REPUBLIC OF BULGARIA

Ministry of Energy

Ministry of Environment and Water

INTEGRATED PLAN

ENERGY AND CLIMATE

THE REPUBLIC OF BULGARIA

UPDATED 2024.

(Note: The integrated energy and climate plan – 2024 update, is subject to a mandatory environmental assessment and an assessment of the compatibility with the object and conservation objectives of Natura 2000 sites)

CONTENT

List of acronyms used:

NPP	Nuclear power station
SEDA	Sustainable Energy Development Agency
NRA	Nuclear Regulatory Agency
GDP	Gross domestic product
WAS	Balancing energy
BGH	Gas Hazzow Balkan
GETP	Bulgarian Energy Trading Platform
BNB	Bulgarian National Bank
BEB	Bulgarian independent power exchange
BFIEK	Bulgarian Federation of Industrial Energy Consumers
RFNBP	Renewable fuels of non-biological origin
RES	Renewable energy sources
HYDROPOWER	Hydroelectric power station
YOU	Renewables
Vic	Water and sanitation
Second plant	Wind power plant
LCP	Large combustion plants
GIS	Geographical Information System
CHG	Gas Distribution Centre
DV	Official Journal
MET	Supplier of last resort
EBRD	European Bank for Reconstruction and Development
EE	Energy efficiency
EU	Electricity system
EIB	European Investment Bank
EC	European Commission
EP	Power line
EVs	Electric vehicles
THE EU	European Union

ESO	Electricity system operator
ERDF	European Regional Development Fund
PLANT	Power plant
EDIC	European Digital Innovation Hub
OSH	Biological Diversity Act
HG	Forests Act
SE	Energy Act
ZEVI	Act on Energy from Renewable Sources
EEU	Energy Efficiency Act
ACT AMENDING THE ACT	Amending Act
ZOIC	The climate change mitigation Act
EPA	Law on protection of the environment
PPA	Public Procurement Act
LULUCF	Land use, land-use change and forestry
ZPZP	Support for Farmers Act
ZTPP	Mill thermal power plants
ZHAV	Clean Ambient Air Act
ICT	Information and communications technology
INECPS	Integrated National Energy-Climate Plan
IFSD	Industrial processes and use of solvents
ISIS	Innovation Strategy for Smart Specialisation
IT	Intelligent Transport Systems
AAQ	Air Quality
KEVR	Energy and Water Regulatory Commission
FEC	Final energy consumption
KETF	Cogeneration of heat and power (CHP)
CC	End Supplier
CCSP	Construction Product Contact Point
CF	Cohesion Fund
LOS	Volatile organic compounds
MBT	Mechanical and biological treatment

ME	Ministry of Energy
MEF	International Energy Forum
IPCC	Intergovernmental Panel on Climate Change
MOEW	Ministry of Environment and Water
MRDPW	Ministry of Regional Development and Public Works
SMES	Small and medium-sized enterprises
MLSP	Ministry of Labour and Social policy
MOF	Modernisation Fund
IFC	Kozloduy International Fund
MFF	Multiannual financial framework
NFA	National Decarbonisation Fund
NEK	National Electricity Company
R & D	Research & development
NMVOC	Non-methane volatile organic compounds
NEMOs	nominated electricity market operators
NPPO	National forestry accounting plan
NRRP	National Recovery and Resilience Plan
NREAP	National Renewable Energy Action Plan
NEBTP	National Forest Biomass Energy Action Plan
NEPEMEZ	National programme for energy efficiency in multi-apartment buildings
NMCD	National Climate Change Action Plan
NNKI	National roadmap for scientific infrastructure
NGOS	Non-governmental organisation
NMMA	National waste management plan
NSI	National Statistical Institute
NSRU	National Social Climate Plan
NCCS	National Agricultural Advisory Service
EIA	Environmental Impact Assessment
UN	United Nations
OPIC	Operational programme 'Innovation and competitiveness'
OPINION	Operational Programme Science and Education for Smart Growth

TSO Transmission System Operators

ODR Open distribution system

GSP Common agricultural policy

BSEC Organisation of Black Sea Economic Cooperation

P/st Substation

PUMPED Pumped storage hydropower plant

NG Greenhouse gas

UGS Underground gas storage

TAX RULINGS Reference mass

PEP Primary energy consumption

ITP Economic Transformation Programme

KIP Competitiveness and Innovation in Enterprises Programme

PCI Projects of common interest

RDP Regional Development Programme 2021-2027

Implementation of the Human Resources Development Programme

CP Industrial system

PTS Transport Connectivity Programme 2021-2027

PMB The clean air package

PMBE A clean air programme for Europe

PRINDIT PRoom "Research, Innovation and Digitalisation for Smart Transformation"

IDR Floor area

ROUKAV Area for ambient air quality assessment and management

SMR Structure for Monitoring and Reporting

SDPSG Strategic plan for the development of the forest sector

ARE Emission trading scheme

TAR Trans-Adriatic Pipeline

MSW Municipal solid waste

TPP Thermal/thermal power plant

TSP Territorial Just Transition Plan

TFPP District heating power plant

FPP Photovoltaic power plant

PHI	Financial instruments
PM	Fine particulate matter
JTF	Just Transition Fund
CCPs Competence Centres	
CP	Policy objective
PPC	Centre of Excellence
DDA	Centralised market for bilateral contracts
CCPs Competence Centres	
CESEC High Level Group on Central and South-Eastern Europe Gas Interconnection	
IBSBulgaria-Serbia gas interconnector	
IGB	Greece-Bulgaria gas interconnector
Irena International Renewable Energy Agency	
ITO	Independent transmission operator
LNG	Liquefied natural gas
NTC	Net transfer capacity
RBP	Regional capacity booking platform
RDF Modified waste derived fuels	
Set plan	European Strategic Energy Strategy Plan
It FOR 55 Fit for 55	
CAFE Directive 2008/50/EC on ambient air quality and cleaner air for Europe	

PART 1

GENERAL FRAMEWORK

SECTION A: NATIONAL PLAN

1. REVIEW AND PROCESS OF DEFINING THE PLAN

1.1. Summary

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

The European Union has made climate change a central element of its external policy, with the reduction of carbon emissions as its long-term goal. European Union (EU) countries are working together with global partners to strengthen international climate engagement and advance international efforts and initiatives.

The Union plays a central role with regard to international agreements on climate policy. In its bilateral relations with non-EU countries, the EU shares its expertise and encourages partners to take bold action against global warming, providing targeted support, where necessary, to those most affected, to assist the transformation of their economies.

As a Member State of the European Union, Bulgaria shares the common value of developing a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050.

The formulation of clear climate targets allows them to be translated into legislation and to contribute to the modernisation of homes and lower energy bills, greener and more efficient transport for current and future generations.

For more effective implementation of climate policies and better predictability for business, decarbonisation is linked to sectoral policies with a focus on energy, industry, transport, buildings, agriculture and land use.

The EU's 2030 target is to reduce greenhouse gas emissions by 55 % and reach 0 % net greenhouse gas emissions in 2050. To achieve it, the European Union is updating its legislation.

The legislative package, known as 'Fit for 55', includes regulations on emissions trading, national emission reduction targets in some sectors, land use change, emissions in transport and other areas. It includes legislative proposals and amendments to existing EU legislation that will contribute to reducing the Union's net greenhouse gas emissions and decarbonising the economy towards climate neutrality in a fair, cost-effective and competitive manner.

This package also includes Regulation (EU) 2023/1804 of the European Parliament and of the Council of 13 September 2023 on the deployment of alternative fuels infrastructure, and repealing Directive 2014/94/EU, which sets mandatory national targets leading to the

deployment in the EU of sufficient alternative fuels infrastructure for road vehicles, trains, vessels and stationary aircraft. It lays down common technical specifications and requirements on user information, data provision and payment requirements for alternative fuels infrastructure.

To fulfil this commitment, the EU set the following binding targets by 2030:

- Reducing the EU's net greenhouse gas (GHG) emissions by at least 55 % compared to 1990 by 2030;
- Reducing the EU's greenhouse gas emissions by 40 % by 2030 compared to the 2005 level in sectors not covered by the EU ETS;
- A reduction in EU energy consumption of at least 11.7 % in 2030 compared to the projections of the 2020 EU Reference Scenario so that the Union's final energy consumption does not exceed 763 Mtoe. Achieving at least a 42.5 % share of energy from renewable sources in the EU's gross final consumption of energy by 2030, aiming to reach 45 % in 2030;
- Achieve a level of at least 15 % of interconnectivity between the electricity systems of Member States.

In accordance with Article 14 of Regulation (EU) 2018/1999, the Republic of Bulgaria undertakes to submit to the European Commission (EC) a draft updated Integrated National Energy and Climate Plan (INECP), which should be approved by the Commission services.

Fulfilling the Energy Union's commitment to climate neutrality in line with the Paris Agreement and achieving the 2030 energy and climate targets requires the contribution of each MS. Therefore, the integrated national energy and climate plans mandated by the Governance Regulation serve as strategic planning, focusing on the period 2021-2030, while taking into account longer-term perspectives. Member States, having initially submitted their 2021-2030 national plans in 2019-2 020 and a draft updated plan in 2023, have the task of submitting a finalised plan, taking due account of the evolving geopolitical dynamics and EU policies marked by increased ambition. The forecast horizon in the updated plan is set until 2050, with a particular focus on 2030.

In accordance with a contractual agreement between the Bulgarian Ministry of Energy and E3-Modelling S.A. to update the projected scenarios for the development of the national energy system for the purposes of the Bulgarian INECPs, the company developed two scenarios – WEM (with existing policies and measures) and WAM (with additional policies and measures). For the purposes of the updated INECP of the Republic of Bulgaria, a comprehensive overview of the scenarios developed in the framework of the project has been prepared and presented in order to meet the requirements.

The WEM scenario reflects the continuation of the current trends of Bulgaria's energy system based on a pre-defined macroeconomic outlook until 2050, incorporates policies and strategic objectives for energy efficiency and RES.

The WAM scenario has a long-term vision that is in line with the EU's climate target – net zero greenhouse gas emissions by 2050. It looks at existing but expanded policies and additional policies and projects (Recovery and Resilience Plan, Roadmap to Climate Neutrality, etc.), as well as new EU legislation and REPowerEU measures (defined after 2022).

The draft updated INECPs reflect the higher targets set by the European Green Deal and the European Climate Law, the Fit for 55 package, the REPowerEU Plan, as well as the latest European Semester report for Bulgaria.

The updated INECP defines ambitious objectives and measures related to:

- The transformation process of the national energy mix;
- Decarbonisation with sustainable and sufficient emission reductions in the energy sector thanks to new low-carbon technologies and a smooth transition to low-carbon sources;
- Adoption of a national climate neutrality target by 2050

Achieving the targets will reinforce Bulgaria's commitments to implement the Paris Climate Agreement and the European Green Deal. The implementation of the ambitious objectives through a set of measures and activities is fully in line with existing European legislation. Bulgaria has launched a legislative initiative to change the national legal framework to help achieve the objectives set out in the INECPs.

Achieving climate neutrality of Bulgarian energy by 2050 is a key objective that requires a profound transformation of the national energy balance towards low greenhouse gas emission sources. The high energy intensity of the economy is due to the specific profile of major industries in Bulgaria and measures should be targeted to support their competitiveness. Slow progress towards the energy efficiency targets of the building sector requires focused policies and measures.

Bulgaria remains one of the energy-intensive economies in the EU. According to Eurostat, in 2022 Bulgaria's energy intensity was 394.95 kgoe/1000Eur, compared to 107.42 kgoe/EUR 1000 for the EU (https://ec.europa.eu/eurostat/databrowser/view/nrg_ind_ei/default/table?lang=en). The high energy intensity of the economy and slow progress towards energy efficiency targets have a negative impact on its productivity and competitiveness.

There is scope for significant energy savings through targeted investments in certain industrial applications, the transport and housing sectors, and for increased investment in low-emission energy production infrastructure. Hydrogen and renewable electricity and improving energy efficiency are key elements of the final objective of the European Union, which is also being pursued intensively in Bulgaria, which will help build a climate neutral energy system.

Our country recognises as a priority the need to introduce simplifications in planning, conducting administrative procedures, connecting to relevant networks and operating

energy facilities for the production of energy from renewable sources and related infrastructure. Such projects will be considered as having a high public interest, except where there is clear evidence that a specific project will have significant adverse effects on the environment that cannot be mitigated or compensated, or in other specific circumstances.

The energy sector is a structurally defining sector and underpins its future development by the efficient use of conventional and alternative energy resources, the development of the energy market and smart systems, the direct involvement of citizens and society in the energy transition, and the active participation of consumers in the electricity market. The main challenge in the upcoming energy transformation is the successful implementation of reforms in carbon-intensive regions. The transition of these areas requires complex horizontal measures, a high level of investment and not least an active social policy. The sustainable shift towards low carbon energy will be phased in by smoothly replacing fossil fuels with new low-emission technologies in a way that does not compromise systemic adequacy.

The main objectives set out in the INECPs are:

- Stimulating low carbon development of the economy;
- Developing competitive and secure energy;
- Increasing energy efficiency and reducing carbon emissions, including by exploiting the full potential of natural gas as an energy source and transitional fuel;
- Reducing dependence on imported fuels and energy;
- Ensuring affordable energy for all consumers.

National energy and climate priorities can be summarised as follows:

Energy:

- Increasing energy security and diversifying the supply of energy resources;
- Developing an integrated and competitive energy market;
- Exploiting the potential for fuel switching from solid fuels to other environmental sources to reduce carbon emissions and increase energy efficiency;
- Speeding up the process of introducing renewable energy production and consumption;
- Promoting self-consumption of renewable energy, the development of renewable energy communities and related energy infrastructure for the transmission, distribution and storage of renewable energy;
- Network development;
- Increasing energy efficiency by developing and applying new technologies to achieve modern and sustainable energy;

- Protecting consumers by ensuring fair, transparent and non-discriminatory conditions for the use of energy services.

Climate:

- Achieving climate neutrality by 2050;
- Under Regulation (EU) 2023/857 (the Effort Sharing Regulation), the Republic of Bulgaria must limit its greenhouse gas emissions for non-emissions trading sectors by 10 % compared to its 2005 emissions;
- Bulgaria must ensure that the sum of greenhouse gas emissions and removals in the LULUCF sector achieved in 2030 does not exceed removals, after applying the flexibility provided for in the Regulation, the target is of – 9 718 kton CO_2 eq.

The following Country Strategy Papers (and draft documents under alignment) have been used to prepare the updated Integrated Energy and Climate Plan:

- Draft Sustainable Energy Development Strategy 2030, with a 2050 horizon;
- Roadmap for climate neutrality of the Republic of Bulgaria;
- A national strategy for the development of the mining industry up to 2030;
- A strategy for Bulgaria's participation in the Fourth Industrial Revolution;
- A long-term national strategy to support the renovation of the national stock of residential and non-residential buildings with an implementation horizon of 2050;
- The long-term strategy for climate change mitigation by 2050 of the Republic of Bulgaria;
- Innovation strategy for smart specialisation;
- National programme for energy efficiency in multi-apartment buildings;
- A national policy framework for the development of the market for alternative fuels in the transport sector and for the deployment of the relevant infrastructure;
- An integrated transport strategy for the period up to 2030;
- National Plan for the Development of Combined Transport of the Republic of Bulgaria by 2030;
- National Forest Biomass Energy Action Plan 2018-2027;
- National Strategy for Adaptation to Climate Change of the Republic of Bulgaria and Action Plan;
- National Strategy for the Development of Research in the Republic of Bulgaria 2017-2030;
- Bulgaria's electricity transmission network development plan for the period 2023-2032;

- The ten-year network development plan for Bulgartransgaz EAD for the period 2023-2032;
- A national roadmap to improve the conditions for unlocking the development potential of hydrogen technologies and hydrogen production and supply mechanisms.

The updated INECP has been developed on the basis of the following key assumptions and strategic objectives:

- Macroeconomic growth and sectoral added value, projecting the corresponding growth in energy demand and supply;
- An aggregation of energy efficiency measures to achieve a decreasing energy intensity curve of the economy;
- An integrated approach to energy modelling and economic development, based on historical data and forecasts, aimed at reflecting the most realistic possible development of the country's economy and society while ensuring environmental protection;
- The integration of applicable EU environmental policies and constraints in the modelling and planning of energy production;
- Development of the energy sector, in particular the electricity sector, with a focus on national and regional energy security;
- Integration of the internal market, development of interconnection with the electricity systems of Bulgaria's neighbouring countries and balancing of the energy mix by providing different national and imported energy sources;
- Achieving and maintaining a sustainable level of external dependence on imports of energy resources below the EU average;
- Continue the liberalisation of energy markets with a commitment to manage possible social risks and negative impacts on vulnerable social groups;
- Sustainable development of renewable electricity production on market bases;
- Setting energy efficiency targets in line with the EC agenda and recommendations;
- Inclusion of new nuclear power generation in the national energy mix after 2030;
- Developing hydrogen energy and promoting investment in hydrogen infrastructure.

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

Bulgaria's strategic energy and climate objectives and priorities cover the five dimensions of the Energy Union – *decarbonisation, energy efficiency, energy security, internal energy market and research, innovation and competitiveness*.

In order to meet the objectives, comprehensive and coordinated action shall be carried out in all economic areas, with efforts aimed at developing and promoting the use of low-

emission energy sources as well as the deployment of new and innovative energy generation technologies.

DECARBONISATION

Under the decarbonisation dimension, Bulgaria encourages and supports reductions in greenhouse gas emissions and an increase in the share of energy from renewable sources (RES) in gross final energy consumption.

The national target for the share of renewable energy in gross final energy consumption by 2030 is 34.96 %.

The electricity sector has a 49.34 % share of renewable energy in gross final consumption of electricity. This share is projected to be achieved by increasing electricity consumption from newly built capacities using renewable energy (mainly wind and solar) by up to 7 160 MW for the period after 2022.

In order to achieve the objective in the electricity sector, it is important to encourage investment in the development of the country's electricity transmission and distribution networks, which will enable the technical connection and integration of the electricity produced from renewable sources, while respecting the security criteria of the electricity system. The envisaged roll-out of energy storage systems will allow for the rapid deployment of new renewable capacity using intermittent production and addresses the problems of grid congestion, balancing and market distortion.

Also, if necessary to achieve the targets set after 2025, it is possible to auction additional renewable energy capacity taking into account market conditions.

Heating and cooling is key to accelerating the decarbonisation of the energy system. The future development of district heating in the country will take into account the need to change the fuel base, increase high-efficiency cogeneration capacity and improve energy efficiency, as well as the use of renewable energy. The heating and cooling sector has been attributed a 44.01 % share of renewable energy in gross final consumption of heating and cooling in 2030.

The long-term use of biomass is projected to continue and consumption will be in line with sustainability and greenhouse gas saving criteria. In the coming years, the uptake of environmental and geothermal energy is expected to be accelerated through the deployment of heat pumps, thus increasing the utilisation of still underused renewable energy in the country and improving efficiency in final energy consumption.

The envisaged changes in the transport sector concern the promotion of the introduction and use of electric and hybrid vehicles in road transport and the creation of lockdowns in cities. The use of biofuels will continue in the coming years, gradually increasing the share of advanced biofuels used. These measures will contribute to a significant reduction of

greenhouse gas emissions in Bulgaria. The transport sector was attributed a 29.93 % share of renewable energy in final energy consumption in transport in 2030.

At the same time, green hydrogen produced using electricity from renewable sources (wind and solar) is consumed as an innovation.

ENERGY EFFICIENCY

The priority of the Republic of Bulgaria is to make the 'energy efficiency first' principle, which means the implementation of the most efficient energy solution in all economic sectors.

Under the energy efficiency dimension, Bulgaria's efforts are aimed at achieving energy savings in final energy consumption by improving the energy performance of buildings and promoting the implementation of energy efficiency measures in energy generation, transmission and distribution.

Energy efficiency plays an important role in improving the country's energy security by reducing dependence on energy imports, reducing energy costs for businesses and households, creating more jobs, also contributing to improving air quality and reducing greenhouse gas emissions and improving citizens' quality of life.

In this respect, national targets have been set to achieve a 11.6 % reduction in primary energy consumption and a 10.7 % reduction in final energy consumption by 2030 compared to the Reference Scenario 2020.

Bulgaria puts emphasis on alternative policies and measures to promote energy efficiency. As such, financial incentives for the implementation of energy efficiency projects, performance contracts (EPC contracts) and renovation of the existing building stock with a view to increasing the number of nearly zero-energy buildings may be mentioned.

ENERGY SECURITY

The Republic of Bulgaria's main priority for ensuring energy security is the diversification of natural gas supply sources and routes, the enhancement of capacities of UGS Chiren and interconnection points, participation in projects for new LNG terminals in the region, efficient use of local energy resources and development of energy infrastructure.

The Republic of Bulgaria encourages the exploration of oil and natural gas in the Black Sea that has begun and, by decision of the National Assembly, instructed the Minister for Energy to negotiate the terms and conditions under which Bulgarian Energy Holding EAD would acquire up to 20 % of the consortium holding the contract for the prospection and exploration of oil and natural gas in Block 1-21 Han Asparuh area.

The gas transmission infrastructure in the Republic of Bulgaria is well developed, but in synergy with the objectives of increasing energy security, diversification of natural gas supply sources and routes, as well as in response to the growing demand for natural gas from alternative sources in the country and region, there is a need for further extension to ensure increasing flows from south to north.

Efforts shall also focus on developing, digitalising networks and providing flexibility to the electricity system, including further development of the 400 kV and 110 kV grid.

INTERNAL ENERGY MARKET

Under the internal energy market dimension, Bulgaria is developing a competitive market by taking action to fully liberalise the market and integrate it into the regional and pan-European market. A key element of the full liberalisation process is the protection of energy poor and vulnerable customers. In line with the Commission's recommendation to develop competitive wholesale and retail markets, Bulgaria is phasing out regulated electricity prices, with this process expected to be completed by the end of 2025. Other policies and measures aimed at developing the internal energy market are demand response in line with the objectives of the Energy Union, stimulating the creation of energy communities for renewable energy production and consumption and stimulating a more active role for consumers.

RESEARCH, INNOVATION AND COMPETITIVENESS

Regarding the research, innovation and competitiveness dimension, Bulgaria is committed to promoting scientific progress in innovative energy technologies, including for the production of clean energy. It is envisaged that projects will be developed to promote business innovation and digitalisation. Bulgaria plans to participate in multiple programmes in this area.

iii. General table of the plan's key objectives, policies and measures

Bulgaria's contribution to the European Union's 2030 targets is presented in the table below, which has been revised in line with the recommendations of the European Commission:

Table 1: *Bulgaria's targets by 2030*

Overview of the 2030 targets	
Renewable energy sources	
National target for share of energy from renewable sources in gross final consumption of energy by 2030	34.96 %
IT IS1	49.34 %

[1] Share of electricity from renewable sources in gross final consumption of electricity

VI-TE and EC2	44.01 %
Your – Transport3	29.93 %
Energy efficiency	
Reduction of primary energy consumption relative to Reference Scenario 2020	15.42 %
Reduction of final energy consumption compared to Reference Scenario 2020	11.61 %
Primary energy consumption 4 "D	13 190 ktoe
Final energy consumption	8 819 ktoe
Emission of greenhouse gases	
A national 2030 GHG emission reduction target compared to 2005 for the non-ETS sectors (buildings, agriculture, waste and transport) pursuant to Regulation (EU) 2023/857 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030	10 %
National target in the land use, land use change and forestry sector pursuant to Regulation (EU) 2023/839	for the periods from 2021 to 2025, GHG emissions do not exceed removals, calculated as the sum of total emissions and total removals on its territory in all land accounting categories combined, and a national annual net removals target in the period from 2026 to 2030 of – 9 718 kton CO_2eq.
Electricity interconnection level	15 %

1.2. Overview of current policy situation

i. The energy system at national and Union level and the policy context of the national plan

The Republic of Bulgaria shall pursue a transparent energy policy in order to protect the State and the public interest. The country's energy policy shall aim at promoting market principles in the energy sector, ensuring energy independence, sustainable energy development in the country, efficient use of energy and energy resources, meeting society's needs for electricity, heating and cooling, natural gas and fuels, and shall aim at:

- Maintaining a secure, stable and reliable energy system;
- Diversification of natural gas supply sources and routes;
- Expansion of gas transmission infrastructure and increase of natural gas transmission and storage capacity;

[2] Share of heating and cooling from renewable sources in gross final consumption of heating and cooling

[3] Share of renewable energy in final energy consumption in the transport sector

- Establishing a fully-fledged, integrated and liberalised market for natural gas;
- Creating conditions for improving access to LNG;
- Decarbonising the electricity sector through fuel switching with less carbon-intensive fuels;
- Sustainable use of indigenous energy resources;
- Modernisation and expansion of energy infrastructure, including electricity transmission and distribution networks;
- Construction of hydrogen transmission infrastructure;
- The development of nuclear energy in accordance with the current requirements of reliability, safety and economy;
- Improving energy efficiency and increasing the use of renewable energy in gross final energy consumption;
- Active participation of the country in the construction of a single and stable European energy market;
- The development of a competitive energy market and a policy aimed at securing energy needs and protecting the interests of consumers;
- Ensuring equal access to the network for each user under clear and non-discriminatory rules;
- Achieving a balance of quantity, quality and price of energy for final consumers.

The main objectives of the European Union's energy policy, namely security of supply, competitiveness and sustainability, were taken into account in the implementation of the country's energy policy, taking into account the five interrelated dimensions of the European Energy Union: energy security, solidarity and trust; a fully integrated European energy market; energy efficiency; contributing to curtailment of consumption; decarbonisation of the economy; and research, innovation and competitiveness.

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

1) **Decarbonisation**

The sectoral policies and measures presented in the INECPs are formulated in a way that is consistent with the plan's main objective of reducing GHG in Bulgaria and implementing existing European climate change legislation. Priority axes for the development of the sector concerned and the corresponding measures to each priority axis have been identified.

The measures are grouped into two strands: those with measurable GHG reduction effects and indirect measures that also achieve emission reductions but are more difficult to measure. For each measure, instruments are proposed which are necessary for its

implementation. These can be legislative amendments, the implementation of laws and regulations, programmes, plans, schemes, etc., as well as the introduction of incentive mechanisms, information campaigns, training, etc. For each measure, the target groups, the institutions responsible for reporting on its implementation, the launch and the timeframe for implementation, as well as the necessary financial resources and funding sources, are identified.

The largest share of total GHG emissions in the country is the energy sector, which also determines its primary importance for meeting national reduction targets. Electricity and heat production from coal contributes to more than 90 % of the GHG emitted in the sector, where the main reduction potential is also concentrated.

Bulgaria is currently pursuing a targeted policy for the development of the renewable energy sector. Over the years, various support schemes have been put in place to ensure that the production and consumption of renewable energy will develop so as to significantly contribute to security and diversity of energy supply, competitiveness, environmental and climate protection, regional development and the use of new technologies.

A set of regulatory, administrative and financial measures have been put in place to promote the production and consumption of renewable energy.

The Renewable Energy Act (ZEVI) is the main legal act governing public relations in the field of renewable energy. This law and its secondary legislation transposes the requirements of Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (Directive (EU) 2018/2001).

The Renewable Energy Act introduces measures aimed at promoting the production and consumption of electricity, heating and cooling from renewable sources, biogas and green hydrogen, energy from renewable sources in transport, with the aim of creating the conditions for sustainable and competitive energy policy and economic growth through innovation, the deployment of new products and technologies and raising the living standards of the population through the cost-effective use of renewable energy.

Clear deadlines have been introduced with regard to the connection of energy facilities for the production of electricity from renewable sources and measures to speed up connection procedures for the modernisation of facilities for the production of electricity from renewable sources.

It also creates the conditions for the development of self-consumers and renewable energy communities, thereby increasing interest and activating the participation of local populations to produce and consume clean energy. This is expected to lead to increased investment activity, a positive uptake of renewable energy, greater consumer choice and greater involvement of citizens in the energy transition.

It is envisaged to develop a Plan for the identification of priority areas for the development of wind power plants. In priority areas, administrative procedures for the construction,

reconstruction and commissioning of energy facilities will take place within a shorter timeframe.

To facilitate the investment process, specific administrative service centres have been set up for each municipality to provide instructions and information and organise the procedures relating to the implementation of investment intentions for the production of energy from renewable sources, including the reconstruction and modernisation of existing energy facilities and facilities for the production of energy from renewable sources.

Creating a supportive legislative, regulatory and financial environment for the expansion, modernisation and digitalisation of the electricity distribution network is key to anticipating investments in this direction with a view to rapidly connecting RES and unlocking the various flexibilities provided by final consumers.

Taking into account the principle that biofuels, bioliquids, solid and gaseous biomass fuels should be produced in a sustainable manner, the Renewable Energy Act requires that these fuels must comply with sustainability and greenhouse gas saving criteria when included to account for the national target for the share of energy from renewable sources in gross final energy consumption, as well as sectoral targets. Compliance with these criteria is a mandatory requirement when implementing support schemes.

The heating and cooling sector is also crucial to accelerate decarbonisation. The potential to decarbonise district heating is by increasing energy efficiency and the use of energy from renewable sources. Taking this into account, the ZEVI provides for an increase in the share of renewable energy in the heating and cooling sector for the periods 2021-2025 and 2026-2030 to increase by an annual average of 1.3 percentage points over the relevant period, calculated on the basis of the renewable energy share in this sector achieved in 2020. This increase should be ensured by increasing the share of energy from renewable sources and from waste heat and cold in district heating and cooling by at least one percentage point on average per year. In this regard, it shall be possible for the heat transmission company to develop a plan for the development of the district heating or cooling system and its conversion into an efficient district heating or cooling system.

A particularly significant sector with extremely high abatement potential is the Waste sector. The sector is one of the main sources of GHG in three main directions – emissions from landfilling, waste water treatment and waste incineration. Measures are mainly concentrated in the waste disposal sub-sector, which accounts for the largest share of emission levels. Many of the measures envisaged in this sector can be achieved by implementing existing legislation, which makes them highly effective. The importance of taking measures in the transport sector is dictated by the fact that it is one of the largest emitters of GHG, with steady growth, but largely ignored until recently in terms of its impact on climate change.

Over the past decades, air transport, as one of the best performing and most dynamic sectors, has played a vital role in the EU economy and in the daily lives of citizens. It is a powerful driver for economic growth, employment, trade and tourism, as well as connectivity and mobility of both businesses and citizens, and the fastest way to connect

remote areas nationally and internationally. The functioning of the air transport sector in the Union is determined by its cross-border nature across the EU and by its global dimension. The aviation market is one of the most integrated sectors in the internal market, governed by uniform rules on market access and operating conditions. The air transport market is subject to strong competition between economic operators globally and across the Union, therefore a level playing field is indispensable. The stability and prosperity of the air transport market and its economic actors relies on a clear and harmonised policy framework where aircraft operators, airports and other aviation actors can operate on the basis of equal rules and opportunities, leading to a vibrant sector and to job opportunities. In particular, it is important to ensure a level playing field across the Union air transport market as regards aviation fuel, which accounts for a significant part of the costs of aircraft operators, while incentivising the decarbonisation of air transport by promoting sustainable aviation fuels (SAF).

