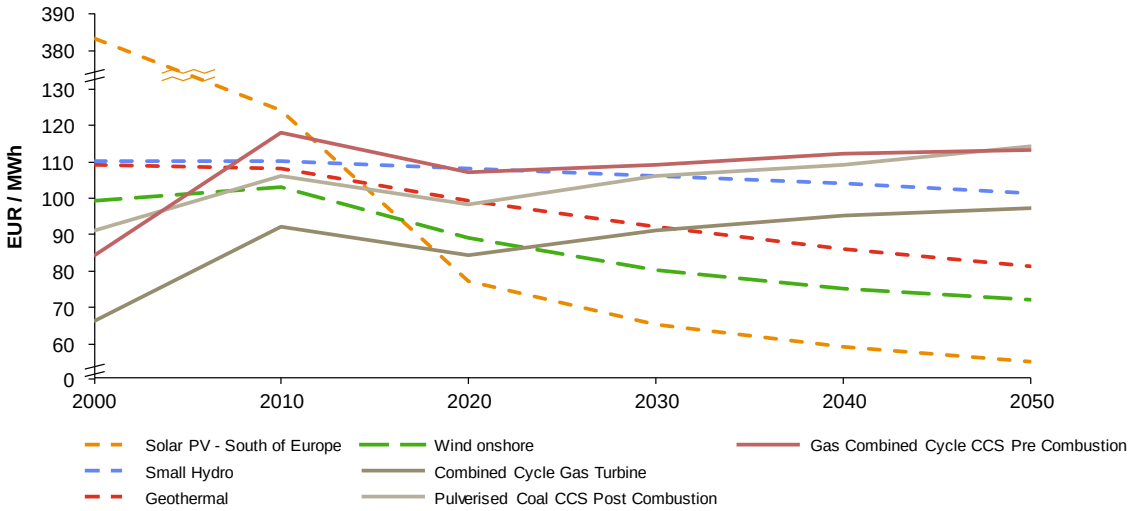
Source: HUPX, CROPEX, IBEX, OPCOM, Strategy for energy development up to 2040, project team analyses

iv. Technology cost developments

The global levelized costs of the RES technologies are expected to decrease, especially for solar power plants, which are reduced almost 7 times in the period 2000-2050. Furthermore, the specific cost of the wind power plants is reduced by 27% in the same period. No significant technological/cost progress is expected for small HPPs.

On the other hand, there is an increase in the levelized costs for coal and natural gas power plants, which are not expected to be technologically advanced except in the context of the development of carbon capturing and storage, CCS.

Figure 54. Levelized costs for electricity generation technologies, 2000 – 2050, €/MWh



Source: Strategy for energy development up to 2040

On Figure 55, the investment costs per technology that are implemented in the model used for energy planning of Macedonia are presented. Biogas has the highest investment costs, while solar PV is the cheapest technology in this regard. However, the production costs of certain technology do not depend only on investment costs, but also, to a higher extent on the national circumstances, such as wind speed and solar irradiation, domestic lignite availability, biogas and biomass potential. Having this in mind, Figure 56 shows the national production costs per technology in the reference scenario. The cheapest production costs have the hydro power plants, while the lignite power plants are the most expensive ones in 2040. The highest reduction of the production cost is achieved by the PV power plants, which is inline with the global trends (Figure 54). In addition, in 2040 the production costs of PV and wind in Macedonia are almost the same as the prices at global level. While the production costs of RES technologies are equal in both scenarios, as a result of higher CO_2 tax in the green scenario (used for calculation of the national targets and objectives), the production costs of lignite and gas power plants are higher than in the reference scenario (used for calculation of the projections with existing policies and measures).

Figure 55. Investment costs per technology

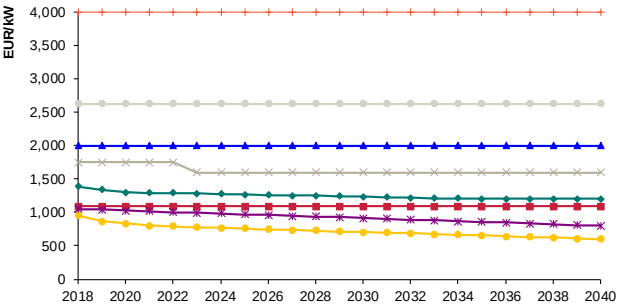
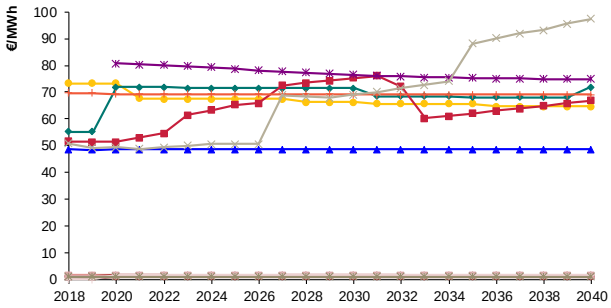
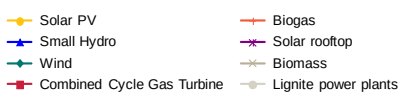


Figure 56. Production costs per technology, reference scenario





Source: MARKAL input data for the Strategy for energy development up to 2040, project team analyses

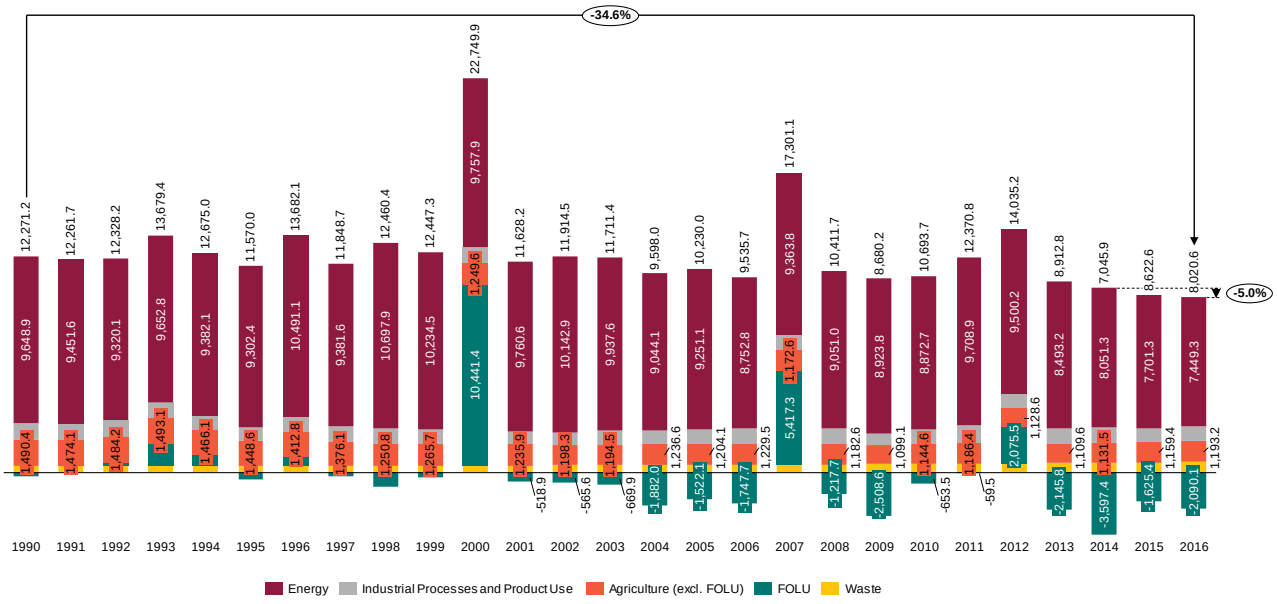
DIMENSION DECARBONISATION

2. GHG emissions and removals

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

The GHG emission and removals at national level are estimated in line with the IPCC 2006 Guidelines, divided into the following main sectors: Energy (including Transport), Industrial Processes and Product Use (IPPU), Agriculture, Forestry and Other Land Use (AFOLU) and Waste. Each sector comprises individual categories and subcategories identified as sources (or sinks) of emissions, so the national inventory was developed at subcategory level. The latest estimates under the TBUR showed that the aggregate GHG emissions and removals (net emissions) in 2016 are 8,021 Gg CO_2-eq (including the FOLU sector) (Figure 57), which represent a reduction of 34.6% compared to emission level in 1990. This is mainly result of reduced electricity production from lignite, fuels switch (residual fuel oil for electricity and heat production is replaced with natural gas), and lower industrial production especially after 2012.

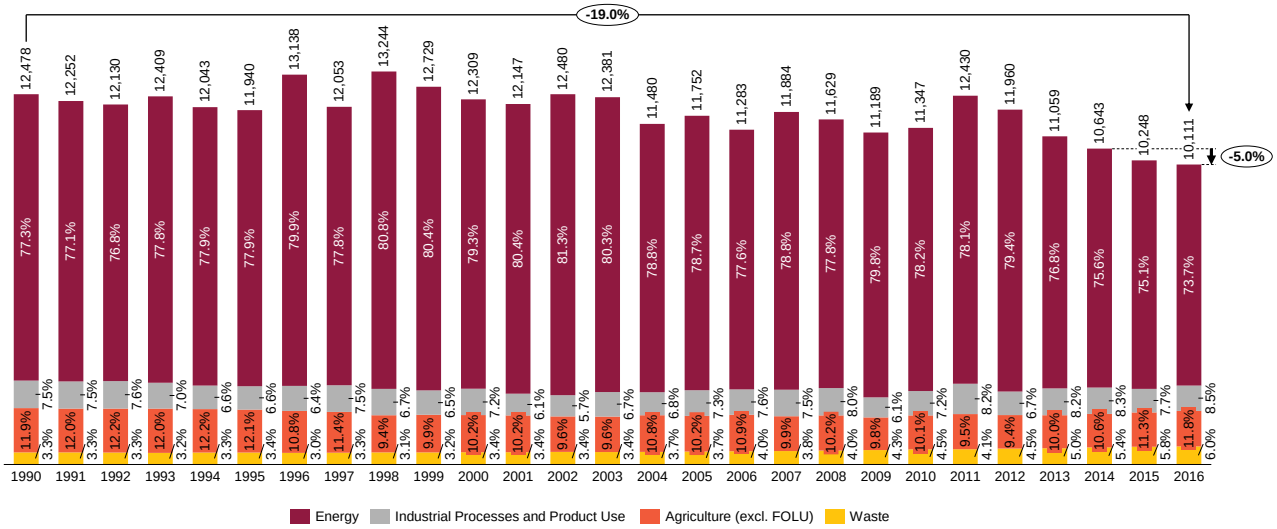
Figure 57. GHG emissions and removals (net-emissions) by sector (in Gg CO_2-eq), 1990-2016



Note: Fluctuations occurred in the net emissions in 2000, 2007 and 2012, where increased emissions can be noticed in the FOLU sector (instead of removals) as a result of the intensified forest fires/wildfires
Source: National GHG Inventory Report (NIR) under 3rd BUR, (Feb. 2020)

If the removals from FOLU sector are not accounted for, then the total GHG emissions in 2016 are 10,111 Gg CO_2-eq (or 19% less compared to 1990). The prevailing share of emissions originates from the Energy sector (evident throughout the overall period), accounting for 73.7% in 2016, followed by the Agriculture (excluding FOLU) with 11.8% and IPPU sector with 8.5% and Waste sector with 6% share.

Figure 58. GHG emissions by sector (in Gg CO_2-eq), 1990-2016



Source: National GHG Inventory Report (NIR) under 3rd BUR, (Feb. 2020)

From the Energy sector, the largest share of emissions is from the Energy Industries category, but its share has decreased from 66.0% in 1990 to 51.5% in 2016 (Figure 59). On the other hand, the largest increase in the share is in the Transport sector, from 8% in 1990 to 28% in 2016. Concerning the emissions in the Energy sector by gases, 97% of the emissions are CO_2 emissions in 2016 (Figure 60).

Figure 59. GHG emissions in Energy sector, by category (in Gg CO2-eq)

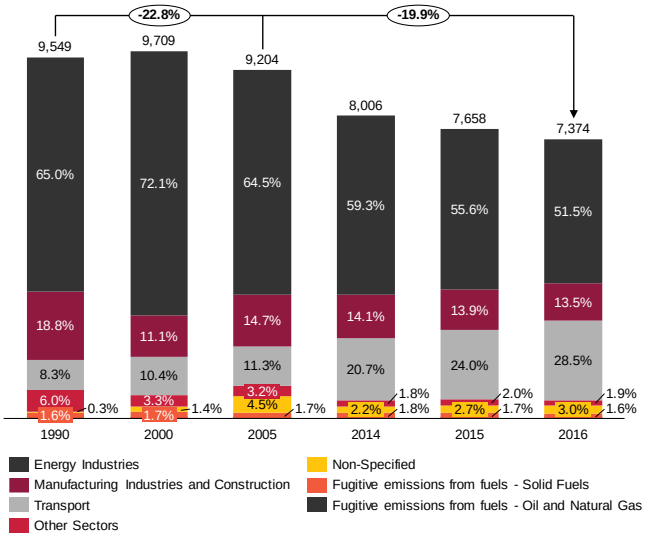
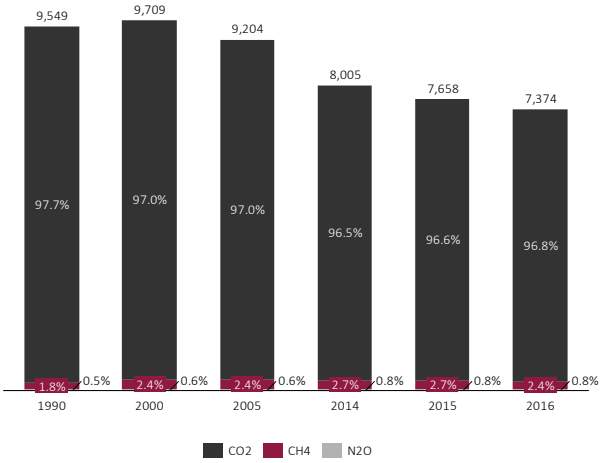


Figure 60. GHG emissions in Energy sector, by gas (in Gg of CO2-eq)



Source: National GHG Mitigation report under 3rd BUR

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

The indicative projections of the GHG emissions using the existing policies and measures show that there is a reduction by 38% in 2030 compared to 1990, as shown in Figure 61. It is important to note that in this figure emissions from electricity import are also included, in order not to use the electricity import (MEMO item) as a mitigation measure. This is crucial for adequately calculating the impact of each measure for Macedonia as import dependent country. The emission factor of the imported electricity is calculated for the Energy strategy as an average of the electricity produced and CO_2 emissions of the following countries WB6, Bulgaria, Croatia, Cyprus, Czech Republic, Greece, Hungary, Romania, Slovakia and Slovenia, using the results from the Power2Sim model. The largest amount of emissions remains in the Energy sector during the whole period, with a share of 76% in 2030 (excluding the FOLU sector, where there are sinks). The category FOLU has

absorptions of emissions during the whole projection period and they are 18 times larger in 2030 compared to 1990.

Beside the total GHG emissions, projections for the emissions without MEMO are also presented (Figure 62), as they are used for comparing the results with other countries and for compatibility purposes with the National GHG Inventory. These results show even higher reduction in the total emissions by 49% in 2030 compared to 1990, which is caused by the exclusion of the emissions coming from the import of electricity.

Figure 61. Projections of total emissions until 2040 by sectors with MEMO

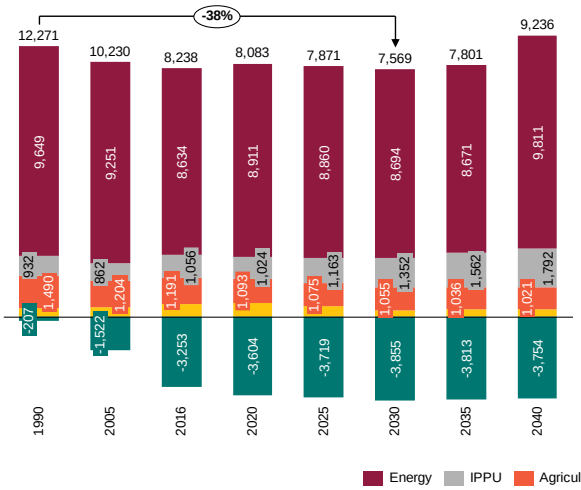
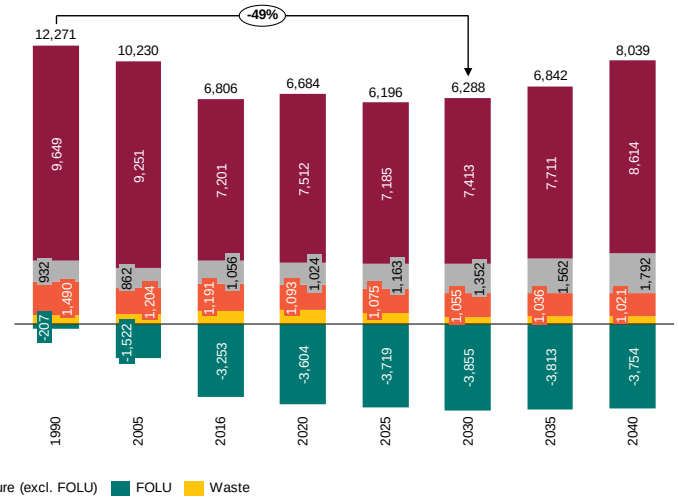


Figure 62. Projections of total emissions until 2040 by sectors without MEMO



Source: National GHG Mitigation report under 3rd BUR

3. Renewable Energy

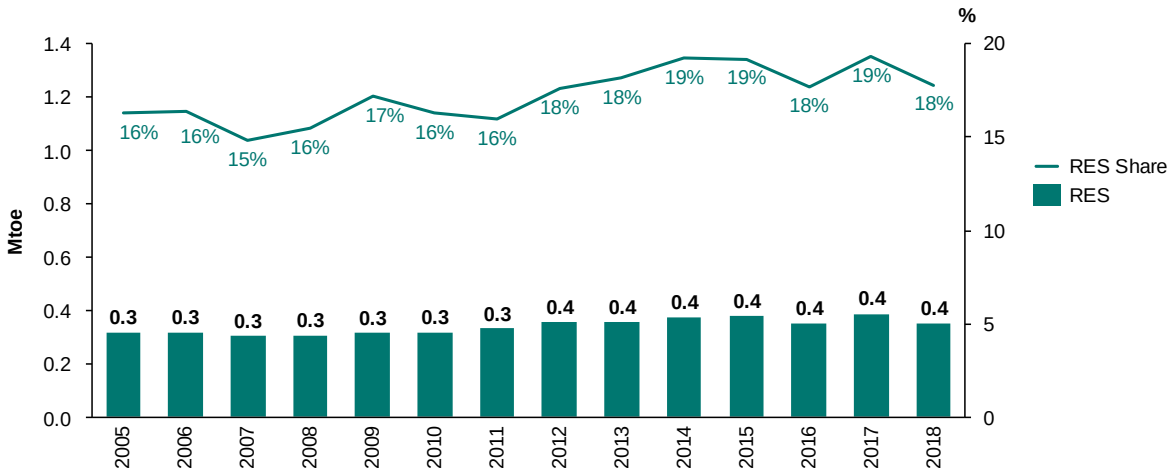
I. Current share of renewable energy in gross final energy consumption and in different sectors (heating and cooling, electricity and transport) as well as per technology in each of these sectors

With decision D/2018/2/MC-EnC of the Energy Community Ministerial Council in 2018, the goal of renewable energy for Macedonia of 23% share in RES in gross inland consumption in 2020 has been accepted. Macedonia's share of RES in 2018 was 18% and Macedonia is missing almost 5% to fulfil the goal. In 2010, the share of RES in gross final consumption was 16%, and in 2014, 2015 and 2017 it reached almost 20% (Figure 63). What is interesting is that in 2018 there is a decrease in the share of RES by almost 1.6%. On the other hand, if the RES share of electricity production is considered, it can be noticed that it is constantly increasing and in 2018 it reached 25% or 8 percentage points more than in 2010 (Figure 64). This increase is primarily due to the investment in RES with preferential tariffs on one hand, but also due to the reduced electricity consumption as a result of the non-constant work of larger industrial capacities that in some periods completely or partially reduced production to meet strict environmental norms. RES share also increased in the heating and cooling sector, which in 2018 was 31% or increased by almost 5 percentage points compared to 2010. This raises the question of why, if there is an increase in RES in electricity generation and in the heating and cooling sector, there is a decrease in total gross consumption. The decline is due to the rapid increase in consumption in the transport sector which is not accompanied by an increase in RES share in this sector. It can therefore be concluded that the transport sector will be one of the major problems for meeting the 2020 target.