In this regard, the main measures in the transport sector are geared towards an optimal balance in exploiting the potential of the different modes of transport and are divided into four priority axes:

- Reducing transport emissions;
- Reducing fuel consumption;
- Diversification of shipments;
- Consumer information and training.

2) **Energy efficiency**

Energy efficiency policy is a very essential element of national and European energy and climate change policies. The process of moving towards low-emission energy requires increasing energy efficiency, increasing the use of renewable energy in gross final energy consumption, improving energy management, developing energy infrastructure and the completion of the internal market, as well as developing different concepts and deploying new technologies and services. In line with the EU's priorities, energy efficiency is the first energy policy priority and is central to the achievement of the 2020-2030 targets.

The legislation on energy efficiency has been aligned with European legislation, the main document ensuring the implementation of the energy efficiency policy is the Energy Efficiency Act (EEOS).

The main priorities and objectives of Bulgaria's energy efficiency policy are as follows:

- Achieving cumulative end-use energy savings for the period 2021-2030 equivalent to new annual savings of at least 0.8 % of final energy consumption;
- Take measures to improve the energy performance of at least 5 % of the total floor area of all heated and/or cooled state-owned buildings used by the public administration;
- Increasing the number of nearly zero-energy buildings;
- Ensuring secure and affordable energy for all;

- Minimising the undesirable effects of energy use on human health and the environment;
- Raising the standard of living of the population;
- Increasing the competitiveness of the Bulgarian economy.

The envisaged policies and measures ensure a correlation between existing and planned policies and measures within the decarbonisation dimension as well as between existing and planned policies and measures under the other dimensions of the Energy Union up to 2030. Due to the specificity and interdependence of the effects and expected results, the measures and policies in the field of renewable energy are integrated together with those of the Energy Efficiency dimension. Efforts have been made to achieve coordination of national climate and energy policies, also using opportunities for regional cooperation with other Member States, so as to attract the necessary investments to implement them.

Policies and measures build on the scope and substance of the current ones, with a view to a wider deployment and better integration of renewable energy, achieving the core benchmarks of affordable, safe, competitive, secure and sustainable energy.

3) **Energy security**

➢ *Security in the electricity sector*

The security policy for the country's electricity sector can be summarised in two priority axes:

- Efficient use of indigenous energy resources;
- Increasing interconnection.

Bulgaria makes full use of the existing potential of indigenous coal while respecting environmental requirements to maintain the adequacy of the EU and ensure security of supply.

The conclusions of the Special European Council of 30 and 31 May 2022 noted the importance of indigenous energy sources for security of supply within a short-term priority to further diversify supply sources and routes and secure energy supply at affordable prices.

The EU Council Conclusions on the European Court of Auditors' Special Report No 22/2022 on "EU support to coal regions: limited focus on socio-economic and energy transition", approved on 14 February 2023, share the EC's view on the findings and recommendations of the Court's report, and in particular that following Russia's invasion of Ukraine in February 2022, it is assumed in the short term that countries may need to increase the use of coal before switching to renewable energy sources, provided that the 2030 climate and energy targets are respected.

Bulgaria relies on lignite-fired power generation in the energy transition period before it is phased out by the end of 2 038.

In connection with Article 4 (4) (1) of the Oil Stocks Act, information is provided by the ME on the stocks of petroleum products by the types and quantities created and maintained by energy companies in accordance with Article 85 (1) and Article 128 of the Energy Act.

In accordance with Article 10 of Regulation (EU) 2019/941 of the European Parliament and of the Council of 5 June 2 019 on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC, a 'National Action Plan for addressing risks in the electricity sector of the Republic of Bulgaria' has been developed. The electricity risk preparedness plan shall set out the procedures to be followed by actors in the electricity sector during crisis situations in order to minimise disruptions caused to customers.

Bulgaria's electricity transmission network comprises electricity lines with a total length of 15 964.93 km, including 400 kV – 3 031.73 km, 220 kV – 2 710.9 km, 110 kV – 10 177.17 km and 60 kV – 11.84 km and cables 400 kV – 0.3 km, 220 kV – 3.24 km and 110 kV – 29.75 km. The network also includes 299 electrical substations, including substations 400/220/110 kV – 8, 400/220/31.5 kV – 1, node station 400/20 kV – 1, substations 400/220/110/31.5/20/10 kV – 4, 400/220/110/31.5/20 kV – 1, 400/220/20/10 kV – 1, 400/110/31.5/20 kV – 3, 400/110/38.5/10 – 5, 400/110/31.1 kV – 5, 400/110/20.2 kV – 1; 220/110/20/10 kV – 9, 220/110/20 kV – 4, 220/110/10 kV – 1, 220/110/38 kV – 5, 220/110 kV – 1, 110/20/10 kV – 1, 110/20/6 kV – 22, 110/10 kV – 16, 110/20 kV – 9, 110/6 kV – 209, 20/110 kV – 1, 110/6/6 kV – 100, nodes 7 kV – 20 stations, 1 kV – 1, node station 1 kV – 1, 110/35/10 kV – 110, kV –, kV –, and OSP TPP 'Republic' kV.

Bulgaria's electricity distribution network comprises 68 204 km in total length of 49 921 km, including 18 283 km of overhead lines, 46 256 km of cable lines and km of transformer stations.

To date, four licensed electricity distribution system operators (ERNs) are active on the territory of Bulgaria: Zapad EAD, Elektrorazpredelenie Yug EAD, Elektrorazpredelenie North AD and Elektrorazpredelenie Zlatni Pyakartsi AD. These companies are electricity distribution system operators and asset owners in the respective areas of the country. They manage the electricity distribution network in Bulgaria and work closely with the system operator on the aspects of the ongoing operation, the exchange of information and the system protection plan.

An energy mix of generating sources is currently available in the EU in the country, in which security and sustainability are only ensured by conventional power plants with systemically important synchronous generators. The power units of TPP Maritsa Iztok 2 EAD, TPP AES-ZS Maritsa Iztok 1 EOOD, TPP Contur Global Maritsa Iztok 3 AD, TPP Varna EAD and TPP Bobov Dol EAD have a total installed gross base capacity of 3 848 MW, and 2 686 MW are regulated per day and are used as base or sub-peak generation capacity, as well as the following particularly important and mandatory tasks performed by the generation capacity of an integrated electricity system:

— Participation in Primary Frequency Regulation of Continental Europe;

— Participation in the secondary regulation of frequency and exchange capacity of Bulgarian EES;

— Maintain tension levels in the main nodes of the EU;

— Keeping the stock sustainable of the EU;

— Maintaining the country's common inertia stock;

— Participation in the EU's defence and recovery plan.

A sustainable shift to low-carbon energy requires a phase-in and a smooth replacement of coal plants with new low-emission technologies so that systemic adequacy is not compromised. These processes should be carried out by maintaining operational capacity in thermal power plants and coal-mining areas for a sufficient period of time and at the same time speeding up the decline in mining activities.

The Maritsa East complex is one of the most affected by the transition in terms of its structural role in power generation and the economy of the regions of Stara Zagora, Haskovo, Sliven and Yambol. In this regard, the most important tasks to be addressed during the energy transition in these regions are:

- Timely investments to develop energy infrastructure and the effect on security of supply;
- Exploiting the potential for economic diversification and corresponding development opportunities;
- Creating quality new jobs and providing upskilling opportunities;
- Implementation of projects for the development of competitive industries with high added value in the field of clean technologies;
- Support to investors, including non-financial ones, to deploy innovations in different energy domains.

In addition to the above-mentioned importance of the Maritsa East complex, important advantages such as:

- The large consolidated area of land;
- Highly developed electricity transmission and distribution networks – 6/20/110/220/400 kV;
- The high technical skills of the workforce;
- Highly developed and diverse transport infrastructure;
- A high level of readiness for investments in energy infrastructure, including from current investors in that region;
- The extremely valuable strategic location and others.

These assets must help the region become a carbon-neutral industrial hub, both in terms of net-zero processes and future carbon neutrality industries.

The process of reducing mining activities is linked to the new mining management plan and the implementation of related activities, such as:

- Reducing the angles of workboard and backyard boards by about 0.50 to 1.00 degrees in order to ensure so-called "long term sustainability";
- Calculation of a new bulk capacity balance and the related expropriation of new areas for external heaps once they have been upgraded;
- Swabling of exposed coal layers with a minimum of 5 m of suitable clay material with the required seal characteristics to neutralise the influence of sulphur contained in lignite;
- Backfilling of the 'Troyanov-1', 'Troyanov-North' and 'Troyanovo – 3' mines to ensure long term sustainability;
- Pouring the areas on the first discoveries and the corresponding loose horizons of the three mines with a free-sipan embankment in order to neutralise the influence of the sulphur contained in the lignite strata in the black clays of which they are built.

Backfilling will affect the areas of the first detection and bulk horizons, as well as swabs at least around 10 m above the level of the swabs.

This process will start in those areas where work on coal-stage swabs has already been completed. Backfilling will affect the areas of the first detection and bulk horizons as well as swabs at + 10 m.

The implementation of these activities will contribute to minimising environmental risks and pave the way for the development of new industrial activities.

The Kozloduy nuclear power plant, as the baseline power plant, has a key role to play in maintaining the resilience of the electricity system. It provides about 33 % of the country's electricity production and is a guarantor of Bulgaria's energy security.

The measures under the programme to extend the lifetime of Units 5 and 6 of the Kozloduy Nuclear Power Plant have been completed. The results of the measures implemented by the integrated long-term operation programme suggest that the two units can operate in compliance with the safety requirements by 2047 for Unit 5 and until 2051 for Unit 6.

In accordance with national legislation, the Nuclear Regulatory Agency extended the operating licences for the two units with the maximum ten-year period allowed, respectively for Unit 5 until 2027 and for Unit 6 until 2029.

As a result of the implementation of the Extension Project, a number of activities (measures) have been identified and planned for implementation, including those relevant to safety within the scope of the Integrated Block Programmes. Integrated programmes bring together several groups of measures resulting from the implementation of:

- Periodic safety review of the unit concerned;
- A long-term block operation project;
- Bring the status of the unit into line with the requirements of the Regulation on ensuring the safety of nuclear power plants of 2016;
- Recommendations from the "stress tests" of nuclear facilities.

- *Increasing interconnection*

Bulgaria has a diverse electricity generation mix and well-developed energy infrastructure that ensures the security of electricity supply for the country and the region. Our country has an important balancing role for the electricity system of South East Europe.

Among the priority issues for CESEC is the integration of electricity markets and Bulgaria is implementing a number of projects to introduce market alliances with neighbouring countries, including Greece, Romania and the Republic of North Macedonia. More intensive work is also expected to start on the integration of wind farms, hydrogen and low-carbon gases.

In order to increase existing electricity interconnection capacity, the following projects have been completed:

- **Interconnection air line (122 km on Bulgarian territory) Maritsa Iztok substation and Nea Santa substation**

On 30.6.2023, the interconnector was connected and put under voltage.

- **Internal air line (94 km) between Maritsa East substation and Plovdiv substation**

All construction and installation works were carried out, the site was put into operation on 1.11.2022.

- **Internal air service (13 km) between Maritsa Iztok substation and TPP Maritsa Iztok 3 DSO**

The site was commissioned with authorisation No ST-05 – 260/26.03.2021.

- **Internal air line between Maritsa Iztok substation and Burgas substation**

The site was commissioned with authorisation No ST-05 – 256/26.03.2021.

- **Internal power line 400 kV connecting Varna and Burgas substations**

The site was put into operation in July 2021.

- **Bulgaria-Romania Capacity Increase Cluster ("Black Sea Corridor"), which includes an internal 400 kV power line between Dobrudzha and Burgas**

The site was commissioned with authorisation NoCT-05 – 596/30.07.2021.

Hydro-pumped storage project in Bulgaria – Yadenitsa

Pre-investment activities were implemented with grants from the Connecting Europe Facility. The EIA decision entered into force on 21.12.2018 and a final project was approved by the Minister for Regional Development and Public Works; the working project with completed coordination procedures has been updated; a financial analysis and risk assessment has been prepared. Measures have been taken in connection with the procedures for issuing building permits for the Yadenitsa project.

- *Security of gas supply*

Bulgaria's gas system covers all activities related to the extraction, transmission, storage, distribution and supply of natural gas to meet customers' needs. It consists of sites and facilities for carrying out the activities of extraction, transmission, storage and distribution of natural gas in the territory of the country, which are interconnected, operating in a single gas transport system with a common operating mode. Bulgaria's gas system consists of a gas transmission network of a total length of 3 594 km, including 151 km of the IGB pipeline on Bulgarian territory, and an underground gas storage facility in Chiren (UGS Chiren), with interconnection points with all neighbouring countries – with Romania (Negru Voda/Cardam and Ruse/Giurgiu), Greece (Kulata/Sidirokastro and Stara Zagora/Komotini). Republic of North Macedonia (Kyustendil/Zidilovo), Serbia (Kirevo/Zaidchar and Kalotina/Dimitrovgrad) and Türkiye (Strandzha/Malcochler and Strandzha 2/Малкочлар).

On the territory of the Republic of Bulgaria, Bulgartransgaz EAD and Ai S Zi Bi AD hold licences for the activity of natural gas transmission. Bulgartransgaz EAD's gas transmission network infrastructure consists of 3 443 km of pipelines and gas pipelines, as well as eleven compressor stations, KS Kardam-1, KS Kardam-2, Vuschi Dol, Polski Senovets, Rasovo, Provadia, new Provadia, Lozenets, Strandzha, Ihtiman and Petrich CC, with an estimated total installed capacity of approximately 389 MW, an electrochemical protection system, purification equipment, communication system, information system and other associated facilities.

The gas transmission infrastructure of Ai Si Zi Bi AD consists of 182.6 km of gas pipeline, of which 151 km on Bulgarian territory, electrochemical protection system, purification facilities, communication system, information system and other associated facilities.

In light of the challenges in the energy sector related to the Russian invasion of Ukraine, and thanks to its strategic location and good connectivity with neighbouring countries, Bulgaria plays an important role in gas security in South-East Europe. The country's efforts to expand and optimise gas infrastructure in the region have facilitated the implementation and full functioning of interconnections with all neighbouring countries.

Achieving a high level of security of gas supply requires access to diverse and reliable sources on independent routes. The ambition of the REPowerEU plan to increase the share of liquefied natural gas (LNG) in the EU energy mix and the diversification ambitions of the countries of South East Europe stimulate the construction of new LNG terminals in the region. The available regasification capacity in the region, amounting to more than 35 billion m^3 per year, and the planned new terminals, mainly in Greece, as well as the increase in flows from the Caspian region, will lead to a significant increase in gas flows from south to north through the territory of the Republic of Bulgaria.

The increasing integration of markets and the increasing role of spot trade in the region make it necessary to expand gas infrastructure to achieve sufficiently high transmission capacities, taking into account the demand in the whole region.

Planning the new gas infrastructure as 'future-proof' (fit for hydrogen) will not lead to a lock-in effect. At the same time, there is increasing demand and supply of significant

quantities of natural gas from reliable sources in the region, which will ensure a high level of security and sustainability of supply in the long term.

The main factors for the security of natural gas supply and energy security in the country are the diversification of sources and routes, as well as the provision of significant natural gas transmission capacity. In order to ensure energy security, Bulgaria is implementing and planning a number of key projects and measures in the field of natural gas that are relevant not only for our country but also for the whole region:

- **Gas interconnector Greece-Bulgaria (IGB)**

The Greece-Bulgaria gas interconnector (IGB) is a key part of the project to develop the Vertical Gas Corridor. The commercial exploitation of IGB was launched on 1 October 2022. The gas connection is an important infrastructure that provides diversification of natural gas supply sources and routes to Bulgaria and the region through access to liquefied natural gas terminals near Alexandroupolis and the Southern Gas Corridor. The interconnection also helps to secure gas supplies from the LNG terminal to Alexandroupolis from LNG producers such as the USA, Qatar, Algeria, Nigeria, etc., and in the future from Israel, Egypt, etc.

- **Bulgaria-Serbia Interconnection (IBS)**

Another project related to diversification of natural gas supply sources and routes is the Bulgaria-Serbia gas interconnector. The project provides additional access for Bulgaria to sources of gas from Western Europe on a completely new route and for Serbia to LNG terminals and other alternative sources from the region.

The technical capacity for natural gas transmission is 1.8 billion metres$^{3\ \text{per year}}$. The commercial operation of IBS was launched in December 2023.

- **LNG terminal project to Alexandroupolis**

The project for the construction of an LNG terminal near Alexandroupolis, in which Bulgaria participates with a 20 % share of the share capital of Gazreid S.A. through Bulgartransgaz EAD, is important for providing new quantities of natural gas from an alternative source to the Bulgarian and regional gas market. The project will provide Bulgaria and the entire region with access to the global liquefied gas market. The terminal will have a regasification capacity of 5.5 billion m (^{3}) and a storage capacity of 153.5 thousand m^3. Bulgaria has expressed interest in participating in the new project for the construction of the Trakia LNG terminal and/or other LNG terminal projects in the region.

The floating terminal for the reception, storage and re-gasification of LNG entered into commercial operation in March 2024.

- **Expanding the capacity of UGS Chiren**

The project of common interest (PCI 6.20.2) to expand the capacity of UGS Chiren, which aims to significantly increase the technical storage capacity from 550 million m^3 to 1 billion m^3 and for extraction and injection to 8-10 m^3, is ongoing. New capacities will provide greater security of supply and stimulate gas supplies, including LNG, from alternative

sources to Bulgaria and the region. The project will contribute to ensuring the security of natural gas supply in the country and region, as well as improving competition and access to natural gas from alternative sources.

The implementation of all elements of the project has been commissioned by Bulgartransgaz EAD and is ongoing. It is expected that the construction of the new infrastructure will be completed and the sites will be put into operation by the end of 2024.

Bulgartransgaz EAD, together with the gas transmission operators DESFA S.A. and Transgaz S.A., is conducting an incremental capacity procedure, in accordance with Chapter V of Regulation (EU) 2017/459, with a view to implementing projects to further increase the technical transmission capacity along the Vertical Gas Corridor in the Kulata/Sidirokastro IP and IP Negrou Voda 1/Кардам. The implementation of the projects will create the conditions for the transport of significantly higher quantities of natural gas from reliable sources from south to north, increasing the energy security of Bulgaria and the countries in the region;

- Bulgartransgaz EAD and Ai Si Zi Bi AD are conducting a procedure for incremental capacity for IP Stara Zagora. A project for upgrading the technical transmission capacity to 159.7 GWh/d from Greece to Bulgaria is planned on the part of Ai Si Bi AD. Once a final investment decision has been taken by Ai Si Zi Bi AD, Bulgartransgaz EAD will also take the necessary actions to ensure a total technical capacity of 159.7 GWh/d by 2025;

- Bulgartransgaz EAD's gas transmission infrastructure fully complies with the N-1 infrastructure standard, as required by Regulation (EU) 2017/1938 of the European Parliament and of the Council of 25 October 2 017 concerning measures to safeguard the security of gas supply and repealing Regulation (EU) No 994/2010. The N-1 standard defines the ability of the technical capacity of the gas infrastructure to satisfy all gas demand in the calculated area in the event of disruption of the single largest gas infrastructure on a day of exceptionally high demand occurring with a statistical probability of once in 20 years. The company has alternative gas supply routes that allow, independently of each other, to fully meet the domestic demand for natural gas.

The emergency plan of the Republic of Bulgaria was updated in March 2 024 in accordance with Article 10 (2) of Regulation (EU) 2017/1938 of the European Parliament and of the Council of 25 October 2 017 concerning measures to safeguard the security of gas supply.

The Emergency Plan includes measures to be taken to remove or mitigate the impact of a disruption of natural gas supplies in Bulgaria. It complies with the National Risk Assessment (NRA) of the Republic of Bulgaria, as required by Article 10 (2) of Regulation (EU) 2017/1938. The action plan reflects the significant changes in the supply of natural gas to Bulgaria resulting from the change at the entry points of the national gas transmission system and the new transit flows.

- **Building a well-functioning, fully integrated and liberalised natural gas market**

In addition to the availability of infrastructure with a high level of interconnection, the establishment of a fully-fledged, integrated and liberalised market in natural gas requires a commercial environment operating in a transparent and standardised way.

Bulgaria operates a licensed natural gas exchange market operating in full regulatory compliance, with sufficient experience in maintaining communication and interfaces with TSO systems offering a wide range of products and services in full compliance with the requirements of Regulation 1227/2011 on market transparency and data reporting.

Gas Heb Balkan EAD is a licensed operator of a fully functional electronic platform offering both long-term and short-term products. The operator shall have the possibility of conducting special auctions and for continuous trading. The work of the Platform is fully in line with the European objectives of building an interconnected and single pan-European gas market.

Bulgarian Energy Trading Platform AD (BETP) owns Licensia No L-533-11 of 25.3.2021 in order to carry out the activity 'Organisation of the natural gas exchange market' for a period of 35 years. BETP AD is founded in order to create, develop and operate a reliable and stable single regional gas market, contributing to increasing the transparency and liquidity of the gas market in the South East European region.

Increasing the level of certainty for platform market participants will reduce risks and further increase market liquidity.

The appropriate measure to achieve the strategic objective/sub-objective of achieving a fully integrated, reliable and well-functioning regional gas market includes the introduction of clearing services for trades executed on the platform, which will provide additional certainty and increase market liquidity.

4) **Internal energy market**

Electricity market liberalisation

The electricity market in the Republic of Bulgaria is in the process of gradual liberalisation, launched already in 2004 and continuing to this day. It consists of two segments, a price-regulated segment and a freely negotiated price segment, or a so-called free market.

Regulated market

In the regulated market segment, end suppliers (connected parties to distribution system operators), within their licensing territories, supply electricity to household final customers at regulated prices, which are set by the Energy and Water Regulatory Commission (KEVR). Since 1 October 2020, all non-household final customers entered the free market and thus only household customers who are also entitled to choose to buy electricity from another supplier (trader) at freely negotiated prices remained entitled to buy electricity at regulated prices.

The Act amending the Energy Act (ZE), adopted on 17.11.2023 and subsequent amendments, made the following main changes:

(1) full liberalisation of the wholesale electricity market has been implemented since 1 July 2025, while maintaining the right of household final customers to purchase electricity on a regulated market until the end of 2025.

The proposed amendments remove the role of National Electric Company EAD (NEK) as a public provider and consequently remove the quotas set for producers for a regulated market. The draft law stipulated that final suppliers of electricity should act as universal service providers and were obliged to supply household customers without the latter being obliged to switch supplier. In the transitional period (1 July 2025 – 31 December 2025), final suppliers will supply household final customers at regulated prices. The territoriality principle for the licensing of end suppliers has been removed. As a general rule, provision is made for the possibility of differentiated compensation of part of the costs of purchasing electricity at regulated prices depending on household customers' consumption until the end of 2025. The liberalisation of the regulated electricity market is fully in line with a decision of the National Assembly of 11.11.2022 according to which household final electricity customers remain on a regulated market until 31 December 2025, after which full retail price deregulation for household customers is gradually ensured, together with the full possibility of switching supplier.

(2) new entrants to the electricity market – citizen energy communities, active customers and aggregators – are regulated. Measures to protect consumers of energy services through the possibility to conclude fixed-term, fixed-price and dynamic electricity price contracts for customers with smart commercial metering installed are also complementary.

(3) the long-term contracts for the purchase of electricity concluded between NEK EAD, in its capacity as a public supplier and producers of electricity from coal-fired power plants, are regulated as well as the realisation of the electricity purchased under those contracts on the open market. It is not permissible to extend the duration of existing long-term contracts after their expiry in 2024 and 2026 respectively, or to conclude other long-term contracts with such producers.

(4) definitions and criteria have been introduced to define 'households in energy poverty' and 'vulnerable electricity customers' for the purpose of liberalising the electricity market and implementing measures to support households in energy poverty, including their priority treatment when implementing energy efficiency improvement programmes in residential buildings.

Free Market

On the free segment, customers can switch their electricity supplier without their geographical location influencing this. Consumers continue to pay prices for transmission and access to the network to which they are connected (transmission or distribution). Energy for the free market is purchased by traders, final non-household customers and network operators (for technological costs) at freely agreed prices and/or by the platforms of the Bulgarian Independent Energy Exchange (BEB). The KEVR has only the role of regulator, which controls market participants. The Commission has the power to determine the electricity trading rules, the level of network prices and the cost of 'public liabilities'.

With amendments to the Energy Act, all RES and high-efficiency cogeneration (RES) producers with an installed capacity greater than or equal to 500 kW must offer their electricity on an organised exchange market.

In line with the liberalisation process, the internal electricity market was built on the model of bilateral contracts and balancing market. Consumers conclude contracts with traders for the supply of electricity and traders in turn purchase the necessary quantities for the needs of their customers from producers. Where there is a discrepancy between the quantities of energy requested and actual consumption or production, the LoW, as operator of the balancing market, covers the unbalances – the differences between the quantities previously claimed and the quantities actually consumed/produced. The resulting costs shall be charged to the relevant market participants in the form of balancing energy prices.

The Bulgarian Independent Energy Exchange was launched in early 2016. In the same year, the 'Instructions on the terms and conditions for changing electricity suppliers for customers holding facilities to which standardised load profiles (SLPs) apply', adopted by the KEVR, enabled household and non-household customers who do not have hourly meters to enter the free market.

These changes, as well as the obligation for electricity transactions for all non-household customers to be part of the free market from 1.10.2020, have substantially altered the design of the electricity market.

Leaving the free market does not entail risks of additional charges or supply uncertainty. As hitherto, the relevant distribution system operator will remain responsible for the maintenance of the infrastructure and the quality of electricity, regardless of who is the selected free market supplier. Since 1 July 2021, non-household final customers who have not selected their electricity supplier have been supplied by a company supplier on a geographical basis, the so-called supplier of last resort ('the supplier of last resort').

In a liberalised (free) market, prices are set by the market – demand and supply. Different factors, as well as combinations thereof, may have different effects on the market. Some of the most significant conditions affecting the Bulgarian market relate to electricity prices on the regional market (Greece, Romania, Hungary). In turn, it is influenced by market levels in Western Europe. Thus, the price levels achieved in the developed markets in Western Europe also affect electricity prices on the free market in Bulgaria. Factors directly responsible for the change in electricity prices on global markets, which are also relevant for Bulgaria, are: changes in demand and supply, changes in prices of essential energy resources (oil, gas, coal, etc.), carbon prices, weather conditions, planned (repairs) and exceptional events (accidents, import/export bans, bankruptcies), energy policies and others.

Liberalisation of the natural gas market

The distribution of gas on the territory of Bulgaria is carried out by private regional and local companies operating under licensing and price regulation for the activity of distribution. The companies with the largest market share in the country are Overgas Networks AD, Sitigaz Bulgaria EAD and Aresgas AD.

Bulgaria currently has two licensed gas exchanges in force. Licences issued shall be for a maximum period of 35 years. The two gas exchanges operate with the same trading platform, Trayport Global Vision Trading System, a product of Trayport Limited UK, which has developed the most common and globally applied software to administer transactions.

Set up in 2019, the company 'Gas Heb Balkan' EAD (BGH EAD) builds up, operates and is responsible for the functioning of the organised market for the trading of natural gas by BGH EAD. The online platform with a segment and for bilateral trade offers modern physical products, including exchange of ownership on a virtual trading point (VTP) and at some of the physical points of the networks. The platform provides equal access, market-based prices, increased transparency as well as improved competition in the natural gas market in Bulgaria.

The short-term segment (spot) of the platform shall include standardised 'intraday', 'day-ahead', as well as temporal and local products for balancing the TSOs' network. Trade takes place on an anonymous basis according to the provisions of Regulation (EU) No 312/2014.

The long term segment of the trading platform offers products that are tradable on a medium and long-term basis – weekly, monthly, quarterly and annual.

The Gas Release Program supply segment at the end of 2022 was completed with the adoption of § 10 of the Transitional and Final Provisions of the Act amending and supplementing the Corporate Income Tax Act (promulgated. SG No 99/2022), which repealed the provisions of Article 176a (1) (4) and (5) of the Energy Act, under which the public supplier was obliged to offer to the organised exchange market certain quantities of natural gas in 2023 and 2024. The long-term contract of Bulgargaz EAD has not been in force since 31.12.2022, and the supplies thereunder were suspended on 27.4.2022. Burgarz EAD needs to provide alternative sources for both its activities as a public supplier and its bilateral contracts and the quantities under the programme. The emerging shortage of the Programme is compensated by alternative suppliers at market conditions. More than 90 traders are licensed to freely trade natural gas on the organised exchange market. In this sense, Bulgargaz EAD competes on the market together and on an equal footing with them for the purchase of natural gas. At the same time, the prices under the programme were regulated by the KEVR for the relevant period. Given the lack of predictability in terms of quantities and price levels and the impossibility of releasing such quantities on the organised stock exchange market under conditions other than the principles laid down in the Regulatory Agreement, conditions are created to generate price deficits for Bulgargaz EAD and distort the market. Further negative effects on this process are caused by disruption of supply on the pan-European market and increased demand for natural gas, which negatively affects the implementation of the Programme by the public supplier. As of December 2023, Gazov Heb Balkan EAD had over 90 registered companies, 40 % foreign companies and 60 % from Bulgaria, including the two operators Bulgartransgaz EAD and ICGB, as well as the gas transmission operator of the Republic of North Macedonia, Nomagas JSC Skopje.

The natural gas market has been fully liberalised and, by fully transposing the provisions of Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2 009 concerning common rules for the internal market in natural gas and implementing Regulation (EC) No 715/2009 of the European Parliament and of the Council of 13 July 2 009 on conditions for access to the natural gas transmission networks into national law, an appropriate regulatory framework has been put in place to ensure consumer protection and equal access to gas distribution infrastructure and services. § 23 of the transitional and final provisions of the Act amending the Energy Act 2012 lays down mandatory requirements in accordance with the European acts described, and activities relating to the distribution of natural gas are to be separated, in legal and organisational terms, from the supply of natural gas to final customers and from the other activities of gas distribution companies, where at least 100 final customers of natural gas are connected to the distribution network concerned. Given the significantly lower number of final natural gas customers connected to the existing distribution networks, this requirement is not applicable to Bulgaria, or the activities of supplying and distributing natural gas are carried out by the same eligible persons and licensed for the activity in the respective licensing territory.

Priority shall be given to addressing and implementing measures for the rehabilitation, modernisation and extension of existing gas transmission infrastructure and the development of interconnection, and these activities shall provide additional opportunities to increase the use of natural gas in the country with the corresponding economic, social and environmental benefits.

In view of the geopolitical developments in recent years, the shutdown of natural gas supplies from Russia to Europe and the war in Ukraine, the Ministry of Energy and Bulgargaz EAD have taken serious action to ensure diversification of natural gas supplies to the country and filling the Chiren underground storage facility in order to ensure the energy security of the country. In accordance with Regulation (EU) No 347/2013, priority corridor: North-South gas interconnections in Central Eastern and South-Eastern Europe (NSI East Gas) by Bulgartransgaz EAD has been prepared for the extension of the Chiren underground gas storage facility. Through its implementation, it provides for a gradual increase in storage capacity in order to achieve higher volumes of stored gas, including increased pressures in the gas reservoir, as well as larger diurnal average flow rates for extraction and injection.

Bulgartransgaz EAD complies with the requirements of the Third Energy Package by implementing the Regional Capacity Reserve Platform (RBP) under Regulation (EU) No 984/2013 establishing a Network Code on Capacity Allocation Mechanisms in Gas Transmission Systems.

iii. Key issues of cross-border relevance

In order to implement the European policy on building a common energy market, Bulgaria is implementing a number of projects of European and regional importance, as detailed in

point 2.4.2. The main ones are to increase the country's energy interconnection with neighbouring countries in the region, as well as with the integration of energy markets. The aim is to increase the energy security of the country and the region, ensure security of supply and diversify sources, routes and the development of the electricity and natural gas market. This will ensure the competitiveness of Bulgarian business and economic development in the country and the region.

iv. Administrative structure of implementing national energy and climate policies

According to Articles 3 and 4 of the Energy Act, the State policy in energy is implemented through the National Assembly and the Council of Ministers and is conducted by the Minister for Energy. In accordance with Article 11 (1) of the Energy Efficiency Act, the activities for the implementation of the state policy for improving energy efficiency are carried out by the Executive Director of the Agency for Sustainable Energy Development (SEDA). Under the ZEVI, the Executive Director of the AUER is responsible for the implementation of the state policy on promoting the production and consumption of electricity, heating and cooling from renewable sources, the production and consumption of biogas and green hydrogen, as well as the production and consumption of energy from renewable sources in transport, renewable liquid and gaseous transport fuels of non-biological origin and recycled fuels in transport.

The Ministry of Environment and Water conducts state policy in the field of environmental protection, including climate policies.

The Ministry of Economy and Industry implements the state policy of building a competitive low-carbon economy, promoting and accelerating investment, innovation and competitiveness.

The Ministry of Transport and Communications conducts state policy in the fields of transport, digital connectivity, electronic communications and postal services. The State policy for road infrastructure development is conducted jointly with the Ministry of Regional Development and Public Works.

The Ministry of Regional Development and Public Works is responsible for implementing the reform of the country's regional development, spatial planning, construction of the main networks and technical infrastructure facilities and implementing the National Energy Efficiency Programme for multi-apartment buildings.

The Ministry of Agriculture and Food conducts state policy in the fields of agriculture, agriculture, forestry and food.

The Ministry of Labour and Social Policy develops, coordinates and implements a social welfare policy. The Social Assistance Agency is active in the provision of social benefits, including targeted heating assistance.

The Ministry of Finance maintains sustainable and transparent public finances in the

country, assisting the government in building an efficient public sector and creating the conditions for economic growth. Bulgarian Independent Energy Exchange EAD holds a ten-year licence for the activity 'Organisation of the electricity exchange market' in the Republic of Bulgaria. The sole shareholder of the company is Bulgarian Fondov Borsa – Sofia AD, with 50 % of the capital of the BFB owned by the Ministry of Finance.

The Ministry of Foreign Affairs directs, coordinates and monitors the implementation of the state policy of the Republic of Bulgaria in its relations with other countries, ensuring the maintenance and development of foreign policy dialogue, security policy and bilateral, regional and multilateral cooperation. Carries out general coordination in the field of foreign policy and international action of the Republic of Bulgaria.

The Ministry of Education and Science implements state policy in the field of education and research.

The Ministry of Innovation and Growth works to build a competitive economy that will ensure growth and development of Bulgarian regions, promote and accelerate innovation and investment across the country and across all sectors of the economy.

The Energy and Water Regulatory Commission is an independent specialised state body which carries out the regulation of energy activities in accordance with the provisions of the Energy Act and the ZEVI and monitors the electricity and natural gas market.

State regulation of the safe use of nuclear energy and ionising radiation and the safe management of radioactive waste and spent fuel is carried out by the Chairman of the Nuclear Regulatory Agency.

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

i. Involvement of the national Parliament

State energy policy is implemented through the National Assembly and the Council of Ministers in accordance with Article 3 of the Energy Act.

ii. Involvement of local and regional authorities

All relevant ministries were consulted and actively involved in the process of developing the update of the Plan.

The competent authority for the implementation of public policy in the field of environmental protection and climate change, the Ministry of the Environment and Water (MOEW), has developed the objectives, policies and measures under the 'Decarbonisation' strand 'Emissions and removals of greenhouse gases' and analysed historical data on GHG emissions and assumed trends. The MOEW provided information on waste management,

the circular economy, air pollution and biodiversity and the management of Natura 2000 sites.

The Ministry of Regional Development and Public Works provided information on energy efficiency in relation to the National Renovation Programme under the Energy Efficiency Directive. In order to ensure coordination and alignment between the different strategic documents, the results of modelling for the purposes of this Plan should be taken into account in the National Renovation Programme as this document precedes the programme.

The Ministry of Transport and Communications provided information on plans and policies for the transport sector. The guidelines for development and the strategic objectives of the national transport system are laid down in the Integrated Transport Strategy for the period up to 2030. The strategy was approved by Decision No 336/23.06.2017 of the Council of Ministers. The national policy framework for the development of the market for alternative fuels in the transport sector and the deployment of the relevant infrastructure was approved by Council of Ministers Decision No 87 of 26.1.2017 and amended by Council of Ministers Decision No 323 of 11.5.2018, covering the period up to 2020 with a horizon of 2030. The National Plan for the Development of Combined Transport of the Republic of Bulgaria until 2 030, approved by Decision No 504 of the Council of Ministers of 21.7.2022, includes a package of measures to stimulate combined transport, both to develop a network of modern intermodal terminals and logistic centres in Bulgaria and to improve the connecting railway infrastructure to existing port and rail road terminals. The Ministry of Transport and Communications provided information on planned policies and measures in the transport sector. Each year, the Minister for Transport and Communications shall approve an annual programme for the construction, maintenance, repair, development and operation of railway infrastructure.

The Ministry of Agriculture and Food provided forecasts on the development of the sector and the available strategic documents, policies and measures. As the only strategic document in the sector since 2020 is currently the National Forest Biomass Energy Action Plan 2018-2027, the modelling for the purposes of this Plan includes historical data from the National Plan and projections have been made on this basis.

The Ministry of Labour and Social Policy develops, coordinates and implements a social welfare policy. The Social Assistance Agency is active in the provision of social benefits, including targeted heating assistance.

The Ministry of Innovation and Growth provided information on the Innovation Strategy for Smart Specialisation 2021-2027, as well as the National Roadmap to improve conditions for unleashing the potential for the development of hydrogen technologies.

The Ministry of Finance has provided information on macroeconomic indicators and trends as well as sources of financing in relation to the implementation of the policies and measures set out in this updated Plan.

The Ministry of Energy, the Ministry of the Environment and Water and the competent authorities listed in Article 4 (1) of the Climate Change Reduction Act shall, through their representatives, actively participate in the inter-institutional dialogue with local authorities

on climate transition as members of working groups or working groups with a specific task that are permanently operational, representing the relevant departments in various fora, round tables and initiatives. Through participation in an inter-departmental working group of Sofia Municipality to form the Climate Transition Unit, part of the intensive exchange is taking place to implement the Mission for the 100 climate neutral and smart cities of the future by 2030 (including Sofia and Gabrovo). In addition, in the course of the preliminary public consultations, the National Association of Municipalities of the Republic of Bulgaria has also received an opinion.

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

The Bulgarian authorities responsible for the preparation of the INECPs participated in various conferences, meetings, roundtables and stakeholder fora where topics related to INECPs were discussed.

The draft INECPs were published for prior public consultations on the official websites of the ME and MOEW on 22.12.2023 and all interested parties had the opportunity to submit their comments and recommendations on it within one month of a dedicated email necp@me.government.bg, which is maintained and open for proposals beyond this deadline. Following the presentation of the INECP project, ministries continued to receive additional opinions and recommendations from various stakeholders.

Written contributions to the INECP project were received from social partners, non-governmental organisations, private and state-owned energy companies, industry associations, economic institutes, citizens, etc.

The comments of the interested parties refer to all sections of the draft INECPs. The follow-up review is a summary of the main comments and recommendations:

General findings

The general comments on the Plan received an opinion expressing support in principle for the current draft INECP, with the expectation that the projected modelling of the evolution of energy consumption by sector and the actual assumptions and analyses will plan the reduction of emissions by sector. Another panellist shared that the Plan did not refer once to the 2020 European Strategy For Energy System Integration.

An opinion was issued on the revision and revision of the main preliminary assumptions, development scenarios, projections of energy consumption, energy and carbon intensity, including at national and sectoral levels, energy efficiency, energy mix, share of RES in final energy consumption, long-term energy balance, etc.

The general opinions sent contain reflections on the direction of energy development in the country and the following recommendations for additions have been made in the finalisation of the Plan:

• Paying particular attention to the main parameters of their structuring and functioning, especially for the Social Climate Plan and the National Decarbonisation Fund;

• Introducing policies for the replacement of smart meters for hourly metering and demand-side management capabilities and real information on their profile;

• Familiarisation with the book "Methodology for strategic planning of national energy" by Prof. Dr. Dimo Georgiev Stoilov from the Technical University of Sofia, as well as a methodological framework for the evaluation of INECPs, drawn up by the Reform Institute in partnership with the Blulinck Foundation;

• Specifying a target for share, policies and programmes to stimulate the development of energy communities and not only in the electricity context, but also in heating and cooling;

• Taking into account the life-cycle costs of new capacity at the Kozloduy nuclear power plant, setting realistic deadlines for construction and providing an alternative to what the country will do in case of serious delays;

• Extension of replacement programmes for heating appliances to a national scale by implementing them in a set of energy efficiency improvement measures;

• Reflecting and developing territorial and distributive (distributive) aspects of the just transition to a low-carbon economy, with the ultimate goal of climate neutrality by 2050;

• Complementarity with data on the expected energy balance in 2030 by sector and energy sources and a quantification of the impact of planned policies on the five dimensions;

• Benchmarking of variant solutions to reach the 2030 and carbon-neutral low carbon economy targets by 2050.

Renewable energy sources

Renewable energy sources are widely addressed in stakeholders' comments. They concern in particular the possibilities for RES deployment in the liberalised energy market and the need for additional mechanisms for the development of RES, active consumers and energy communities. The focus is on measures to support and promote new and existing hydropower capacities and their integration into the national energy system.

Recommendations have been made to upgrade the grid and develop smart grids; implement a phased replacement of conventional energy sources (coal, wood, etc.) with carbon-neutral alternatives and adopt legislation regulating and stimulating the development of the production, transport and consumption of carbon-neutral gases and gas blends.

Requests have been made to seek and analyse proposals from municipal administrations related to potential local RES projects.

Many comments express a desire to make biofuel production a priority in the country's energy strategy.

Proposals have been made in the transport sector to look for other options in addition to electrification of vehicles, including the deployment of synthetic fuels, low-carbon fuels, biofuels, hydrogen as well as hybrid propulsion; provide for measures to decarbonise heavy-duty transport and financial incentives for the use of electric vehicles; stimulate the construction of charging stations (electricity, hydrogen) and associated infrastructure to provide clean energy (small photovoltaic and/or wind installations, etc.).

There are proposals to provide for measures to promote the development and use of rail and urban electric transport by the population, as well as measures for the use of renewable liquid and gaseous fuels of non-biological origin and recycled fuels in transport, including municipal transport.

A request has been made not to allow the construction of wind farms in agricultural land – third and fourth categories – fertile, arable agricultural land.

Energy efficiency

Energy efficiency is discussed in detail with specific comments and suggestions, many of which call for an increase in the role and relevance of EE in INECPs.

Some comments requested that specific quantitative targets be set to reduce energy integrality and improve the FEC/SMP ratio so that by 2035 Bulgaria is on an equal footing with the EU average by; the targets set out in the INECPs to adjust and complement them in line with the projection of the development of final energy consumption by 2030, considering more ambitious targets for energy efficiency and greenhouse gas emission reductions; set a national energy efficiency commitment beyond the minimum reduction of the Energy Efficiency Directive formula of no more than 13.71 %.

Recommendations are made for an innovative demand-side approach to a formula for improved energy efficiency and better balancing of local consumption, regional consumption and interconnection.

It is also proposed to use the potential of energy and environmental experts from industry organisations to complement the INECPs and meet EC and EP requirements under the Green Deal and EU energy policies.

Another proposal relates to the extension of energy efficiency to all existing technologies, including industrial technologies, that contribute to the achievement of the national EE target, as well as to develop policies for the introduction of smart meters for hourly metering and demand-side management capabilities.

It is proposed that the renovation of the public building stock be prioritised, with shorter deadlines and that intermediate performance indicators be formulated.

Requests have been made to explicitly include all key historical data and predictive parameters, scenarios and projections and a clearly presented methodological apparatus, in accordance with the EC guidelines.

It is proposed that replacement programmes for heating appliances should be extended to reach a national scale, combined with the following measures:

- Increasing energy efficiency;
- Measures focusing on electrification of heating and deployment of energy-efficient heat pumps in combination with RES and storage measures;
- Innovative long-term energy storage systems with a lifetime of more than 20 able to coordinate autonomously balanced storage and return of electricity to the grid.

The lack of reference of the INECPs to the 2020 European Strategy for Energy System Integration, addressing the interlinkages between energy use in different sectors and sub-sectors, lack of ambition and innovation, insufficient attention to electrification, was noted as gaps.

National and overall energy objectives

The opinions on the updated INECPs point to the need for a clear identification of the annual energy targets and the need to give sufficient attention to the electricity sector in view of the forecasts for electrification of transport, production of green hydrogen and the expected increase in electricity consumption, especially after 2030. It is also stated that the country's final energy consumption model and the projection until 2030 should take into account the policies and measures described in the Plan, as well as others omitted from this version of the updated plan, bearing in mind the demographic situation.

Concrete proposals have been received to increase the RES target for final energy consumption from 29.9 % to at least 33 % according to the formula in Annex II to Regulation (EU) 2018/1999, align primary and final energy consumption projections with the EC Reference Scenario 2020 (15 600 ktoe for primary and 10 000 ktoe of final energy consumption) and specify the final energy consumption target for 2030, which should amount to 8476.7 ktoe and set the historical and projected GDP growth data required by the Commission, based on the main gross and final energy consumption projections at national and sectoral level and other derived key energy sector parameters and national energy balance by 2030.

According to some of the participants in the discussion, there is a need to define specific targets for an energy storage facility according to their different uses – without going to the grid, for self-generation and for sale, as a stand-alone site of consumption and production and to a producer, as well as specifying objectives, policies and measures to reduce energy poverty, and most policies and measures should focus on the long-term and development of a long-term programme to reduce energy poverty. A proposal has been received to initiate, where necessary, changes to the main strategic and sectoral documents and to the measures and incentives envisaged in individual areas in order to align them with more ambitious targets (NRPs 2030) for convergence towards average productivity and income levels in the EU 27.

Energy security

With regard to the Energy Security dimension, missing texts have been identified concerning maintaining and ensuring the operation of critical energy infrastructure, enabling peak demand response and emergency response and ensuring the necessary static and dynamic resilience of the electric energy system.

The opinions received in this area contain proposals for the elaboration of the National Energy – Power Balance per year for the period up to 2038, setting out the strategic framework for the long-term reserve capacity and the development of a National Plan (procedure) to maintain the necessary composition of synchronous and back-up generation sources as a key element of critical energy infrastructure and national energy security.

Recommendations have been made for the inclusion of TPP Maritsa East 2 EAD in a mechanism to ensure the reliability of the energy system and the introduction of a capacity mechanism in the form of a strategic reserve following the example of a number of European countries, as well as to maintain the leading position in the energy sector of the Bulgarian refinery in Burgas and to ensure the construction of an oil pipeline from the Mediterranean Sea, in particular the Alexandroupolis – Burgas axis.

According to some participants in the discussion, a further measure is needed to establish appropriate regulations for the production and use of alternative fuels from non-hazardous waste, as well as channelling funds in the priority areas of production and use of electricity produced from RES, improving energy efficiency and energy storage and modernising energy networks.

In the field of hydropower, proposals have been made for an adequate assessment of the role of HPPs as a leading production technology which is becoming even more important, to pay particular attention to the possibilities of supporting and promoting new and existing hydropower capacity in order to optimise the structure of generation capacity, to refine the provisions of existing legislation on the construction and operation of hydrotechnical facilities for electricity production, and to stimulate investment in the long-term maintenance and modernisation of hydropower facilities by providing for appropriate measures and reasonable feed-in mechanisms.

In order to ensure energy security, the following projects have been proposed to include in the updated INECPs:

→ An increase in the volume of the lower equilibrator of the Chayira pumped hydroelectric power plant with the construction of the Ydenitsa dam and a reversible irrigation tunnel to connect to the Paraya dam (in short, the Yadenitsa project);

→ Construction of a pumped hydroelectric power plant (PAVPP) 'Batak' at dams already built from the 'Batachki Water Road' cascade (in short, the Batak PAVPP);

→ Construction of a pumped storage hydropower plant (PAVPP) 'Dospat' in the case of dams already built from the 'Bataski Water Road' cascade (in short, the Dospat PAVPP).

Decarbonisation

Decarbonisation of the Energy sector, as a major source of greenhouse gases, is essential to achieve the objectives set out in the updated INECPs. In this regard, opinions were received with recommendations to set an objective of decarbonising district heating networks and paying sufficient attention to the development potential of low-temperature district heating networks. Other proposals make it necessary to identify areas and productions where measures are planned, including the theoretical potential to find a cost-effective place for the deposit of captured emissions or subsequent production, as well as to explore the market potential of industrial options to remove greenhouse gases by capturing, storing or processing them into high value-added products and to incorporate the results into mathematical modelling.

With regard to energy networks, proposals have been made to provide for specific measures for the development of the transmission network, as well as to specify the content of the 'transmission system' (whether it refers only to the electricity network of the country or also to include electricity distribution networks) and to provide for measures specifically aimed at the development of distribution networks with a view to the participation of the final customer in the market, including digitalisation through the introduction and integration of various smart technologies, and the development of an appropriate regulatory framework reflecting the new role of operators.

In the same area, recommendations are also made to consider the development of distribution networks as a stand-alone, separate topic, given the increasing share of RES (and especially solar energy) and the need for significant investments to expand and digitalise it, and to draw up an indicative financial assessment of the investments needed to develop distribution grid infrastructure and to integrate decentralised renewable energy production, taking into account the pace of its increase.

Natural gas

In the area of natural gas, opinions were received with proposals and recommendations for the priority development of the gas transmission network to points outside cities, the definition of specific measures to reach secure and affordable energy sources and to invest in the construction of highway gas deviations and gas distribution networks, as well as to complement the gas interconnection projects of the Republic of Bulgaria – the Republic of North Macedonia (Petrich – Negotino), to expand the infrastructure of Bulgartransgaz EAD and to optimise the participation of Bulgartransgaz EAD in Gaztreid S. A.

Recommendations have also been received to rethink gasification as a solution for households and instead to focus on electrification of heating and deployment of energy-efficient heat pumps in combination with RES and storage measures and to create a national market for greenhouse gas allowances.

Energy market

The country's energy market opinions concluded that the balancing market should not be an incentive to investors, but instead balancing auctions should be conducted.

Another finding reflects the absence of a SWOT analysis and a cost-benefit analysis and that it does not take into account how the reforms of the European Carbon Trading System and the new one from 2028 (ETS 2) will affect the process and what their contribution would be. It is also reflected that the energy market texts have elements concerning diversification and not liberalisation.

The specific proposals in this segment refer to the need to take into account the essential status and obligations of TPP Maritsa Iztok 2 EAD under the legislation in force and to introduce a capacity mechanism in the form of a strategic reserve following the example of other European countries, as well as the introduction of a regulatory new service 'Power System Resilience' to ensure the operation of a number of synchronous turbine generators of the heat plants.

A proposal has been received to complement the Plan with the potential of existing gas distribution networks and with a clear plan to fully liberalise the gas market by 2 030 in a similar model to the electricity market, and to formulate key objectives – equal treatment of all gas market players, gradual liberalisation of all market segments and deregulation of activities, adoption and implementation of legislation regulating and incentivising the development of production, transmission and consumption of carbon-neutral gases and gas blends. According to some of the participants in the discussion, deadlines need to be set to reflect the country's long delay in removing the regulated segment of the market, which should not exceed 3 years.

For the district heating sector, a proposal has been received to develop a vision for the development of the heat market and access of small producers to district heating networks.

Transport

With regard to the transport sector, various proposals have been made to include in the Plan its final design as a subsidy for citizens wishing to purchase electric vehicles, as well as for the construction of charging stations, complementing the main policy objectives of reducing greenhouse gas emissions in the area of promoting the production, consumption and demand of green vehicles and accelerating the deployment of charging infrastructure.

It has been recommended not to rely solely on electrification of vehicles, but to embed various options such as synthetic and low-carbon fuels, biofuels, hydrogen and hybrid propulsion.

The proposals include adding that the programmes should provide for measures to promote the development and use of rail and urban electric transport by the population through measures for the use of energy from renewable sources and natural gas and complement with measures to decarbonise heavy-duty transport.

Indigenous energy resources

Significant attention from the participants in the discussion on the Plan is focused on local energy resources, as reflected in the opinions submitted with recommendations for the development of local natural gas extraction through exploration for new oil and gas deposits, outlining the role of government decisions and plans for granting licences for oil

and gas exploration and production in deep waters in the Black Sea and indicating the need to set standards and regulations for safe operations of facilities and infrastructure in the Black Sea shelf. It is also of particular importance to draw up a clear plan on which land will be affected by the future coal mining activity in the economic mining activity and the cessation of all measures aimed at the depopulation of the villages of Beli Coast and Troyanovo.

Reference has been made to the need for specific land recultivation activities – time limits, financial liability, damaged areas, necessary funding, the development of work projects and a new legal basis for recultivation for degraded areas for future industrial purposes, and the development of detailed plans for the development of coal mining, to be synchronised with the other underlying documents for the development of energy (Climate Neutrality Roadmap, Energy Strategy 2030, 2050 horizon, etc.).

One of the opinions recommended the introduction of a fuel quality standard for coal (national), surrogate measures to reduce the moisture content of used firewood in municipalities that do not meet the air quality criteria PM10 and, possibly, a maximum moisture content standard for firewood, in line with the National Air Pollution Control Programme 2020-2030. that the Regulation on quality requirements for solid fuels used for domestic heating, the conditions, procedure and method for their control, adopted by Council of Ministers Decree No 22 of 17.2.2020, in force since 22.3.2020, and Regulation No 6 of 7 October 2019 on the requirements and control of wood used for domestic heating, are already applicable.

Research, Innovation and Competitiveness

In the research, innovation and competitiveness dimension, recommendations have been made to include innovative technologies for carbon capture and utilisation from industrial activity, innovative long-term energy storage systems with a lifespan above 20 able to coordinate autonomously balanced storage and return of electricity to the grid and incentives for the deployment of innovative technologies to reduce and recover carbon emissions from industrial activity and gravity energy storage systems.

The opinions include not limiting state support for technology transfer to the financing of the future Stara Zagora hydrogen valley, but also allowing for profitability studies on early development investments and minimising the risks associated with the introduction of new technologies, and for public support funds for the public and private sectors to be allocated, in consultation with the scientific community and industry, according to a developed methodology and key indicators for the evaluation of funding projects.

Assessment of energy saving measures

One of the recommendations to the Plan states that the descriptions and evaluations of the measures should clearly show their links with the relevant policies and objectives, using the same energy measurement units, and clearly demonstrate the contribution of each measure to the respective target.

When updating the INECPs, in addition to assessing potential energy savings and emission reductions, it is necessary to make a financial assessment of the investments and benefits. It is necessary to define a financial framework for the duration of the Plan, against which it is necessary to assess whether the objectives set can be met, what priorities should be set, and which measures may remain, which measures should be removed and which new ones should be replaced.

Consultation and public consultation

Some of the opinions suggest that following the submission of the next version of the plan, a new public consultation procedure should be organised in order to meet EC and EP requirements under the Green Deal and EU energy policies.

In this context, proposals have been made to exploit the potential of energy and environmental experts and industry organisations, to seek and analyse proposals from municipal administrations related to potential projects on their territories and to grant at least 8 weeks of public consultation time before the deadline for sending to the EC in June 2024.

The proposals are to launch as soon as possible a qualitative process of public consultation and the full involvement and mobilisation of social partners and the involvement of civil society and all stakeholders in the process of discussing and adopting the updated INECPs.

With regard to the environmental assessment of the Plan, the Ministry of Energy sent a notification to the Ministry of the Environment and Water in application of the Regulation on the conditions and procedure for carrying out an environmental assessment of plans and programmes. In response, the MoEW referred to Article 8 of the Climate Change Reduction Act and § 1 of the Additional Provisions of the Environmental Protection Act, according to which the Ministry of the Environment and Water is the contracting authority of the update of the INECPs and the environmental assessment. In this regard, the competent authority responsible for both the commissioning and carrying out an environmental assessment of the updated plan is the Ministry of the Environment and Water.

iv. Consultations with other Member States

Having regard to the provisions of Article 12 (1) 4 of Regulation (EU) 2018/1999, with the participation of the Republic of Bulgaria in international fora, roundtables and various initiatives through their representatives, the main points of this update of the Plan have been presented repeatedly as part of the national contribution to the common European objectives.

v. Iterative process with the Commission

Regulation (EU) 2018/1999 provides for a continuous consultation process with the EC, consisting of an evaluation of the INECPs by the Commission, as well as an update of the plans and the preparation of progress reports by the Member States.

1.4. Regional cooperation in preparing the plan

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

In line with the ambition of the European Green Deal to climate neutrality by 2050 and as a backbone of the clean energy transition, the energy targets established under the Fit for 55 package are established. These objectives have been further strengthened by the EC's Rehabilitation Plan to reduce the EU's energy dependency in the context of the ongoing military conflict in Ukraine, with the aim of building a more independent EU energy system. REPowerEU proposes further actions to save energy, diversify fuel supply, rapidly replace fossil fuels by accelerating the clean energy transition, scaling up renewable electricity generation, smart blending of investments and reforms. In parallel, existing coal-fired capacities could also be used longer than initially expected, subject to compliance with environmental requirements. Nuclear energy as a proven low-emission source also plays an important role.

International tensions in a geopolitical context and volatile levels of energy prices have increased the need to strengthen regional cooperation in the EU by establishing coherent policies and greater solidarity among Member States on the energy security dimension, achieving a diversified energy supply as well as a more resilient Energy Union.

The development of regional cooperation is important to ensure consistent planning and addressing risks related to security of energy supply, with a view to ensuring the construction of energy infrastructure and promoting market integration. Changes in energy policy demonstrate the need for regional cooperation to contribute to increasing the resilience and preparedness of the energy system and to accelerating the clean energy transition.

Bulgaria is an active participant in European flagship energy initiatives such as the Central and South-Eastern Europe Energy Connectivity Initiative, the European Gas Purchase Platform, the Energy Community, the Union for the Mediterranean and the International Renewable Energy Agency, as well as international energy initiatives such as the Black Sea Economic Cooperation Organisation and the International Energy Forum. The Republic of Bulgaria is a founding member of the International Atomic Energy Agency and has been a full member since its creation.

Central and South-Eastern Europe Energy Connectivity Initiative (CESEC)

Regional energy cooperation in South-East Europe is implemented through CESEC. The main reason for the establishment of CESEC is the historical vulnerability of the South East European region to the security of energy supply, in particular natural gas.

CESEC contributes to strengthening the region in terms of security of supply by prioritising the implementation of new interconnection infrastructure projects. A number of infrastructure projects that are central to Bulgaria are identified in the CESEC Action Plan, namely the Trans-Adriatic Pipeline, gas connections with Bulgaria's neighbouring countries, including Greece, Romania and Serbia, and the strengthening of Bulgaria's gas transmission network. In addition, CESEC also discusses operational topics related to reflows, cross-border tariffs and capacity allocation.

CESEC focuses on the operational and infrastructural side of regional gas cooperation. A number of market alliance projects are being implemented as part of the CESEC Action Plan, which has been extended beyond gas. The Republic of Bulgaria participates in the consolidation of the 'Day ahead' exchange market with Greece and Italy; developing a methodology for calculating total capacity in the South-East European region with Romania and Greece; bringing together the 'Day Forward' stock market with the Republic of North Macedonia, Croatia and Serbia.

A number of studies on the development of renewable energy in the South East Europe region show untapped economic potential. This topic is part of CESEC's plan to assess the potential of renewable energy (up to 2030 and 2050) as well as to promote the development of instruments for financing renewable energy. CESEC considers energy efficiency as a priority policy, including its role in combating energy poverty, in the framework of the exchange of information and best practices.

EU Energy Platform

The Platform has been set up to coordinate work on diversifying the EU's gas supply through a voluntary mechanism for the purchase of gas and renewable hydrogen for the EU, making optimal use of the EU's collective political and market weight.

Council Regulation (EU) 2022/2576 on enhancing solidarity through better coordination of gas purchases, exchanges of gas across borders and reliable price benchmarks, adopted on 19 December 2022, provides a legal framework for the EU Energy Platform to support Member States in preparing for winter 2023/24 and in particular for filling their storage facilities.

Five regional groups have been set up to identify needs and opportunities for common use of energy infrastructure and potential new suppliers. Through a process of aggregation of data on necessary gas volumes to be requested for purchase, meetings held with representatives of stakeholders, including industry, joint purchases were launched in May 2023.

South East Europe Regional Group, part of the European Gas Purchase Platform

The South East Europe Regional Group has identified the different problems in the different pillars of the region (consumption, electricity and gas swaps, infrastructure, interconnection agreements, supply, drafting of an action plan, financing). The Regional Group shall cooperate with the Energy Community Contracting Parties and the Energy Community Secretariat in its efforts to fully enhance energy security in the South East Europe region.

Energy community

The Energy Community is an international organisation that brings together the European Union and its neighbours to create an integrated pan-European energy market. The organisation is founded by the Treaty establishing the Energy Community, signed in October 2 005 in Athens, Greece, in force since July 2006. The main objective of the Energy Community is to extend the rules and principles of the EU's internal energy market to the countries of South East Europe, the Black Sea region and beyond, on the basis of a legally binding framework.

Union for Mediterranean

The Union for the Mediterranean (UfM) is an intergovernmental organisation that brings together 43 countries to strengthen regional cooperation and dialogue through concrete energy and climate projects and initiatives to address challenges in these areas in the region, while supporting progress towards more secure and sustainable energy models.

International Renewable Energy Agency (IRENA)

IRENA is a leading global intergovernmental agency for energy transformation, serving as the main platform for international cooperation, supporting countries in their energy transitions and providing state-of-the-art data and analysis on technology, innovation, policy, finance and investment. IRENA promotes the widespread acceptance and sustainable use of all forms of renewable energy, including bioenergy, geothermal, water, ocean, solar and wind energy in the pursuit of sustainable development, access to energy and energy security, for economic and social sustainability and prosperity and a sustainable climate future.

Organisation for Black Sea Economic Cooperation (BSEC)

BSEC is a regional economic organisation for cooperation in the Black Sea region. The main task of the BSEC is to serve as a model for a multilateral political and economic initiative that harmonises the actions of member countries, ensures peace, security and development in the Black Sea region in the spirit of friendly relations. One of the primary areas of cooperation within the BSEC is the energy sector. Bulgaria is an active member of the BSEC, working actively under its four Presidencies both to develop sectoral cooperation and to strengthen the links of the Black Sea region with the European Union.