Additionally, it must be noted that heat pumps, which can also contribute to the increase of RES share in the gross final energy consumption, are not included in the calculations in the lack of detailed statistical data for them. According to the Annual implementation report of the EnC, Macedonian State Statistical Office (SSO) in the energy field is one of the best in the region. Implementation in the statistics sector of Macedonia is almost completed (98%). However, there is a need for the EnC or some other donor to support the SSO for

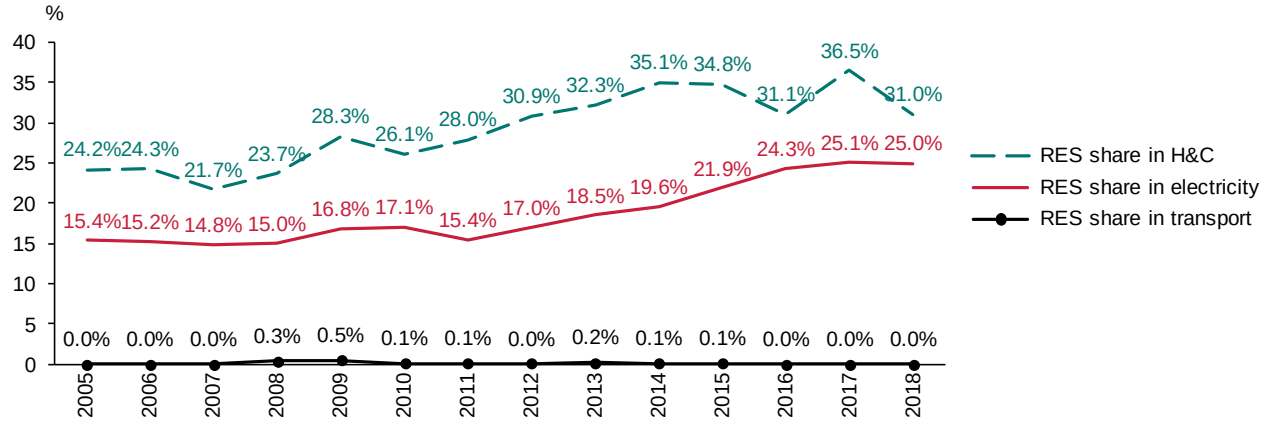
data collection of heat pumps in Macedonia. The heat pumps with a certain Coefficient of Performance (COP) are considered renewable energy sources and as such may have great impact in the RES share.

Figure 63. Share of energy from renewable sources in gross final consumption of energy, 2005-2018



Source: SSO energy balances MAKSTAT database, project team analyses

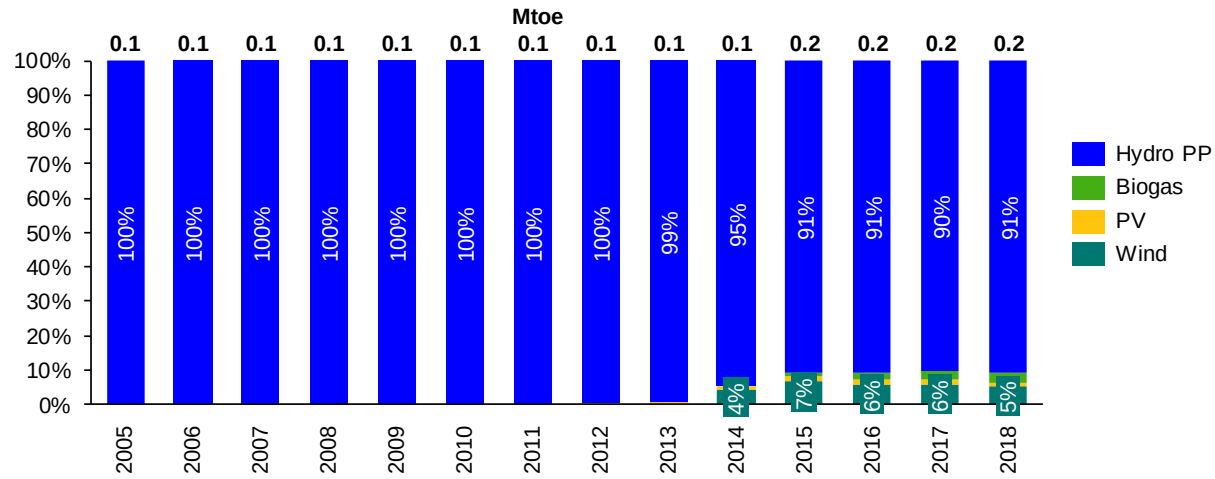
Figure 64. Share of renewable energy in final energy consumption in the electricity, heating and cooling and transport sector, 2005-2018



Source: SSO energy balances MAKSTAT database, project team analyses

Concerning the RES share per technology, in the electricity sector, it can be noted that up to 2012, 100% is supplied by hydro power plants (Figure 65). In 2018, 91% of the gross final energy consumption in the electricity sector is from hydro power plants, 5% wind, 3% biogas and 1% PV. The highest increase is from the wind power plants, reaching a maximum of 7% in 2015.

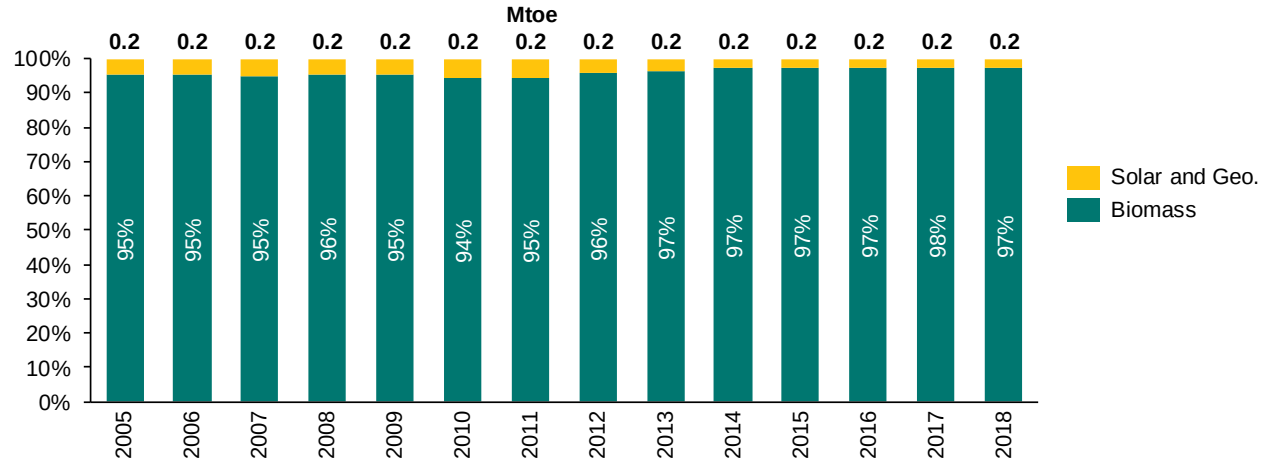
Figure 65. RES share by technology in gross final energy consumption, electricity sector



Source: SSO energy balances MAKSTAT database, project team analyses

RES technologies that are used in the heating and cooling sector in Macedonia are biomass, solar and geothermal (Figure 66). By far, the highest share in the gross final energy consumption in this sector is from biomass, reaching 97% in 2018.

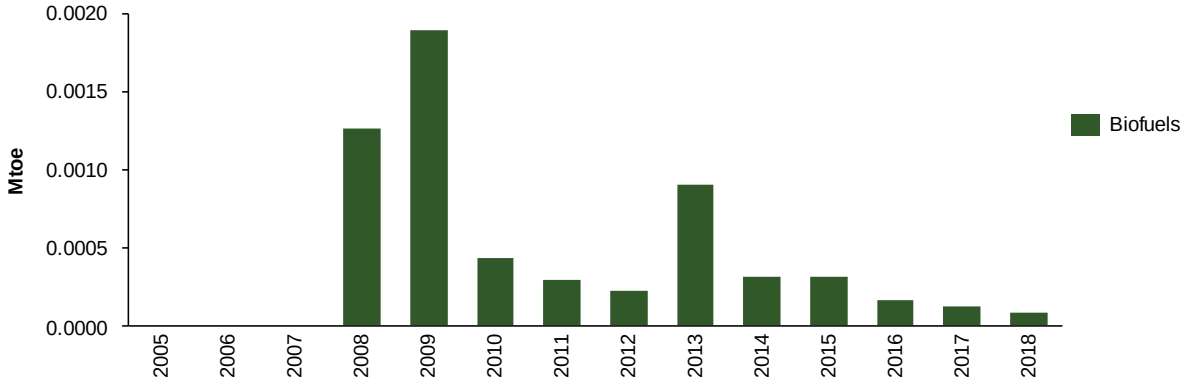
Figure 66. RES share by technology in gross final energy consumption, heating and cooling sector



Source: SSO energy balances MAKSTAT database, project team analyses

In the transport sector, small amounts of biofuels are used, with a maximum value of almost 0.002 Mtoe in 2009 (Figure 67).

Figure 67. RES technology in gross final energy consumption, transport sector

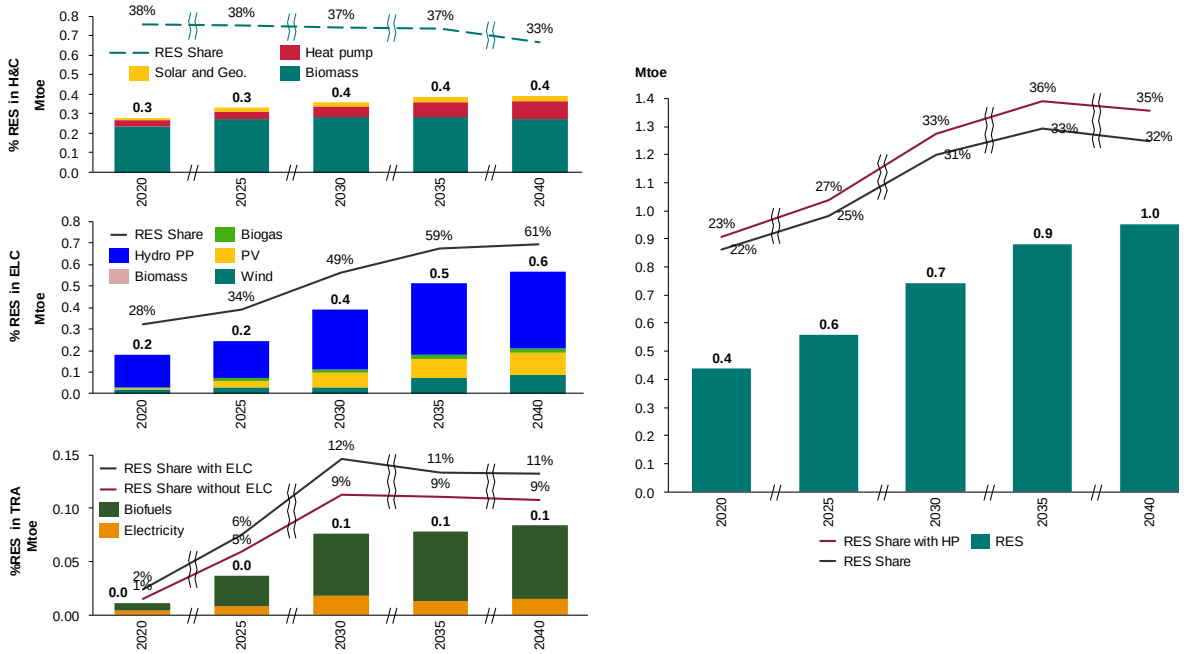


Source: SSO energy balances MAKSTAT database, project team analyses

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 the existing policies and measures are used, the RES share in the gross final energy consumption can reach 31% in 2030 (Figure 68). However, if the heat pumps are included in the calculations of the RES share (which is in case, if the collection of data for heat pumps is improved and the Macedonian SSO calculates its contribution), this share can reach a higher value of 33% in 2030. Within this overall RES share, the highest part is from the heating and cooling sector, in which 37% is from renewable energy sources. Additionally, the biomass has the most important role in this sector, with a share of 80% in 2030. However, the RES share in the heating and cooling sector is decreasing and it reaches 33% in 2040, mainly due to the constant consumption of biomass and the slow progress of the heat pumps and solar and geothermal technologies, accompanied by increased final energy consumption in this sector. On the other hand, the RES share in the electricity sector is increasing, with a value of 49% in 2030 and a maximum value of 61% in 2040. The highest share in this sector remains from the hydropower plants (71% in 2030), but there is a significant increase in the share of PV (18% in 2030), wind (7% in 2030) and biogas (4% in 2030). In the transport sector, there is also an increase of the RES share, with a value of 9% in 2030. If additionally, the electric vehicles are included in calculating the RES share in the transport sector, then this percentage reaches 12% in 2030, where the major part is again from biofuels.

Figure 68. Indicative projections of RES share 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



Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

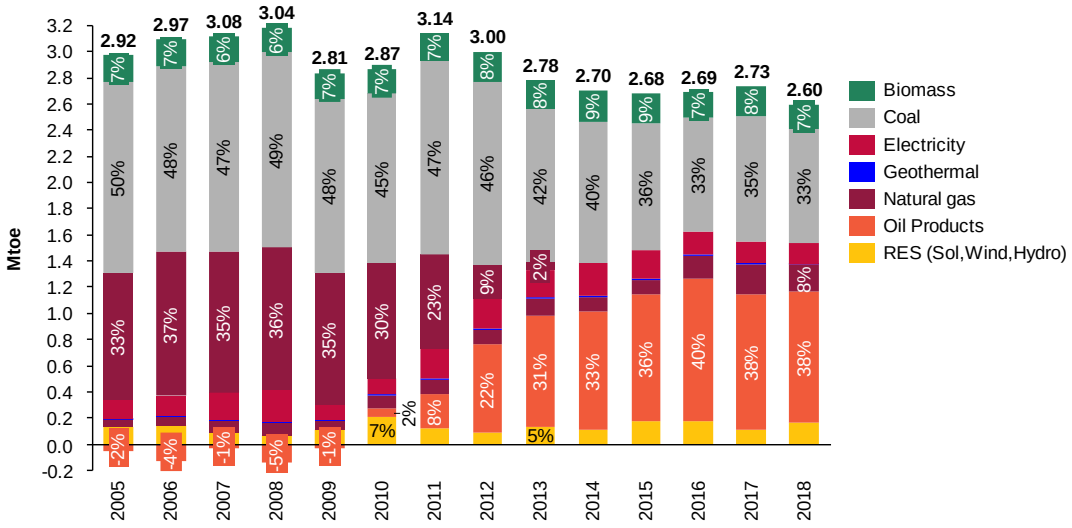
DIMENSION ENERGY EFFICIENCY

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

The analysed period 2005-2018 shows that Macedonia already started the energy transition process (Figure 69). Up to 2015, the most dominant fuel in Macedonia was coal (predominantly lignite) which has accounted for an average of about 45% of the primary energy consumption in the period 2005-2015. However, its share is constantly decreasing, as a result of the reduced electricity production from lignite, and in 2016, for the first time, the coal is not the dominant fuel in the primary energy consumption. Additionally, there is no consumption of crude oil after 2013. On the other hand, the increased number of vehicles, as a result of the transport policies and measures in Macedonia, has increased the consumption of oil products, and thus they have the highest share in the period 2016-2018 (in average 39%). Biomass consumption is constant during the analysed period. In the period 2016-2018 there is a significant increase of the natural gas consumption, as result of the electricity production from gas CHPs in Macedonia.

The total primary energy consumption is reduced by 17% in 2018 compared to 2011. This is mainly a result of replacing electricity production from lignite with: import of electricity, production from gas CHP which have higher efficiency, as well as electricity production from RES with feed-in tariffs. Additionally, the reduced energy consumption from the industry sector, because of the implementation of environmental standards (one big industry capacity is still in the process of implementation of these standards) contribute to the overall reduction of the primary energy consumption.

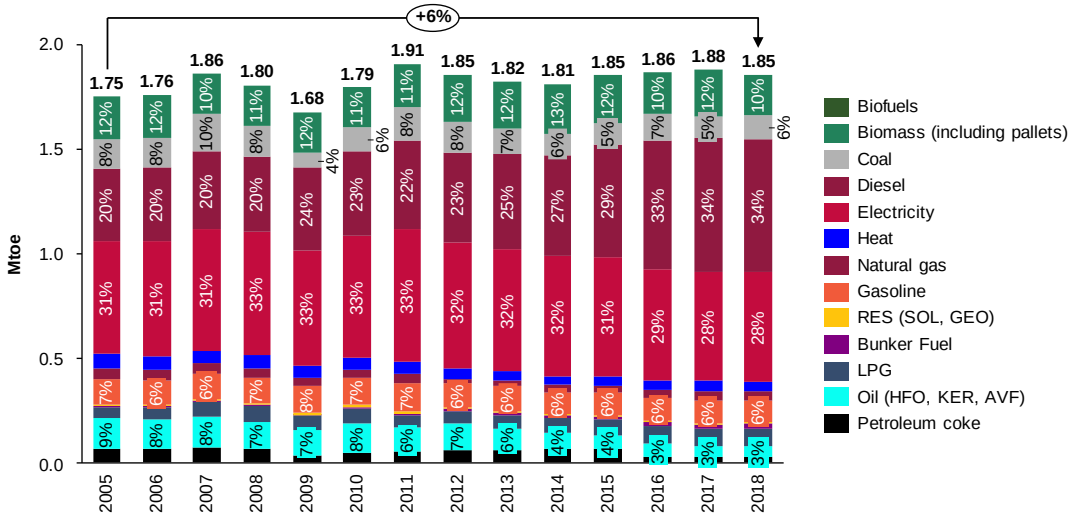
Figure 69. Primary energy consumption by fuels, 2005-2018



Source: SSO energy balances MAKSTAT database, project team analyses

The final energy consumption does not follow the same trend line as the primary energy consumption (Figure 70). The final energy consumption remained stable after 2012, beside the fluctuations of industry and transport consumption. However, compared to 2005, the final energy consumption in 2018 is increased for 6%. As in the case of primary energy consumption, the increased number of vehicles makes the diesel dominant fuel (34%) in the final energy consumption after 2016.