International Energy Forum (ICEF)

The MEF provides one of the most important platforms for open energy dialogue between its 72 governments, as well as with a large number of interested international and national

energy companies. The MEF has facilitated dialogue between international organisations to deepen cooperation and strengthen global energy market governance. At the heart of this is the tripartite programme of work between the MEF, the International Energy Agency (IEA) and the Organisation of Petroleum Exporting Countries (OPEC). In addition, the MEF has a broad mandate to address various energy issues related to oil and gas, renewable energy, sustainability and energy transition, new technologies and data transparency. Energy poverty is also an important focus of the organisation.

International Atomic Energy Agency

The International Atomic Energy Agency is the main intergovernmental forum for scientific and technical cooperation in the nuclear field. The IAEA shall help Parties to use nuclear science and technology to monitor emissions and environmental changes in the ocean and ecosystems, to reduce greenhouse gas emissions from energy production and land use and to adapt to new climate realities, including food and water scarcity and ecosystem losses.

Tripartite Declaration between the Republic of Bulgaria, the Hellenic Republic and Romania on the development of renewable energy in the region

A declaration was signed in Athens on 19.1.2024 committing to cooperate in the preparation of joint cross-border projects in the field of offshore wind, renewable hydrogen and electric vehicle charging infrastructure. The document foresees that Bulgaria, Greece and Romania will support and promote a common initiative to explore and develop the sustainable use of offshore wind potential in the Black and Aegean Seas. The three countries will jointly apply for cross-border RES status under the ongoing Connecting Europe Facility call. Cooperation on a joint project under the call for cross-border renewable energy initiatives is also being considered.

The initiative will also help map offshore wind potential in south-east Europe and provide the basis for the development of a harmonised regulatory framework.

The creation of a regional renewable hydrogen cluster with the participation of the governments of the three countries, transmission system operators and industry is also envisaged. Both cross-border status under the ongoing Connecting Europe Facility call and the possibility of a joint project between the three countries will be sought. The regional cluster will develop cross-border projects to stimulate renewable energy, including wind and solar, its integration into a low-emission and renewable hydrogen production system for the energy, industrial and transport sectors, as well as the development of dedicated hydrogen infrastructure.

The Declaration provides that the Parties may extend cooperation to other areas by mutual agreement, as well as strengthen their dialogue and cooperation. The development of projects of regional and Community interest is aimed at achieving a just transition towards a decarbonised and climate-neutral economy.

ii. Explanation of how the Plan addresses regional cooperation

Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action establishes a flexible and robust system for transparent and mutually reinforcing cooperation between EU Member States and the European Commission. This helps ensure a consistent approach between energy and climate policies and coordinated action across Member States.

In this context, a number of projects of European and regional relevance are being implemented in the implementation of the European policy on the construction of a common energy market. The main projects are to increase energy interconnection with neighbouring countries in the region, as well as the integration of energy markets. The aim is to increase the energy security of the country and the region, ensure security of supply and diversify energy sources and routes.

Identifying and developing the potential of cooperation mechanisms in the field of renewable energy sources and energy efficiency will speed up the process and contribute to the implementation of joint projects in order to provide "European added value".

In the context of the green transition, it is essential to achieve a smooth process of decarbonising the existing gas market and progressively establishing a competitive, cost-effective and transparent EU hydrogen market. The envisaged promotion of the deployment of innovative technologies should provide opportunities for upgrading existing gas infrastructure as well as for the uptake of low-carbon gases, combined with a sufficient transition period.

It is essential to strengthen the potential of public-private partnerships aimed at initiatives to accelerate the development of new technologies to implement the green transition and energy storage.

Opportunities for effective regional energy cooperation are exploited through activities for the preparation and implementation of memoranda and cooperation contracts to build partnerships at regional, pan-European and international level.

It is actively involved in coordinating common messages and European initiatives with key partners to promote EU initiatives internationally with actions to ensure a coherent position on regional and global energy issues in international energy fora and platforms.

2. NATIONAL OBJECTIVES AND TARGETS

2.1. Decarbonisation dimension

2.1.1. GHG emissions and removals

i. The elements referred to in Article 4(a) (1)

The European Council adopted on 12 December 2019 the objective of achieving the Union's climate neutrality by 2050. On 10 December 2020, it adopted an increase in the EU's collective climate target of 40 % to 'at least 55 %' by 2030.

The two climate targets, as well as the need for contributions from all sectors, were enshrined in EU legislation with the adoption on 5 May 2021 of the so-called European Climate Law Regulation, a framework act ensuring that all sectors are involved in the achievement of the targets. The regulation sets an EU emission reduction target of "at least 55 %" by 2030, limiting the role of sinks in achieving it, the Union's climate neutrality by 2050 and negative emissions thereafter, the establishment of indicative carbon budgets and an additional European scientific body.

On 14 July 2021, the EC presented 15 pieces of legislation from the so-called 'Fit for 55' package, which put forward the Commission's proposals to achieve the increased climate target of 'at least 55 %', putting the road to climate neutrality by 55 and taking into account the need for contributions from all sectors.

To combat climate change and its impact on the economy, Bulgaria prepared a National Strategy for Adaptation to Climate Change and its Action Plan, adopted by decision of the Council of Ministers in 2019.

The document outlines the strategic framework and priorities for adaptation to climate change by 2030. The aim is to reduce the country's vulnerability to the effects of climate change and to improve the capacity of environmental, social and economic systems to adapt to the impacts of climate change.

The National Strategy for Adaptation to Climate Change covers nine sectors as follows: agriculture, Forests, Biodiversity and Ecosystems, Water, Energy, Transport, Urban Environment, Human Health and Tourism. It also includes an analysis of the macroeconomic effects of climate change and an assessment of the disaster risk management sector.

The strategy fills a gap in Bulgaria's climate change policy by outlining the country's approach to adapt key sectors of the economy to a changing climate.

Part of the document is the developed Action Plan, which sets out the objectives and priorities for improving adaptation capacity. The plan sets out in detail activities for each sector, including necessary financial resources, expected results, responsible institutions for their implementation.

The scope of adaptation options for sectors reflects the scope and complexity of climate change impacts. The main focus of the measures is to: strengthening the policy and legal framework for mainstreaming climate change adaptation; building adaptive capacity and developing financial, social and political guidelines for risk management; improving knowledge management, research, education and communication with stakeholders.

The main category contributing to the elimination of greenhouse gases is the forestry sector. All other categories (cropland, settlements, water) are sources of CO_2 emissions. The main reason for the overall permanent sink performance is due to the decline in forest removals and the slight increase in emissions from cropland, settlements and water.

Bulgaria relies not only on forest biomass under the National Forest Biomass Energy Action Plan 2018-2027 to provide the required biomass, but also uses the untapped potential of

the biodegradable fraction of products, waste and residues of biological origin from agriculture, including vegetal and animal waste, from forestry and related industries together with fisheries and aquaculture, as well as the biodegradable fraction of waste, including industrial and municipal waste of biological origin, fulfilling the sustainability criteria set out in Article 29 of Directive (EU) 2018/2001 of 11 December 2018 on the promotion of the use of energy from renewable sources (RED II Directive).

For the supply of conventional biofuels, the land needed to produce them will decrease between 2020 and 2030. The additional land needed for the production of advanced biofuels, due to the introduction of additional measures incentivising the use of advanced biofuels from 2020, will be compensated by the overall reduction of land needed for conventional biofuels.

Power plants in coal regions produce a significant part of the electricity in the country. These power plants use lignite and brown coal and do not have access to an adequate high-pressure gas transmission infrastructure with sufficient capacity to allow fuel switching with less carbon-intensive fuels such as natural gas, which can be used as a transition fuel towards carbon neutrality. Action has been taken to build a new high-pressure gas transmission infrastructure for the transport of natural gas to thermal power plants and other potential users in coal regions.

This will create market conditions for the modernisation of the combustion plants of thermal power plants and other energy consumers, the introduction of lower emission fuels in the energy mix, a significant reduction of greenhouse gas emissions from combustion processes, including from the production of electricity from solid fuels in these regions.

This will create the necessary conditions for flexible and efficient operation of the installations after their modernisation, in line with the commitments to decarbonise the energy sector and achieve net carbon neutrality.

Further economic, social and environmental benefits will be realised by increasing the efficiency of energy conversion, reducing the cost of greenhouse gas emission allowances and reducing emissions of harmful substances – sulphur and nitrogen oxides and fine particulate matter.

The development of greenhouse gas capture, processing and storage technologies, which are subject to separate requirements and as such need to be considered separately and accordingly modelled separately, will contribute to reducing emissions.

Following the adoption of the legislative proposal for a net-zero industry, the mentioned technologies (CO_2 – transport and carbon capture, utilisation, and storage technologies) will have the status of strategic technologies and projects related to them will be preferentially considered under shortened authorisation schemes. CO_2 storage projects are only economically viable when there is a business interest along the entire value chain, including transport.

In this context, it is important to explore the market potential of industrial opportunities to eliminate greenhouse gases by capturing, storing or processing them into high value-added products.

The decarbonisation objectives in the industrial sector can be achieved by taking into account the characteristics of the existing industrial symbiosis model and in particular the metal recycling industry, which makes a major contribution to both the circular economy and climate policy, saving primary resources, energy and CO_2. Recycling metals will reduce landfilling and save up to 20 times (i.e. between 6095 %) the energy needed compared to the extraction of these metals from ores.

The production of metals from secondary raw materials significantly reduces CO_2 emissions compared to their primary production (i.e. extraction) and also reduces the resulting impact on water and land.

Carbon capture and storage (CCS)

Carbon Capture and Storage (CCS) is an option to reduce CO_2 emissions. It may include fossil carbon capture or the absorption of carbon dioxide from the atmosphere through the use of bioenergy associated with CCS (Bioenergy Carbon Capture and Storage, BECCS) and Direct Air Carbon Capture and Storage (DACCS).

The use of CCS is necessary because it enables the decarbonisation of industrial sectors where carbon dioxide emissions are an inevitable part of a production process. CCS and CCUS are technologies that can make a significant contribution to reducing carbon emissions, especially in hard-to-abate industrial sectors.

The first project for carbon capture, utilisation and storage in Bulgaria is the ANRAV project of Heidelberg Cement Group (Devnja Cement) approved for funding under the Innovation Fund.

The project will offer safe storage of carbon dioxide in a depleted gas deposit in the Black Sea, linking the carbon capture facility at the Devnya Cement plant to the deposit through the existing system of pipelines on land and in water. The aim is to maximise the purity of carbon dioxide, to use a minimum amount of energy, to maximise the rate of carbon dioxide captured by the furnace and to reduce the technical risks in an existing kiln line in order to ensure a high capacity for modernisation.

The ANRAV project will avoid 7.8 million tonnes of carbon dioxide in the first ten years of operation and thus address 8.3 % of Bulgarian industrial emissions. The start date of the project is 1.1.2023 and the date of commissioning is 1.4.2028, with the capacity to capture 800 kt of carbon dioxide per year. The project is designed to be extended to other industries in the area.

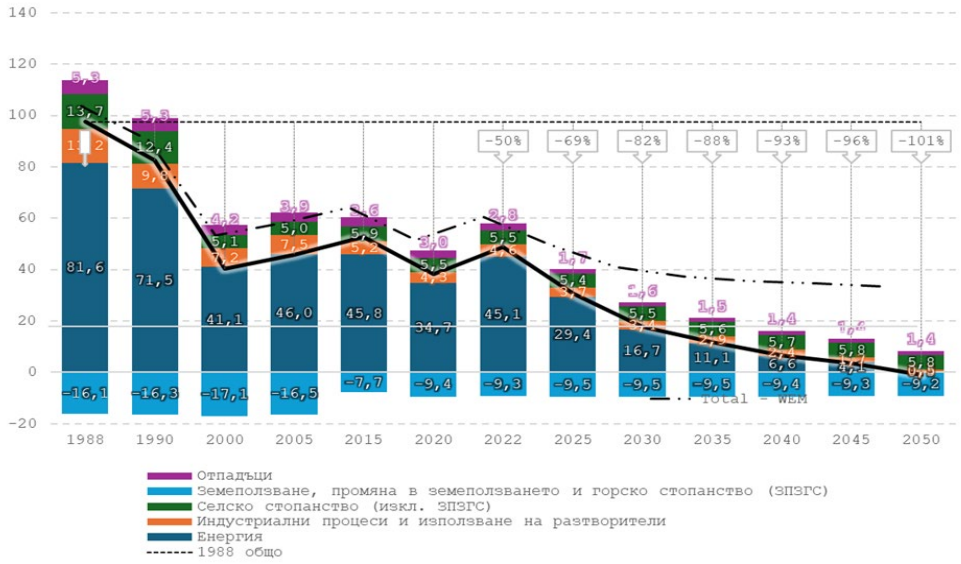
In 2024, the 'Beli Net Zero' project of Holsim Bulgaria AD for the capture, transport and underground storage of carbon dioxide was also launched for funding under the Innovation Fund. If successful, it will be the first project of terrestrial (rather than offshore) carbon storage in Eastern Europe. So far, the geological conditions studied in the region have significant potential for capacity expansion, which would allow the creation of a regional

hub/CCS cluster for carbon storage, as well as the possibility of importing carbon dioxide from third countries.

Projections of greenhouse gas emissions and removals by scenario with additional measures and policies (WAM)

Under the WAM scenario, net GHG emissions in 2030 decrease by 82 % compared to 1988, reaching net zero in 2050.

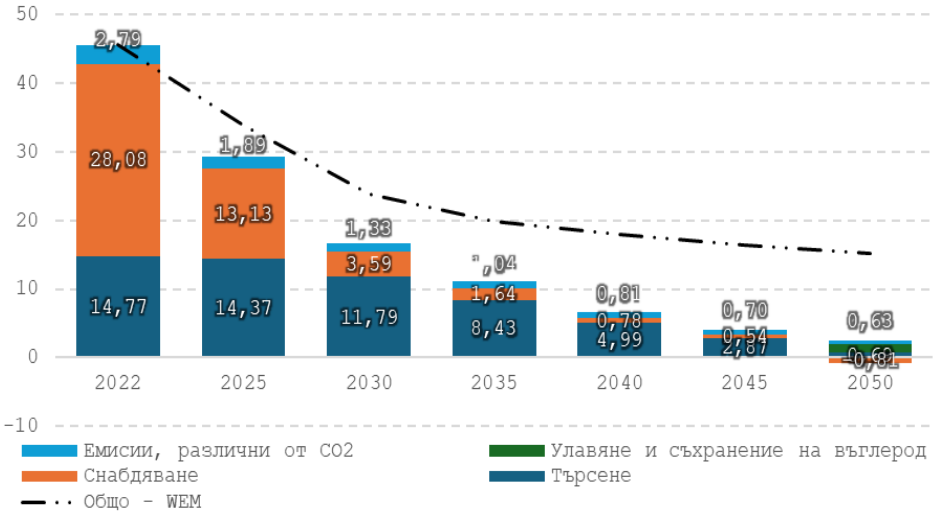
Figure 1: *GHG emissions by GHG sources and removals in Bulgaria, historical data (1990-2022) and (B) EST WAM projections (2025-2050), (ktn CO2-eq)*



Source: MOEW; (B) EST model, E3-Modelling

The energy sector, which is responsible for approximately three quarters of GHG emissions between 1988 and 2022, shows the largest reduction over the projection horizon, achieving an average annual GHG emissions reduction of 14.8 %. Both supply and demand contribute to the reduction of energy-related greenhouse gas emissions through a combined shift to clean energy technologies and a reduction in final energy demand. Residual greenhouse gas emissions in 2050 are reduced through carbon capture and storage (CCS).

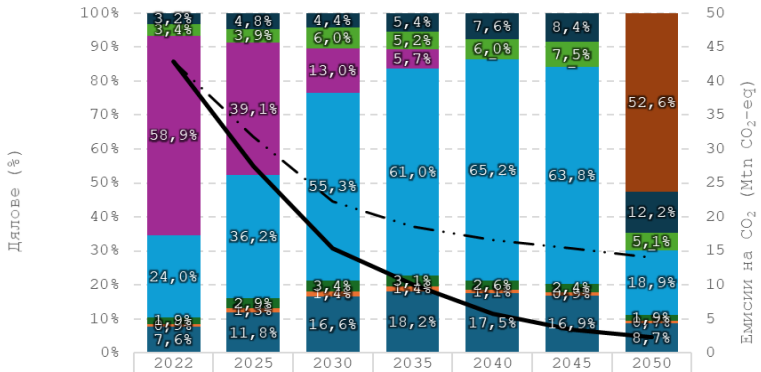
Figure 2: *Energy related GHG emissions in Bulgaria (2022) and (B) EST WAM projections (2025-2050), (MTN CO_2– eq)*



Source: MOEW; (B) EST model, E3-Modelling

By focusing on energy-related CO_2 emissions, all sectors contribute to the observed reductions. Despite significant demand-side efforts (with an average annual reduction of CO_2 emissions between 2022 and 2050 between 9.5 % and 11.0 %), CO_2 emissions in the energy sector are the main medium- and long-term factor (responsible for 65.5 % of energy-related CO_2 emissions in 2022 and 89 % of the CO2 emissions achieved in 2 030 in the WAM scenario).

Figure 3: *Energy $CO2_{emissions}$ by sector in Bulgaria historical data (2022) and projections (B) EST WAM (2025-2050), (MTN CO2-eq)*



	2022	2025	2030	2035	2040	2045	2050
Улавяне и съхранение на въглерод	-	-	-	-	-	-	1,20
Остатък от енергията	1,39	1,31	0,67	0,55	0,44	0,29	0,28
Индустриални предприятия	1,44	1,08	0,92	0,52	0,34	0,26	0,12
Производство на ел. енергия	25,25	10,74	2,00	0,57	-	-	-
Транспорт	10,30	9,96	8,50	6,14	3,77	2,18	0,43
Услуги	0,81	0,81	0,52	0,31	0,15	0,08	0,04
Домакинства	0,40	0,35	0,21	0,14	0,06	0,03	0,02
Индустрия	3,26	3,26	2,56	1,83	1,01	0,58	0,20
Общо	42,85	27,50	15,38	10,08	5,77	3,41	2,28
Общо - WEM	42,85	31,81	22,26	18,59	16,67	15,33	14,05

Source: MOEW; (B) EST model, E3-Modelling

Emissions under the Emissions Sharing Regulation (ESR) in 2030 with additional policies and measures are reduced by 11.06 % compared to the baseline year 2005.

Removals from the LULUCF sector of – 9 557 Act CO_2 eq. in 2022 with additional policies and measures reached in 2030 – 9 516 Act CO_2 eq.

ii. Where applicable, other national objectives and targets consistent with the Paris Agreement and the existing long-term strategies. If applicable with a view to contributing to the Union's overall greenhouse gas emission reduction commitment, other objectives and targets, including sectoral and climate change adaptation targets, if any

Long-term Strategy for Climate Change Mitigation by 2050 of the Republic of Bulgaria

Bulgaria's long-term strategy to mitigate climate change by 2050 (the Long-term Strategy) is a vision for achieving climate neutrality by 2050 and presents possible paths for energy system development beyond 2030 by not committing to specific targets.

The long-term strategy describes different scenarios that Bulgaria can choose to achieve the 2050 greenhouse gas emission reduction targets.

Three different scenarios have been identified based on a large amount of data and credible assumptions, possible development lines and targets for reducing greenhouse gas emissions from action areas defined in the target definition:

- A scenario of existing policies and measures (WEM);
- Additional Policies and Measures Scenario (WAM);
- Decarbonisation scenario (WAM +).

The available (and acceptable) technological solutions in Bulgaria's national context are to avoid a single choice of technology so that measures can be applied flexibly depending on technological progress and the structure of final energy consumption per sector after 2030.

Adaptation – Objectives, risks and vulnerabilities

Bulgaria is located in one of the regions that is particularly vulnerable to climate change (mainly through temperature increases and intense rainfall) and to the increasing frequency of extreme climate change events such as droughts and floods. Risks caused by climate-change-related phenomena can lead to loss of human life or cause significant damage affecting economic growth and prosperity, both nationally and across borders.

The main climate risks and vulnerabilities for Bulgaria identified in the 2023 NIMH study 'Bulgaria's changing climate – data and analyses' include heatwaves, extreme rainfall, floods, drought and frost.

In a large part of the country, seasonal temperatures and rainfall have changed significantly since the mid-20th century. Temperature changes include both increases in average seasonal temperatures and more frequent temperature extremes. The shift towards a warmer (and dry in some areas) climate is consistent with the long-term increase in average annual and seasonal temperatures observed on a global and regional scale.

Between 1991 and 2020, the annual average temperature in Bulgaria increased by 0.8 °C compared to the period 1961-1990. Mountains are generally less fertilised, while in some high fields, river-Danube areas and individual locations on the river valleys (mostly in northern Bulgaria) the gap is above 1.0 °C. There is also a clear upward trend in the frequency of heat waves in recent decades. The worst heatwaves associated with the prolonged retention of very high temperatures were recorded in 2007, followed by those in 2000 and 2012. In a changing climate, the frequency and extreme frequency of dangerous weather events are expected to increase further in the coming decades. The duration and spatial extent of extreme heat is expected to increase significantly by the end of the century.

The precipitation regime also shows changes in seasonal quantities and in the distribution of low, moderate and high rainfall. Overall, a reduction in precipitation is expected in the projected future climate, but also changes in rainfall – less abundant rainfall and longer dry periods. The largest changes in the number of extreme convective rainfall are expected in coastal and mountainous areas, while the increase in the number of cases does not preclude a decrease in total rainfall in these areas. This can be explained by the increase in the period during which these rainfall is possible due to the rise in temperatures. The intense rainfall leading to heavy and rainy floods accounted for 77 % of the floods recorded in the NIMH archive between 2016 and 2022.

The Mediterranean region and south-eastern Europe are considered to be one of the most vulnerable on the continent, and the projected future summer warming is expected to exceed global levels by 40 %. Climate projections of floods and droughts in Europe with global warming of + 2 °C relative to the pre-industrial era show increasing intensity and duration. Intense rainfall is expected to increase significantly over the whole continent, including in the Balkan Peninsula. Droughts in some areas will become more intense and longer, mainly due to lower overall rainfall and higher evaporation. Changes in the hydrological cycle will lead to both increased droughts and more flooding. In a changing climate, flood forecasting is one of the main risk mitigation and mitigation measures and requires international cooperation on flood risk management at river basin level. The DAREFFORT project, in which Bulgaria is a participant, establishes a platform for a standardised international exchange of hydrometeorological data to improve the quality of forecasts and the efficiency of national predictive centres.

Bulgaria has developed a National Strategy for Adaptation to Climate Change and an Action Plan up to 2030 (Council of Ministers Decision No. 621 of 25.10.2019). It assesses the risks associated with climate change in nine economic sectors: agriculture, biodiversity and ecosystems, energy, forests, human health, tourism, transport, urban environment and water. The areas studied include disaster risk management and macroeconomic impacts of climate change.

The national strategy has a vision "to develop the country's highest possible level of resilience against climate change, taking all necessary and feasible measures, thereby ensuring the smooth functioning of the country's economic sectors, the protection of the health and well-being of the population and the preservation of natural resources".

The long-term objective of the Strategy is "Active action towards achieving long-term and highly effective economic, social and environmental sustainability and flexibility to enable Bulgarian citizens, the private sector and state institutions to adequately prepare for and protect themselves from vulnerability arising from climate change". The ultimate goal is to make the natural environment, buildings and infrastructures, health and emergency care, as well as key economic sectors, not only risk-resilient but also ready to make the most of the opportunities.

The strategy sets out several general strategic objectives as follows:

- Inclusiveness and mainstreaming of climate change adaptation. This includes strengthening the adaptation policy and legal framework and integrating adaptation considerations into existing national and sectoral plans and programmes;

- Building institutional capacity to adapt to climate change. This includes building expertise, training, knowledge base, monitoring and research to activate and support adaptation actions;

- Raising awareness on adaptation to climate change. This includes raising public education and awareness on climate change adaptation issues and the need for adaptation actions to be carried out in Bulgaria to build socially acceptable policies and participation in adaptation actions;

- Building resilience to climate change. This includes improved infrastructure and asset management and natural capital protection, covering water system infrastructure, energy supply infrastructure and the protection and enhancement of ecosystem services, including those provided by forest resources.

Strategic objectives are also set for each sector, which stem from the specific sectoral context and adaptation needs. As part of the Strategy, 9 sectoral evaluation reports have been developed which contain specific operational objectives linked to the strategic objectives:

Agriculture Sector

- Sustainable management of agricultural practices for adaptation to climate change;
- Promoting adaptation and information capacity in the agricultural sector;
- Promoting research and innovation for adaptation to climate change;
- Strengthening the policy and legal framework for the adaptation of the agricultural sector.

Biodiversity and ecosystems sector

- Improving ecosystem management;
- Improving knowledge management and communication with stakeholders on ecosystem adaptation;
- Creating space for biodiversity and ecosystems;
- Strengthening resilience to climate change by reducing non-climate-related pressures;
- Sustainable use of regulatory and cultural ecosystem services for adaptation.

Energy Sector

- Institutional capacity building, knowledge and use of adaptation data;
- Mainstreaming climate change considerations into policies, plans and financing mechanisms in the energy sector;
- Integrating climate resilience into design and engineering;
- Increasing the sustainability of energy supply.

The Forests Sector

- Improving the knowledge base and raising awareness on adaptation to climate change;
- Improvement and protection of forest resources;
- Improving the potential for sustainable use of forest resources.

Human Health Sector

- Improving adaptation management;
- Creating a knowledge and awareness base on adaptation;
- Adapting the external environment to reduce the impact of climate change on health.

Tourism Sector

- The inclusion of climate change adaptation in the policy development process and the legal framework for the tourism sector;
- Increasing awareness and knowledge base on climate adaptation in the tourism sector;
- Building adaptive capacity in the tourism sector;
- Developing specific adaptive actions for the tourism sector.

Transport Sector

- Building institutional capacity and knowledge base in the transport sector;
- Mainstreaming climate adaptation into key planning and decision-making processes.

Urban Environment Sector

- Strengthening the policy and legal framework for mainstreaming climate change adaptation;
- Capacity building for adaptation;
- Developing financial, social and risk management policies to adapt to climate change;
- Improving knowledge management, research, education and communication with stakeholders on adaptation.

Water Sector

- Improving adaptation management;
- Strengthening the knowledge and awareness base on adaptation;
- Improve adaptive management of water system infrastructure.

The Strategy has developed an Action Plan describing which adaptation actions should be undertaken by economic sector, indicating potential budgetary implications and funding sources, envisaged duration and expected results, performance indicators and responsible institutions. Separate factsheets for each sector look at the planning of actions by sector.

The Action Plan should be seen as an evolving document and the scope and granularity of the actions supporting each strategic objective should be improved over time, as foreseen in the monitoring and reporting procedure.

In accordance with the Energy Union Governance Regulation, reporting on the implementation of national adaptation actions takes place every two years, starting in 2021. An assessment of progress in implementing the measures set out in the Strategy's Action Plan is carried out in interim and final reports to be submitted to the Council of Ministers in 2025 and 2031 respectively. All reports are submitted to the Climate Change Coordination Council (see point 3.1.3) for approval. On the basis of the interim report in 2025, the Coordination Board will assess the need to revise/update the strategy and make appropriate recommendations for updating (together with specific deadlines) if necessary.

Ensuring effective and efficient progress towards all general and sectoral strategic objectives and related adaptation action plans requires a high level of coordination between relevant ministries and agencies across all sectors. This is particularly necessary to promote the inclusion and integration of climate change adaptation considerations in existing national and sectoral plans and programmes.

2.1.2. Energy from renewable sources[4]

i. The elements referred to in Article 4(a) (2)

The national target for the share of energy from renewable sources in gross final consumption of energy from renewable sources set by the Republic of Bulgaria by 2030 is 34.96 %. The national target thus set is higher than the 33 % target set for Bulgaria in COM/2023/796final5. Under the WAM scenario assumptions for meeting this target, gross final consumption of energy from renewable sources is expected to reach 3.33 Mtoe in 2030.

Looking ahead to 2050, WAM scenarios plan to reach a 85.50 % share of renewable energy in the country's gross final energy consumption, which will require renewable energy consumption to reach 4 893 ktoe.

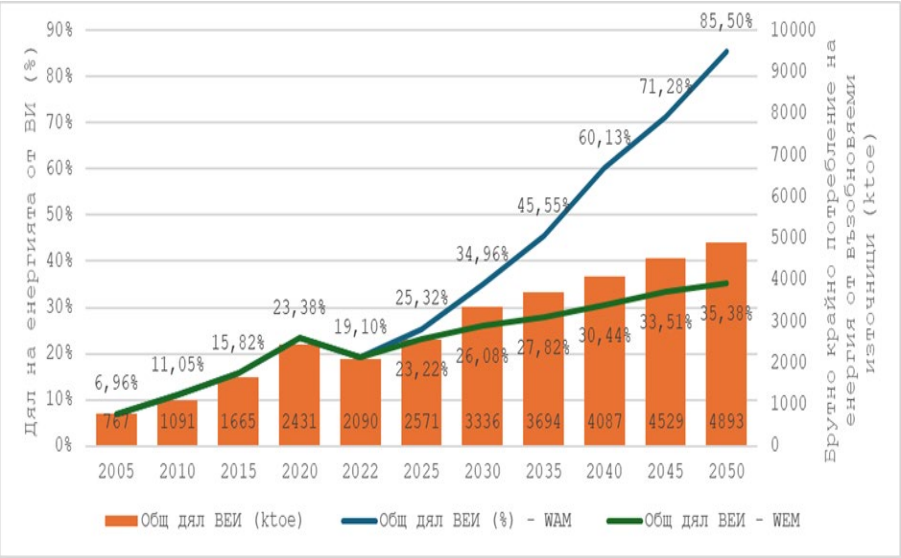
The targets are estimated from the mathematical model ((B) EST model, E3-Modelling), taking into account the requirements and targets of Directive (EU) 2023/2413 amending

[4] Data from SHARES tool 2020, SHARES tool 2022, Eurostat used for the period 2020-2022

[5] communication FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN Economic AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS EU wide assessment of the draft updated National Energy and Climate Plans An important step towards the more ambitious 2030 energy and climate objectives under the European Green Deal and Rehabilitation

Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources (Directive (EU) 2023/2413). The Directive provides for an increase of the overall Union renewable energy target to 42.5 % in 2 030 in order to significantly accelerate the current pace of renewable energy deployment, aiming to reach 45 %. Taking into account these requirements, the model proposes the most realistic contribution of individual technologies to harnessing the respective renewable sources to the national targets and taking into account existing circumstances, including economic development, social acceptance, etc.

Figure 4: *Indicative trajectory for the share of renewable energy in the country's gross final energy consumption 2020-2050, WAM and WEM scenarios*



Source: Eurostat, SHARES, (B) EST model, E3-Modelling

Bulgaria has the right climate conditions for the development of the renewable energy sector, but there are some objective constraints linked to certain localities where renewable energy production facilities cannot be deployed.

During the period of INECPs, the development of renewable energy will comply with all requirements stemming from environmental legislation, including as regards protected species, protected areas and protected areas and Natura 2000.

All projects for the construction of energy facilities for the production of energy from renewable sources will be carried out in compliance with the provisions of the

Environmental Protection Act, the Biological Diversity Act, the Protected Areas Act and other environmental legislation.