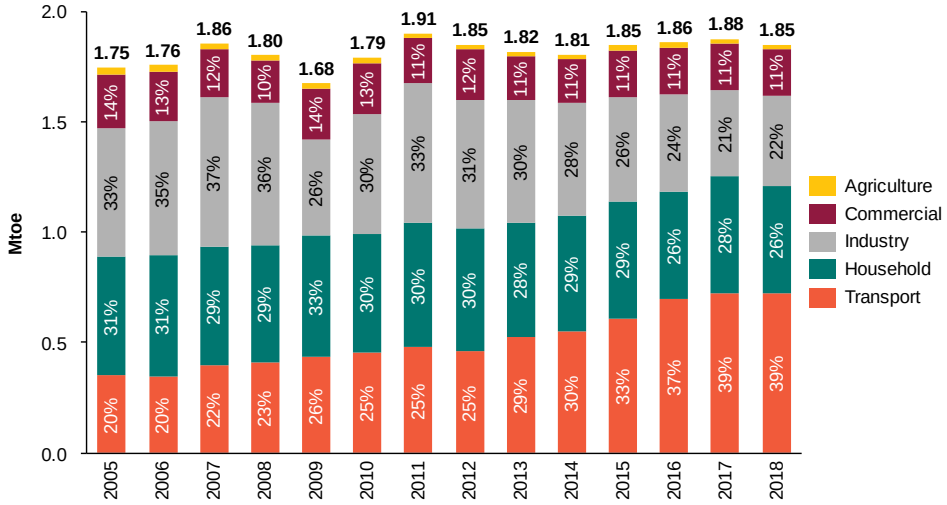
Figure 70. Final energy consumption by fuels, 2005-2018



Source: SSO energy balances MAKSTAT database, project team analyses

The previous conclusions about the transport and industry sector for the primary and final energy consumption can be approved by the results from the final energy consumption by sectors (Figure 71). It is clear that the consumption in the transport sector is dramatically increased (with a share of 39% in 2018 in the final energy consumption), which is more than doubled in 2018 compared to 2005. In contrary, the commercial and household sectors decreased their consumption for around 11% in 2018 relative to 2005, mainly as a result of energy efficiency measures (improved building performance and more efficient technologies).

Figure 71. Final energy consumption by sectors, 2005-2018



Source: SSO energy balances MAKSTAT database, project team analyses

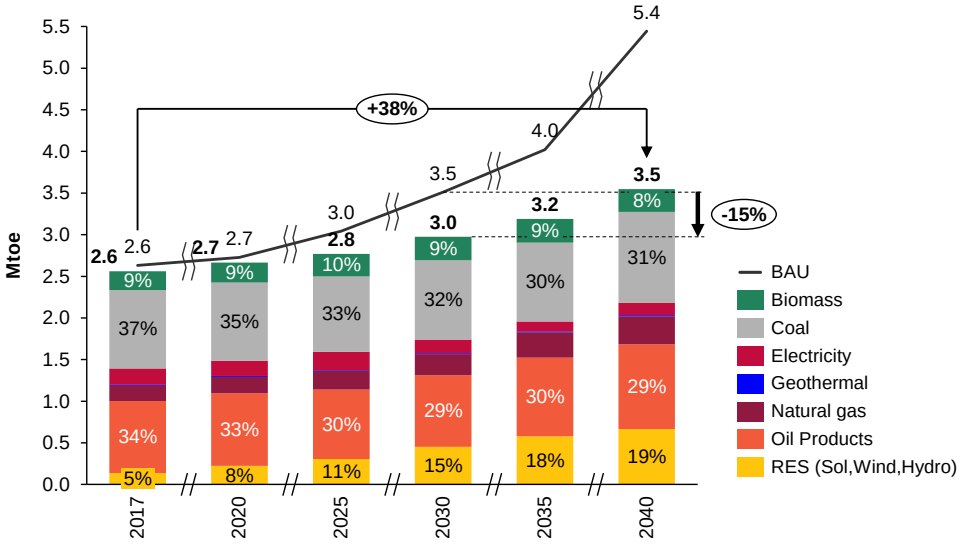
II. Current potential for the application of high-efficiency cogeneration and efficient district heating and cooling

During the preparation of this document, there is no assessment of the potential for application of high-efficiency cogeneration and efficient district heating and cooling, nor is there a study that can determine that. According to the EE Law, this type of study is planned to be developed during the development of the Program for the realization of the Energy Strategy.

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)

Although, it is projected that the primary energy consumption will increase for 38% during the period up to 2040 compared to 2017, coal consumption will remain at almost the same level during the whole planning period (Figure 72). In order to fulfill the increased needs for primary energy, RES will increase their share for 14 percent points. Also, natural gas, primarily used for electricity generation, will increase for 38% in 2030 compared to 2017. At the same time, the electricity generation from gas, as well as, from RES will decrease the import of electricity for 17% in 2030 relative to 2017.

Figure 72. Projection of primary energy consumption



Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses
Note: Excluding final non-energy consumption

In the projections with existing policies and measures, it is assumed that the industry will work with full capacity. This means that all the existing industry facilities will fulfill the highest environmental standards. In addition, the GDP growth rate will mainly be driven from the industry sector. This will almost double the final energy consumption in this sector and double the coal consumption in 2030 compared to 2017 (Figure 73, Figure 74). In addition to this, the electrification of the heating and cooling sector, as well as transport sector will increase the electricity consumption for 32% in 2030 compared to 2017. This electrification of the heating and cooling sector, as well as the improved building performances will not allow high increase of the final energy consumption in the household sector (10% increase in 2030 relative to 2017), although the needs for heating, cooling, cooking, lighting, etc. will increase for 24% in 2030 compared to 2017.

The final energy consumption will increase by 27% in 2030 compared to 2017, while the primary energy consumption will increase by 16% in 2030 relative to 2017. This means that the overall efficiency of the energy system will be increased, as a result of the usage of more efficient technologies.

As the Macedonia EE target is express relative to the BAU scenario (explained in details in the Energy Strategy, EE part), the implementation of the existing measures will reduce the final energy consumption for 10.3%, while the primary energy for 15.3% in 2030 compared to BAU. In absolute terms, the primary energy consumptions in 2030 is almost at the same level as it is predicted in the study of Energy Community for the calculation of EE, RES and GHG targets published in 2019 (2.86 Mtoe).

Figure 73. Projections for final energy consumption by fuels

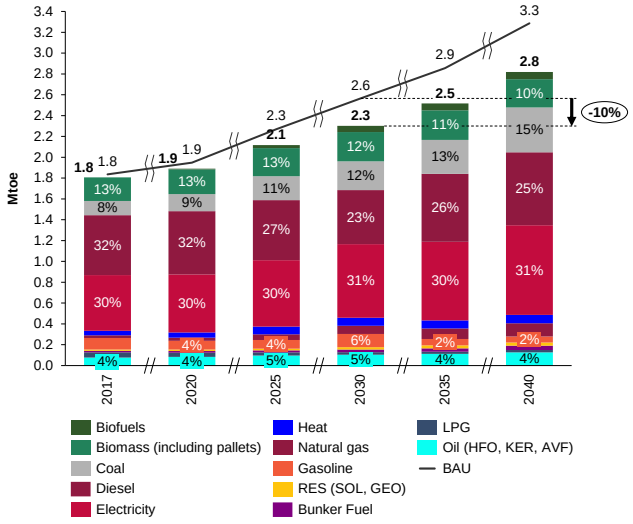
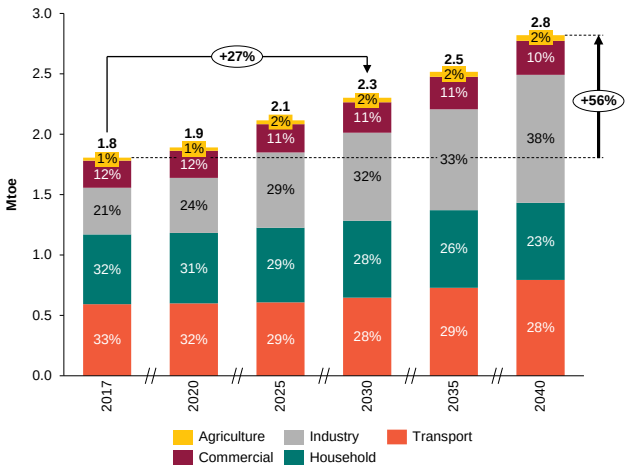


Figure 74. Projections for final energy consumption by sectors



Note: Excluding final non-energy consumption
Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

IV. Cost-optimal levels of minimum energy performance requirements resulting from national calculations, in accordance with Article 5 of Directive 2010/31/EU

During the development of this document, Macedonia still has not set the cost-optimal levels of minimum energy performance requirements. However, according to the Work Program 2019-2020 of the Energy Efficiency Coordination Group[40] within Energy Community, the Contracting Parties shall apply a methodology for calculating the energy performance of buildings and ensure that minimum energy performance requirements for buildings or building units are set with a view to achieving cost-optimal levels. In Macedonia, within the ongoing project REEP Plus, in which the EE Law was prepared, it is planned to develop calculation methodology and software, as well as to set the minimum energy performance standards.

40 https://www.energy-community.org/dam/jcr:fb86f45f-ed6e-488f-8978-6d3ddaa074fd/EECG_WP_2019_2020.pdf

DIMENSION ENERGY SECURITY

To be included according to the Governance Regulation: i. Current energy mix, domestic energy resources, import dependency, including relevant risks ii. Projections of development with existing policies and measures at least until 2040 (including for the year 2030).

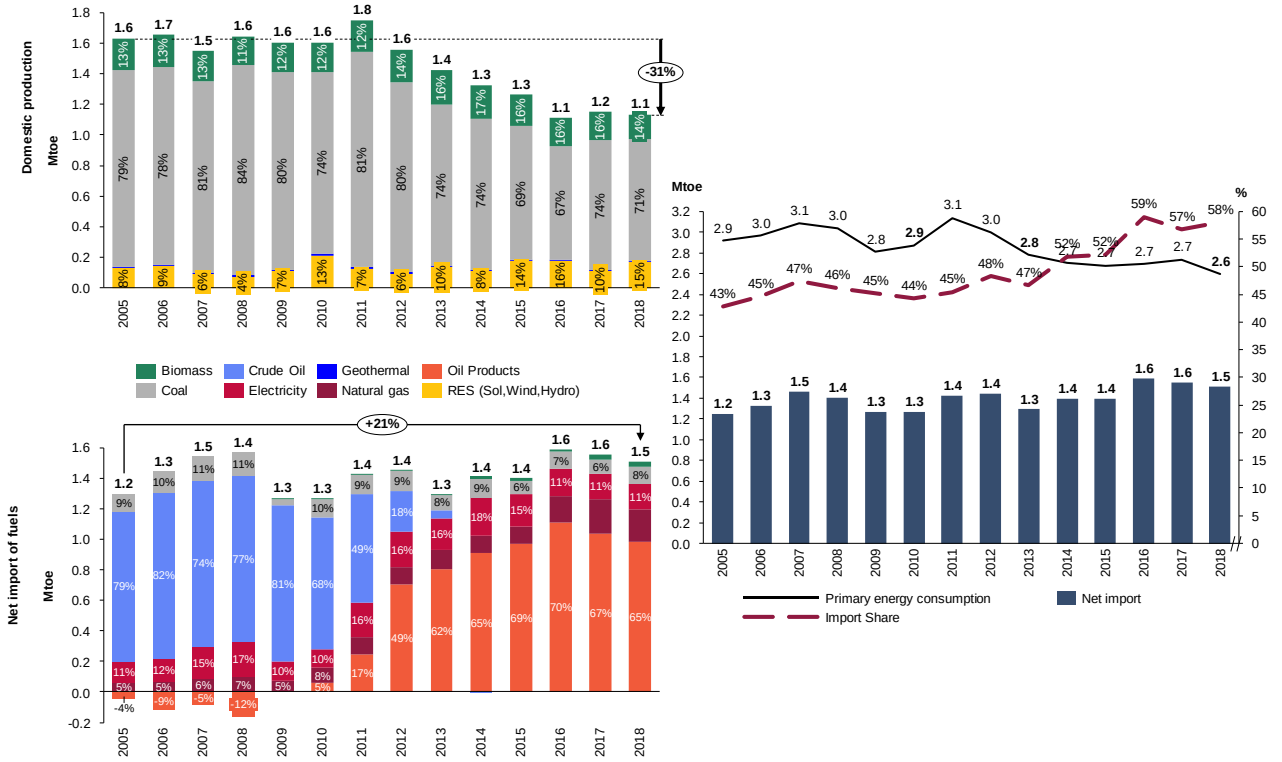
I. Current energy mix, domestic energy resources, import dependency including relevant risks

The energy mix from domestic resources in Macedonia is dominantly based on lignite, biomass and, depending from the hydrology, electricity production from hydro power plants. 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. The domestic production in the period 2005-2012 is almost at the same level, with very small variations. Starting from 2012, the domestic production is reduced by more than 30% in 2018, mainly as a result of reduction of the electricity production from lignite.

On the other hand, with the liberalization of the electricity market, the import of electricity is increasing because most of the companies participate in the open market and are not obliged to buy electricity from domestic production. In the period from 2005-2015 the electricity import is increased for almost 60%, but in the period 2015-2018 it is reduced by 24% as a result of the higher electricity production from the gas CHP power plants, as well as the lock-down of some industry facilities that should fulfill the environmental standards.

The overall import dependence is almost 60% in the last three years of the analyzed period, which is around 17% points more than 2005. If this already high import dependence continues to increase it can be also considered as a risk for a country like Macedonia, because that can have influence on the financial market and the overall economy of the country.

Figure 75. Current energy mix by domestic resources and imports, as well as import dependence, 2005-2018

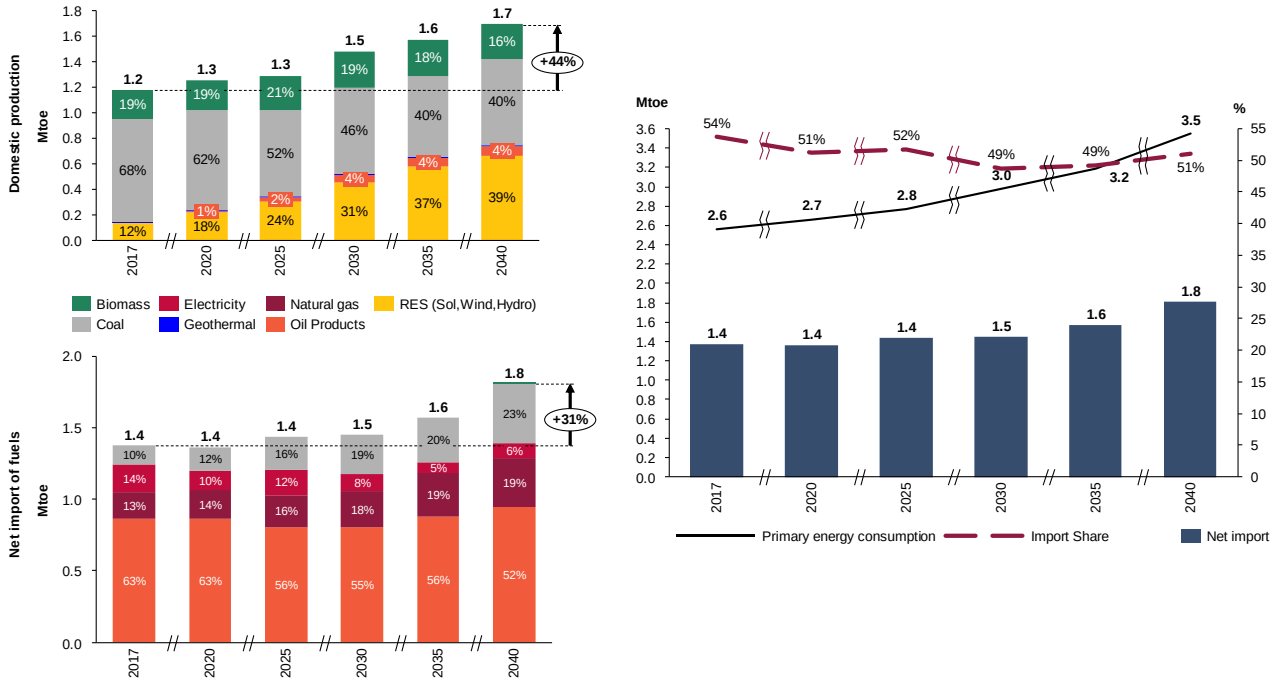


Source: SSO energy balances MAKSTAT database, project team analyses

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

The potential risks, mentioned in the previous section, were taken into consideration during the process of preparation of the Energy Strategy. Therefore, the domestic production is increased for around 25% in 2030 compared to 2017 (Figure 76). Additionally, it is diversified, mainly with introduction of more RES for electricity production which will increase their share for almost 20 percentage points in 2030, relative to 2017. The aggressive investment in RES for electricity production will lead to stable net import of fuels in the period 2020-2030. Furthermore, energy efficiency measures, as well as, electrification of transport sector will contribute to reduction of import dependence, so in 2030 it is reduced for 5 percentage points compared to 2017.

Figure 76. Projections of the energy mix by domestic resources and imports, as well as import dependence



Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

DIMENSION INTERNAL ENERGY MARKET

1. Electricity interconnectivity

To be included according to the Governance Regulation: i. Current interconnection level and main interconnectors (3)ii. Projections of interconnector expansion requirements (including for the year 2030)(4).

I. Current interconnection level and main interconnectors

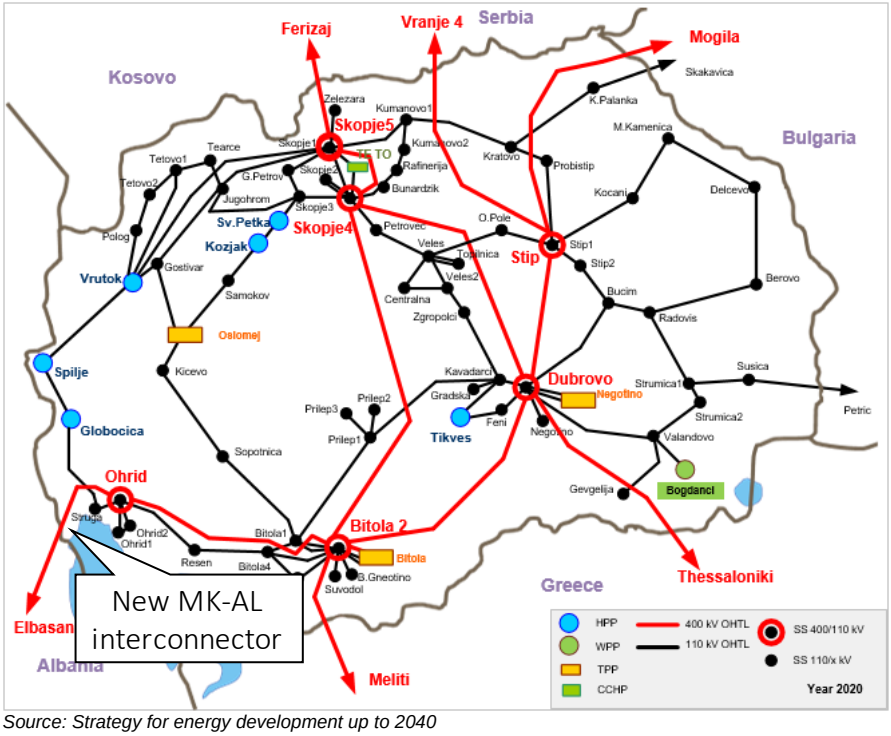
Macedonia's electricity transmission system is well connected with the systems of the neighbouring countries on 400 kV and 110 kV voltage levels (Figure 77). There are five interconnections at 400 kV with:

- 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

Figure 77. Electricity transmission infrastructure including the interconnections of Macedonia



Source: Strategy for energy development up to 2040

In 2018, the electricity entered in the Macedonian power system from the neighboring countries was 4,145 GWh, while in 2019 it is increased to 4,733 GWh. Together with the domestic production, as well as the electricity form the distribution system, the total electricity entrance in the transmission network was 9,124 GWh in 2018 and 9,948 GWh in 2019. On the other hand, the total electricity transmission from Macedonia to the neighboring systems was 2,223 GWh and 2,908 GWh in 2018 and 2019, correspondingly.

The interconnectivity of the Macedonian electricity transmission system is at a very high level, of about 85%, as presented in Section 2, Figure 42. This great level of interconnectivity is mainly result of the investments

in the electricity transmission system, which is of crucial importance not only for Macedonia, but because of its geographical location in the center of the Balkan Peninsula, for the whole region.

II. Projections of interconnector expansion requirements (including for the year 2030)

Macedonia, as previously mentioned, 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 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, which will contribute to connection of two different regional markets. Within the project, in addition to the construction of the transmission line, it is planned to build 400/110 kV Ohrid SS. The total investment of the project is 35 Mil. €. It is expected that in the next two to three years the transmission line will be constructed and operational.

2. Energy transmission infrastructure

To be included according to the Governance Regulation: i. Key characteristics of the existing transmission infrastructure for electricity and gas (5) ii. Projections of network expansion requirements at least until 2040 (including for the year 2030) (6)

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 Macedonian 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 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 (Figure 77). 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.

In the Strategy for reconstruction/revitalization of the electricity transmission network it is concluded that although the average ages of the lines are:

- 42.2, according to the year of commissioning,
- 41.8, according to the year of commissioning and the length of the lines
- 30.3, according to the year of last reconstruction
- 30.8, according to the year of the last undertaking, respecting it and the length of the lines

the network is well maintained which is directly reflected in the assessment of the network parameters.

Regarding the **gas transmission infrastructure**, Macedonia has only one interconnection gas pipeline, with the Republic of Bulgaria. The entry point is at Deve Bair on the border with Bulgaria and extends through Kriva Palanka, Kratovo and Kumanovo to Skopje (Figure 78). The installed capacity of the gas pipeline is 800 million nm3/year under the working pressure of 54 bar and a diameter of the main line of 530 mm. Capacity can be increased to 1,200 million nm3/year by building a compressor station on the first section of the main gas pipeline. The maximum permeability of the main gas pipeline is 180,000 nm3/hour. This pipeline is operated by the JSC GAMA, which has a licence for transmission and operation of the natural gas transmission system. GAMA reported that in 2018 the gas entered in the Macedonian natural gas transmission system from Bulgaria was 253 million nm^3. Although the annual capacity of the pipeline has been used by 32%, there is a large imbalance in the monthly consumption of natural gas. In the winter months, when most of the natural gas is used to generate electricity and heat, the utilization of the pipeline reaches up to 80%.

JEC GAMA is responsible only for the natural gas pielines Kriva Palanka, Kratovo and Kumanovo to Skopje, as well as the ring around Skopje , while the state company National Energy Resources is responsible for the

construction of the new transmission lines in Macedonia. Up to 2019 two additional transmission lines were constructed:

1. Klechovce-Valve station 5(Stip), with length of 61 km and diameter of 500mm, finished in 2016 (light blue line in Figure 78), and
2. Valve station 5(Stip)-Negotino, with length of 38 km and diameter of 500mm, finished in 2019 (purple line in Figure 78).

Figure 78. Natural gas transmission system of Macedonia

Source: ERC annual report 2018, project team analyses

II. Projections of network expansion requirements at least until 2040 (including for the year 2030)

In order to continue with the good performance, the **Strategy for reconstruction/revitalization of the electricity transmission network** gives detailed plan for the reconstruction. This plan is divided in three periods: 2025-2030 total length of 172.3 km line should be reconstructed with an investment costs of 15.9 mill. EUR, 2030-2035 total length of 201.2 km line should be reconstructed with an investment costs of 14.7 mill. EUR and 2035-2040 total length of 189.9 km line should be reconstructed with an investment costs of 17 mill. EUR. The detailed list of the projects, as well as length and investment by projects are given in Table 3.

Table 3. Electricity transmission network projects in the period 2025-2040

Line	Length (km)	Investment (mill. EUR)
Sopotnica-Bitola	30.7	2.5
Kicevo-Sopotnica	33.3	2.7
Oslomej-Kicevo	15	1.1
Oslomej-Gostivar	36.5	2.9
Strumica 1-Strumica 2	1.9	0.2
Valandovo-Strumica 2	15.6	1.8
Dubrovo-Valandovo	39.3	4.7

Total (2025-2030)	**172.3**	**15.9**
Oslomej-Samokov	17.5	2.01
Gostivar-Jegunovce	36.9	2.21
Vrutok-Spilje	45.6	3.19
Globocica-Struga	32.4	2.27
Vrutok-Polog	15.3	1.68
Spilje-Globocica	13.5	0.81
Tikves-Kavadarci	8.1	0.65
Gorce Petrov-Skopje 1	11.1	0.67
Skopje3-Gorce Petrov	20.8	1.25
Total (2030-2025)	**201.2**	**14.74**
Stip1-Kocani	27.8	1.95
Stip 1-Stip 2	5.4	0.38
Radovis-Berovo	38.3	3.83
Bucim-Radovis	10.5	0.74
Kratovo-Probistip	17.5	1.93
Skopje4-Bunardzik	19.4	2.04
Bitola 1- Bitola 2	13	1.30
Bitola 1- Bitola 2	13	1.30
Kavadarci-Prilep 1	44	3.52
Total (2030-2025)	**188.9**	**16.97**

Source: MEPSO, Strategy for reconstruction/revitalization of the electricity transmission network, project team analyses

The state has an ambitious **gasification** plan. In 2020 two additional gas pipelines should be finished by National energy resources:

1. Negotino (Kavadarci)-Bitola, with length of 92 km and diameter of 500mm, 90% realized up to June 2020 (green line in Figure 78)
2. Skopje-Tetovo-Gostivar, with length of 76 km and diameter of 500mm, and additional branch to Tetovo with length of 10 km and diameter of 150 mm, 53.1% realized at the beginning of November 2019 (yellow line in Figure 78).

It is expected that in the near future the construction of three additional gas pipelines will be started:

1. Gostivar-Kicevo, with length of 34 km, in a process of obtaining building permit (to be finished by 2022)
2. Sveti Nikole – Veles, with length of 32 km, in a process of preparing project documentation (to be finished by 2023)
3. Kicevo-Ohrid (to be finished by 2025)
4. Bitola – Ohrid (to be finished by 2025)
5. Valve station 5 (Stip)-Radovis-Strumica, with length of 60 km

3. Electricity and gas markets, energy prices

I. Current situation of electricity and gas markets including energy prices

With the adaptation of the Energy law in 2018, the overall electricity market became liberalized. According to Energy Regulatory Commission, in 2018 47.5% of the electricity is purchased at the open market, while in

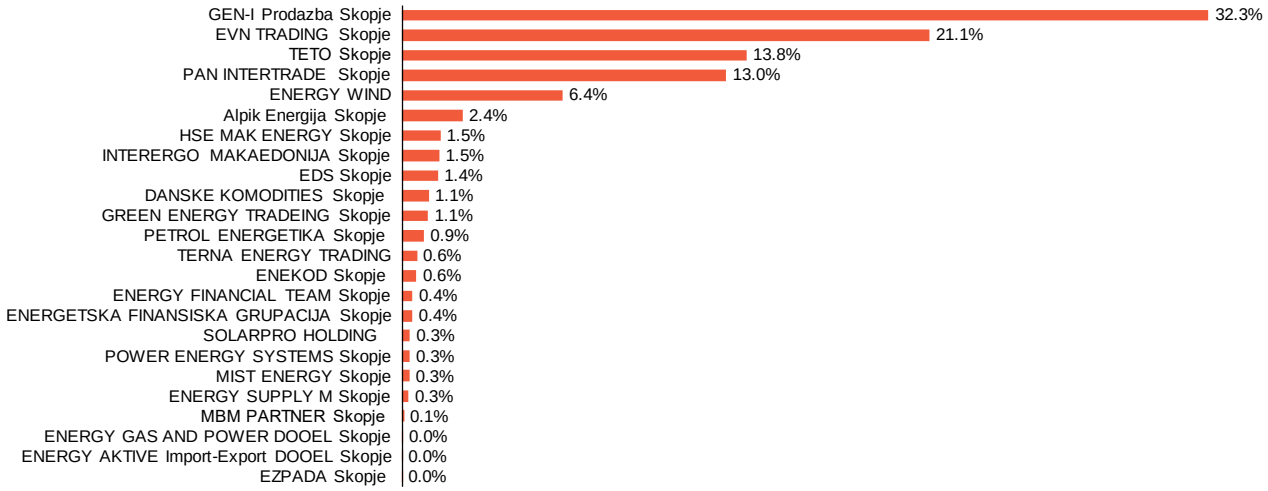
2019 this percentage achieved 49.1%. Although, there is an increase of the percentage of the electricity purchased on the open market, it should be noted that certain industry entities that purchase electricity on the open market, are working with reduced capacity or they are not working at all (because of the environmental standards). It these capacities are included in the calculations, then this percentage is even higher (around 60%).

After the adoption of the Energy Law, all bylaws that regulate the functioning of the electricity market were also adopted by the Energy regulatory commission and MEPSO. This include market rules, balancing code and supply rules of electricity and natural gas, as well as rules for heat supply.

In the electricity section, the market operator, which was functioning within MEPSO, was separated as an independent company. This was needed, in order to certify MEPSO as a power system operator. However, there is still no organized electricity market operator in Macedonia. In the Energy Law there are two options. The first one is for the Government to appoint the market operator as a regulated market operator, and the second is to conduct a tender procedure with the aim to select a company that will perform the role of regulated market operator. With a decree the Government appointed the market operator as an organized electricity market operator. However, the process of establishing of organized market is still ongoing.

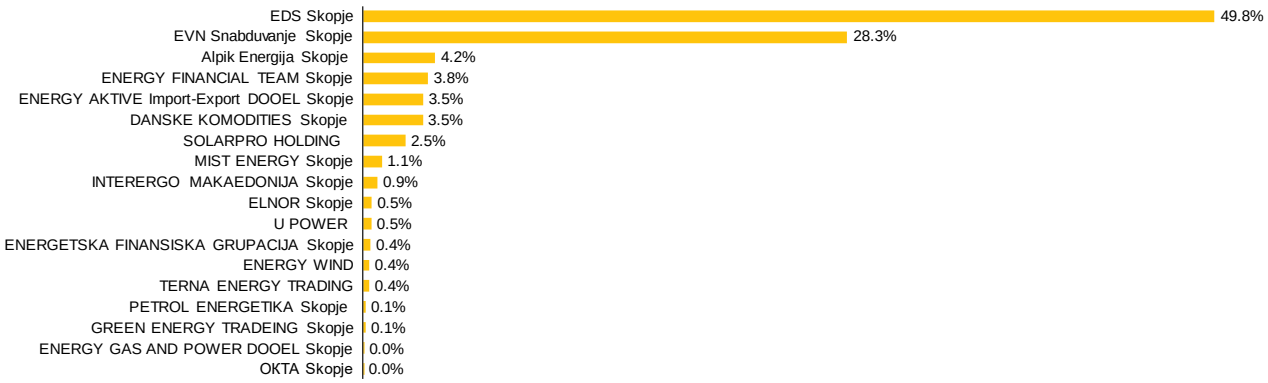
There are 62 legal entities with a license for trade in Macedonia and 31 legal entities with a license for supply. In 2018 at the wholesale market, there were 24 active participants, of which GENI-I Prodazba and EVN TRADING participated with more than 50% of the total sale of electricity (Figure 82). On the other hand, the large and small consumers were supplied by 18 active suppliers/traders in 2018 (Figure 80). EDS Skopje had almost 50% share in this market, followed by EVN Snabduvanje with 28%.

Figure 79. Average share of suppliers and traders on the wholesale market electricity, 2018



Source: ERC annual report 2018, project team analyses

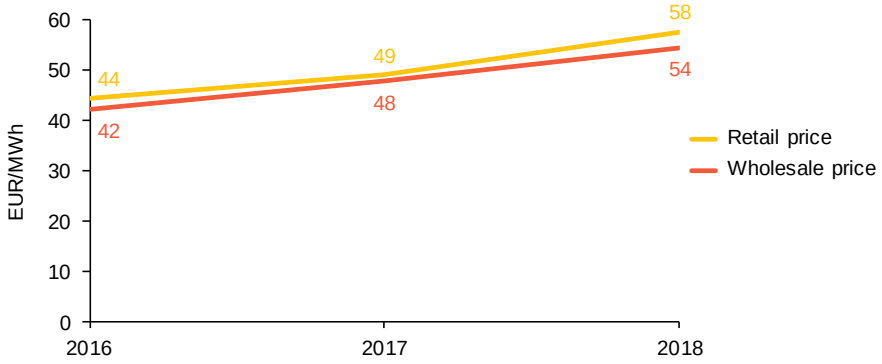
Figure 80. Average share of suppliers and traders in the open market (large and small consumers) of electricity, 2018



Source: ERC annual report 2018, project team analyses

The price of the electricity on the wholesale market in Macedonia increased by about 30% in the period 2016-2018. In 2018, the price of electricity on the wholesale market was around 54 EUR/MWh and it is about 4 EUR/MWh lower than the retail price (Figure 81).

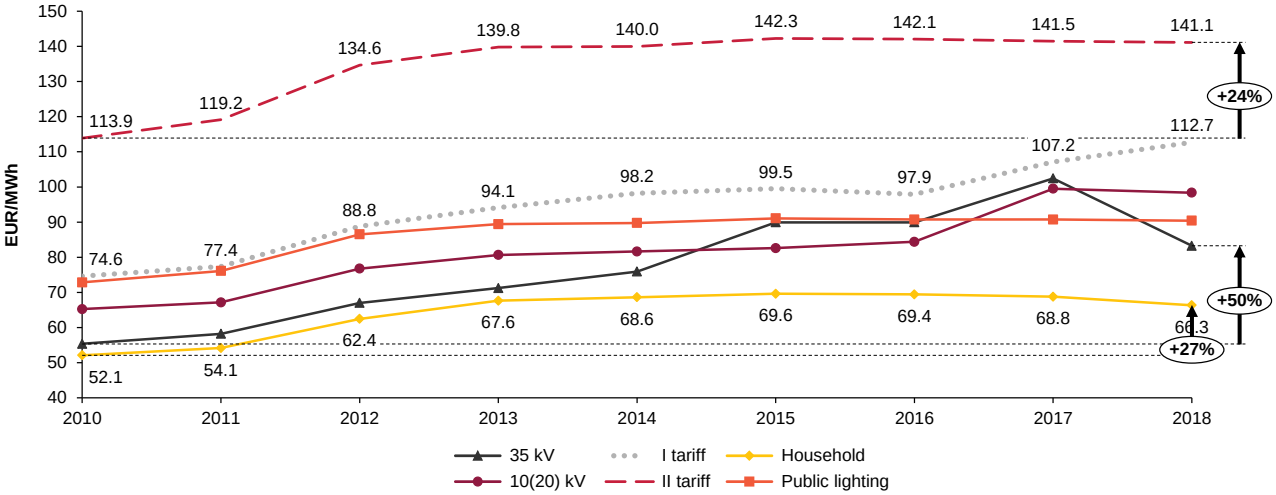
Figure 81. Average price at retail and wholesale markets in Macedonia



Source: ERC annual report 2018, project team analyses

The electricity price of the households, over the analyzed period (2010-2018), is the cheapest one compared to the price for the other types of consumer categories. The average price of electricity in the period 2010-2018 is increased by 27% reaching 66.3 EUR/MWh. The highest price of electricity is achieved in 2015, almost 70 EUR/MWh. In the last two yeast of the analyzed period, the average price is reduced mainly as a result of the introduction of cheap tariff during the day. The price for consumers connected to 35 kV (mainly industry entities) in 2018 is around 80 EUR/MWh, which is 50% more compared to the 2010 level. The highest price is paid by the consumers of the category II tariffs (140 EUR/MWh).

Figure 82. Electricity prices by type of consumer category connected at the distribution network, 2010-2018



Source: ERC annual reports 2010-2018, project team analyses

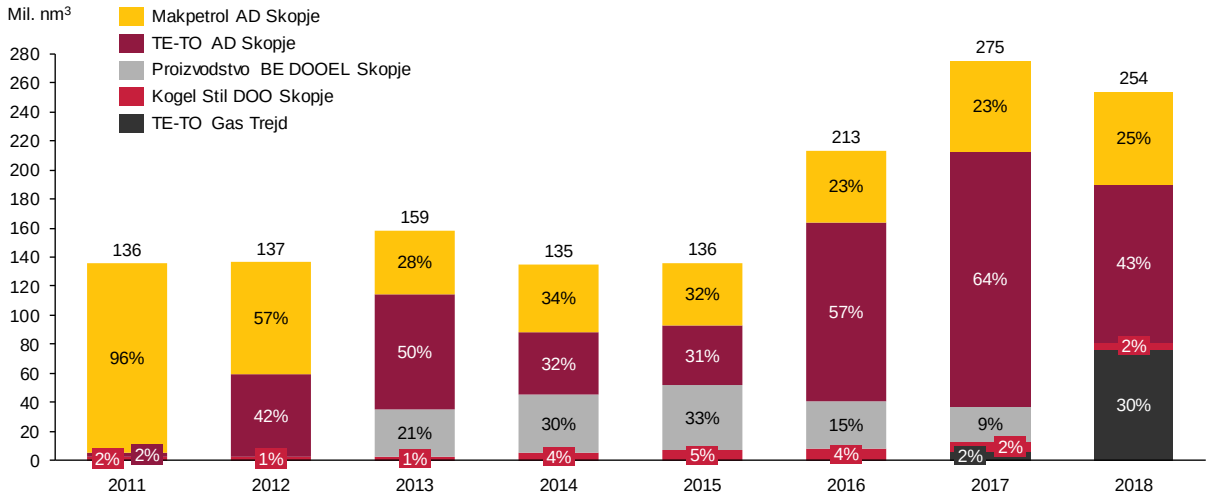
The **gas market** in Macedonia has been completely liberalized starting from 1.1.2015. The Energy Regulatory Commission determines only the tariffs for the transmission and distribution of the natural gas.