In line with the changes made by Article 3 of Directive 2018/2001/EC, Bulgaria sets an indicative target of 6.2 % for innovative renewable energy technologies by 2030, calculated in relation to newly installed renewable energy capacity.

Table 2: *Indicative target for innovative renewable energy technologies*

Share of newly installed capacity by innovative technologies,%	**2022**	**2025**	**2030**
	0.0	0.0	5.9

Source: Eurostat, SHARES; (B) EST model, E3-Modelling

Innovative renewable power generation technologies are projected to reach a share of 5.9 % in 2030, with their share expected to reach 34.2 % of newly built installed capacity using renewable energy sources in 2050. The innovative technologies envisaged in the WAM scenario cover the use of solar and onshore and offshore wind energy.

In 2030, the contribution of the NPBP to industry is projected to be 42.04 % of the amount of hydrogen used in final consumption for energy and non-energy needs, increasing to 60.10 % in 2040.

Table 3: *Share of renewable fuels of non-biological origin in industry (RFNBP),%*

Share of AMBP in industry,%	**2022**	**2025**	**2030**	**2035**	**2040**
	0.00	0.00	42.04	60.09	60.10

Source: Eurostat, SHARES; (B) EST model, E3-Modelling

ii. Estimated trajectories for the sector share of energy from renewable sources in gross final energy consumption from 2021 to 2 030 in the electricity, heating and cooling and transport sectors

In order to reach the national target for the share of energy from renewable sources in gross final energy consumption by 2030 (34.96 %), the following breakdown by sector is projected:

→ 49.34 % share of energy from renewable sources in the electricity sector;

→ 44.01 % share of renewable energy in heating and cooling;

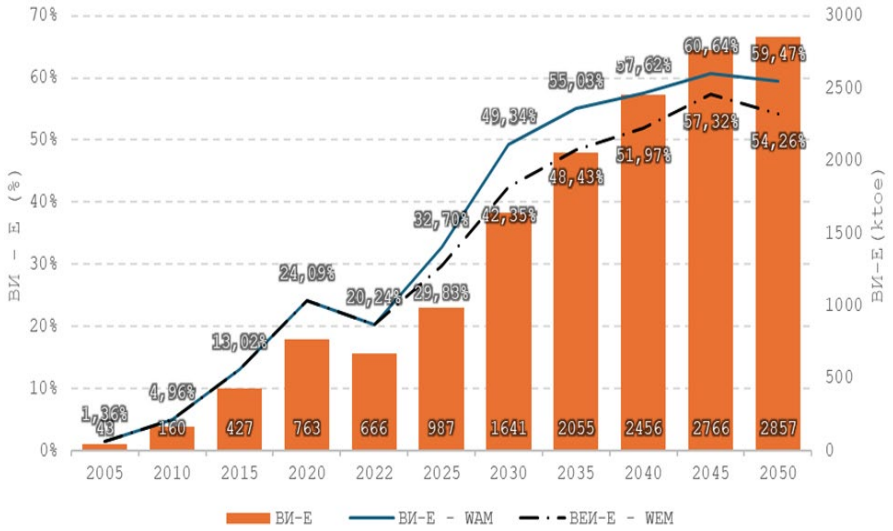
→ 29.93 % share of energy from renewable sources in the transport sector.

Between 2022 and 2030, the electricity sector is predicted to increase the consumption of electricity from renewable sources, largely due to an increase in solar and wind power production, and to a lesser extent hydropower and biomass production meeting sustainability and GHG emissions reduction criteria.

Renewable electricity production increased by nearly 1.4 times in 2030 compared to 2022 and by more than five times by 2050, leading to a share of renewable energy of 49.34 % and 59.47 % respectively.

In a WAM scenario compared to the WEM scenario in 2030 and 2050, the achieved share of renewable electricity in gross final electricity consumption is expected to be 7 and 5 percentage points higher, respectively.

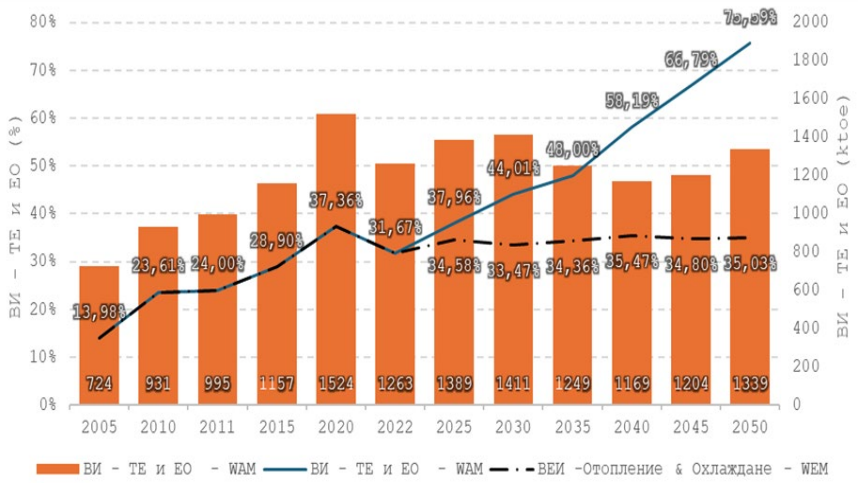
Figure 5: *Indicative trajectory for the share of electricity from renewable sources in gross final consumption of electricity 2020-2050 – electricity sector (RES-E), WAM and WEM scenarios*



Source: Eurostat, SHARES; (B) EST model, E3-Modelling

In the heating and cooling sector, the share of renewable energy in gross final consumption of heating and cooling is expected to increase and reach 44.01 % in 2030. The projected increase in the share of heating and cooling from renewable sources in the period 2021-2025 is around 2 percentage points on average per year. For the period 2026-2030, the projected increase in this share is approximately 1.2 percentage point on average per year.

Figure 6: *Indicative trajectory for the share of heating and cooling from renewable sources in gross final consumption of heating and cooling for the period 2020-2050 – heating and cooling sector, WAM and WEM scenarios*

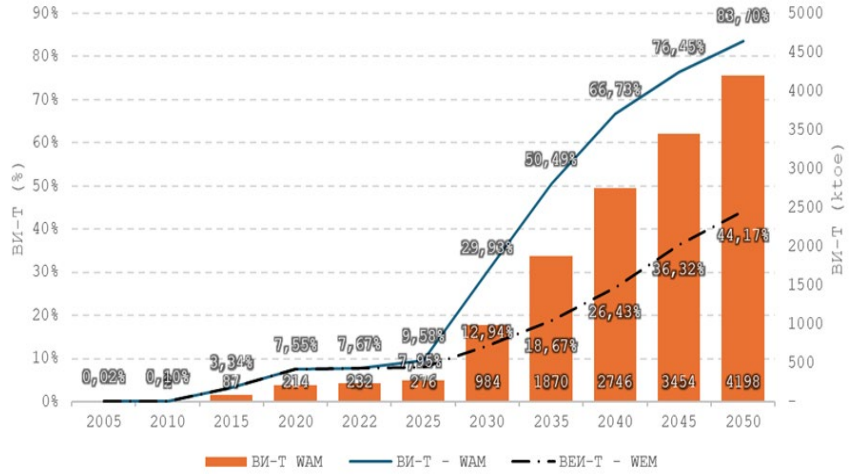


Source: Eurostat, SHARES; (B) EST model, E3-Modelling

In a longer term perspective (2030-2050) under WAM scenarios, the consumption of renewable energy in heating and cooling is expected to decrease quantitatively and is expected to be 5 % lower in 2050 compared to 2030. The share of renewable energy in the sector is increasing in percentage terms, given the decrease in gross final consumption of heating and cooling in the country.

Between 2022 and 2030, the share of renewable energy in the transport sector is expected to increase to 29.93 % in 2030. This is the sector where significant efforts are expected to increase renewable energy consumption.

Figure 7: *Indicative trajectory for the share of renewable energy in final energy consumption 2020-2050 – transport sector (WI-T), WAM and WEM scenarios*



Source: Eurostat, SHARES; (B) EST model, E3-Modelling

iii. Estimated trajectories per renewable energy technology that a Member State intends to use to meet the overall and sectoral trajectories for renewable energy for the period 2020-2030, including the estimated total gross final energy consumption for each technology and sector in Mtoe as well as total planned installed capacity (divided by new capacity and capacity increase of existing installations) per technology in MW

In order to achieve the targets in the heating and cooling sector, the following new requirements should be taken into account:

- → An increase in renewable energy (excluding waste heat and cold) in gross final consumption of energy in heating and cooling by at least 0.8 percentage points, calculated as an annual average for the period 2021-2025 and by at least 1.1 percentage points on average over the period 2026-2030, starting from the share of renewable energy in heating and cooling in 2020;
- → Increase the share of energy from renewable sources and from waste heat and cold in district heating and cooling by an indicative 2.2 percentage points as an annual average calculated for the period 2021 to 2030, starting from the share of energy from renewable sources and from waste heat and cold in district heating and cooling in 2020.

In order to achieve the target in the transport sector, the following requirements of Directive (EU) 2018/2001 (including changes to Directive (EU) 2023/2413) should also be taken into account:

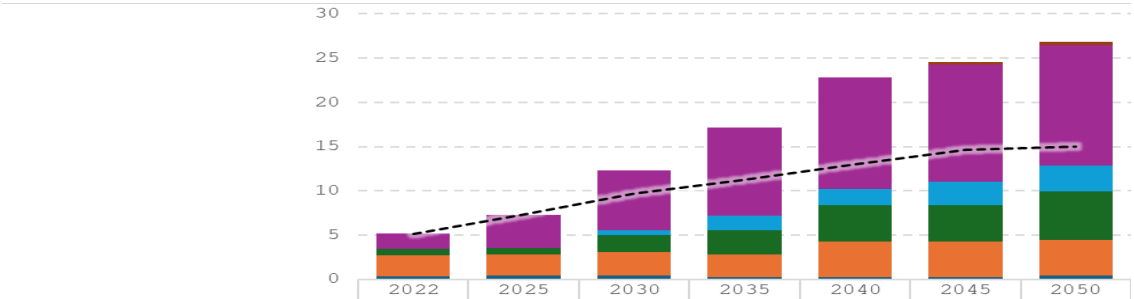
- → Limit the use of conventional biofuels to 7 % of final energy consumption in the transport sector in 2030;
- → The combined share of advanced biofuels and biogas produced from the feedstock listed in Part A of Annex IX and of renewable fuels of non-biological origin in the final energy consumption in the transport sector is at least 1 % in 2025 and at least 5.5 % in 2030, of which the share of renewable fuels of non-biological origin shall be at least one percentage point in 2030;
- → Limiting the use in the transport sector of biofuels and biogas produced from feedstock listed in Part B of Annex IX to Directive (EU) 2018/2001 (waste oil and animal fats) to a maximum of 1.7 %;
- → The share of biofuels and biogas produced from the feedstock listed in Annex IX to Directive (EU) 2018/2001 and of renewable fuels of non-biological origin shall be considered to be twice their energy content;
- → The share of electricity from renewable sources shall be considered to be four times its energy content when supplied to road vehicles and can be considered to be 1.5 times its energy content when supplied to rail transport;
- → The share of advanced biofuels and biogas produced from feedstock listed in Part A of Annex IX consumed in the aviation and maritime transport sectors

shall be considered to be 1.2 times their energy content and the share of renewable fuels of non-biological origin shall be considered to be 1.5 times their energy content.

Electricity sector

In 2030, an increase of 7 160 MW in the installed capacity of RES power plants is expected compared to 2022. This increase is accompanied by an increase in installed capacity for photovoltaic power plants (PV) of 5 050 MW and for onshore wind power plants (OWPs) by 1 280 MW. The projected increase of this type of plant is due to a combination of factors, including the introduction of planned policies and measures to accelerate the development of these technologies, as well as a reduction in the investment costs of their construction. The first 2 030 MW offshore plants are expected to be operational in 500.

Figure 8: *Forecast of installed renewable electricity generation capacity by type of plant, GW*



	2022	2025	2030	2035	2040	2045	2050
Геотермална енергия	–	–	–	–	–	0,29	0,35
Слънчева енергия	1,73	3,75	6,78	9,88	12,58	13,21	13,66
Вятърна енергия в морето	–	–	0,50	1,71	1,87	2,69	2,90
Вятърна енергия на сушата	0,71	0,71	1,99	2,72	4,09	4,09	5,45
Водна енергия	2,36	2,46	2,60	2,60	4,07	4,07	4,07
Биомаса	0,36	0,39	0,45	0,21	0,21	0,21	0,40
Общо – WAM	5,15	7,31	12,31	17,12	22,82	24,55	26,84
Общо – WEM	5,15	7,31	9,69	11,21	12,95	14,62	15,02

Source: Eurostat, SHARES; (B) EST model, E3-Modelling

The accelerated roll-out of new FPPs leads to a 45 % share of electricity generation from renewable sources in 2030, thus ending the leading role of hydropower. After 2025, the role of wind energy in electricity generation from renewable sources is expected to become increasingly important, with the onshore share of electricity from renewable sources expected to reach 13.7 % in 2025 and 21.7 % in 2030. In 2030, with the introduction of the first offshore thermal power plant, the share of electricity from renewable sources will reach 29.6 % of electricity from renewable sources. Hydropower generation is not expected to undergo significant changes, with an estimated growth of 8.6 % in 2030 compared to 2022. The use of biomass for electricity production and accounting for electricity produced as renewable is highly dependent on compliance with sustainability criteria and GHG

emissions reductions. Biomass electricity production is expected to almost double in 2030 compared to 2022.

Table 4: *Estimated trajectories for renewable energy production by technology for the period 2020-2030, GWh*

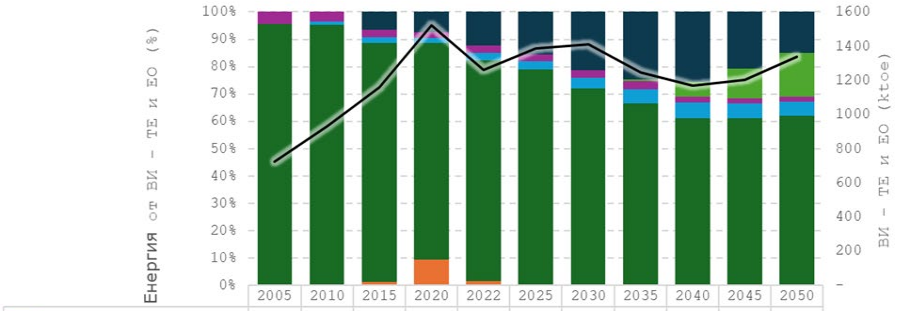
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
ВЕЦ	4 099	4 059	4 111	3 927	3 867	4 401	4 297	4 444	4 581	4 709	4 464
ВтЕЦ на сушата	1 611	1 572	1 412	1 495	1 423	1 567	2 042	2 626	3 222	3 825	4 140
ВтЕЦ в морето	0	0	0	0	0	0	0	0	0	0	1 507
ФЕЦ	1 468	1 467	2 093	3 050	3 831	5 254	5 681	6 430	7 182	7 936	8 700
ЕЦ на биомаса	1 698	1 155	128	516	698	257	980	1 018	1 054	1 088	267
Общо	**8 876**	**8 251**	**7 744**	**8 989**	**9 819**	**11 480**	**12 999**	**14 519**	**16 039**	**17 559**	**19 079**
Брутно крайно потребление на електрическа енергия	36 840	38 535	38 268	36 854	36 152	35 105	36 081	36 892	37 577	38 163	38 669
Дял на електрическа енергия от ВИ, %	**24,09**	**21,41**	**20,24**	**24,39**	**27,16**	**32,70**	**36,03**	**39,36**	**42,68**	**46,01**	**49,34**

Source: Eurostat, SHARES; (B) EST model, E3-Modelling

Heating and cooling sector

Biomass accounts for the largest share of heating and cooling. Out of 1.41 Mtoe of renewables in heating and cooling in 2030, 1.01 Mtoe were biomass. In the medium term, there is a gradual uptake of heat pumps and, in the long term, of the NDBMP. As a result of these changes in the fuel mix, the share of RES in the heating and cooling sector is expected to reach 44.01 % in 2030.

Figure 9: *Renewable energy in heating and cooling, ktoe and per type of renewable energy in%*



	2005	2010	2015	2020	2022	2025	2030	2035	2040	2045	2050
Възобновяема енергия от термопомпи	-	-	75	112	154	217	299	307	297	248	202
ВГНБП	-	-	-	-	-	-	-	7	66	132	213
Геотермална енергия	33	33	33	36	37	34	41	40	26	21	26
Слънчева енергия	-	10	22	27	32	40	53	64	67	67	66
Биомаса & отпадъци	691	884	1014	1204	1022	1098	1017	831	714	735	832
Твърда биомаса	1	4	13	145	18	-	-	-	-	-	-
ВИ - ТЕ и ЕО	724	931	1157	1524	1263	1389	1411	1249	1169	1204	1339

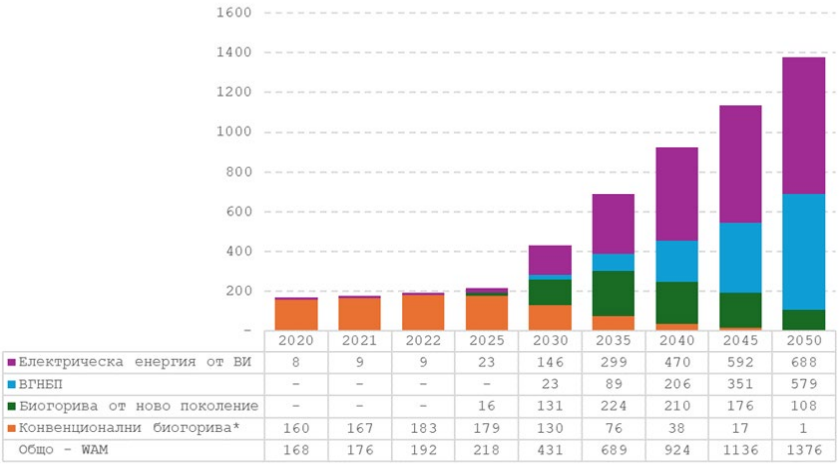
Source: Eurostat, SHARES; (B) EST model, E3-Modelling

Transport sector

In the transport sector, renewable energy use is expected to increase, reaching 29.93 % in 2030 and 83.70 % in 2050. In terms of volumes of renewable energy used, conventional biofuels are the largest contributors in the medium term, contributing 30.02 % to renewable energy in the sector by 2030 (130 ktoe out of a total of 431 ktoe). The

consumption of advanced biofuels is also increasing and reached 2030 ktoe in 117. Renewable electricity will become increasingly important in road and rail transport, with this type of energy expected to gradually replace the consumption of biofuels. At the same time, the consumption of renewable fuels of non-biological origin will be introduced and increased. From 23 ktoe in 2030, rising to 579 ktoe in 2050, accounting for 42.1 % of the renewable energy sector.

Figure 10: *Projected development of renewable energy in the transport sector by fuel type, ktoe*



	2020	2021	2022	2025	2030	2035	2040	2045	2050
Електрическа енергия от ВИ	8	9	9	23	146	299	470	592	688
ВГНБП	-	-	-	-	23	89	206	351	579
Биогорива от ново поколение	-	-	-	16	131	224	210	176	108
Конвенционални биогорива*	160	167	183	179	130	76	38	17	1
Общо - WAM	168	176	192	218	431	689	924	1136	1376

Source: Eurostat, SHARES; (B) EST model, E3-Modelling

In the short term, 13.5 % growth in renewable energy consumption is projected between 2022 and 2025 and almost 98 % growth between 2025 and 2030. Between 2022 and 2025, electricity consumption in transport is projected to grow more than 1.5 times and more than 5 times between 2025 and 2030.

Table 5: *Estimated trajectories by renewable energy technologies for 2020-2030, ktoe – transport sector (without multipliers)*

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Конвенционални биогорива*	160	167	183	187	190	179	169	159	150	140	130
Биогорива от ново поколение	0	0	0	0	0	16	39	62	85	108	131
ВГНБП	0	0	0	0	0	0	0	0	0	0	23
Електрическа енергия от ВИ	8	9	9	14	17	23	53	82	111	141	146
Общо -	**168**	**176**	**192**	**201**	**207**	**218**	**261**	**303**	**346**	**388**	**431**

Source: Eurostat, SHARES; (B) EST model, E3-Modelling

Note: In line with the requirements of Directive (EU) 2018/2001, only conventional biofuels and advanced biofuels that comply with the sustainability and greenhouse gas emissions saving criteria shall be counted towards the transport sector target.

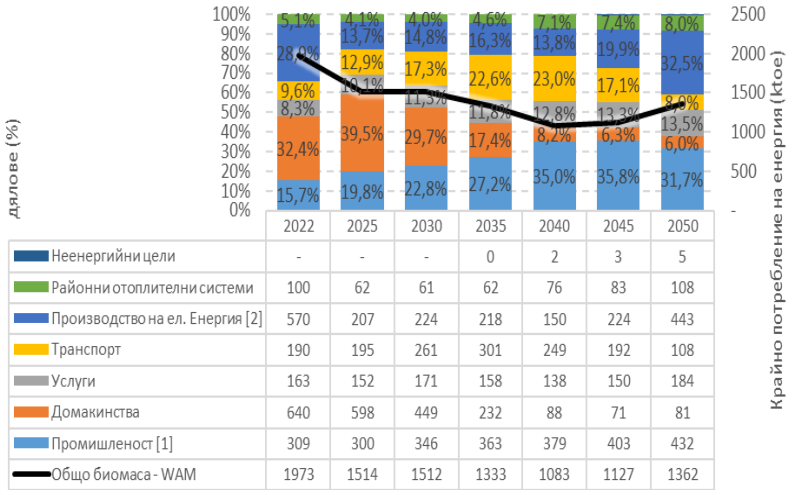
iv. Estimated trajectories for biomass energy consumption, divided between heat and electricity and transport, and trajectories for the supply of biomass from different feedstocks, with indication of their origin (distinguishing between domestic production and imports). For forest-based biomass, an assessment of its origin as well as an assessment of the impact on LULUCF carbon sinks

By 2030, final energy consumption from biomass is expected to decrease by more than 23 % compared to 2022 (the WAM forecast scenario). Looking ahead to 2050, the reduction in biomass use will continue and reach a reduction of more than 30 % compared to 2022.

The decline in final biomass consumption by 2030 will result from limiting the use of biomass in the sectors: energy production and households. Increasing energy efficiency, increasing the production of electricity from solar and wind energy, increasing the uptake of heat pumps and reducing the demand for heat produced by district heating plants are key drivers of the projected reduction. By 2030, growth in the use of biomass is expected in the transport and industry sectors, resulting from an increase in the sustainable use of biofuels and advanced biofuels and solid biomass.

In the period 2030-2050, final biomass consumption in centralised heat generation is expected to recover and to exceed by nearly 8 % final energy consumption by 2 050 in 2022. By 2050, compared to 2030, the use of biomass for electricity production will increase, but it will remain lower than the final biomass consumption achieved in 2022. In the household sector, the reduction of biomass consumption is expected to continue, reaching 2050 ktoe in 81. Given the specificity of consumption in the industry, services and transport sectors, they will continue to rely more heavily on biomass as an energy source to decarbonise them. Final biomass consumption in these sectors will reach 725 ktoe 2050, at 663 ktoe in 2022. These sectors are expected to account for 51 % to 53 % of the final consumption of solid biomass, biogas and waste in Bulgaria between 2030 and 2050.

Figure 11: *Final consumption of solid biomass, biogas and waste by sector (2025-2050), ktoe and shares in%*

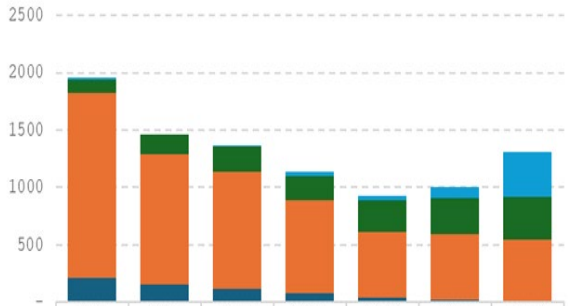


	2022	2025	2030	2035	2040	2045	2050
Неенергийни цели	-	-	-	0	2	3	5
Районни отоплителни системи	100	62	61	62	76	83	108
Производство на ел. Енергия [2]	570	207	224	218	150	224	443
Транспорт	190	195	261	301	249	192	108
Услуги	163	152	171	158	138	150	184
Домакинства	640	598	449	232	88	71	81
Промишленост [1]	309	300	346	363	379	403	432
Общо биомаса - WAM	1973	1514	1512	1333	1083	1127	1362

Source: (B) EST model, E3-Modelling

Forestry and agriculture will make a significant contribution, albeit with decreasing amounts (1 016 ktoe and 119 ktoe in 2030, compared to 1 611 ktoe and 213 ktoe in 2022, respectively) to secure the necessary amounts of biomass for energy production in the country. The use of waste is projected to increase (222 ktoe in 2030 compared to 120 ktoe in 2022). After 2035, biomass imports are projected to increase, with imported biomass volumes projected to reach 2050 ktoe in 385.

Figure 12: *Use of biomass for energy purposes by origin (ktoe), (2025-2050)*



	2022	2025	2030	2035	2040	2045	2050
Внос	12	-	4	31	31	102	385
Отпадъци	120	176	222	214	282	315	377
Горски сектор	1611	1138	1016	811	573	573	544
Селско стопанство	213	152	119	77	39	17	1
Общо суровини за производство на енергия от биомаса	1956	1466	1362	1133	925	1007	1307

Source: (B) EST model, E3-Modelling

v. If applicable, other national trajectories and targets, including long-term or sectoral (e.g. share of renewable energy in district heating, use of renewable energy, renewable energy produced by cities, energy communities and self-consumers, energy extracted from sludge obtained from wastewater treatment)

Not applicable

2.2. Dimension energy efficiency

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

Indicative national energy efficiency contribution

Total cumulative energy savings target for the period 2021-2030 under Article 8 on energy savings obligations under Directive 2023/1791/EU

According to Article 8(1)(b) of Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2 023 on energy efficiency and amending Regulation (EU) 2023/955 (recast), Member States shall achieve cumulative end-use energy savings equal to new savings each year from 1 January 2021 to 31 December 2030 of:

- → 0.8 % of annual final energy consumption from 1 January 2021 to 31 December 2023, averaged over the most recent three-year period preceding 1 January 2019;
- → 1.3 % of annual final energy consumption from 1 January 2024 to 31 December 2025, averaged over the most recent three-year period preceding 1 January 2019;
- → 1.5 % of annual final energy consumption from 1 January 2026 to 31 December 2027, averaged over the most recent three-year period preceding 1 January 2019;
- → 1.9 % of annual final energy consumption from 1 January 2028 to 31 December 2030, averaged over the most recent three-year period preceding 1 January 2019.

Based on the average annual final energy consumption for the period 2016-2018, the energy savings to be achieved in the period 2021-2030 and the cumulative energy saving target to be achieved by 31 December 2030 are calculated. These figures are presented in the following table.

Table 6: *Annual energy savings in final energy consumption, ktoe*

Year	Annual energy savings in final consumption										Total
2021	78.58										78.58
2022	78.58	78.58									157.16
2023	78.58	78.58	78.58								235.74
2024	78.58	78.58	78.58	127.69							363.43
2025	78.58	78.58	78.58	127.69	127.69						491.12
2026	78.58	78.58	78.58	127.69	127.69	147.34					638.46
2027	78.58	78.58	78.58	127.69	127.69	147.34	147.34				785.79
2028	78.58	78.58	78.58	127.69	127.69	147.34	147.34	186.63			972.42
2029	78.58	78.58	78.58	127.69	127.69	147.34	147.34	186.63	186.63		1 159.04
2030	78.58	78.58	78.58	127.69	127.69	147.34	147.34	186.63	186.63	186.63	1 345.67
Total cumulative savings 2021-2030											6 227.39

ii. The indicative milestones for 2030, 2040 and 2050, measurable progress indicators established at national level and their contribution to achieving the Union's energy efficiency targets included in the roadmaps set out in the long-term strategies for the renovation of the national stock of residential and non-residential buildings (private and public) in accordance with Article 2a of Directive 2010/31/EU

Pursuant to Directive (EU) 2018/844 of the European Parliament and of the Council amending Directive 2010/31/EU on the energy performance of buildings adopted on 30 May 2018, Member States should develop a long-term renovation strategy to support the renovation of the national stock of residential and non-residential buildings, both public and private, to achieve a highly energy efficient and decarbonised building stock by 2050, facilitating the cost-effective transformation of existing buildings into nearly zero-energy buildings. In this regard, a long-term national strategy was developed to support the renovation of the national stock of residential and non-residential buildings by 2050, setting out:

→ indicative interim targets for 2030, 2040 and 2050;

→ a description of the financial means to support the implementation of the strategy;

→ effective mechanisms to encourage investment in building renovation.

The following table provides information on indicative milestones for ten annual periods starting from 2021 to 2050.

Table 7: *Indicative milestones for the renovation of the residential and non-residential building stock*

Indicator		2021 – 2030	2031 – 2040	2041 – 2050
Total energy savings	**GWh/y**	**2 917**	**6 502**	**7 329**
Residential buildings	GWh/y	2 477	5 694	6 294
Non-residential buildings	GWh/y	440	808	1 035
Renovated area	**m²**	**22 203 509**	**49 570 668**	**55 823 015**
Residential buildings	m²	19 026 656	43 735 175	48 343 297
Non-residential buildings	m²	3 176 852	5 835 493	7 479 718
Renovated surface of the existing building stock for renovation	%	7.9 %	17.5 %	19.8 %
Saving CO2 emissions	**tone**	**1 306 435**	**2 891 610**	**3 274 453**
Residential buildings	tone	1 065 184	2 448 461	2 706 441
Non-residential buildings	tone	241 251	443 149	568 012

The objectives thus set in the buildings sector are expected to contribute to the fulfilment of the obligations under Article 7 of Directive (EU) 2018/2002 of the European Parliament

and of the Council of 11 December 2 018 amending Directive 2012/27/EU on energy efficiency.

An analysis of the available information from effectively certified buildings shows that, in order to achieve the quantitative dimensions of the indicators, renovation policies should focus as a priority on buildings with energy consumption classes E, F and G for all building categories.

A key objective of the common transport policy is sustainable development. This requires an integrated approach aimed at ensuring the effective functioning of Union transport systems, taking into account social standards and environmental objectives. Sustainable development of air transport requires the introduction of measures, including economic instruments, aimed at reducing the carbon emissions from aircraft departing from Union airports and developing a market for the production and supply of SAF. Such measures should contribute to meeting the Union's climate objectives by 2030 and 2050.

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

The achievement of the energy efficiency targets set is strategically linked to building stock renovation and priority will be given to energy efficiency combined with the use of renewable energy sources in the buildings sector.

Priority will be given to the uptake of high-efficiency cooling and heating systems, the introduction of innovative geothermal, solar energy technologies and the use of waste heat and cold.

In addition, the use of efficient district heating and district cooling will be promoted. New district heating networks and extensions of existing district heating networks are intended to meet the needs of public sector buildings and services that are not connected to district heating.