On the wholesale natural gas market, the following participants act independently in the procurement of natural gas from imports:

- District heating producers (in the City of Skopje),
- Combined heat and power plants
- Other traders

As the electricity production from gas CHPs is increased is Macedonia in the period from 2012-2018, the quantity of natural gas traded is almost doubled in the last two years (Figure 83). Furthermore, the dominant share of Makpetrol AD Skopje before 2012, has been reduced to 25% in 2018, while the remaining share is from the combined heat and power plants and the district heating producers.

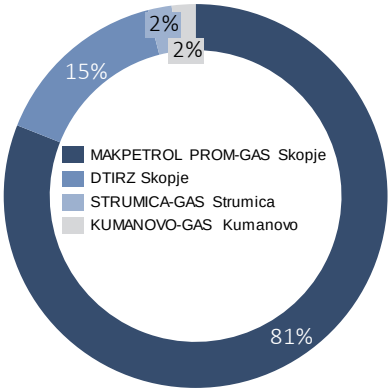
Figure 83. Market share of participants on the wholesale natural gas market, 2011-2018



Source: ERC annual reports 2010-2018, project team analyses

At the retail natural gas market, the dominant supplier is MAKPETROL PROM-GAS (81% in 2018), which supplies consumers connected to the natural gas transmission system in Skopje (Figure 86). The consumers connected to the distribution gas systems (Kumanovo, Strumica and DTIRZ) are supplied by the companies: KUMANOVO-GAS Kumanovo, STRUMICA-GAS Strumica and DTIRZ Skopje, which according to the law are also operators of the distribution systems.

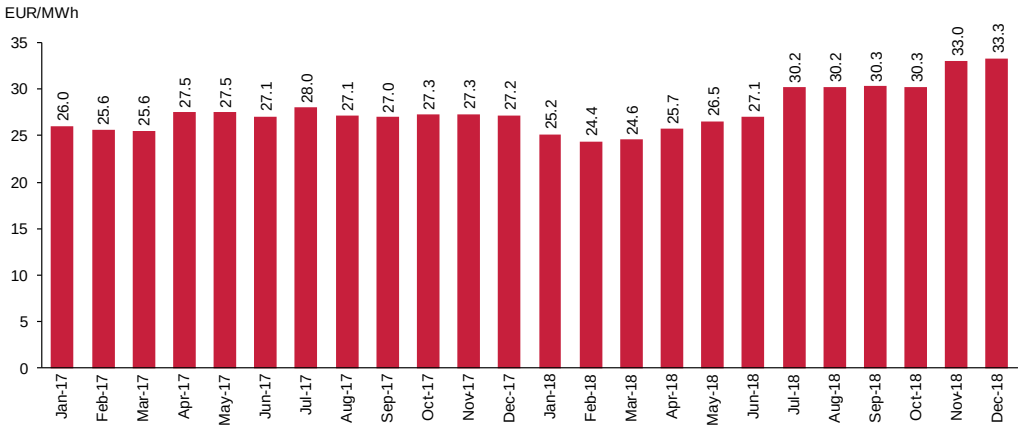
Figure 84. Market share of participants on the retail natural gas market in 2018



Source: ERC annual report 2018, project team analyses

The average natural gas price on the wholesale market in Macedonia in the period 2017-2018 is between 24 and 33 EUR/MWh (Figure 85).

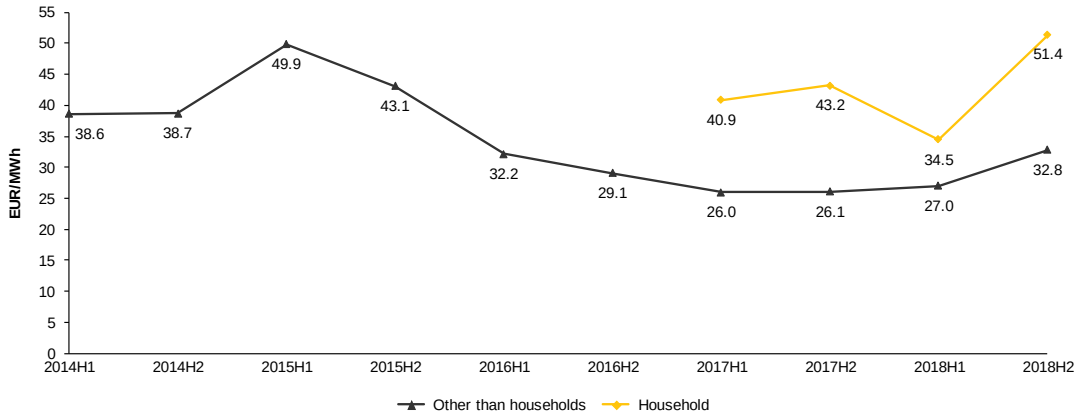
Figure 85. Average monthly natural gas price on the wholesale market, 2017-2018



Source: ERC annual reports 2017-2018, project team analyses

Regarding the final gas price of the consumers, there are fluctuations during the period 2014-2018 (Figure 86). The price for all other consumers except households during the period 2014-2018 is ranging from 26 to 50 EUR/MWh. In 2017 and the first half of 2018 this price has the lowest values. The households have started to consume natural gas from the distribution network in the recent few years, and the average price in the second half of 2018 reached 51 EUR/MWh.

Figure 86. Gas prices at 6 months period by type of consumer, 2014-2018



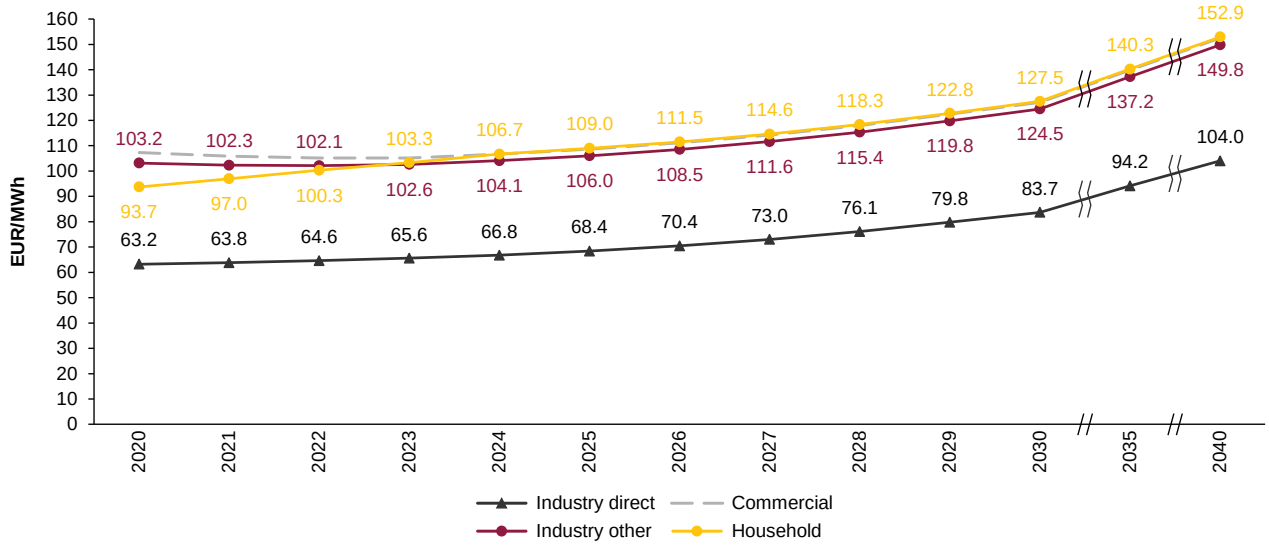
Source: ERC annual reports 2014-2018, project team analyses

II. Projections of development with existing policies and measures at least until 2040

The projections of the electricity prices for the consumers is based on the projected technology mix, as well as the trends of the regional prices of electricity, and the decreased level of the consumers (especially SME) supplied by the universal supplier. Therefore, it is assumed that the price of electricity for households will be slightly increased in the period 2020-2025, while after 2025 it will be a little bit higher than the SME sector (commercial and other industry), reaching around 153 EUR/MWh. It should be noted that this price for the household sector is for the high tariff (Figure 87).

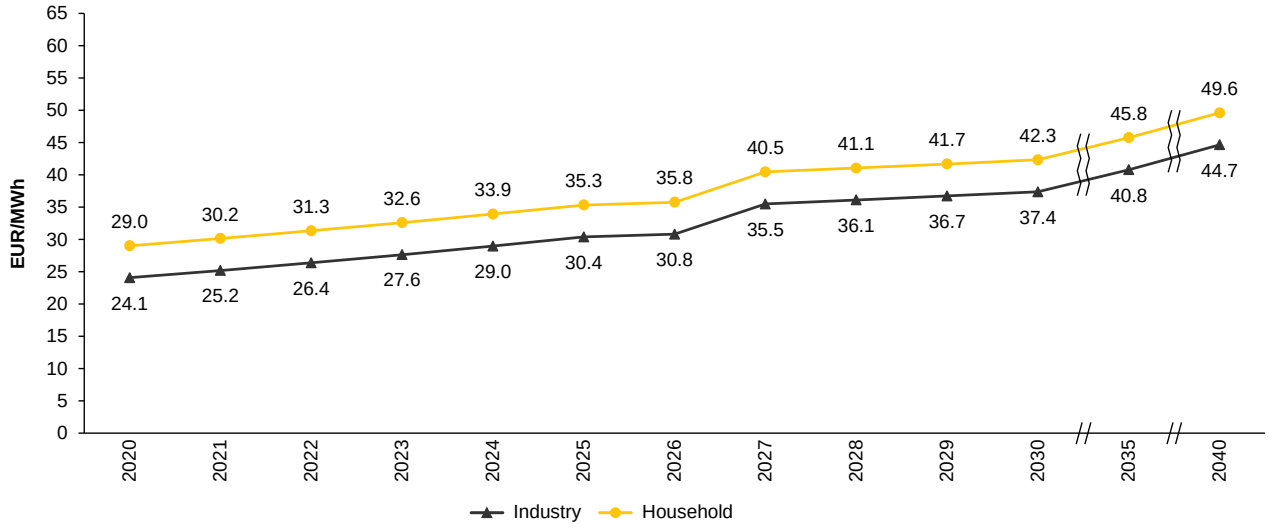
It is projected that the gas prices for Macedonia will follow the regional gas trends (Figure 52). Based on these trends and the historical values for the natural gas prices of the different consumers, it is projected that the gas price for the households will reach around 50 EUR/MWh (an increase of 71% in 2040 compared to 2020), Figure 85. The consumers from the commercial sector will have similar price as the household consumers. Furthermore, the price for the industry sector is lower (for around 5 EUR/MWh at yearly level) compared to the other two sectors during the whole period and it reaches around 45 EUR/MWh in 2040 (85% higher than in 2020).

Figure 87. Projected electricity prices by type of consumer



Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

Figure 88. Projected gas prices by type of consumer



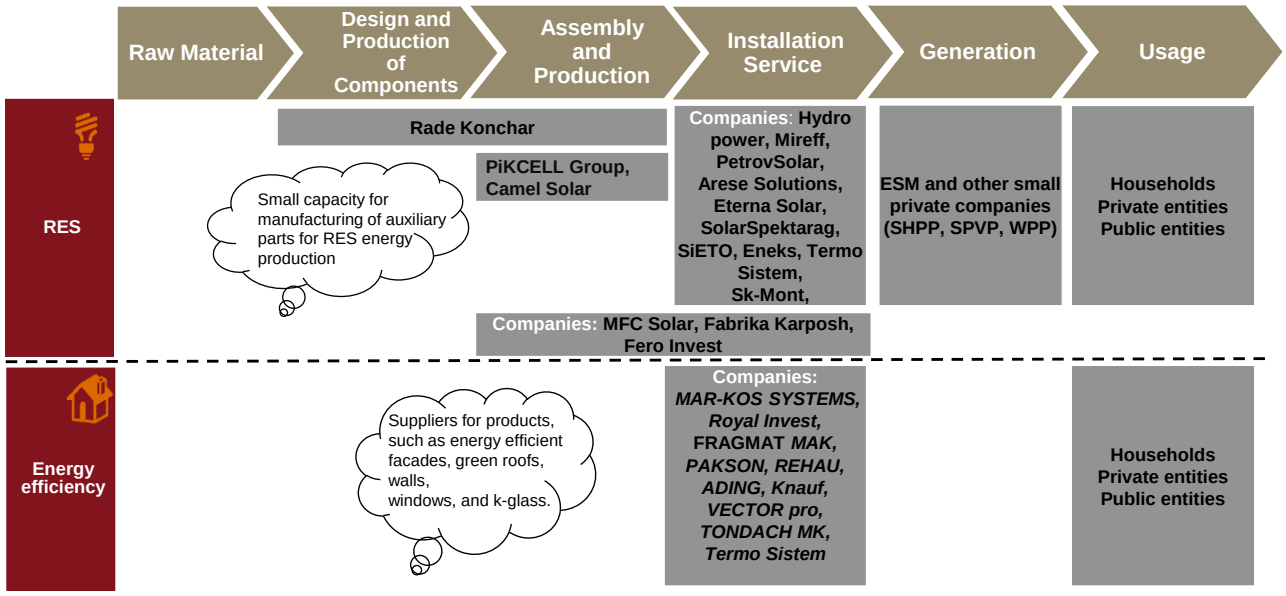
Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

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)

Currently, in North Macedonia there are limited number of producers of low-carbon technologies. Nevertheless, the low-carbon transition could stimulate the SMEs to start to pursue this market as well. Most of the SMEs in the energy sector offer only installation services, mainly in RES and EE (Figure 89). Therefore, there is a significant potential for scaling-up low-carbon and energy-efficient solutions, starting from the demonstration stage and up to the market of renewable energy technologies and to greater energy savings.

Figure 89 SMEs contribution to energy development across the value chain in North Macedonia



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

North Macedonia is categorized as a "modest innovator"[41]. Although the analysis identifies enhanced export of medium and high technologies and increased public investment in research and development, the total expenditure for research and development (R&D) as a percentage of the GDP remains significantly low i.e. 0.4% R&D expense from total GDP. According to Eurostat, the intramural R&D expenditures (GERD)[42] in North Macedonia in 2018 are estimated to 39.07 Mil. EUR and most of it are realized in the higher education sector (58%) and business enterprise sector (30.6%), while the rest are in the government sector (9.8%) and private non-profit sector (1.6%). There are no specific data available on how much of these expenditures are related to low-carbon technologies. Within the Innovation Strategy 2012-2020, as well as the Economic Reform Programme 2018 - 2020 developed by the Government, utilization of RES and enhancement of energy efficiency are one of the main government priorities and strategic objectives.

[41] European Innovation Ranking List, 2019

[42] Eurostat, Database: Science and Technology - Statistics on research and development https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_e_gerdfund&lang=en

According to the TBUR[43], most of the funding for research and innovation related to climate change (and energy sector) is provided by the financing mechanisms of EU and UNFCCC.

Under the EU Mechanisms, the country is eligible to participate in Horizon 2020, COSME, CEF, Erasmus+, IPA Programmes. From energy and climate aspect as most relevant is Horizon 2020, which is the biggest EU Research and Innovation programme ever, with nearly €80 billion of funding available for over 7 years (2014 to 2020) for research and development. In the period 2014 – 2019, 44% of total EU contributions under Horizon 2020 for North Macedonia[44] were associated with projects focused on various topics from energy thematic area. Majority of spending was used for the following themes: secure, clean and efficient energy 2.85 mil EUR (19 participants), climate action, environment resource efficiency and raw materials 1.11 mil EUR (5 participants) and smart, green and integrated transport 0.12 mil EUR (2 participant). In terms of sector involvement, majority of spending was used by private sector 2.75 mil. EUR, higher education 2.55 mil. EUR, research organisation and public sector 1.11 mil EUR. From private sector, only one SME subject participated with used net contributions of 1.28 mil. EUR.

The financial mechanism under the UNFCCC Convention provides financial resources (grants and lending instruments) to assist developing countries to meet their objectives under the international environmental conventions and agreements. The Global Environment Facility (GEF) and the Green Climate Fund (GCF) are two operating entities of this financial mechanism. The list of approved and under realization GEF projects in North Macedonia includes four projects in climate change (with inactive allocation of budget of 2 million US$). The country has also approved financing from the Green Climate Fund, for one cross-cutting project, Green cities facility[45], together with eight other countries. The aim of the project is to enable the transition of cities to low-carbon, climate-resilient urban development with minimized environmental impact and maximized support to natural environment (by including energy efficiency in building, transport, waste reduction, water management and green planning).

The country is also receiving funds for research and development in the energy and climate change field from international donors, national public donors and private sector. Available international donors' funds which historically have supported energy and climate-related projects, such as EBRD, EIB, EU funds, UNDP, KfW, UNIDO, USAID, World Bank, are underutilized due to weak organizational structures, inadequate skills, and limited facilities and resources.

At a national level, the Fund for Innovation and Technology Development (FITD), as a public fund for SMEs, 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 FITD has financed 63 climate change related projects mainly under instruments of innovation with commercialization (INS1), technology development (INS3) and grown start-ups (INS2), with financial contribution and co-financing of 7.55 mil. EUR.

III. Breakdown of current price elements that make up the main three prices components (energy, network and taxes/levies)

The current situation of electricity and gas markets in the country including the energy prices are described in the chapter for the Dimension Internal Energy market.

The breakdown of electricity prices for household consumers in 2019 (bi-annual data) by price components for different levels of annual electricity consumption are presented in Table 4. The same breakdown, but for non-households consumers, are presented in Table 5. The calculations include all non-household electricity consumers (connected directly to the transmission network and non-household consumers connected to the distribution networks), on the regulated electricity market and the unregulated electricity market.

[43] TBUR, Current status of the research, development, innovation and technology transfer related to climate change in the Republic of North Macedonia - Rapid Assessment Report
[44] Horizon 2020 Dashboard - North Macedonia (last accessed April 2020)
[45] https://www.greenclimate.fund/document/green-cities-facility

Table 4.Average electricity prices for households

End-user consumer bands	Annual electricity consumption in KWh		Prices in EUR/kWh								
			energy and supply	network costs		VAT excluded	VAT included	energy and supply	network costs		VAT excluded	VAT included
				transmission	distribution				transmission	distribution		
	lowest	highest	(I-VI) 2019					(VII-XII) 2019				
D1	< 1000		0.049	0.003	0.016	0.068	0.080	0.046	0.003	0.019	0.068	0.080
D2	1000	<2500	0.049	0.003	0.015	0.067	0.079	0.046	0.003	0.018	0.067	0.080
D3	2500	<5000	0.049	0.003	0.014	0.066	0.078	0.046	0.003	0.018	0.067	0.079
D4	5 000	<15 000	0.049	0.003	0.013	0.065	0.077	0.046	0.003	0.018	0.067	0.079
D5	≥15 000		0.049	0.003	0.014	0.066	0.078	0.046	0.003	0.019	0.068	0.080
Average			0.049	0.003	0.014	0.066	0.078	0.046	0.003	0.018	0.067	0.079

Source: SSO MAKSTAT database

Table 5. Average electricity prices for non-household consumers

End-user consumer bands	Annual electricity consumption in KWh		Prices in EUR/kWh									
			energy and supply	network costs		VAT excluded	VAT included	energy and supply	network costs		VAT excluded	VAT included
				transmission	distribution				transmission	distribution		
	lowest	highest	(I-VI) 2019					(VII-XII) 2019				
I1	< 20		0.049	0.003	0.069	0.122	0.144	0.053	0.003	0.068	0.124	0.147
I2	20	<500	0.055	0.003	0.031	0.089	0.105	0.057	0.003	0.031	0.091	0.107
I3	500	<2000	0.058	0.003	0.007	0.069	0.081	0.062	0.003	0.008	0.073	0.087
I4	2 000	<20 000	0.061	0.003	0.005	0.069	0.082	0.065	0.003	0.005	0.073	0.087
I5	20 000	< 70 000	0.063	0.003	0.002	0.068	0.081	0.063	0.003	0.003	0.069	0.082
I6	70 000	<150 000	0.063	0.003	0.000	0.067	0.079	0.074	0.003	0.000	0.076	0.090
I7	≥150 000		0.055	0.003	0.000	0.059	0.069	0.059	0.003	0.001	0.062	0.074

Source: SSO MAKSTAT database

The producers of electricity and heat (i.e. CHP and heating plants) have a dominant share of 82% in the consumption of natural gas in the country for 2019, followed by the industrial consumers (mainly from the metal industry) with a share of 16%. The remaining share is for the consumers connected to the distribution network systems. The breakdown of natural prices for non-household consumers in 2019 (bi-annual data) by price components for different levels of annual electricity consumption are presented in Table 6. The calculations include non-household natural gas consumers connected directly to the transmission network and non-household consumers connected to the distribution networks. The breakdown for households consumers is presented in Table 7.

Table 6. Average gas prices per nm3 for non-household consumers

End-user consumer bands	Annual gas consumption in TJ		Prices in EUR/nm3									
			energy and supply	network costs		VAT excluded	VAT included	energy and supply	network costs		VAT excluded	VAT included
				transmission	distribution				transmission	distribution		
	lowest	highest	(I-VI) 2019					(VII-XII) 2019				
I1	<1		0.424	0.023	0.024	0.470	0.555	0.429	0.023	0.022	0.474	0.559
I2	≥1	<10	0.327	0.022	0.006	0.356	0.420	0.311	0.022	0.004	0.337	0.398

I3	≥10	<100	0.317	0.022	0.004	0.342	0.404	0.311	0.022	0.004	0.337	0.397
I4	≥100	<1 000	0.295	0.022	-	0.316	0.373	0.285	0.022	-	0.307	0.362
I5	≥1 000	<4 000	-	-	-	-	-	-	-	-	-	-

Source: SSO MAKSTAT database

Table 7. Average gas prices per nm3 for household consumers

End-user consumer bands	Annual gas consumption in GJ		Prices in EUR/nm3									
			energy and supply	network costs		VAT excluded	VAT included	energy and supply	network costs		VAT excluded	VAT included
				transmission	distribution				transmission	distribution		
	lowest	highest	(I-VI) 2019					(VII-XII) 2019				
D1	<20		0.479	0.005	0.047	0.532	0.627	0.479	0.005	0.047	0.531	0.626
D2	≥20	<200	0.486	0.004	0.047	0.537	0.634	0.464	0.007	0.047	0.518	0.611
D3	≥200		-	-	-	-	-	-	-	-	-	-

Source: SSO MAKSTAT database

IV. Description of energy subsidies including fossil fuels

The Energy Law sets the regulation for supportive measures for electricity producers that use RES. Such measures enable the promotion of investments in RES and optimal use of their available potential and help the country to achieve the national mandatory goals for participation of renewable energy sources in total energy consumption and GHG emission reduction. In addition to the existing feed-in tariffs, the Energy law introduces the premiums as new support mechanism. In 2019, the Government adopted a Decree on Support Measures for Electricity Production from RES, which regulates the conditions and manner for determining the premiums and feed-in tariffs.

Pursuant to the Decree, the **feed-in tariffs** is awarded to a preferential producer for electricity produced from hydropower plants (HPPs), wind power plants (WPP), and biomass and biogas thermal power plants. For the use of feed-in tariffs, the maximum installed power of the producers' power plant should not exceed 10 MW for a hydropower plant, 50 MW for a wind power plant and 1 MW for a biomass and biogas thermal power plant. The feed-in tariffs and the period of support are given in Table 8.

Table 8. Feed-in tariffs for electricity production from RES

Type of power plant	Feed-in tarrif	Period of support
Hydro power plants	for the monthly amount of electricity delivered per block: I block: 12,00 €¢/kWh (≤ 85.000 kWh) II block: 8,00 €¢/kWh (> 85.000 и ≤ 170.000 kWh) III block: 6,00 €¢/kWh (> 170.000 и ≤ 350.000 kWh) IV block: 5,00 €¢/kWh (> 350.000 и ≤ 700.000 kWh) V block: 4,50 €¢/kWh (> 700.000 kWh)	20 years
Wind power plants	8,9 €¢/kWh	20 years
Biomass thermal power plant	18 €¢/kWh	15 years
Biogas thermal power plant	18 €¢/kWh	15 years

Source: Decree on Support Measures for Electricity Production from RES

The government also adopted (in February 2019) a Decision on the total installed capacity of the preferential producers of electricity, according to which total installed capacity for feed-in tariffs is:

- 160 MW for wind power plants,
- 10 MW for biomass thermal power plants, and
- 20 MW for biogas thermal power plants, where:
- No limit for small hydro power plants

Before the new Energy Law entered into force, feed-in tariff was also granted for photovoltaic (PV) power plants, which resulted with the progressive installation of these type of power plants in the country, thus fulfilling the limit of their total installed capacity set with the previous Decision of the Government on the total installed capacity of preferential producers adopted in 2013 (Official Gazette No. 56/13).

As of December 31, 2019, the number of preferential producers in the country that use a feed-in tariff is 197. The PV power plants (with a number of 102) have the largest share of ~52% of the total number of preferential producers.[46]

Premiums, as a support mechanism**,** will only be awarded to privileged energy producers that produce energy from wind power plants and photovoltaic power plants. The Premiums will be granted in a tendering procedure carried out by electronic auction, and the criteria for choosing will be the lowest amount offered on a fix premium. The fixed premium will be granted as an additional fixed amount on the price that the producer achieves through the sale of each kWh produced on the wholesale electricity market. As stipulated in the Decree on Support Measures for Electricity Production from RES, in order for the privileged power producer to be eligible to use Premiums, the maximum installed power of the power plant should not exceed 50 MW for a wind power plant and 30 MW for a photovoltaic power plant. According to the Decision on the total installed capacity of the preferential producers of electricity, the total installed capacity for PV power plants for which premiums are granted is 200 MW.

In 2019, the Ministry of Economy announced two public announcements for granting the right to use premium for electricity produced by photovoltaic power plants. The first public announcement was intended for PV plants that will be built on land owned by the Republic of Northern Macedonia. The total installed capacity of photovoltaic power plants, for which a premium was awarded with this public announcement, is 35 MW, distributed to 11 photovoltaic power plants. The second public announcement was intended for PV power plants that will be built on land that is not owned by the Republic of Northern Macedonia. The total installed capacity of photovoltaic power plants, which were awarded a premium with this public announcement, is 27 MW.

Besides the support schemes on the supply side, the Government also promotes usage of RES and EE in households by proving incentives under an annual National Programme. The implementer of the programme is the Ministry of Economy realizing the following support schemes stipulated in the programme:

- up to 30% reimbursement, but not more than 300 EUR (~18,000 MKD), of the costs for purchasing and installation of solar thermal collector system;
- up to 50% reimbursement, but not more than 500 EUR (~30,000 MKD) of the costs for purchasing and installation of PVC or aluminium windows; and
- up to 50% reimbursement, but not more than 500 EUR (~30,000 MKD) of the costs for purchasing pellet stove.

Each year, the programme is revised with some new technologies for support being considered that has been increasing in terms of allocated funds. The interest for the programme is obvious given the increase in overall applicants each year.

Support schemes for promotion of EE and RES have been also implemented at local level. The City of Skopje is leading by example with the Program for subsidizing citizens on the territory of the City of Skopje for buying pellet stoves. The support scheme has started in 2016 and covers a partial reimbursement or up 70% of the stove value, but not more than 30,000 MKD (~500 EUR). In 2019 the City of Skopje have introduced a new subsidy for households that bought a more efficient heating device - inverter air conditioner, by reimbursing them up to 50% of the costs incurred in purchasing the device, but not more than 250 EUR (~15,000.00 MKD).

According to the EnC study on fossil fuel subsidies in the Contracting Parties[47], for the period covered by the study 2015-2017 in North Macedonia there were no direct subsidies for electricity generation from coal, with the exception of public finance support in the form of state loan guarantees, estimated to 1.23 EUR/MWh (average for period 2015-2017).

[46] Energy Regulatory Commission, Annual Report for 2019.
[47] https://energy-community.org/news/Energy-Community-News/2019/06/20.html

5. ASSESSMENT OF IMPACTS OF PLANNED POLICIES AND MEASURES WITH EXISTING POLICIES AND MEASURES

IN THIS SECTION:

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). 149

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 154

3. Overview of investment needs 157

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 . 160

5. ASSESSMENT OF IMPACTS OF PLANNED POLICIES AND MEASURES

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

In the WAM scenario, the total projected GHG emissions and removals in 2030 are 6,059 and 3,854 Gg CO_2-eq, respectively, or the net-emissions are estimated to 2,204 Gg CO_2-eq. This is a reduction of 82% in 2030, compared to the 1990 level (Figure 90). Compared to the WEM scenario, there is 65% net-emissions reduction in 2030 in the WAM scenario (Figure 91). The difference between WEM and WAM scenarios is in the Energy sector (having in mind that the measures in the AFOLU and Waste sectors are the same in both scenarios), mainly in Electricity and Heat production (73% of the difference between the net-emissions in the scenarios).

Figure 90. GHG emissions and removals (net-emissions) by sector in WAM (in Gg CO_2-eq)

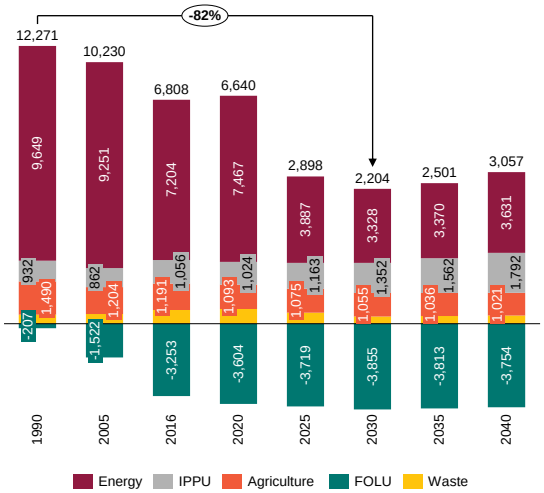
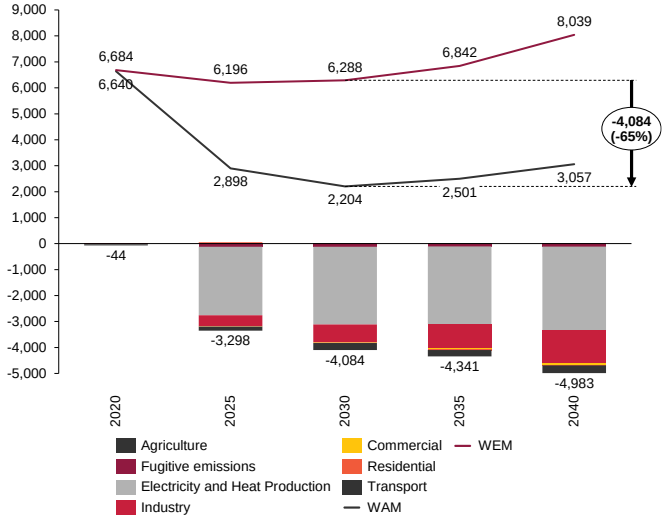


Figure 91. Difference between GHG emissions and removals in WEM and WAM scenario (in Gg CO_2-eq)



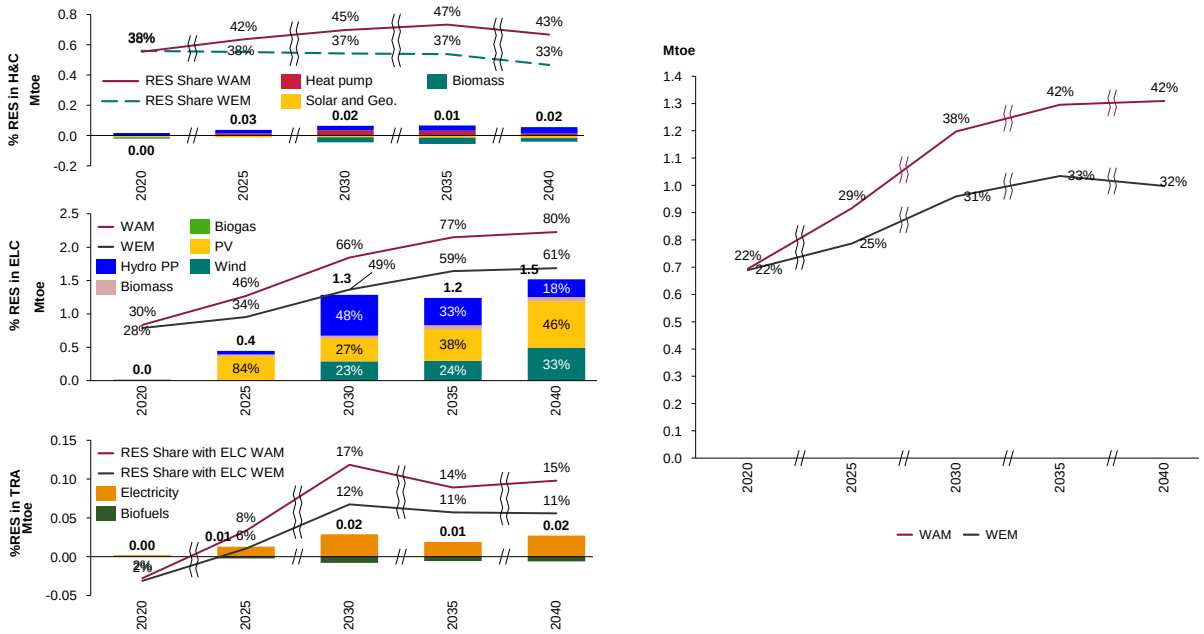
Source: National GHG Mitigation report under 3rd BUR, MARKAL results from the Strategy for energy development up to 2040, project team analyses

The share of RES in gross final energy consumption in WAM scenario is 7 percentage points higher, compared to the WEM scenario in 2030 (Figure 92). By sectors, the RES share in the WAM scenario in 2030 is higher than in the WEM scenario by:

- 8 percentage points in the Heating and cooling sector, mainly as a result of the introduction of more ambitious energy efficiency measures, although, the RES consumption in WAM scenario is slightly higher than in the WEM scenario;

- 17 percentage points in the Electricity sector as a result of more PV and Wind power plants, as well as decommissioning of Bitola power plant;
- 5 percentage points in the Transport sector, as a result of the higher ambition electrification of this sector.

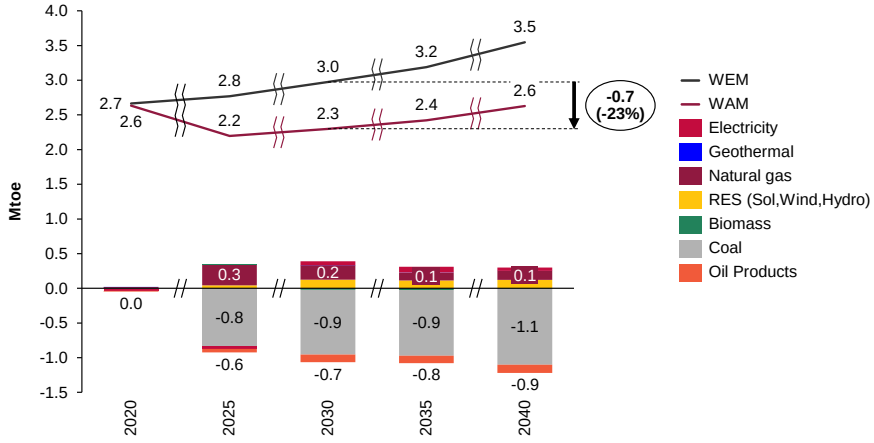
Figure 92. Difference between WEM and WAM in indicative projections of RES share in gross final energy consumption and in different sectors (heating and cooling, electricity and transport) as well as per technology in each of these sectors



Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

From the Energy efficiency perspective, as well as from Security of supply point of view, the primary and the final energy consumption in 2030 are reduced by 23% (Figure 93) and 12% (Figure 94), respectively in WAM scenario, compared to the WEM scenario. The reduction in the primary and final energy consumption is mostly due to the replacement of usage of coal for electricity production, as well as in the industry sector mainly with gas and RES. On the other hand, the consumption of natural gas is 0.2 Mtoe higher in 2030 in WAM, compared to WEM scenario. The difference in the final energy consumption between the scenarios is almost equally distributed among the Households (33%), Industry (29%) and Transport (26%) sector in 2030 (Figure 95).

Figure 93. Difference between WEM and WAM in primary energy consumption



Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

The decommissioning of TPP Bitola in the WAM scenario will reduce the domestic production for 39%, compared to the WEM scenario in 2030. At the same time, mainly as a result of the implementation of Energy efficiency measures, but also higher level of investments in RES for electricity production, the import of fuels in WAM is reduced by 19%, compared to the WEM in 2040. The energy dependence in WAM scenario is

higher for 10 percentage points in 2030, compared to the WEM scenario. The most critical period in the WAM scenario is 2025-2028, when decommissioning of the TPP Bitola is planned. In this period, the price of electricity for the consumers in WAM is higher by around 30 €/MWh, compared to WEM, while during the rest of the planning period the difference in the price of electricity is between 0.3 and 6 €/MWh.