The energy efficiency potential of district heating and cooling infrastructure lies in the rehabilitation of heat transmission networks. It is envisaged to use the most efficient means of transferring a heat carrier through pre-insulated pipes and to increase the share of waste heat use in order to reduce heat losses in networks. The use of advanced management strategies and monitoring solutions such as sensors and smart meters to optimise the flow of heat/cooling, including reducing the temperature of heat carriers and integrating more RES, is envisaged to increase the efficiency of the heat transmission networks.

Investing in modernising existing convectional district heating systems and gradually converting them into smart heat grids will meet future energy needs characterised by increasing dependence on variable renewable energy sources. By promoting smart control

and data sharing across the system, work is expected to be optimised in the short and medium term.

Adequate incentives for efficient district heating through national policies and the involvement of local authorities and stakeholders, as well as support for new investments through direct and indirect funding are foreseen. Opportunities will be used to integrate district heating planning into urban planning and the corresponding adjustment of building and urban planning to enable connection to district heating networks as well as decentralised district heating systems.

Households are the second largest energy consumer in Bulgaria. In recent years, the energy mix structure of the sector's final consumption has maintained the share of electricity. Reduce the quantities of coal and briquettes used, while increasing the amount of wood (firewood) that is combusted poorly. According to information from the 2021 population and housing census in the Republic of Bulgaria, the energy used to heat occupied dwellings is as follows: almost half of occupied dwellings (47.7 %) are heated with electricity, 36.3 % with wood, 13.3 % with heat from a central source (steam), 4.8 % with coal, 4.1 % with pellets, 2.5 % with natural gas from a central source. By way of comparison, according to final data from the 2011 count, domestic heating of dwellings is mainly carried out with wood and coal – 53.9 % of occupied dwellings. Electricity is heated at 28.6 %, with steam from a central source of 15.1 % and with gas from a central source of 1.3 % of the dwellings.

Gasification covers the construction of gas distribution networks, the retrofitting of combustion plants to replace the used solid, liquid and electricity fuels and the supply of natural gas, as well as a set of measures and actions to improve the management of combustion installations at final customers.

Appropriate measures to harness the potential for energy savings through the development of gasification include incentivising end-users to switch to natural gas, optimising the regulatory framework to facilitate the procedures necessary for the construction of market-based gas distribution infrastructure, and encouraging and supporting the accelerated construction of interconnecting gas infrastructure where necessary.

2.3. Dimension Energy security

i. The elements set out in Article 4(c)

A key EU priority in the energy sector is diversifying Europe's energy sources and ensuring energy security through solidarity and cooperation between Member States, enhancing the diversification of the EU's energy supply and developing and using indigenous energy resources. The main objective is to ensure security of energy supply, which means ensuring a continuous and adequate supply of energy from all sources to all consumers.

The established South East Europe Regional Group has identified the different problems in the different pillars of the region (consumption, electricity and gas swaps, infrastructure, interconnection agreements, supply, drawing up an action plan, financing under

REPowerEU, etc.). The Regional Group shall cooperate with the Energy Community Contracting Parties and the Energy Community Secretariat in its efforts to fully enhance energy security in the region.

The first meeting of the Regional Task Force, part of the EU Energy Platform, took place in the framework of the Regional Ministerial Meeting on Energy Security, Diversification and Green Transition, which took place in Sofia on 5 May 2022. On 1 June 2022, the South East Europe Regional Group agreed an Action Plan to guide the next steps for diversification and security of supply in the region following the disruption of gas supply from Russia. The Action Plan foresees a joint effort between the region and the European Commission on three pillars:

1. Gas demand needs of the region, including potential for demand reduction through electricity;
2. Infrastructure capabilities and resolution of outstanding issues;
3. Gas supply capabilities.

Once the action plans of all regional groups have been finalised, the main focus is to discuss the potential for joint purchases in each region.

On 20 October 2022, the European Council endorsed the joint purchasing of gas, coordinating and prioritising negotiations with reliable partners to seek mutually beneficial partnerships by leveraging the collective, political and market weight of the Union and making full use of the EU Energy Platform, such as some of the measures to address the energy crisis in Europe.

On 19 December 2022, Council Regulation (EU) 2022/2576 was adopted to enhance solidarity through better coordination of gas purchases, exchanges of gas across borders and reliable price benchmarks. The Regulation provides a legal framework for the EU Energy Platform to support Member States in preparing for winter 2023/24 and in particular to fill their storage facilities.

An EU Energy Platform was launched following a mandate from the European Council in response to the need for diversification of gas supplies from Russia. Covers a number of actions on natural gas and liquefied natural gas (and in the future hydrogen) to support the EU's security of supply and access to affordable energy, including international coverage, demand aggregation and efficient use of EU gas infrastructures.

The Platform aims to coordinate the EU's actions and negotiations with external gas suppliers to prevent mutual bidding between EU countries and to use the weight of the EU – as one of the world's largest gas consumers – to achieve better conditions for all EU consumers.

Five regional groups have been set up to identify needs and opportunities for common use of energy infrastructure and potential new suppliers. The process of aggregating data on the necessary gas volumes to be requested for purchase is launched. A number of meetings

were held with representatives of stakeholders, including industry, to complete the data aggregation process in April and launch joint purchases in May 2023.

Taking this into account, Bulgaria's energy security objectives relate to:

- Diversification of the supply of energy resources;
- Development of the gas transmission network and expansion of capacity of UGS Chiren and interconnection points;
- Implementation of 'future-proof gas infrastructure' projects to increase entry and exit capacities at interconnection points with neighbouring countries, including projects to increase capacities in the Kulata/Sidirokastro IP and the Nebru Voda/Cardam IP, included in the Vertical Gas Corridor initiative;
- Participation in new LNG terminal projects in the region;
- Sustainable use of indigenous energy resources, including the development of local natural gas extraction projects;
- Establishment of a strategic national natural gas reserve;
- Introducing minimum storage and filling obligations for natural gas storage facilities;
- Increasing the flexibility of the national energy system;
- Addressing limited or interrupted supplies from an energy source in order to improve the resilience of regional and national energy systems;
- Improving network and information security (cybersecurity).

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

Diversification of natural gas supply sources

In order to improve the diversification of natural gas supplies, Bulgaria aims to increase natural gas transmission capacity at interconnection points with neighbouring countries, as well as additional supplies:

- From the Caspian region through the Southern Gas Corridor;
- Liquefied natural gas from the Mediterranean region and other countries through LNG terminals.

The implementation of planned "future-proof gas infrastructure" (fit for hydrogen) projects to increase entry and exit capacities at interconnection points with neighbouring countries that are part of the Vertical Gas Corridor initiative would contribute to overall diversification. Further contribution to diversification and security of natural gas supply will be involved in other LNG terminal projects in the region, as well as the development of

local natural gas extraction through exploration for new oil and gas deposits, including in the deep Black Sea.

Diversification of nuclear fuel supply

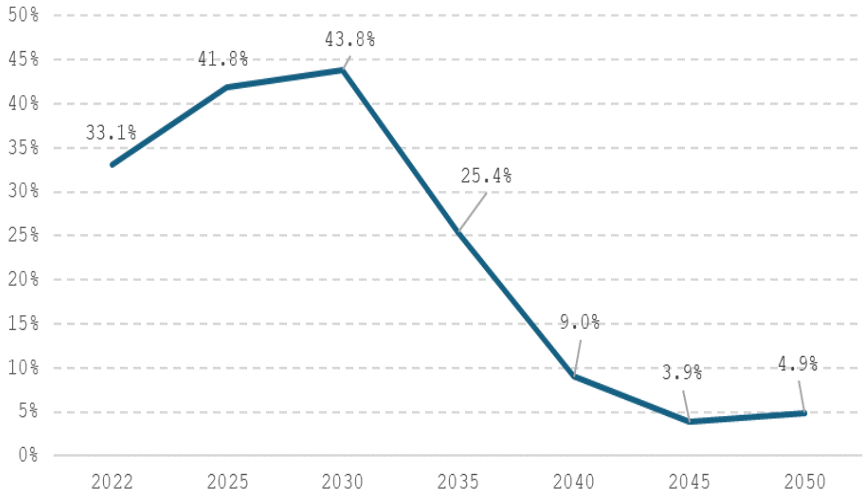
The aim of diversifying the supply of virgin nuclear fuel is to ensure the continued operation of nuclear capacity as well as the security and reliability of electricity production.

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

Increasing the resilience of the national energy system is linked to the diversification of natural gas sources and routes. In this context, Bulgaria is implementing and planning a number of projects to expand the gas transmission network and increase natural gas transmission and storage capacities.

In order to increase the resilience of energy systems at regional and national scale, Bulgaria is making efforts to maintain and reduce its dependence on imports of energy resources.

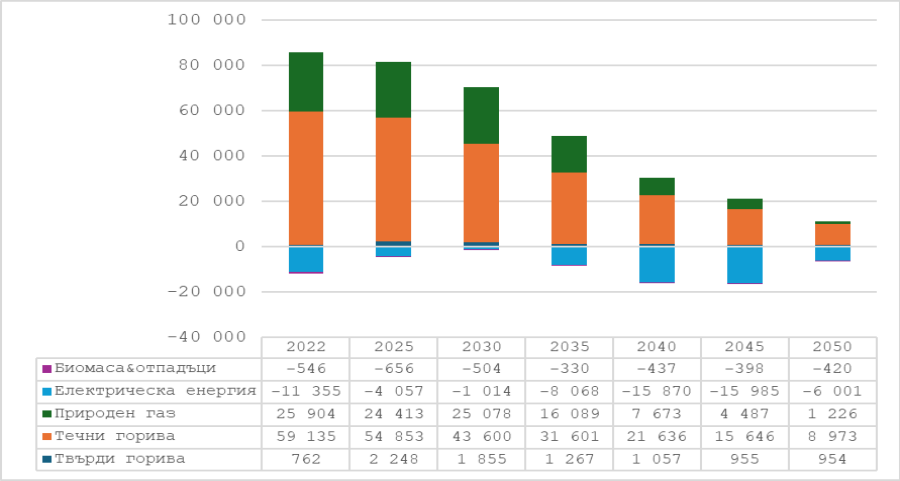
Figure 13: *Energy dependency (%), WAM scenario*



Source: (B) EST model, E3-Modelling

According to the WAM scenario, the country's dependence on energy imports would increase to 43.8 % in 2030 and then a decrease to 4.9 % at the end of the period considered.

Figure 14: *Net fuel imports (GWh), WAM scenario*



	2022	2025	2030	2035	2040	2045	2050
Биомаса&отпадъци	-546	-656	-504	-330	-437	-398	-420
Електрическа енергия	-11 355	-4 057	-1 014	-8 068	-15 870	-15 985	-6 001
Природен газ	25 904	24 413	25 078	16 089	7 673	4 487	1 226
Течни горива	59 135	54 853	43 600	31 601	21 636	15 646	8 973
Твърди горива	762	2 248	1 855	1 267	1 057	955	954

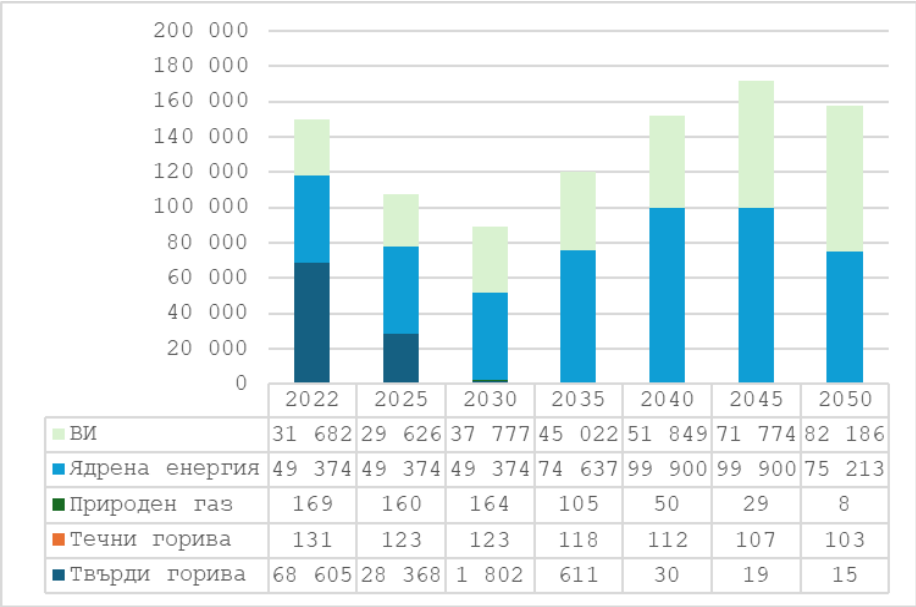
Source: (B) EST model, E3-Modelling

Over the period considered, the WAM scenario predicts an increase in low carbon production in the country, in line with which there will be a decreasing trend in imports of natural gas and liquid fuels. No net imports of electricity and biomass are foreseen to satisfy consumption in Bulgaria.

The most notable is the expected reduction of 50 162 GWh (almost 85 %) in imports of liquid fuels, reaching 2 050 GWh by 8 973. Over the period, natural gas imports are projected to decrease from 25 904 GWh in 2022 to 1 226 GWh in 2050.

For solid fuels, imports are expected to increase by 192 GWh (25 %), reaching 954 GWh at the end of the period.

Figure 15: *Production of primary energy (GWh), WAM scenario*



	2022	2025	2030	2035	2040	2045	2050
ВИ	31 682	29 626	37 777	45 022	51 849	71 774	82 186
Ядрена енергия	49 374	49 374	49 374	74 637	99 900	99 900	75 213
Природен газ	169	160	164	105	50	29	8
Течни горива	131	123	123	118	112	107	103
Твърди горива	68 605	28 368	1 802	611	30	19	15

Source: (B) EST model, E3-Modelling

Given additional policies and measures, the WAM scenario expects a gradual increase of 5 % in primary energy production, reaching 157 526 GWh in 2050.

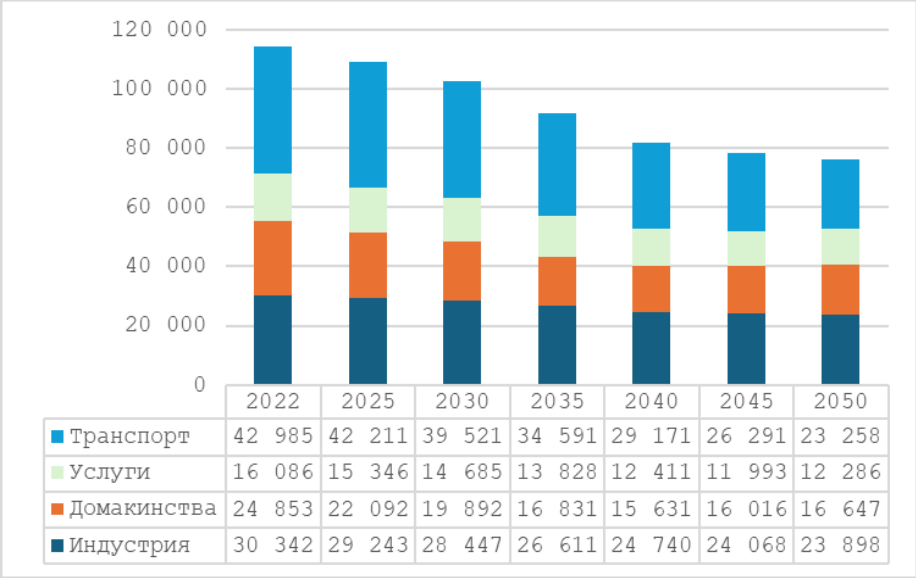
In line with the country's aspiration for climate neutrality, the share of primary energy produced from renewable sources is projected to increase significantly. Energy production from renewable sources is expected to be close to 160 % higher than in 2 050 in 2022, reaching 82 186 GWh.

By 2045, primary energy production from nuclear fuel is expected to increase by around 102 % compared to the beginning of the period, before decreasing to 75 213 GWh in 2050.

A significant reduction of close to 100 % is projected for fossil fuel energy production, which from 68 605 GWh in 2022 will reach 15 GWh at the end of the period considered. By 2030, relatively constant levels of primary energy production from natural gas are expected, with production decreasing after this period and reaching 2 050 GWh in 8.

In 2030, the WAM scenario predicts 13.19 Mtoe of primary energy use, i.e. a decrease from the PRIMES 2020 baseline projection of 15.42 %. Final energy consumption is also decreasing to 8.82 Mtoe, i.e. a decrease from the PRIMES 2020 baseline projection of 11.61 %.

Figure 16: *Final energy consumption by sector (GWh), WAM scenario*



	2022	2025	2030	2035	2040	2045	2050
Транспорт	42 985	42 211	39 521	34 591	29 171	26 291	23 258
Услуги	16 086	15 346	14 685	13 828	12 411	11 993	12 286
Домакинства	24 853	22 092	19 892	16 831	15 631	16 016	16 647
Индустрия	30 342	29 243	28 447	26 611	24 740	24 068	23 898

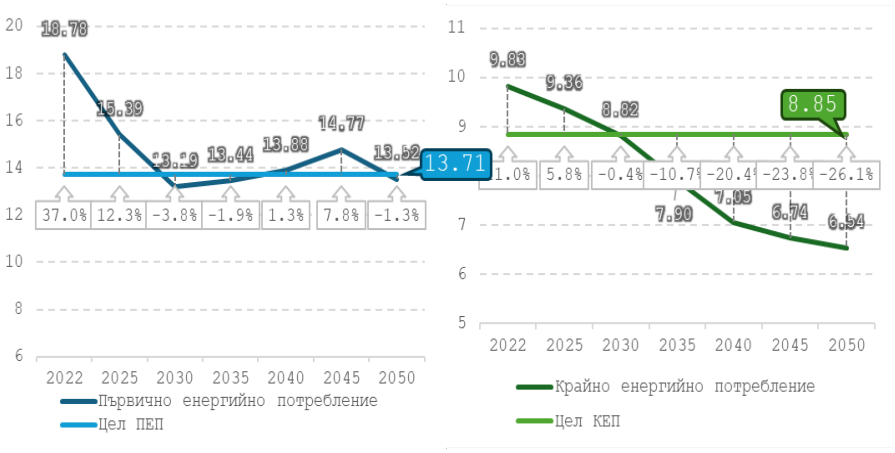
Source: (B) EST model, E3-Modelling

Achieving the targets with additional policies and measures will have a positive impact on energy consumption in all sectors of the country's economy. In this regard, the WAM scenario projects an overall reduction of more than 33 per cent in final energy consumption, which from 114 268 GWh in 2022 is expected to reach 76 089 GWh in 2050.

The largest reduction of almost 46 % is expected for final energy consumption in the transport sector, *from* 42 985 GWh in 2022 to 23 258 GWh in 2050. Although less high, a reduction in final energy consumption is also projected in the household *(* 8 206 GWh) and *industry* (6 445 GWh) sectors, reaching 16 647 GWh and 23 898 GWh respectively at the

end of the period. For the *services* sector, a smoother reduction of FEC is expected from 16 086 GWh in 2022 to 12 286 GWh in 2050.

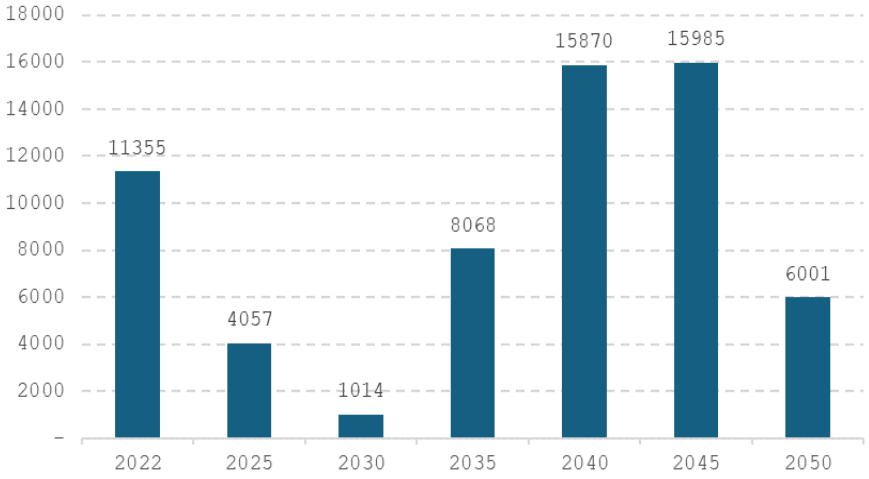
Figure 17: *Primary and final energy consumption in Bulgaria, target, historical data (2022) and projections (B) EST WAM (2025-2050) (Mtoe)*



Source: (B) EST model, E3-Modelling

Throughout the forecast period, Bulgaria maintains its position as a net exporter of electricity, albeit with some fluctuations. By 2030, the early decommissioning of solid fuel power plants and the short lead time for renewable energy projects lead to a reduction in exports.

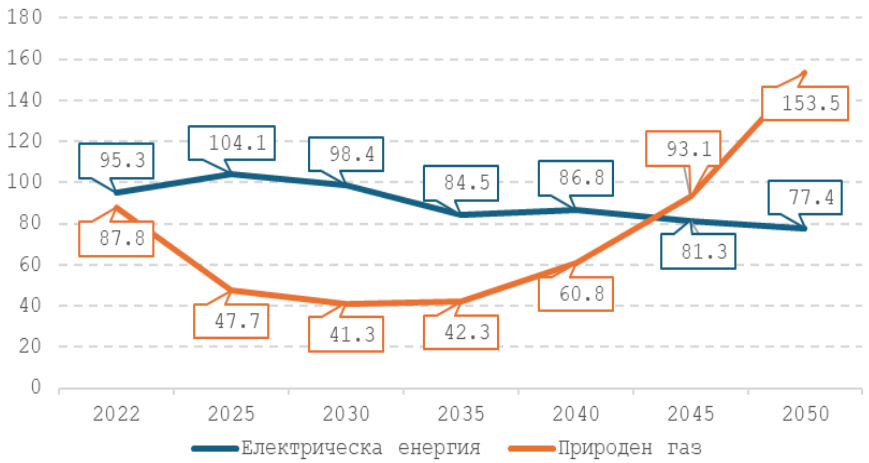
Figure 18: *Electricity**exports (GWh), WAM scenario***



Source: Eurostat; (B) EST model, E3-Modelling

However, with the commissioning of two new nuclear units in the nuclear power plant in 2035 and 2040, exports increased significantly. By 2050, with the decommissioning of Unit Fifth of the Kozloduy Nuclear Power Plant, the country continued to support its exports, but to a lesser extent.

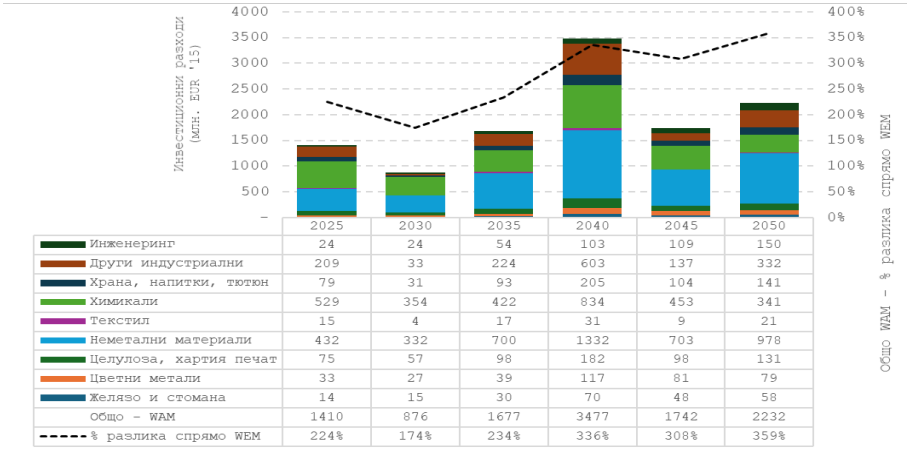
Figure 19: *Electricity and gas consumer prices in Bulgaria, historical data (2022) and forecasts (B) EST WAM (2025-2050) (EUR 15/MWh)*



Source: Eurostat; (B) EST model, E3-Modelling

The transition to carbon neutrality is expected to have a multi-faceted impact, manifested both at country and energy sector level, up to the level of individual consumers. Consumer electricity prices, after some small increases in 2025 and 2030, mainly due to the CO_2 price level, decreased from 2035 onwards. Consumer prices of natural gas correspond to mixed pipeline gas, which from 2040 onwards includes a significant share of hydrogen, biogas and synthetic methane, a fact that explains the upward trend between 2040 and 2050.

Figure 20: *Investment costs for heat recovery in industry by sector in Bulgaria, (B) EST WAM estimates (EUR '15 million for 5 year)*

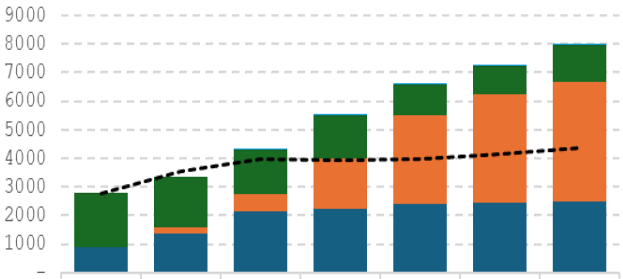


	2025	2030	2035	2040	2045	2050
Инженеринг	24	24	54	103	109	150
Други индустриални	209	33	224	603	137	332
Храна, напитки, тютюн	79	31	93	205	104	141
Химикали	529	354	422	834	453	341
Текстил	15	4	17	31	9	21
Неметални материали	432	332	700	1332	703	978
Целулоза, хартия печат	75	57	98	182	98	131
Цветни метали	33	27	39	117	81	79
Желязо и стомана	14	15	30	70	48	58
Общо - WAM	1410	876	1677	3477	1742	2232
% разлика спрямо WEM	224%	174%	234%	336%	308%	359%

Source: (B) EST model, E3-Modelling

As energy efficiency is promoted more intensively under the WAM scenario, the corresponding investment costs across all industrial sectors increase by more than 2-3 times compared to the WEM scenario. Under the WAM scenario, the costs of implementing energy efficiency investments range from EUR 876 to almost EUR 3 500 million over a five-year period.

Figure 21: *System expenditure in households by category in Bulgaria, (B) EST WAM projections (EUR million '15)*



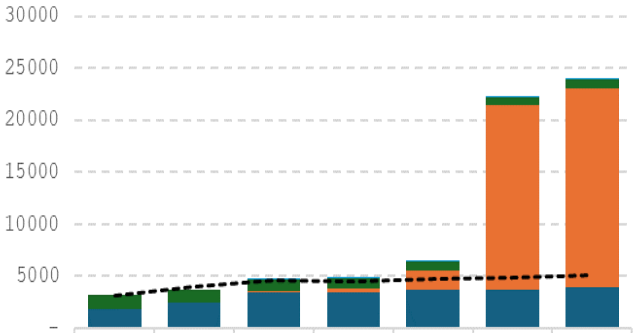
	2022	2025	2030	2035	2040	2045	2050
Емисии&енергийни такси	-	-	10	10	6	4	2
Горива	1869	1764	1579	1532	1112	997	1268
Инвестиции в ефективност	-	197	585	1733	3070	3805	4173
Оборудване	907	1393	2148	2256	2419	2442	2507
Общо - WAM	2777	3354	4322	5531	6607	7249	7951
Total - WEM	2777	3560	3957	3946	3967	4143	4364

Source: (B) EST model, E3-Modelling

For households, overall system expenditure followed an upward trend, which stabilised until 2035. Due to realised investments in energy modernisation of residential buildings, household expenditure is shifting, with fuel expenditure accounting for a decreasing share (reaching 16 % of total system expenditure in households by 2050) in favour of investment expenditure on equipment and direct efficiency. Asa consequence of the replacement of appliances and equipment in households, equipment costs are expected to increase over the period considered, reaching EUR 2 050 million in 2 507.

Overall, there is an increase in system expenditure in households, mainly due to investments in equipment and fuel purchases, with the latter contributing at least 47 % to total system expenditure in households over the entire projection horizon of the WEM scenario.

Figure 22: *System expenditure for services and agriculture by category in Bulgaria, (B) EST WAM estimates (EUR million '15)*

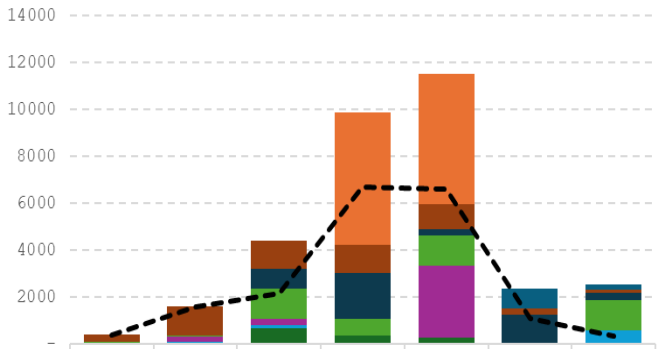


	2022	2025	2030	2035	2040	2045	2050
Емисии&Енергийни такси	-	-	10	9	4	3	1
Горива	1355	1188	1076	1002	834	699	834
Инвестиции в ефективност	-	36	162	428	1886	17775	19205
Оборудване	1793	2416	3382	3396	3653	3718	3893
Общо - WAM	3148	3640	4630	4835	6377	22194	23933
Общо - WEM	3148	3946	4562	4514	4673	4826	5115

Source: (B) EST model, E3-Modelling

Services and agriculture in the WAM forecast show a decreasing share of fuel costs, which is offset by increased investment costs in direct efficiency measures and equipment purchases.

Figure 23: *Investment costs for electricity by plant type, (B) EST WAM estimates (million EUR '15)*

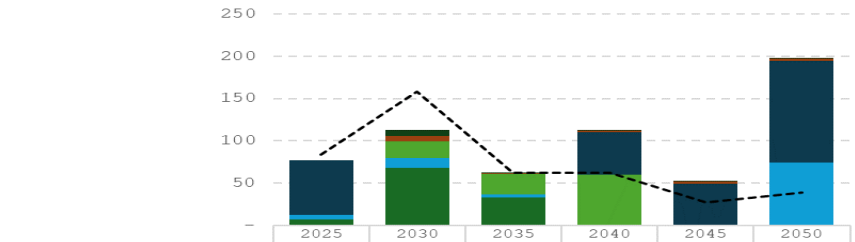


	2022	2025	2030	2035	2040	2045	2050
Ядрена енергия	-	-	-	5640	5550	-	-
Геотермална енергия	-	-	-	-	-	829	183
Фотоволтаици	323	1264	1238	1209	1054	263	157
Вятър в страната	-	-	825	1948	262	1255	319
Офшорен вятър	7	8	1280	720	1294	-	1260
Хидро	-	217	290	-	3067	-	-
Биомаса	3	52	96	23	-	-	593
Природен газ	58	58	688	336	279	-	-
Общо - WAM	391	1599	4418	9876	11507	2347	2513
Общо - WEM	391	1599	2170	6673	6621	1084	331

Source: (B) EST model, E3-Modelling

The penetration of RES projected for the energy sector in the WAM scenario is responsible for the increased investment costs, which in 2030 are more than double the corresponding costs of the WEM scenario. Concentrated mainly in 2035 and 2040, the WAM scenario requires an additional EUR 3.3 billion and EUR 4.9 billion respectively.