Figure 94. Difference between WEM and WAM in final energy consumption, by fuel

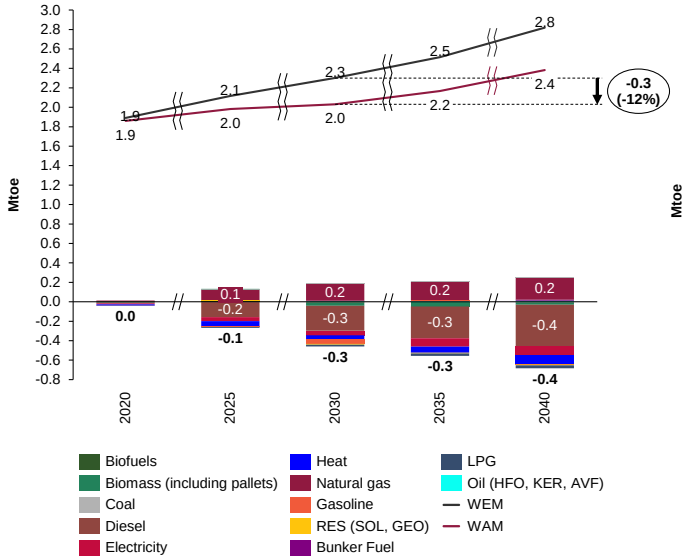
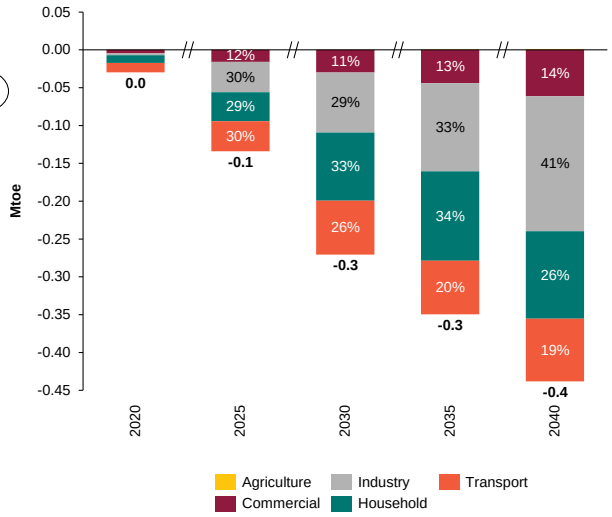
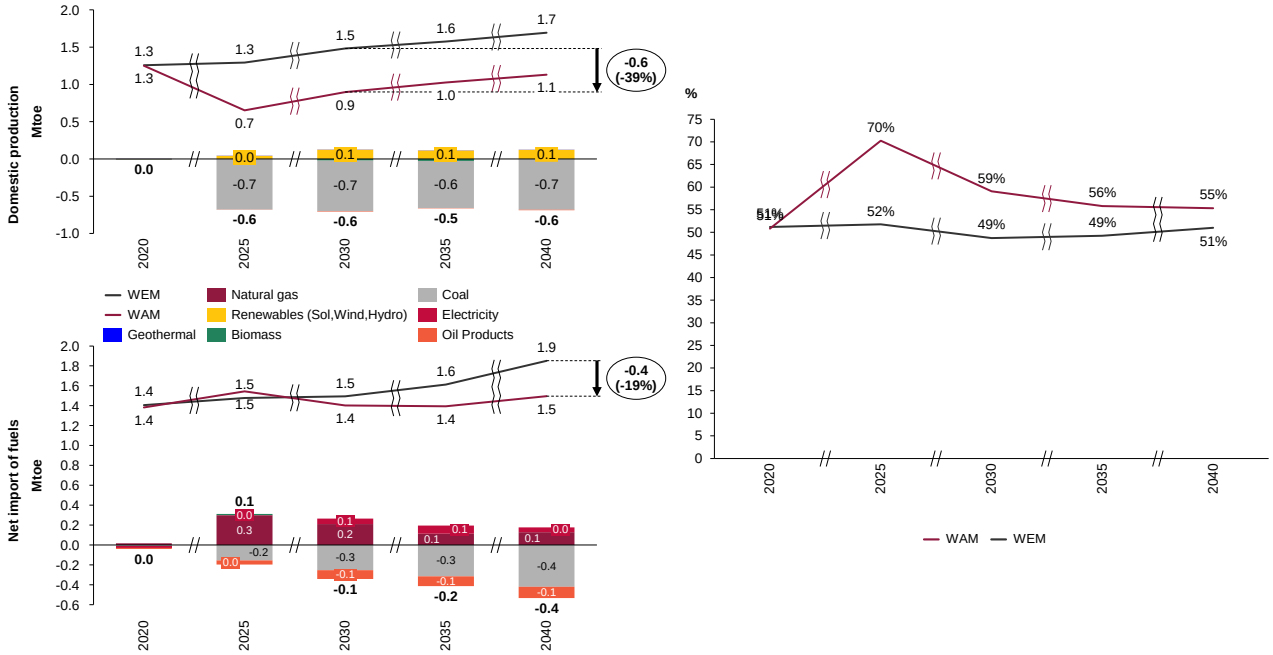


Figure 95. Difference between WEM and WAM in final energy consumption, by sector



Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

Figure 96. Difference between WEM and WAM in energy dependence



Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

II. Assessment of policy interactions (between existing policies and measures and planned policies and measures within a policy dimension and between existing policies and measures and planned policies and measures of different dimensions) at least until the last year of the period covered by the plan, in particular to establish a robust understanding of the impact of energy efficiency/ energy savings policies on the sizing of the energy system and to reduce the risk of stranded investment in energy supply

Each of the proposed measures and policies within this NECP is modeled individually in order to evaluate its individual effect (presented in the tables for each measure). However, in the scenario with existing measures

and the scenario with additional measures, all policies and measures are modeled together, in order to take into account the interaction between them and to avoid the risk of unnecessary investments and oversizing of the system. For example, in a scenario where no energy efficiency measures would be implemented, electricity consumption in 2030 could reach 9.2 TWh in Macedonia. In the scenario with existing measures it is reduced to 8.2 TWh, and in the scenario with additional measures it is 7.7 TWh. This means that if the electricity generation system aims to produce 9.2 TWh, and in the meantime energy efficiency measures have been implemented and the consumption does not exceed 7.7 TWh, and also at the regional level there are surpluses of electricity, the system is oversized and **unnecessary investments are made**. This emphasizes the importance of parallel implementation of all measures in a given scenario. Given that energy efficiency measures and policies are the most cost-effective, the model (MARKAL) automatically incorporates these measures and policies, **thus implementing the energy efficiency first principle**. But even in the Energy efficiency dimension, unnecessary investments can occur in certain measures, for example, if in a household that does not have insulation, first a heating system is installed and then it is insulated, the heating system may be oversized and again unnecessary investments may occur. By using the MARKAL model, where all measures are considered at the same time, this kind of stranded investments are avoided.

In addition, the implementation of certain measures depends to a large extent on the implementation of other measures proposed in the given scenario. For example, with the greater inclusion of variable renewable energy sources, parallel implementation of measures for increasing the flexibility of the system is required (such as, construction hydro-pumped storage power plants (Chebren), demand response measures, electrification of the transport). At the same time, the network should not be an obstacle to building new renewable energy sources, but should follow their trend, with proper upgrading and maintenance. Also, the consumption of biomass, primarily for heating in households, must be in coordination with the forestry sector and the measures proposed in that sector, in order to preserve its sustainability.

Furthermore, if each of the measures is implemented separately, the total investment cost is much higher, than if all measures and policies are implemented in parallel, exactly due to their interaction. More details on the investment costs are given in section 5.3.

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 proposed policies and measures in AFOLU and Waste sectors, in the scenario with additional measures are the same as in the scenario with existing measures, while measures in the Energy sector are planned to be implemented with much higher intensity in the scenario with additional measures. The proposed policies and measures are aimed at fulfilling the set targets and objectives at the national level, which in turn are in line with the dimensions of the European Union and will also contribute to meeting the objectives set by the Energy Community. Table 9 gives an overview of the contribution of each policy/measure within each Energy Union and EnC dimensions.

Table 9. Interactions between the policies and measures with Energy Union and EnC dimensions

	Policy/measure	Decarbonisation	Energy Efficiency	Energy Security	Internal Energy Market	R&I and competitiveness
PM_D1	Introduction of CO2 tax	√		√		√
PM_D2	Reduction of CH4 emissions from enteric fermentation in dairy cows by 3%	√				
PM_D3	Reduction of N2O emissions from manure management in dairy cows by 20%	√				
PM_D4	Reduction of NO2 emissions from manure management in swine farms by 13%	√				
PM_D5	Reduction of N2O emissions from manure in dairy cows by 20% for farms below 50 Livestock Units	√				
PM_D6	Establishing integrated management of forest fires	√		√		

PM_D7	Afforestation	√		√		
PM_D8	Conversion of land use of field crops above 15% inclination	√				
PM_D9	Contour cultivation on areas under field crops on inclined terrains (5-15%)	√				
PM_D10	Perennial grass in orchard and vineyards on inclined terrains (>5%)	√				
PM_D11	Use of biochar for carbon sink on agricultural land	√				√
PM_D12	Landfill gas flaring	√				√
PM_D13	Mechanical and biological treatment (MBT) in new landfills with composting	√				
PM_D14	Selection of waste - paper	√				
PM_D15	Improved waste and materials management at industrial facilities	√				
PM_D16	Program for just transition	√				√
PM_D17	Identification of the proper location for solar and wind power plants	√				√
PM_D18	Large hydro power plants	√		√	√	√
PM_D19	RES without incentives	√		√	√	√
PM_D20	Photovoltaic Irrigation	√		√	√	√
PM_D21	Incentives feed-in tariff	√		√	√	
PM_D22	Incentives feed-in premium	√		√	√	
PM_D23	Solar rooftop power plants	√		√	√	√
PM_D24	Solar thermal collectors	√		√	√	
PM_D25	Biomass power plants (CHP optional)	√		√	√	
PM_D26	Development of the biofuels market	√		√	√	√
PM_EE1	Energy efficiency obligation schemes	√	√	√		
PM_EE2	Retrofitting of existing residential buildings	√	√	√		√
PM_EE3	Retrofitting of existing central government buildings	√	√	√		√
PM_EE4	Retrofitting of existing local self-government buildings	√	√	√		√
PM_EE5	Retrofitting of existing commercial buildings	√	√	√		√
PM_EE6	Construction of new buildings	√	√	√		√
PM_EE7	Construction of passive buildings	√	√	√		√
PM_EE8	Improvement of the street lighting in the municipalities	√	√	√		
PM_EE9	Green procurements	√	√	√		√
PM_EE10	Labeling of electric appliances and equipment	√	√	√		√
PM_EE11	Increased use of heat pumps	√	√	√		√
PM_EE12	Public awareness campaigns and network of energy efficiency (EE) info centers	√	√	√		
PM_EE13	Phasing out of incandescent lights	√	√	√		
PM_EE14	Energy management in manufacturing industries	√	√	√		√
PM_EE15	Introduction of efficient electric motors	√	√	√		√
PM_EE16	Introduction of more advanced technologies	√	√	√		√

PM_EE17	Increased use of the railway	√	√	√		√
PM_EE18	Renewing of the national car fleet	√	√	√		
PM_EE19	Renewing of other national road fleet	√	√	√		√
PM_EE20	Advanced mobility	√	√	√		√
PM_EE21	Construction of the railway to Republic of Bulgaria	√	√	√		√
PM_EE22	Electrification of the transport	√	√	√		√
PM_EE23	Increased use of central heating systems	√	√	√		√
PM_EE24	Smart communities	√	√			√
PM_EE25	Reduction of network losses		√		√	√
PM_IEM1	Construction of 400 kV electricity transmission interconnection Macedonia-Albania (Bitola-Elbasan)			√	√	√
PM_IEM2	Develop natural gas cross-border infrastructure to diversify supply routes and increase market competitiveness			√	√	√
PM_IEM3	Develop gas transmission network			√	√	√
PM_IEM4	Develop gas distribution network			√	√	√
PM_IEM5	Pursue regional electricity market integration			√	√	√
PM_IEM6	Develop further distribution system network to integrate more RES, including prosumers and more electric vehicles (EVs), as well as continuously improve network reliability	√	√	√	√	√
PM_IEM7	Price signal demand response	√		√	√	√
PM_IEM8	Adoption of annual program for vulnerable consumers			√	√	
PM_RIC1	Participation in development of energy transition technologies and measures	√				√
PM_RIC2	Increased level of education of sustainable energy needs	√	√			√
PM_RIC3	Inter-sectoral and geographical mobility of researchers					√
PM_RIC4	Increase the role of SME sector in energy transition	√	√	√	√	√

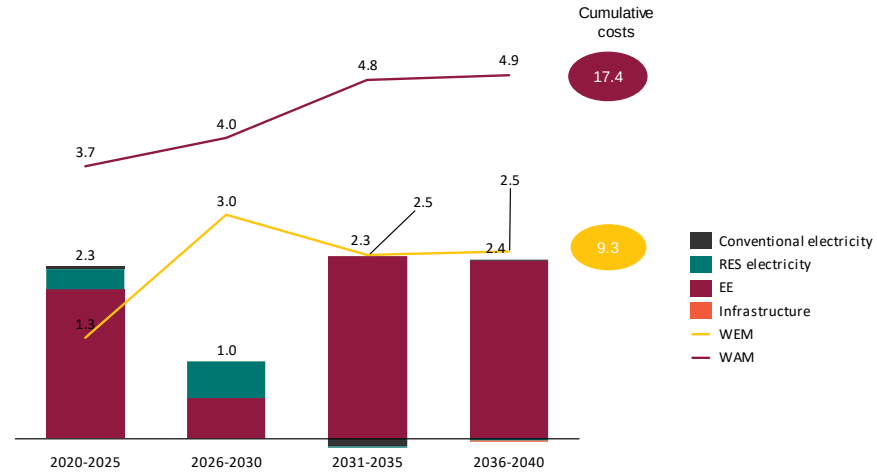
2. Macroeconomic and, to the extent feasible, the health, environmental, employment and education, skills and social impacts, including just transition aspects (in terms of costs and benefits as well as cost-effectiveness) of the planned policies and measures described in section 3 at least until the last year of the period covered by the plan, including comparison to projections with existing policies and measures

Macroeconomic analyses for the Energy sector are based on the results for investments obtained from the MARKAL model. The results for the Energy sector show that the realization of the scenario with existing measures requires about 9.3 billion EUR, while the implementation of the scenario with additional measures

requires 17.4 billion EUR (Figure 97). The largest investments in the WAM scenario are in the period from 2036-2040, and in the WEM scenario in the period 2026-2030. The main difference between the two scenarios is in the level of investments in energy efficiency measures. The investments in the Energy sector participate with more than 99% of the total investments (including the AFOLU and Waste sectors), which amount to 9.4 in WEM and 17.5 in WAM.

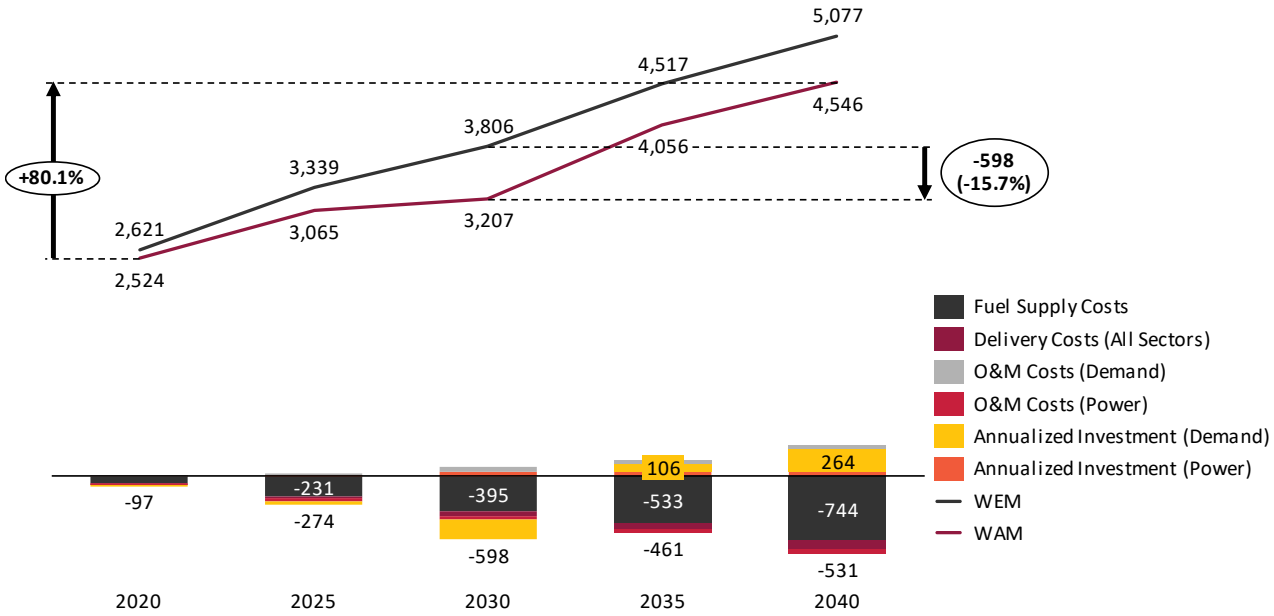
Although investments in the scenario with additional measures are greater, the total cost of the system is lower by 15.7% in 2030 compared to the scenario with existing measures (Figure 98). The biggest savings are in Fuel Supply Costs. Total system costs increase by about 80% in 2040, compared to 2020, in the scenario with additional measures and in 2030 they amount to 3,207 mil. EUR.

Figure 97. Investment costs by scenario (mil. EUR), and the difference between the scenarios by type of investment in the Energy sector



Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

Figure 98. Total energy system costs (mil. EUR) and the difference between the scenarios by type of cost



Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

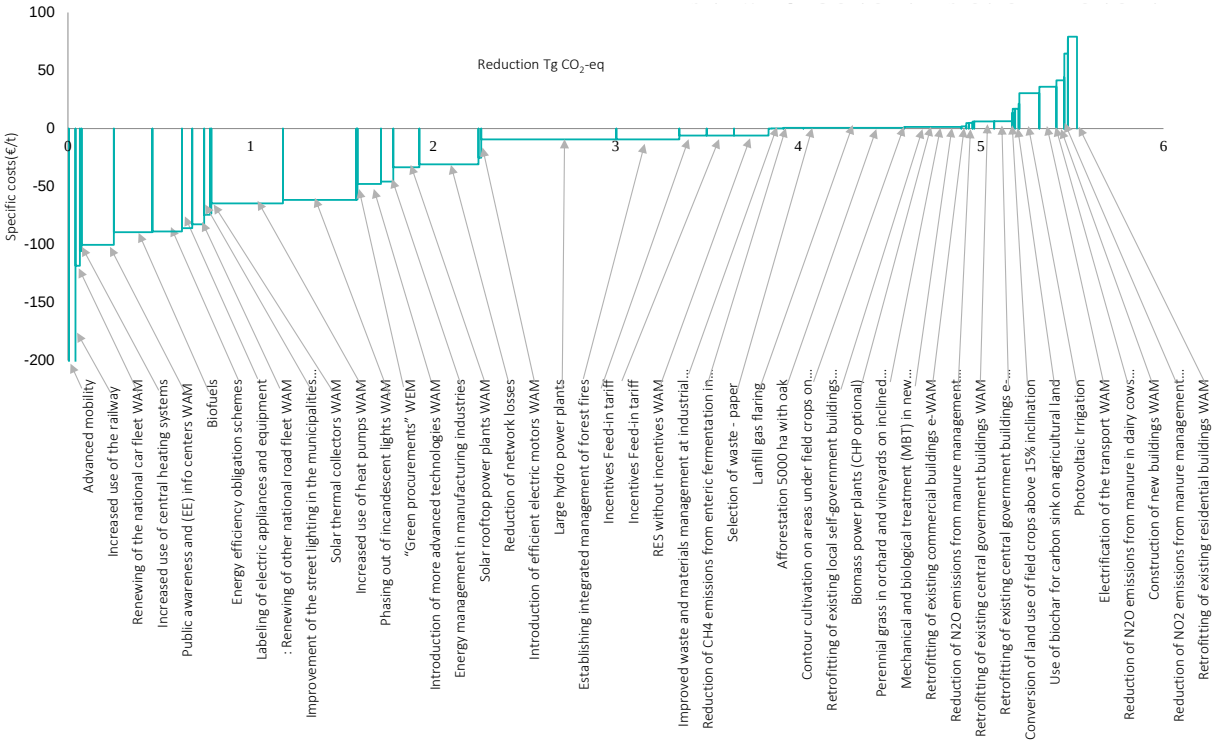
Additionally, the proposed measures/policies are presented on a Marginal abatement cost curve (MAC curve), where the economic and environmental aspects are considered for each of them, in terms of their specific cost and the potential for CO_2-eq reduction (Figure 99). It is shown that around 70% of the proposed measures/policies reduce GHG emissions by negative specific costs (lower costs than in a scenario without measures), or they are called win-win options.