Figure 24: *Investment costs in CI and CI by plant type, (B) EST WAM forecasts (million EUR '15)*

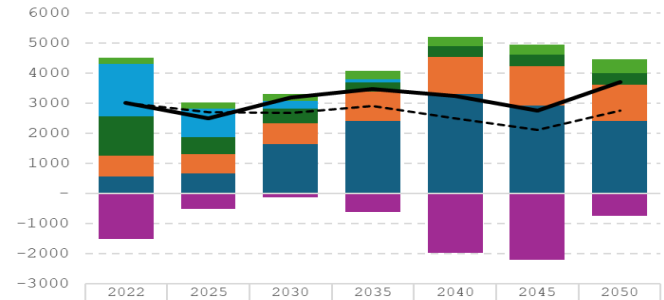


	2025	2030	2035	2040	2045	2050
ОЦ електричество	–	–	–	–	–	–
ОЦ слънце	–	7	1	1	1	1
ОЦ геотермия	–	7	1	2	2	2
ОЦ биомаса	64	–	–	50	50	120
ОЦ газ, нефт	–	19	24	60	–	–
ОЦ твърди горива	–	–	–	–	–	–
ВКП биомаса	5	12	3	–	–	75
ВКП газ	7	68	34	–	–	–
ВКП твърди горива	–	–	–	–	–	–
ВКП ядрена енергия	–	–	–	–	–	–
Общо – WAM	77	113	63	113	52	198
Общо – WEM	84	158	62	62	27	39

Source: (B) EST model, E3-Modelling

With regard to investments in CI and CI, the WAM scenario predicts lower costs over the medium term than the WEM scenario, as the heat needs are lower. In order to achieve the necessary emission reductions by 2050, investments are made in biomass cogeneration and heat installations, thus requiring increased investment costs in 2040-2050 compared to the WEM scenario forecast.

Figure 25: *Electricity supply costs, (B) EST WAM forecasts (million EUR '15)*



	2022	2025	2030	2035	2040	2045	2050
Мрежи	219	206	231	264	326	355	447
Други разходи/приходи [2]	-1516	-517	-123	-597	-1965	-2194	-740
Емисии/енергийни такси	1722	954	268	98	–	–	–
Горива	1315	548	472	324	363	364	398
Негоривни	700	658	693	958	1229	1306	1205
Основни разходи [1]	569	669	1657	2430	3305	2939	2410
Общо – WAM	3009	2518	3199	3476	3258	2771	3718
Общо – WEM	3009	2703	2687	2925	2497	2120	2759

[1] Annual equivalent

[2] Costs related to carbon storage and import/export related costs/revenues

Source: (B) EST model, E3-Modelling

The higher electricity supply costs from 2 030 in the WAM scenario, compared to the WEM scenario, mainly reflect higher capital costs. This can be expected as subsidies for renewable technologies are available in the WAM scenario.

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

Objectives with regard to increasing the flexibility of the national energy system:

- Maintaining the role of indigenous energy resources (coal) and using them, in line with the requirements of environmental legislation;
- Exploiting the potential of natural gas and phasing out the fuel base from solid fuels to natural gas;
- Increasing the capacity, extraction and injection of UGS Chiren;
- Participation in new LNG terminal projects in the region;
- Maintaining the role of nuclear energy, which is considered as a local energy source;
- Maintaining and developing the transmission capacity of electricity and natural gas transmission networks;
- Demand response in the energy system by developing energy markets;
- Increase electricity and gas storage capacity by developing existing and building new storage facilities.

From 2023 to 2030, measures related to the development and digitalisation of energy infrastructure, support for the integration of electricity produced from renewable sources into the electricity grids and the wider use of smart energy storage systems are foreseen. The implementation of such measures will lead to a more complete use of electricity produced from renewable sources, thanks to its easier integration into the electricity system.

2.4. Dimension Internal energy market

2.4.1. Electricity interconnection

i. The level of electricity interconnectivity that the Member State aims for in 2 030 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.

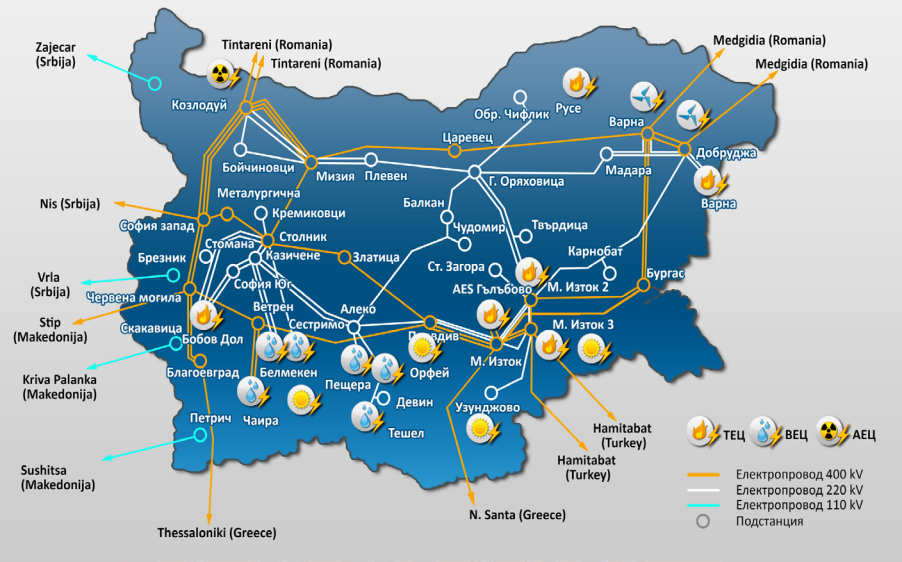
Any new interconnector shall be subject to a socio-economic and environmental cost-benefit analysis and shall only be realised if the potential benefits outweigh the costs.

According to European legislation, the electricity interconnection level for each Member State must be at least 10 % by 2020 and at least 15 % by 2030, relative to installed capacity. The maximum level of capacity of interconnectors and network elements should be made available, subject to safety standards, for secure network operation, including compliance with the security standard in emergency situations. In line with the European recommendations, Bulgaria has set a target of at least 15 % electricity interconnection. This objective will be achieved through the implementation of projects of common interest and complementary initiatives.

As required by Regulation (EU) No 1999/2018, three indicators of urgent action in this area should be taken into account in the interconnection strategy as a complement to the European interconnection target.

The nominal transmission capacity of the interconnectors shall be at least 30 % of the peak load.

Figure 26: *Interconnection*



Source: ESO EAD

The nominal transmission capacity of interconnectors shall be at least 30 % of the installed production from renewable sources.

According to preliminary estimates, the figures are as follows:

- 7 651 MW – estimated installed production capacity from renewable sources for 2025;
- 12 320 MW – total nominal transmission capacity of interconnectors, which is 162 % relative to installed production capacity from renewable sources.

It has to be taken into account that the nominal capacity of the 400 kV line with 2xACO500 wires is 1 200 MW and for 3xACO400 wires is 1 280 MW (taking into account the capacity of all conductor elements of the line and an average power factor of 0.93). There is also a further reduction in interconnection capacity due to 1 600 A current transformers in neighbouring border substations. In Bulgarian border substations, the current transformers are 2 000 A.

The Bulgarian EEU works in parallel with the EU of the countries of continental Europe. Our EES is connected to the united European EEC through four electricity interconnections with Romania, two with Türkiye and Greece, and one each with Serbia and the Republic of North Macedonia, as follows:

- EP 400 kV Kozloduy (BG) – p/st Tunceareni (RO);
- EP 400 kV Kozloduy (BG) – p/st Tunceareni (RO);
- EP 400 kV/st Varna (BG) – p/st Mezzidia (RO);
- EP 400 kV p/st Dobrudzha (BG) – p/st Mezzidia (RO);
- EP 400 kV Maritsa Iztok 3 (BG) – p/st Hamitabat (TR);
- EP 400 kV Maritsa Iztok 3 TPP (BG) – p/st Hamitabat (TR).

- EP 400 kV/st Sofia West (BG) – p/st N (RS);
- EP 400 kV p/st Red Mogila (BG) – p/st Styp (MK);
- EP 400 kV p/st Blagoevgrad (BG) – p/st Thessaloniki (GR);
- EP 400 kV/st Maritsa East (BG) Bulgaria – Na Santa (GR) Greece.

2.4.2. Energy infrastructure

i. The main electricity and gas infrastructure projects and, where appropriate, upgrade projects that are necessary to achieve the objectives and targets under the five dimensions of the Energy Union Strategy

The main electricity and gas infrastructure projects and modernisation projects are:

1. In the field of electricity transmission infrastructure

- The reconstruction and development of the 110 kV internal grid and an increase in transformer capacity at 110 kV/SRN substations to ensure the transmission of electricity from RES to the interior of the country and neighbouring countries;
- Hydro-pumped storage project in Bulgaria – Yadenitsa.

The project aims at increasing the volume of the lower equilibrator of the pumped storage hydroelectric power plant 'Chayira' with the construction of the Ydenitsa dam and a reversible irrigation tunnel for connection to the Chayira dam.

- Batak pumped storage plant;
- Hydroelectric pumped storage 'Dospat'.

The projects provide for the construction of a pumped storage plant 'Batak' and a pumped storage hydropower plant 'Dospat' in the case of dams already built from the 'Batachki Water Road' cascade. Each of the two projects will add to the system around 800 MW of new installed capacity in generation mode and 730 MW in pumping mode, by connecting and using the dams 'Greater Beglik' and 'Shiroka Polyana' as an upper reservoir and as the lower equator of the Batak and Dospat dams.

The projects are under consideration by the project promoter and apply for inclusion in ENTSO-E DRM 2024, with the prospect of applying for inclusion in the next possible list of EU PCIs.

- Investment C4.I4. Digital transformation of the electricity grid, National Recovery and Resilience Plan;
- ECO projects under the Modernisation Fund.

In order to make better use of existing electricity grid capacities and the introduction of smart technologies, ESO EAD implements investment C4.I4 'Digital transformation of the electricity grid', part of the recovery and resilience plan (RRP) of the Republic of Bulgaria,

with an approved budget of BGN 611 000 000 (co-financing of BGN 370 000 000 from the Recovery and Resilience Facility and BGN 241 000 000 of own funds). The investment is implemented under Operational Agreement No СПОР-1/03.01.2023 signed by the Ministry of Finance, the Ministry of Energy, acting as the Monitoring Structure and ESO EAD, as the final recipient of funds from the RRP and includes a comprehensive programme for the overall digital transformation of the systems and processes of the national electricity transmission operator. The implementation of the Investment will achieve: (1) increase grid connection capacity by at least 4 500 MW to integrate new renewables into the electricity system and (2) cross-border capacity increase of at least 1 200 MW to optimise the use of existing assets. The implementation of the investment is essential to ensure national energy security, as the integrated implementation of the SASP is an integral part of the overall modernisation of Bulgaria's electricity network planning, management and maintenance activities, by introducing state-of-the-art digital means and methods to provide the necessary manoeuvrability, security and speed in managing the electricity system in a low-carbon generation environment.

- Project "Sustainable adaptation of the national electricity grid to fully integrate renewable energy production potential – GREENABLER"

The total cost of the project is EUR 857 million, with EUR 568 million foreseen to be made available from the Modernisation Fund and EUR 203 million from the National Recovery and Resilience Plan, the RestaurChapter, while the rest is the own financing of ESO EAD. The proposed investment will provide the technical possibility to connect around 4 500 MW of new RES to the national network after 2 026 year. The project is divided into two main groups of investments:

— First group – investment in the reconstruction of approximately 720 km of existing power lines to increase their nominal voltage from 220 kV to 400 kV and synchronised reconstruction at their adjacent substations from 220/110 kV to 400/110 kV. The CID 110/15.02.2024 approved this investment pool for funding from the Modernisation Fund;

— Second group, investments in the reconstruction of the Hemus-Stara Mountain Pipeline from 220 kV to 400 kV, reconstructing 888 kilometres of 110 kV power lines and doubling 92 km of 110 kV power lines to increase the capacity of existing overhead lines. This investment group is to be included for funding from the National Recovery and Resilience Plan, chapter REPower EU.

The project will contribute significantly to the implementation of the national energy sector development strategy over the 2053 time horizon, as well as to the achievement of the main objectives set out in Rehabilitation – energy security, diversification of the Union's energy supply, increased use of renewable energy sources and energy efficiency, increased energy storage capacity and the necessary reduction of dependence on fossil fuels by 2030, especially in light of the energy and economic consequences of the war in Ukraine. The main objective is to integrate renewable energy with a 100 % contribution to the green objective of the EU Recovery and Resilience Plan, and in this respect the project is expected to bring the following benefits:

– Ensure gradual and consistent decarbonisation of the electricity sector and increase the share of RES in the country's energy mix;

– Cooperation with neighbouring EU Member States in the field of renewable energy with regard to projects facilitating the integration of RES;

– Significant use of wind and solar energy from renewable sources, including combined with energy storage facilities;

– Connecting a significant amount of new modules for renewable energy parks and ensuring that their exits are transferred to primary consumption centres, without restricting existing power generating and/or interconnection modules for the exchange of electricity with neighbouring energy systems;

– Improving the security of the electricity system and limiting process losses.

• Project of Common Interest (PCI) 12.2 Carmen/Carmen (Bulgaria, Romania)

The project is for deeper cross-border cooperation between transmission system operators (TSOs) and data sharing, for deeper cooperation between TSOs and distribution system operators (DSOs), for investing in grid expansion and increasing capacity to integrate new renewable energy sources, and for improving grid stability, security and flexibility. PCI 12.2 Carmen is included in the list of projects of common and common interest of the Union for the construction of trans-European energy infrastructure in the priority thematic area Smart Grid Deployment by EC Delegated Regulation of 28.11.2023 amending Regulation 2022/869.

The objective of the project is to modernise the existing electricity transmission infrastructure by applying the standards for smart grids in the electricity transmission and distribution systems of Romania and Bulgaria.

ESO EAD's participation in the project consists of investments to enhance the capabilities of the Bulgarian electricity transmission system to exploit the identified high renewable energy potential at national and regional level, in the following main areas:

1. Comprehensive digitalisation and automation of the transmission network, including, but not limited to, by: installing a dynamic monitoring system for transmission capabilities by extending the existing recording system to new PMUs; deployment of flexible AC solutions (FACTS); and enabling more efficient demand-side management (DSR), in cooperation with national distribution system operators;

2. Modernisation, strengthening and increasing the capacity of the transmission system in Northern Bulgaria with a view to making it ready to integrate and transfer significant amounts of renewable energy from the large RES in Northern Bulgaria to consumption centres, both in the country and at regional level, along the North-South priority corridor, in particular to and through Romania. This planned extension is driven not only by the massive deployment of RES, but also by the expected development of electric and hydrogen recharging infrastructure throughout Bulgaria to accommodate and catalyse the transition to underground mobility.

Digitalisation, strengthening and increasing the capacity of the transmission system in Northern Bulgaria will enable the integration and transmission of significant amounts of renewable energy from the large RES in Northern Bulgaria to the consumption centres in the country, but also at regional level along the priority corridor North-South, in particular to and through Romania. This planned expansion and smartness of the grid is required not only by the massive deployment of RES, but also by the expected development of electric and hydrogen recharging infrastructure on the territory of Bulgaria, which will boost and catalyse the transition to emission-free mobility.

- Project 1226 of ENTSO-E 2024 Ten-Year Plan – North-South Electricity Corridor in Eastern Europe

Decarbonising Europe's electricity sector is a major task for the EU, as it is an important condition for mitigating climate change and contributes to Europe's independence from external energy sources. The targets set out in several documents and adopted by Member States (e.g. the Fit For 55 package, RePower Europe, etc.) aim at a large increase in renewable energy. These targets are published in the respective NREAP for each Member State.

In order to achieve the ambitious objectives set, it is necessary to overcome certain obstacles, which are mainly linked to the state of the transmission network in the region. The project aims to overcome these obstacles and achieve the following objectives:

– Strengthening the grid by using traditional methods (adding new lines, substations, etc.) and new technologies (batteries) capable of storing energy and transferring excess energy to more remote energy systems due to the simultaneous surplus of renewable energy production in neighbouring systems;

– Setting operational measures and rules to ensure security and allow further integration of renewable energy sources;

– Exploring and introducing new common technologies to balance active and reactive power to address RES volatility driven by specific geographical and meteorological conditions in the countries of the regions;

– Exploring and implementing appropriate operational planning procedures that ensure a minimum inertia stock in the system;

– Explore and implement appropriate operational planning procedures for cross-border sharing of secondary and tertiary regulation reserves (FCR, FRR and RR).

Project 1226 covers the networks of Greece, North Macedonia, Serbia, Bulgaria, Hungary, Slovakia, Romania, Czechia and Poland. It is also possible to consider parts of the networks of Ukraine and Moldova, as they also affect the transmission of electricity in the region.

2. Main gas transmission infrastructure projects

In compliance with the requirements of the Energy Act, Bulgartransgaz EAD prepares and publishes annually a 10-year plan for the development of gas transmission networks. The plans set out the vision for the development of the company as independent transmission

operator and underground storage operator. It is in line with the main European, regional and national priorities, namely enhancing security of gas supply, ensuring diversification of supply sources and routes, establishing a stable, liberalised and interconnected gas market on a lasting basis and in line with Europe's climate and environmental policies.

The implementation of the Vertical Gas Corridor initiative involving the gas transmission network operators of Bulgaria, Greece, Romania, Hungary, Slovakia, Ukraine and Moldova will contribute to these priorities. The initiative aims to maximise the use of existing gas transmission infrastructure and provides for specific targeted projects to increase natural gas transmission capacity from south to north, taking into account the increasing demand for liquefied natural gas from existing and planned terminals in Greece. Key for Bulgaria and the region are Bulgartransgaz EAD's projects to increase capacity in IP Kulata/Sidirokastro and IP Negrou Voda/Cardam, as well as of the Greece-Bulgaria Interconnector.

Figure 27: *Gas transmission infrastructure of Bulgartransgaz EAD and extension projects*

Source: Bulgartransgaz EAD

Bulgartransgaz EAD's projects aim to ensure the security of natural gas supply to the country by expanding the possibilities for the transmission of significant quantities of natural gas on independent routes and for underground storage of natural gas. Another main objective is to give more municipalities and final customers access to natural gas, which will contribute to improving the environment, quality of life and energy efficiency. In this context, the extension of the existing gas transmission network to new regions of the country is envisaged in order to enable new end-users or distribution networks to be connected to the gas transmission network. For the development of a regional gas market, the construction and operation of new infrastructure projects, the extension of UGS Chiren and the increase of transmission capacities at interconnection points are essential.

- Gas interconnector Greece-Bulgaria (IGB)

The Greece-Bulgaria gas interconnector (IGB) is a key part of the project to develop the Vertical Gas Corridor. The commercial exploitation of IGB was launched on 1 October 2022. The gas connection is an important infrastructure that provides diversification of natural gas supply sources and routes to Bulgaria and the region through access to LNG terminals near Alexandroupolis and the Southern Gas Corridor.

The gas connection has a total length of 182 km, of which 151 km on Bulgarian territory and a natural gas transmission capacity of 3 bcm/a. If there is commercial interest, the capacity can be extended to up to 5 bcm/. The IGB pipeline connects the transmission systems of DESFA and TAP in Komotini, the Hellenic Republic, to the transmission system of Bulgartransgaz EAD in the area of the village of Zagore, Stara Zagora Municipality.

The direct effects of the implementation of the project are: achieving a real diversification of natural gas supply sources for the Republic of Bulgaria and the region, enabling natural gas supplies from the Southern Gas Corridor and liquefied natural gas (LNG) sources.

Construction of the interconnector between Greece and Bulgaria was completed, the gas interconnector became operational on 1.10.2022.

- Bulgaria-Serbia Interconnection (IBS)

The Bulgaria-Serbia gas interconnector (IBS) connects the gas transmission networks of the Republic of Bulgaria and the Republic of Serbia at a new interconnection point IP Kalotina/Dimitrovgrad. It has a total length of 170 km from the town of Novi Iskar, the Republic of Bulgaria, to the town of Nis, Republic of Serbia, of which 62.2 km on Bulgarian territory. The commercial exploitation of the project started in December 2023.

IBS provides additional access for Bulgaria to sources of gas from Western Europe on a completely new route and for Serbia to LNG terminals and other alternative sources from the region.

The technical capacity of the reverse gas pipeline for the transport of natural gas is 1.8 billion metres (^{3}), with the possibility, if there is commercial interest, to increase it to 3.2 billion metres (^{3}). To this end, phase 3 of Bulgartransgaz EAD's project for the modernisation, rehabilitation and extension of the gas transmission infrastructure, including the construction of a compressor station near Novi Iskar with a capacity of 20 MW and 19 km of a new pipeline of DN700 diameter in the Gorni Bogrov – Nowy Iskar section, needs to be implemented.

The Bulgaria-Serbia interconnector is included in the fifth list of projects of common interest for the European Union pursuant to Regulation (EU) No 347/2013 on guidelines for trans-European energy infrastructure adopted by the European Commission on 19.11.2021.

A grant of up to EUR 27 602 809 was awarded for the construction of the gas connection under the Connecting Europe Facility, representing 36 % of the estimated eligible costs for the construction of the interconnector.

The total cost of the project of common interest is EUR 81 million for the construction of the route on Bulgarian territory. The commercial exploitation of IBS started in December 2023.

- LNG terminal project to Alexandroupolis

The project for the construction of an LNG terminal near Alexandroupolis, in which Bulgaria participates with a 20 % share of the share capital of Gazreid S.A., is important for providing new quantities of natural gas from an alternative source to the Bulgarian and regional gas markets. The project will provide Bulgaria and the entire region with access to the global liquefied gas market. The terminal will have a regasification capacity of 5.5 billion m (^{3}) and a storage capacity of 153.5 thousand m^3. Bulgaria has expressed interest in participating in the new project for the construction of the Trakia LNG terminal and/or other LNG terminal projects in the region.

The construction of the liquefied natural gas terminal in Alexandroupolis, Greece, aims to provide new volumes of gas to supply the Greek and regional markets in south-east Europe, while contributing to diversification of gas supply sources and routes, fostering competition to the benefit of final customers, as well as enhancing security of supply. Potential sources of supply include LNG producing countries such as Algeria, Qatar, the USA, etc.

The terminal will be located 17.6 km south-west of the port of Alexandroupolis and about 10 km from the coast. The facility will be connected to Greece's national natural gas transmission system and to the Bulgarian gas transmission system, through the existing IP Kulata/Sidirokastro and the Bulgaria-Greece interconnector.

The project company for the realisation of the terminal is Gaztreid S.A. In implementation of a decision of the Council of Ministers of 8 January 2020, Bulgartransgaz EAD entered as a shareholder with a 20 % share in the construction of the liquefied natural gas terminal at Alexandroupolis.

The second phase of the market test was successfully completed in March 2020. Ten participants booked a total capacity of up to 2.6 bcm/. Bulgargaz EAD's participation in the legally binding phase for capacity booking was also essential.

The final investment decision of the shareholders was taken on 27.1.2022.

The floating LNG reception, storage and regasification terminal is expected to be commercially operational in the second quarter of 2024.

The project was removed from the fifth list of projects of common interest for the European Union under Regulation (EU) No 347/2013 on guidelines for trans-European energy infrastructure (adopted by the European Commission on 19.11.2021).

- New LNG terminal projects in the region

Given the increasing share of LNG in energy consumption in the EU and the lower LNG storage and regasification capacity compared to other EU regions, it is promising and

appropriate to involve Bulgaria through Bulgartransgaz EAD in new LNG terminal projects in the region.

- Extension of capacity of UGS Chiren

The project to expand the Chiren gas storage facility, which will contribute to ensuring the security of natural gas supply in the country and the region, as well as improving competition and access to natural gas from alternative sources, is also being implemented.

The project for the extension of the capacity of the underground gas deposit (UGS) Chiren involves a gradual increase in the capacity of the sole gas storage facility on the territory of Bulgaria, in order to achieve higher volumes of gas stored, increased pressures in the gas reservoir and larger daily average flows for extraction and injection. It is planned to increase the volume of gas produced to 1 billion m^3 and increase the extraction and injection flow to 8-10 mcm/day. The achievement of these objectives will be made possible by the construction of new above-ground facilities, 10 new high-productivity operating wells and 3 new observatory wells, as well as the necessary new infrastructure connecting the storage facility to the gas transmission network of the company.

UGS Chiren is a crucial tool for ensuring security of gas supply for both Bulgaria and the region. The achievement of the new technical parameters of the underground gas storage facility will contribute to ensuring security of supply, by providing a significant reserve in the event of supply disruptions and by incentivising supplies from alternative and reliable sources, including liquefied natural gas.

The project to expand the capacity of UGS Chiren is a project of common interest to the European Union included in the fifth PCI list adopted by the European Commission on 19.11.2021.

The investment required for the overall construction of the project amounts to EUR 308 million. On 22 June 2022 Bulgartransgaz EAD signed a grant agreement granting grants under the Connecting Europe Facility to construct above-ground facilities and run new wells. The estimated grant for the construction of the surface installations and the drilling fund is EUR 77 910 017.

The gas pipeline connecting UGS Chiren to the existing gas transmission network of Bulgartransgaz EAD in the Bhutan area, as part of the project to expand the gas storage capacity, will be financed from the company’s own resources.

The implementation of all elements of the project has been commissioned by Bulgartransgaz EAD and is in the process of being implemented. It is expected that the construction of the new infrastructure will be completed and the sites will be put into operation by the end of 2024.

- Rehabilitation and modernisation of the national gas transmission system

The integrated project for the modernisation, rehabilitation and extension of the existing gas transmission infrastructure on the territory of Bulgaria is carried out in 3 phases and includes the following types of activities: modernisation and rehabilitation of compressor

stations; inspections to ascertain and describe the condition of the pipelines; repairs to and replacement of sections of the pipeline following inspections; extension and modernisation of the existing gas transmission network; implementing systems to optimise the management of the technical condition of the network. The project is included in the fifth list of projects of common interest adopted by the European Commission on 19.11.2021.

The investments needed to build the project amount to EUR 339 million. The funding is implemented through own funds and grants under the Connecting Europe Facility.

In 2018 Phase 1 of the project's activities were completed, with the entry into operation of the 20 km gas pipeline section in the section 'Lozenets' – OC 'Nedyalksko'.

Within Phase 1 and Phase 2 of the project and using Bulgartransgaz EAD's own resources, four compressor stations – Lozenets CS, Ihtiman, Petrich and Strandzha CC – were modernised, in which a total of 10 new gas turbo compressor units (GTCA) were installed.

The implementation of Phase 2 of the project is financed under two agreements concluded under the Connecting Europe Facility, with a total grant of up to EUR 1 032 000 for pre-investment activities and EUR 27 185 000 for works to replace two sections with a total length of 81 km.

In January 2022, the transmission line 'OS Beglez' – KV Dmerantsi – KV 'Batultsi' – KV Kalugerovo (58 km) was put into operation.

With the completion, in July 2022, of the works to replace the section of the 'Valchi dol' OS – LKV Preselka (23 km), all the activities of Phase 2 of the project were completed.

Phase 3 of the project will allow the capacity of the IBS project to be increased from the current 1.8 billion m (^{3}) to 3.2 billion m (^{3}). This requires the construction of a new compressor station near Novi Iskar with a capacity of 20 MW and 19 km of a new gas pipeline with DN700 diameter in the Gorni Bogrov – Novi Iskar section.)

- Increase of technical capacity to transfer from Greece to Bulgaria in IP Kulata/Sidirokastro

The project is part of the Vertical Corridor initiative and includes the construction of 47 km of DN700 (Kulata – Kresna) and 50 km of a new DN500 pipeline (Piperevo – Pernik). The new infrastructure will provide incremental capacity from Greece to Bulgaria of 35.4 GWh/d, bringing the total technical capacity to 101.9 GWh/d.

The project will contribute to improving security of supply by improving the interconnection between Bulgaria and Greece and by ensuring access to additional volumes of LNG and gas from alternative sources in Greece for Bulgaria and all neighbouring countries.

The expected date for commissioning is 2027.

An extended project including an additional 85 km of luping DN700 (Cresna – Piperevo), the installation of an additional GTCA at a 9 MW Petrich compressor station, the replacement of 50 km DN700 (Ihtiman-G. Bogrov) gas pipeline, the reversion and reconstruction of connections and nodes in Ihtiman KS is also under consideration.

When implementing the extended option, the total technical capacity in IP Kulata/Sidirokastro will provide incremental capacity from Greece to Bulgaria of 68 GWh/d above the planned capacity and the total capacity will reach 171 GWh/d from Greece to Bulgaria.

- Increase of technical transmission capacity from Bulgaria to Romania

The project is part of the Vertical Corridor initiative and includes the construction of 63 km of lupings with DN1200 diameter (Rupcea – Vettrino) and reversion activities of the Cardam CC (without the need for new compressors) and an extension of the capacity of its management system. The new infrastructure will provide incremental capacity from Bulgaria to Romania of 137.2 GWh/d.

The project will contribute to improving security of supply by improving interconnection between Bulgaria and Romania and ensuring access to additional amounts of LNG and gas from alternative sources for the countries of the region, including Ukraine and Moldova.

The expected date for commissioning is 2028.

- New LNG terminal projects in the region

The role of LNG is crucial for the energy security of EU countries, including in South-East Europe, and its share of the energy mix is expected to continue to grow. The Bulgarian gas transmission operator Bulgartransgaz EAD analyses all possibilities and plans to invest in a second liquefied gas terminal in Greece.

- "H2 Interconnection Bulgaria-Greece"

The project for hydrogen interconnector Bulgaria – Greece, organised by Bulgartransgaz EAD, is part of the thematic area 'Hydrogen and electrolysers'.

The infrastructure on Bulgarian territory is linked to a project by the Greek operator DESFA S.A. for a hydrogen transmission network on Greek territory in group 'H2 Interconnection Bulgaria-Greece'.

The project will make an important contribution to the realisation of the South-East Priority Corridor, which will provide a route for the transport of green hydrogen from South East to Central Europe, from both local production and import. Its inclusion in the PCI list will allow the implementation of fast-track permitting procedures and apply for grants during all stages of implementation. The project is an example of Bulgaria's efforts towards decarbonising the gas system and the uptake of low-carbon gases.

The project envisages the construction of infrastructure dedicated to the transport of 100 % hydrogen. It includes a pipeline of DN 1000 and a length of approximately 250 km and two compressor stations. The expected time for the infrastructure to be put into operation is by the end of 2029.

Bulgartransgaz EAD's project is the first phase in the implementation of the concept for the development of new infrastructure for the transport of clean hydrogen on the territory of the Republic of Bulgaria, including the hinterland of the country and for connectivity with

neighbouring countries. As a next step, it is envisaged to continue its expansion both within Bulgaria and to cross-border interconnection points with neighbouring countries.

The implementation of the project will provide capacity for bi-directional cross-border hydrogen transport between Bulgaria and Greece at a new connection point in the Kulata/Sidirokastro area. The project is planned to subsequently develop in a northern and eastern direction and thus provide further cross-border connectivity to Romania and the countries of the region at a later stage.

The project represents an important milestone in the development of H_2 networks in the region. The planned infrastructure is intended to stimulate the process of large-scale deployment of hydrogen both in Bulgaria and in the South East Europe region.