In addition to environmental and economic effectiveness, as part of the TBUR (mitigation report), the social benefits for some of the proposed measures/policies have been evaluated (Figure 100). With the

implementation of the measures from the WAM scenario, 10,000 green jobs can be created in 2035, while in the WEM scenario, a maximum of 5,200 jobs can be created in 2030. Most of the jobs are in Retrofitting and construction of buildings.

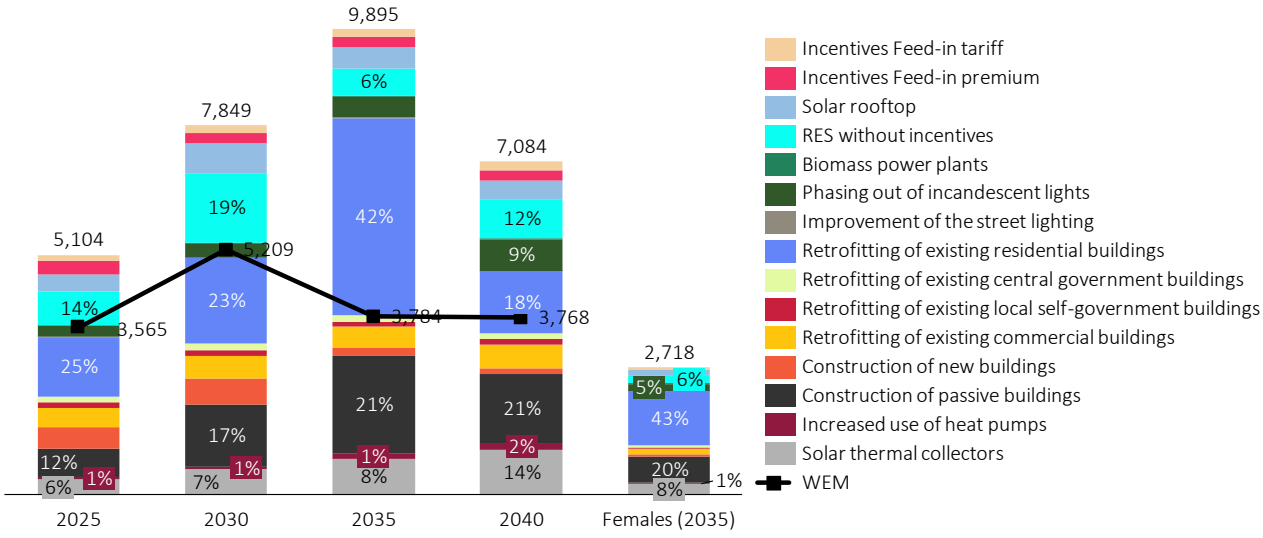
Detailed studies on the transport sector and heating of households in the city of Skopje were made as part of SBUR, where the effect of the proposed measures on air pollution is analyzed. The conclusion of these studies is that in parallel to the GHG emission reduction, the air pollution will also be reduced. For example, the emission of PM_{10}, CO, NO_x and SO_x from the heating in households in Skopje can be reduced for 60%, 43%, 4.4% and 50% respectively, in 2025 compared to 2015. Additionally, in the same period, the emissions from the transport sector can be reduced by 94% $PM_{2.5}$, 78% CO and NMVOC, 74% NO_x and 31% NH_3.

Figure 99. Marginal abatement cost (MAC) curve



Source: National GHG Mitigation report under 3rd BUR

Figure 100. Number of green jobs



Source: National GHG Mitigation report under 3rd BUR

3. Overview of investment needs

I. existing investment flows and forward investment assumptions with regard to the planned policies and measures

The investments per dimension, show that more than 80% of the total investments should be spent in energy efficiency (Figure 101). In order WAM scenario to be realized, in the decarbonisation dimension additional 3,500 mill EUR should be spend compared to WEM scenario.

For each of the proposed policies and measures, the budget for realization, the source of finance and implementation entities are given in Chapter 3. However, in this part summary table is given (Table 10). If we consider the investment costs separately for each measure (without taking into account their interaction), the total costs in the WAM scenario is 24.7 billion EUR, while in the WEM scenario it is 13.5 billion EUR. However, by implementing the policies and measures in parallel (including the energy efficiency first principle), the investment costs reduce to 17.5 and 9.4 in WAM and WEM scenario, respectively.

Figure 101. Investment costs by dimensions (mill.EUR)

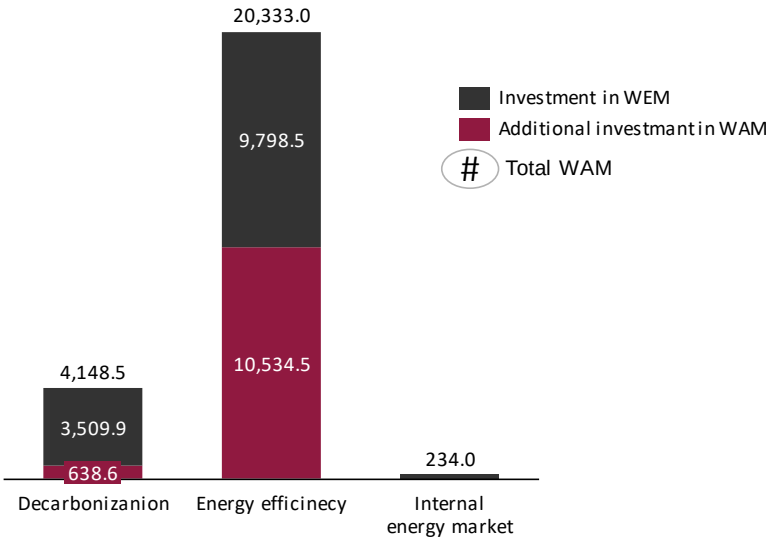


Table 10. Investment costs by measure (mill.EUR)

	Policy/measure	WEM	WAM	Diff. (WAM-WEM)
PM_D1	Introduction of CO2 tax	/	/	/
PM_D2	Reduction of CH4 emissions from enteric fermentation in dairy cows by 3%	0.2	0.2	0.0
PM_D3	Reduction of N2O emissions from manure management in dairy cows by 20%	1.0	1.0	0.0
PM_D4	Reduction of NO2 emissions from manure management in swine farms by 13%	1.0	1.0	0.0
PM_D5	Reduction of N2O emissions from manure in dairy cows by 20% for farms below 50 Livestock Units	1.0	1.0	0.0
PM_D6	Establishing integrated management of forest fires	1.5	1.5	0.0
PM_D7	Afforestation	7.8	7.8	0.0
PM_D8	Conversion of land use of field crops above 15% inclination	1.5	1.5	0.0
PM_D9	Contour cultivation on areas under field crops on inclined terrains (5-15%)	1.0	1.0	0.0
PM_D10	Perennial grass in orchard and vineyards on inclined terrains (>5%)	1.0	1.0	0.0
PM_D11	Use of biochar for carbon sink on agricultural land	30.0	30.0	0.0
PM_D12	Landfill gas flaring	20.5	20.5	0.0
PM_D13	Mechanical and biological treatment (MBT) in new landfills with composting	36.1	36.1	0.0
PM_D14	Selection of waste - paper	2.0	2.0	0.0

PM_D15	Improved waste and materials management at industrial facilities	/	/	/
PM_D16	Program for just transition	/	/	/
PM_D17	Identification of the proper location for solar and wind power plants	/	/	/
PM_D18	Large hydro power plants	1716.2	1716.2	0.0
PM_D19	RES without incentives	777.0	1325.5	548.5
PM_D20	Photovoltaic Irrigation	47.0	47.0	0.0
PM_D21	Incentives feed-in tariff	356.9	356.9	0.0
PM_D22	Incentives feed-in premium	240.6	240.6	0.0
PM_D23	Solar rooftop power plants	227.1	263.4	36.3
PM_D24	Solar thermal collectors	16.2	70.0	53.8
PM_D25	Biomass power plants (CHP optional)	24.3	24.3	0.0
PM_D26	Development of the biofuels market	/	/	/
PM_EE1	Energy efficiency obligation schemes	182.0	182.0	0.0
PM_EE2	Retrofitting of existing residential buildings	941.8	1708.2	766.4
PM_EE3	Retrofitting of existing central government buildings	55.0	170.0	115.0
PM_EE4	Retrofitting of existing local self-government buildings	50.0	150.0	100.0
PM_EE5	Retrofitting of existing commercial buildings	530.0	530.0	0.0
PM_EE6	Construction of new buildings	474.1	282.7	-191.4
PM_EE7	Construction of passive buildings	/	1068.0	1068.0
PM_EE8	Improvement of the street lighting in the municipalities	19.5	25.3	5.8
PM_EE9	Green procurements	16.0	24.0	8.0
PM_EE10	Labeling of electric appliances and equipment	71.0	71.0	0.0
PM_EE11	Increased use of heat pumps	235.0	474.4	239.4
PM_EE12	Public awareness campaigns and network of energy efficiency (EE) info centers	630.0	704.0	74.0
PM_EE13	Phasing out of incandescent lights	177.6	558.0	380.4
PM_EE14	Energy management in manufacturing industries	/	/	/
PM_EE15	Introduction of efficient electric motors	99.7	113.0	13.3
PM_EE16	Introduction of more advanced technologies	141.8	438.6	296.8
PM_EE17	Increased use of the railway	180.6	180.6	0.0
PM_EE18	Renewing of the national car fleet	1599.5	2167.7	568.2
PM_EE19	Renewing of other national road fleet	2300.0	2300.0	0.0
PM_EE20	Advanced mobility	/	/	/
PM_EE21	Construction of the railway to Republic of Bulgaria	720.0	720.0	0.0
PM_EE22	Electrification of the transport	1201.7	8292.3	7090.6
PM_EE23	Increased use of central heating systems	3.2	3.2	0.0
PM_EE24	Smart communities	/	/	/
PM_EE25	Reduction of network losses	170.0	170.0	0.0
PM_IEM1	Construction of 400 kV electricity transmission interconnection Macedonia-Albania (Bitola-Elbasan)	34.0	34.0	0.0
PM_IEM2	Develop natural gas cross-border infrastructure to diversify supply routes and increase market competitiveness	/	/	/
PM_IEM3	Develop gas transmission network	200.0	200.0	0.0
PM_IEM4	Develop a gas distribution network			
PM_IEM5	Pursue regional electricity market integration	/	/	/

PM_IEM6	Develop further distribution system network to integrate more RES, including prosumers and more electric vehicles (EVs), as well as continuously improve network reliability	/	/	/
PM_IEM7	Price signal demand response	/	/	/
PM_IEM8	Adoption of annual program for vulnerable consumers	/	/	/
PM_RIC1	Participation in development of energy transition technologies and measures	/	/	/
PM_RIC2	Increased level of education of sustainable energy needs	/	/	/
PM_RIC3	Inter-sectoral and geographical mobility of researchers	/	/	/
PM_RIC4	Increase the role of SME sector in energy transition	/	/	/
	Total	**13542.4**	**24715.5**	**11173.1**

II. sector or market risk factors or barriers in the national and regional context

One of the major factors that affect the realization, not only of WAM, but also of the WEM scenario is the non-construction of:

- Chebren and the other planned large hydropower plants that significantly improve the flexibility of the system and enable greater inclusion of variable RES in the system. Additionally, in conditions of reduced production or decommission of TPP Bitola, this measure is crucial for increasing the security of supply, and also contributes to increasing the RES share. The sensitivity analyses were done and they show that if Chebren and other hydro PP are not built, the construction of gas power plant should be considered. This will increase the flexibility of the system, but in comparison with hydro power plants option, it is not going to contribute as much to improving the overall RES share and to decreasing import dependence. Construction of new gas PP is conditioned on construction of new interconnection gas pipeline. The last, most unfavorable option is increase the import of electricity.
- natural gas pipeline to Greece, which enables energy sources diversification, increases the capacity for natural gas import, that enables increased use of this fuel by the industry, as a step in the transition towards low carbon industry.
- access to gas transmission network, especially to the industry entities

The implementation of the policies and measures usually involves more institutions. Therefore, of critical importance for the realization of the set targets and objectives is the higher level of cooperation between the instructions, as well as improvement of their capacities. This is also important for speeding up and facilitation of the processes and procedures for the investors.

Government policies should be aimed at meeting the set goal, but also to represent an example for private companies and investors. In addition, it is necessary to continuously monitor the provision of funds and, if there is a problem in certain sectors, the Government should intervene by finding additional sources of funds.

The realization of the scenario with additional measures leads to an increase in energy prices. In order to reduce the risk of energy poverty, it is necessary to constantly monitor the vulnerable categories and to adequately adjust the level of subsidies for this category of citizens.

III. analysis of additional public finance support or resources to fill identified gaps identified under point ii

For each of the proposed policies and measures, Chapter 3 provides information on possible source of funding as well as responsible entities for their implementation. Many of the funds are from private investors and therefore it is very important to create appropriate conditions for simpler, more smooth and timely investments. It is also necessary to increase awareness of the possibilities and ways of accessing European and other funds.

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

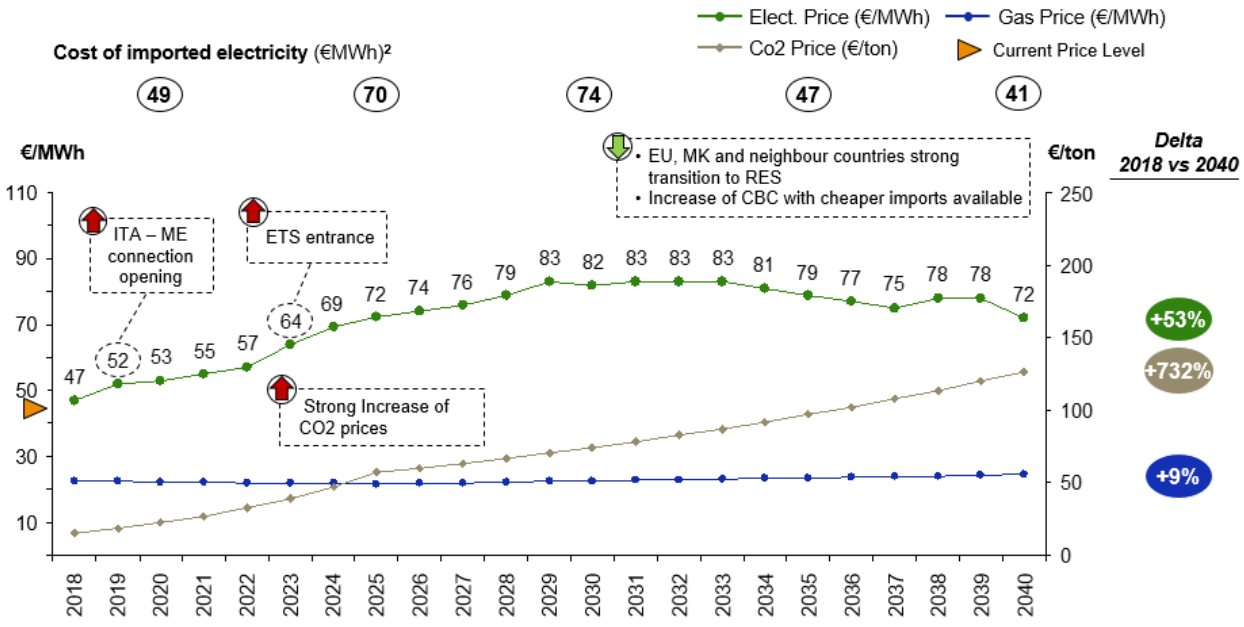
I. Impacts on the energy system in neighboring and other Member States in the region to the extent possible

Given the fact that Macedonia will continue to be an import-dependent country, its impact on the energy systems of neighboring countries is very small, especially in terms of defining energy prices. However, in terms of electricity transmission, Macedonia has a central role, due to its geographical location, because much of the electricity exchange takes place through the transmission system in Macedonia. Also, the increased investment in solar and wind power plants in Macedonia, can lead to a greater load on certain cross-border lines, in order to balance the system.

II. Impacts on energy prices, utilities and energy market integration

As previously mentioned, Macedonia has a very small impact on the energy prices at regional level. On the other hand, the development of energy markets in Europe, especially in the field of electricity, has been taken into account in the development of the Energy Strategy of Macedonia. Detailed analyzes have been made on the impacts of the development of the European energy system on the energy system in Macedonia. According to the Energy Strategy, in the WAM scenario, the price of electricity on the wholesale market, mainly as a result of the introduction of CO_2 tax in all countries in the region, will increase by about 30 €/MWh in 2030 compared to 2019 (Figure 102). The planned construction of the RES in Greece and Albania will significantly affect the flow of electricity in Macedonia, as well as the overall electricity market in the region. Namely, after 2030, the competition is expected to increase, so that the price will gradually decrease and will reach 72 €/MWh (10 €/MWh less compared to 2030).

Figure 102. Wholesale electricity prices



Source: Strategy for energy development up to 2040

III. Where relevant impacts on regional cooperation

The importance of regional cooperation is emphasized several times within this document and the most important is the cooperation with the following countries:

- Serbia and Montenegro, for SMM block
- Bulgaria, for electricity market coupling, possible access to gas hub in Bulgaria, railway construction
- Albania, construction of cross-border transition line Bitola-Elbasan, as well as potential gas pipeline
- Greece, Kosovo* and Serbia construction of natural gas pipelines

However, the cooperation within EnC is very important for harmonizing the policies and measures than can contribute towards reaching the EnC targets and objectives.

In addition, the cooperation with other countries is also important, especially with the EU countries, primarily to gain experience from their implemented policies and measures, but also in the field of Research and Innovations for development and implementation of new technologies.