Bulgartransgaz EAD is preparing project proposals for the subsequent extension of the hydrogen transmission infrastructure to ensure interconnection with Romania, which will be proposed to the Commission for inclusion in a 2nd list of projects of common interest and projects of mutual interest. The options under consideration include a new hydrogen infrastructure to transport 100 % hydrogen from the Sofia region to the Bulgarian-Romanian border:

- In the area of Kozloduy with a length of 240 km DN 1000 and 2 compressor stations with a total capacity of 48 MW;
- In the area of Ruse with a length of 330 km DN 1000 and 3 compressor stations with a total capacity of 72 MW;
- In the area of Cardam with a length of 480 km DN 1000 and 3 compressor stations with a total capacity of 72 MW.

Figure 28: *Hydrogen infrastructure of the Republic of Bulgaria*

Source: Bulgartransgaz EAD

The construction of hydrogen transmission infrastructure in Bulgaria will have a catalytic effect for large-scale investments, including in relation to projects set out in the National Roadmap for improving the conditions for unlocking the development potential of hydrogen technologies and hydrogen production and supply mechanisms.

The planned H_2 infrastructure is expected to contribute to sustainable economic growth, the decarbonisation of the economy and energy, employment and industrial competitiveness in Bulgaria and the region.

The project meets all relevant technical, general and specific criteria for project proposals in the field of hydrogen transmission stemming from Regulation (EU) 2022/869 for trans-European energy infrastructure.

The inclusion of the project proposed by Bulgartransgaz EAD in the VIth list of Projects of Common Interest is essential for its successful and timely implementation in an effective manner and for the realisation of the priority South-East hydrogen corridor.

- Infrastructure for transmission of blends of hydrogen and natural gas in different proportions

Ensuring compatibility of existing natural gas infrastructure for hydrogen blends in certain ratios has the potential to accelerate the uptake of hydrogen in the energy mix in an efficient manner to sufficient production capacities and demand for clean hydrogen.

Bulgartransgaz EAD is developing a SMART project to upgrade the existing gas grid, which will allow an efficient deployment of renewable and low-carbon gaseous fuels, including up to 10 % hydrogen.

The planned activities include relevant feasibility studies, deployment of new facilities and installations, introduction of intelligent monitoring systems, control and management of transmission of renewable gas blends.

The project is currently in the exploration phase. Activities are planned to be phased in by the end of 2027.

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

- Construction of a new double interconnector 400 kV between the Republic of Bulgaria and the Republic of Serbia"

The project is included as a new investment in ENTSO-E's latest ten-year electricity grid development plan for Europe of 2018. The assessment of the need to build the second interconnection between Bulgaria and Serbia is made in the framework of market research carried out by the ENTSO-E regional group. The project will increase the interconnection capacity at the Bulgarian-Serbian border and accelerate trade flows between the western borders of Romania and Bulgaria with the Western Balkans region.

- Construction of a new 400 kV interconnector between Bulgaria and Türkiye;
- Construction of new 400 kV internal power lines between Vetren hub station and p/st Blagoevgrad and between p/st Tsarevets and p/st Plovdiv;
- Modernisation and extension of internal grid elements and management systems to increase efficiency, flexibility, security of supply;
- Connection of new low- and between-based electricity sources.

2.4.3. Market integration

i. National general objectives related to other aspects of the internal energy market, such as increasing system flexibility, in particular by promoting competition-driven electricity prices in accordance with relevant sectoral legislation, market integration and aggregation, with the aim of increasing the tradable capacity of existing interconnectors, smart grids, bundling, demand response, storage, distributed generation, mechanisms for distribution, redistribution or curtailment and real-time price signals, including a timetable for achieving the objectives

Liberalisation of the electricity market

In recent years, a number of legislative changes have been introduced to liberalise the Bulgarian electricity market. Electricity producers are characterised by multiple market advantages resulting from the variety of products they can provide on a liberalised market, competitive prices and flexibility.

The amendments to the Energy Act have significantly changed the conditions under which participants in the electricity market in the country, including the Public Electricity Supplier, operate. The scope of the regulated market has significantly decreased to the detriment of an increase in the relative share of the free market. All transactions for the purchase and sale of electricity by producers are carried out via the BEB EAD platforms in order to maximise transparency in trade.

In line with the Commission's Third Liberalisation Package, Bulgaria has taken steps towards full liberalisation of the electricity market. As a result of legal changes since the beginning of 2018, all electricity produced for the free market is only traded on the BEB commercial platforms.

With the Act amending the Energy Act adopted on 17.11.2023 and subsequent amendments adopted, the following main changes were made:

1) Full liberalisation of the wholesale electricity market took place from 30 June 2025, while maintaining the right of household final customers to purchase electricity on a regulated market until the end of 2025.

The proposed amendments remove the role of National Electric Company EAD (NEK) as a public provider and consequently remove the quotas set for producers for a regulated market. The draft law stipulated that final suppliers of electricity should act as universal service providers and were obliged to supply household customers without the latter being obliged to switch supplier. In the transitional period (1 July 2025 – 31 December 2025), final suppliers will supply household final customers at regulated prices. The territoriality principle for the licensing of end suppliers has been removed. As a general rule, provision is made for the possibility of differentiated compensation of part of the costs of purchasing electricity at regulated prices depending on household customers' consumption until the end of 2025. The liberalisation of the regulated electricity market is fully in line with a decision of the National Assembly of 11.11.2022 according to which household final electricity customers remain on a regulated market until 31 December 2025, after which full retail price deregulation for household customers is gradually ensured, together with the full possibility of switching supplier. As NEK EAD ceases to function as a public supplier, the change will have a positive impact on the company's activities in the second half of 2025, as the planned electricity volumes should be realised in the 'Bilateral Contracts' segment, which in turn implies a longer term predictability of revenue levels from electricity sales.

The challenge for NEK EAD, with the withdrawal of the public supplier's licence, is to participate much more actively in a free market with the quantities of electricity it produces as the operator of 31 hydropower plants and with that under the current contract with TPP E Maritsa Iztok 1 OOD, which comes to an end in May 2026. At the same time, NEK EAD will continue to be the main supplier of balancing energy to ensure the normal operation of the electricity system in the country.

(2) new entrants to the electricity market – citizen energy communities, active customers and aggregators – are regulated. Measures to protect consumers of energy services are

also complemented by the possibility to conclude fixed-term, fixed-price and dynamic electricity price contracts for customers with smart metering equipment installed;

(3) the long-term contracts for the purchase of electricity concluded between NEK EAD, in its capacity as a public supplier and producers of electricity from coal-fired power plants, are regulated following the loss of the public supplier's function, and the realisation of the electricity purchased under those contracts on the open market. It shall not be possible to extend the duration of existing long-term contracts after their expiry in 2024 and 2026 respectively, or to conclude other long-term contracts with such producers;

(4) definitions and criteria have been introduced to define 'households in energy poverty' and 'vulnerable electricity customers' for the purpose of liberalising the electricity market and implementing measures to support households in energy poverty, including priority treatment when implementing energy efficiency improvement programmes in residential buildings.

Introduction of an intraday market

In 2018, the intraday market was launched, which is the link between long-term contracting, the day-ahead market and the real-time market, the balancing market. With its introduction, the overall structure of the market in Bulgaria, as it exists in most European markets, has been built up, allowing participants to change their contractual positions, according to the forecast of production or consumption, as close as possible to the real time of trade.

Participation in integration processes

The EEA EAD, together with all transmission system operators in Europe, in accordance with the requirements of Regulation (EU) 2015/1222, signed in May 2018 the Agreement on the coordinated implementation of the single intraday market coupling function between TSOs and NEMOs (IDOA) and the TSO Cooperation Agreement (TCID), thereby launching its participation, together with the BEB, in the process of integrating a Bulgarian border with the common European market in the framework of the XBID project for an intraday time horizon.

Bulgaria is part of the regional LIP 15 project and, since November 2019, it has had an operational, unified intraday market across the border between Bulgaria and Romania. With this step, the Bulgarian-Romanian border is the first limit at which capacity will be allocated implicitly, over the intraday time horizon, within a unified European region.

The nominated electricity market operators (NEMOs) and Transmission System Operators (TSOs) participating in the intraday market grouping (formerly XBID) declare that 15-minute products are available on the Romanian-Bulgarian border as of 1 October 2022 (delivery day). Three years after Bulgaria and Romania joined the SIDC as part of the second wave of accession, and after Romania started offering 15 minutes of products on the intraday market in February 2021, an important step towards better market integration of RES was achieved. The introduction of products with a shorter delivery period for continuous trade at this limit will give Bulgarian market participants access to the available

liquidity of 15 minutes of products, allowing them to better adapt their trading positions in this market. Thus, a 15-minute offer will be compared with another offer for a 15-minute product in the already integrated intraday markets in Austria, Germany, the Netherlands, Belgium, Hungary, Romania and Slovenia.

SIDC currently combines the intraday continuous trading markets of 23 countries: Austria, Belgium, Bulgaria, Croatia, Czechia, Denmark, Estonia, Finland, France, Germany, Hungary, Italy, Latvia, Lithuania, Luxembourg, Norway, the Netherlands, Poland, Portugal, Romania, Slovenia, Spain and Sweden.

For the time horizon 'Day Forward', a project for market integration at the Bulgarian-Greek border was launched. ESO, BEB and Greek operators (IPTO, HEnEx) wrote to the regulators of both countries to approve and include the Bulgarian-Greek border to a regional IBWT-Italian Border Working Table project. The "Day Forward" market alliance with Greece started in real work on 11.5.2021, with an implicit allocation of transmission capacity at this border.

Balancing and balancing model of RES

The balancing model in Bulgaria is transparent, provides for a level playing field for balancing regardless of the production technology, the size of the sites and whether they are supplied at regulated or freely negotiated prices.

The total installed capacity of RES is relatively high in relation to the capacity available in the country, and the availability of two large single capacity at Kozloduy EAD, each of 1 000 MW, in relatively small EES, is responsible for maintaining capacity in a cold reserve, as well as ensuring the availability of additional services (primary and secondary regulation). The inclusion of consumers in the provision of a slow tertiary reserve, by reducing demand in the event of a shortfall in capacity in the EU, was implemented through the development of rules and the first auction held in October 2018. This increases the sources of balancing and the potential for dispatchable capacity available to the operator, thereby reducing balancing costs.

Implementing reform *C4.R8: The liberalisation of the electricity market* by the NRRPs has taken concrete actions to achieve a reform of the balancing energy market, with the following main objectives being met:

- The purchase of balancing capacity and balancing energy is market-based through public auctions;
- The estimated balancing energy prices shall be published within 15 minutes after intraday closure;
- A single balancing price shall be introduced for periods without balancing energy activation;
- A 15-minute imbalance settlement period has been introduced;
- No price caps are set for balancing electricity.

The stated objectives were implemented through amendments to the Energy Act and changes to secondary legislation (Electricity Trading Rules, Methodology for fixing balancing energy prices, Instructions for notifying and validating commercial and production schedules in the 'Day ahead' and 'Intraday' market segments, etc.).

Aggregators of units for participation in the balancing market

The ESO has launched a project under the EU structural reform programme to support the development of requirements for registration of aggregators, technical connectivity to ESO EAD systems and electricity distribution system operators, communication between network operators, determination of the regulatory energy provided and payments.

Since the introduction of standardised load profiles in 2016, low-voltage household and non-household customers have been able to switch their electricity supplier and enter into freely negotiated prices. However, the segment of the trading market at regulated prices is currently significant, accounting for around 40 % of net electricity production.

Phasing out regulated prices for all end-users and producer prices will increase competition between electricity suppliers. Full liberalisation of the electricity market will create the conditions for increasing system flexibility by providing conditions to achieve competitive prices and increase liquidity in the electricity market.

Full liberalisation of the electricity market is a prerequisite for achieving the objective of full integration of the electricity market into the common European energy market.

Integration and integration of electricity markets

In order to achieve the interconnection targets, Bulgaria has taken concrete measures to increase the integration of the electricity market at regional level. The country is implementing connectivity projects with Romania, Greece, the Republic of Serbia and the Republic of North Macedonia, with varying degrees of implementation. The implementation of some of these projects depends on the development of electricity markets in the above-mentioned countries.

Table 8: *Integration of the electricity market*

Project	Status
Bulgaria – Republic of North Macedonia **'Day ahead' market**	A prerequisite for market reunification is the creation of exchanges of power exchange and the 'Day ahead' operational market in the Republic of North Macedonia, which is expected to take place in 2024.
Trilateral market reunification between Bulgaria-Serbia – Croatia	Launch and participation in a project for tripartite market integration "Day ahead" of the bidding zones of the Republic of Bulgaria, the Republic of Serbia and the Republic of Croatia

Regulation (EU) 2019/943 on the internal market for electricity sets the minimum capacity available for cross-border trade at 70 % of electricity transmission capacity, respecting operational safety limits following unforeseen situations as of 2026. Furthermore, Article 15 of the Regulation requires the development of a specific action plan to address the 70 % threshold.

In this context, the Bulgarian electricity transmission operator applied for a derogation pursuant to Article 16(9) of Regulation (EU) 2019/943. The granting of a derogation shall be subject to approval after regional consultation with the regulatory authorities of neighbouring countries. The derogation period shall be a maximum of 1 year.

Liberalisation of the natural gas market

The liberalisation of the gas market plays an important role in European energy policy and is linked to the strategic objectives of improving security of supply and diversification of sources and routes of supply of natural gas, as well as building an interconnected and single pan-European gas market. Expanding gas interconnectors, diversifying natural gas supply sources and creating a gas hub will create real conditions for the operation of a liquid natural gas exchange.

Bulgaria currently has two licensed gas exchanges in force. Licences issued shall be for a maximum period of 35 years. The two gas exchanges operate with the same trading platform, Trayport Global Vision Trading System, a product of TrayportLimited UK, which has developed the most common and globally applied software to administer transactions.

Set up in 2019, the company 'Gas Heb Balkan' EAD (BGH EAD) builds up, operates and is responsible for the functioning of the organised market for the trading of natural gas by BGH EAD. The online platform with a segment and for bilateral trade offers modern physical products, including exchange of ownership on a virtual trading point (VTP) and at some of the physical points of the networks. The platform provides equal access, market-based prices, increased transparency as well as improved competition in the natural gas market in Bulgaria.

The short-term segment (spot) of the platform shall include standardised 'intraday', 'Day ahead', as well as temporal and local products for balancing the TSOs' network. Trade takes place on an anonymous basis according to the provisions of Regulation (EU) No 312/2014.

The long term segment of the trading platform offers products that are tradable on a medium and long-term basis – weekly, monthly, quarterly and annual.

The Gas Release Program supply segment at the end of 2022 was completed by the adoption of § 10 of the Transitional and Final Provisions of the Act amending the Corporate Income Tax Act (promulgated. SG No 99/2022), which repealed the provisions of Article 176a (1) (4) and (5) of the Energy Act, under which the public supplier was obliged to offer to the organised exchange market certain quantities of natural gas in 2023 and 2024. The long-term contract of Bulgargaz EAD has not been in force since 31.12.2022 and the supplies thereunder were suspended on 27.4.2022. BULargaz EAD needs to provide

alternative sources for both its activities as a public supplier and its bilateral contracts and the quantities under the Programme. The emerging shortage of the programme is compensated by alternative suppliers at market conditions. More than 90 traders are licensed to freely trade natural gas on the organised exchange market. In this sense, Bulgargaz EAD competes on the market together and on an equal footing with them for the purchase of natural gas. At the same time, the prices under the Programme were regulated by the KEVR for the relevant period. Given the lack of predictability in terms of quantities and price levels and the impossibility of releasing such quantities on the organised stock exchange market under conditions other than the principles laid down in the Regulatory Agreement, conditions are created to generate price deficits for Bulgargaz EAD and distort the market. Further negative effects on this process are caused by disruption of supply on the pan-European market and increased demand for natural gas, which negatively affects the implementation of the Programme by the public supplier. As of December 2 023, Gazov Heb Balkan EAD had over 90 registered companies, 40 % foreign companies and 60 % from Bulgaria, including the two operators Bulgartransgaz EAD, ICGB, as well as the gas transmission operator of the Republic of North Macedonia, Nomagas JSC Skopje.

Bulgarian Energy Trading Platform AD (BETP) owns Licensia No L-533-11 of 25.3.2021 in order to carry out the activity 'Organisation of the natural gas exchange market' for a period of 35 years. BETP AD is founded in order to create, develop and operate a reliable and stable single regional gas market, contributing to increasing the transparency and liquidity of the gas market in the South East European region.

Priority shall be given to addressing and implementing measures for the rehabilitation, modernisation and extension of existing gas transmission infrastructure and the development of interconnection, and these activities shall provide additional opportunities to increase the use of natural gas in the country with the corresponding economic, social and environmental benefits.

In view of the geopolitical developments of the last year, the shutdown of natural gas supplies from Russia to Europe and the war in Ukraine, the Ministry of Energy and Bulgargaz EAD have taken serious action to ensure diversification of natural gas supplies and filling of the underground storage facility in Chiren, in order to ensure the energy security of the country.

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

As required by Regulation (EU) 2019/943 and Directive (EU) 2019/944 on the internal market for electricity and with a view to the future full liberalisation of the electricity market, Bulgaria shall endeavour to promote the participation of final customers in demand response through aggregation and to allow the participation of final customers, including

those offering demand response by aggregating all electricity markets alongside generators.

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

Bulgaria aims to progressively remove regulatory and trade barriers for consumers to use, store and sell on the market the electricity they produce and to participate in the market by providing flexibility to the system, through energy storage and demand response.

In order to encourage energy consumers to participate more actively and effectively in the market, further action will be taken (further developed in section 3.4). These measures include:

- The promotion of local energy communities within the meaning of Directive (EU) 2019/944 and the regulation of rules for their establishment and operation;
- Creating options such as contracts with dynamic electricity prices and aggregation, developing platforms to increase transparency of information, especially for the benefit of households and micro enterprises;
- Development of the regulatory framework to promote consumers.

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

Full liberalisation of the electricity market will create the conditions for increasing system flexibility by providing conditions to achieve competitive prices and increase liquidity in the electricity market.

Increasing system flexibility shall be ensured through the development of balancing capacity, energy storage capacity and capacity to manage it.

In order to alleviate internal congestion and increase interconnection capacity, it is envisaged to upgrade the transmission capacities of the networks.

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

In line with the Commission's Third Liberalisation Package, Bulgaria has taken steps towards full liberalisation of the electricity market. Phasing out regulated prices for final consumers will lead to increased competition between electricity suppliers, but at the same

time this may expose consumers to greater price volatility. In this regard, Bulgaria's objective is to ensure adequate protection for vulnerable household electricity consumers.

2.4.4. Energy poverty

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

The term "energy poverty" has emerged in recent years as a derived effect in the beginning of the global climate transformation, which calls for concrete commitments from EU Member States to achieve targets to reduce net greenhouse gas emissions by at least 55 % by 2030 compared to 1 990 levels. The concept of 'energy poverty' has its nature and definition in Article 29 of Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2 019 concerning common rules for the internal market in electricity and amending Directive 2012/27/EU. The adoption and implementation of appropriate measures to support vulnerable customers and households in energy poverty shall be a commitment of individual Member States, according to their national specificities. The transposition into Bulgarian law of the texts of the Directive concerning vulnerable customers and energy poverty sets out the main framework for Bulgaria's obligations to protect them.

Bulgaria currently applies a measure to support the most vulnerable persons and families meeting the defined income and wealth criteria, providing these persons and families with targeted heating support from the social assistance system during the heating season.

In the additional provisions of the Act amending the Energy Act (Act amending the Energy Act) adopted on 5.10.2023 by the 49th National Assembly of the Republic of Bulgaria, readopted on 10.11.2023, promulgated in SG No 96/17.11.2023, national definitions of 'household in a situation of energy poverty' and 'vulnerable customer for the supply of electricity' were introduced for the first time, which, together with the amendments provided for in Article 38e of the Act, are essential for the implementation of Reform C4.R3. "Development of definition and criteria for "energy poverty" (Reform) of the National Recovery and Resilience Plan of the Republic of Bulgaria (NRRP). In view of the provisions of the newly adopted Act amending the Energy Act, the Council of Ministers was obliged to adopt the Regulation referred to in Article 38e (2) of the Act no later than three months after its publication (pursuant to § 50 of the Transitional and Final Provisions of the Act amending the Energy Act).

In accordance with Article 38e of the Act amending the Energy Act and in order to fully implement the reform of the NRRP, joint efforts have been made between the Ministries responsible for defining and implementing protection and financial support measures for vulnerable customers and households in energy poverty – the Ministry of Labour and Social Policy, the Ministry of Regional Development and Public Works and the Ministry of Energy, for drafting the Regulation. It describes the arrangements and mechanisms for the operation of an information system to determine this status, as well as the modalities for

assessing the number of households in energy poverty. The Regulation was dealt with within the shortened time limit adopted by the Council of Ministers by Decree No 267 of 7 December 2023 and promulgated in State Gazette No 103 of 12.12.2023.

The Regulation provides:

- For the average monthly income per member of a household, account should be taken of the available funds, reduced by the cost of the energy consumption of the dwelling determined by reference to the energy performance of the dwelling. The available average monthly income is compared with the officially declared poverty line for the purpose of determining the status of a household in energy poverty, as defined in the additional provisions of the Act amending the Energy Act;

- In order to determine the status of vulnerable customer for the supply of electricity, criteria have been introduced according to age, health, available average monthly income, reduced by energy costs, need for independent living aids and/or life-sustaining medical devices whose functioning depends on a source of electricity, receipt of monthly social benefits;

- In determining the disposable income of eligible persons, it is proposed to take into account both non-taxable income and income subject to tax under the ZDFL, and when calculating it, it was proposed to introduce an exception for scholarships paid by schools and higher education institutions for the benefit of pupils and students;

- In addition, according to the definition of 'vulnerable customer for the supply of electricity' in the Energy Act, the definition covers a person who is a household customer purchasing electricity for the household of which he is a member and he and/or another household member is critically dependent on electrical equipment due to age and/or state of health and/or receives monthly social benefits and/or targeted heating allowance under the Social Welfare Act. According to the Regulation, the conditions relevant for determining the vulnerable customer status of the entitled persons are linked to the age of 65 years, a low disposable income (less than or equal to the poverty line after a reduction in energy consumption), 50 or more than 50 % of permanently reduced capacity for work or type and degree of disability, the need for life-sustaining aids for independent living and/or medical devices, the functioning of which depends on a continuous supply of energy, as well as those covered by other social support mechanisms in force.

The law states an obligation to assess the number of households in energy poverty and to establish and maintain an information system on the number of households in energy poverty and for vulnerable electricity customers. This should be done by a national responsible institution designated for the development of a National Social Climate Plan pursuant to Regulation (EU) 2023/955 of the European Parliament and of the Council of 10 May 2023 establishing a Social Climate Fund and amending Regulation (EU) 2021/1060 (OJ L 130/1 of 16 May 2023) or by another body designated by an act of the Council of Ministers.

The estimated number of households in energy poverty in 2024 is assessed in accordance with Article 3 (3) (d) of Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 and in accordance with the Regulation laying down the criteria, conditions and procedures for determining the status of a household in energy poverty and the status of vulnerable customer for the supply of electricity (the Regulation), adopted by Council of Ministers Decree No 267 of 7.12.2023, published in State Gazette No 103/12.12.2023, in force since 12.12.2023. The assessment of the number of people in energy poverty amounted to 1.809 million in 2023 according to the Economic and Social Council.

The Social Climate Plan, to be prepared and submitted to the European Commission by 30 May 2025, will implement the objectives of the Social Climate Fund to support vulnerable households, vulnerable micro-enterprises and vulnerable transport users. The plan will contain a coherent set of existing and new national measures and investments addressing the specific economic impacts resulting from the inclusion of greenhouse gas emissions from buildings and road transport in a new Emissions Trading System for these sectors from 2027.

The Plan will necessarily include national and, where applicable, based on analyses and mapping of energy and transport poverty, local and regional measures and investments to carry out building renovations and decarbonisation of heating and cooling of buildings, including the integration of renewable energy production and storage, as well as to extend the use of zero- and low-emission mobility and transport. The Plan may also include national measures providing temporary direct income support to vulnerable households and vulnerable transport users. All measures and investments will be in line with the 'do no significant harm' principle (DNSH), in terms of environmental and climate components, seeking further benefits to accelerate decarbonisation efforts, adaptation to climate change, improving ambient air quality and the urban environment.

As a result of the adoption of the Regulation, and given the need to unambiguously designate a competent authority to develop and coordinate appropriate policies and measures to tackle energy poverty, including the development of NCMCs, as well as the need for an intensive exchange of good practices with other Member States on policies and measures to tackle energy poverty, actions have been taken towards the establishment of an Observatory to tackle energy poverty in the Republic of Bulgaria.

The proposed Observatory aims to be a platform for bringing together a wide community of practices, officials and researchers working in this area in Bulgaria and beyond. The main reason for the establishment of the Observatory as a supranational body attached to the Council of Ministers of the Republic of Bulgaria to coordinate specific policies and measures for their implementation is due to the need to establish a decision-making support centre dedicated to this issue in Bulgaria, a Member State where energy poverty rates are among the highest in Europe and where structural problems in the links between energy, low incomes and unrenovated housing are particularly pronounced.

The aim is to create a new knowledge centre, which not only serves as a comprehensive information resource for stakeholders on the levels of energy poverty in Bulgaria and measures to address it, but also to stimulate progress in state-of-the-art analytical research into the causes and consequences of the problem in Bulgaria. In addition, the Observatory will develop innovative policies and practices to tackle energy poverty and will also serve as a reference point for stakeholder discussions and exchange of knowledge on the topic. Financing of the reform is foreseen through the Recovery and Resilience Facility. The maintenance of the Observatory after its establishment and the implementation of other specific activities related to tackling energy poverty will be supported by the EU Social Climate Fund, other financial instruments with a source of EU funding and the national budget.

The initiative is proposed to be included as a reform under Rehabilitation. The implementation of the reform should be carried out jointly by the teams of the MoF, MLSP, MRDPW and ME (responsible institutions for implementing appropriate support measures, in accordance with the provisions of Article 38e of the Energy Act) and supported by an international financial institution following the example of other major reforms in the country (such as Reform C4.R1 'Establishment of a National Decarbonisation Fund' under the NRRP, supported by DG Reforms of the European Commission and with the cooperation of the European Investment Bank, PeresurotarhousCuperz and Ecoros, implementing the project 'Support for the establishment of a National Decarbonisation Fund', as well as the Renovation Wave for Europe initiative, under the REACT-EU initiative funded by Next Generation EU).

2.5. Dimension Research, innovation and competitiveness

i. National objectives and funding targets for public and available private research and innovation in relation to the Energy Union, including, if appropriate, a timeline for achieving the objectives

The need to deploy new energy technologies is undeniable. We aim to speed up this process in order to achieve a faster transition to clean and high-efficiency energy technologies. It is also one of the mechanisms to achieve secure, sustainable, environmentally friendly and highly efficient energy. The deployment of new technologies will contribute to reducing technological network losses, expanding the energy market, addressing decarbonisation challenges, reducing energy costs for consumers, reducing harmful emissions, thereby also increasing people's quality of life.

In this respect, the objectives set by the Bulgarian State in the field of research, innovation and competitiveness are:

- Achieving the objectives of the EU's Fit for 55 package, as well as developing a low-carbon economy in the long term;
- Achieving the Energy Union objectives of increasing security of energy supply and improving energy and resource efficiency in transport;

- Encouraging the creation of innovations, their commercialisation and the technological renewal of enterprises;
- Supporting local industries in the adoption of low-carbon technologies and the public, administrative and household sectors in the use of new high-efficiency energy-saving technologies;
- Improving ambient air quality;
- The deployment of new energy-saving technologies to improve the quality of life and the working conditions of Bulgarian citizens;
- Deployment of new thermal insulation materials for glazed surfaces;
- Building smart grids for automated control of electricity systems, both on the supplier's side and on the consumer's side, in order to ensure the highest quality electricity supply to consumers and renewable energy utilisation to the maximum degree. The ultimate aim is to upgrade and automate existing electricity networks.
- Construction of energy storage facilities;
- Supporting research and innovation in the field of nuclear energy, research for the sustainable and safe management of radioactive waste;
- Support for studies and research into the possibilities of innovation of models to strengthen chains and provide opportunities for industrial symbiosis;
- Enhancing the competitiveness and market position of the Bulgarian industry, as well as promoting the development of innovative and high value-added industries;
- Preserving the competitiveness of the underlying energy-intensive industries and limiting the risks of carbon leakage;
- Development of electric cars and hydrogen technologies;
- Upskilling and creating a skilled workforce to support the manufacturing of net-zero technologies, including the creation (or participation) of net-zero academies;
- Establishment of industrial parks within the meaning of the Industrial Parks Act.

ii. Where available, national targets for 2050 related to the promotion of clean energy technologies and, if appropriate, national objectives, including long-term targets (2050) for the deployment of low-carbon technologies, including decarbonisation targets for the energy sector and energy and carbon intensive industries and, if applicable, targets for the relevant CO2 transport and storage infrastructure

In view of the ambitious objectives set out in the Green Deal and the European Commission's 'Fit for 55' strategic legislative package, in which the production of hydrogen

from renewable sources and its consumption by the economies of the Member States occupy an important place, the Bulgarian State places a major emphasis on the development of this sector.

Following the structuring of Europe's first Strategic Energy Technology Plan (SET), which aimed to accelerate the development of low-carbon technologies through cooperation between Member States, business, research institutions and the EU itself, the planning under this plan was revised in 2022. On the proposal of the EC, much more emphasis is placed on the development of hydrogen technologies.

Hydrogen produced from renewable sources is key to replacing natural gas, coal and oil in hard-to-decarbonise industries and transport, which is also highly valid for Bulgaria. In this regard, and in implementation of Reform C4.R7 'Unleashing the potential of hydrogen technologies and hydrogen production and supply' in the National Recovery and Resilience Plan, in 2023 the Bulgarian MU adopted the National Roadmap to improve the conditions for unlocking the development potential of hydrogen technologies and the mechanisms for production and supply of green hydrogen.

The national roadmap sets the path for building a hydrogen industry. The aim of the roadmap is to provide the basis for a coherent framework for the efficient, smooth and consistent uptake of hydrogen production, transport and use technologies in industry, energy, transport and household, to foster innovation and investment. Sectors and phases will be defined to maximise the impact on climate neutral economy commitments, to create new hydrogen value chains, to strengthen the partnership at national, regional and European level. The Roadmap sets out the amendments to the legislative provision to be prepared by the competent institutions. The amendments will remove the key barriers identified in the roadmap for the development of green hydrogen technology. Specific measures necessary for the development of the entire green hydrogen value chain are also identified.

iii. Where applicable, national objectives with regard to competitiveness

Balancing the EU's climate ambition with industrial competitiveness is essential. The abundance and competitive prices of clean electricity for hydrogen production are an essential prerequisite for green ammonia to become competitive and to change current production technology. To realise the transition to green ammonia, broad support for investment and operational expenditure is needed. Of course, it is also important to create markets that stimulate production. But above all, there must be fruitful cooperation between the EU, Member States and regional authorities to support industries to introduce new technologies, such as providing financial incentives and cooperation in the development of hydrogen resources. Hydrogen produced from renewable sources is key to replacing natural gas. There is scope for Bulgaria to be among the first in Europe to build new installations and hydrogen hubs, also linked to the creation of new jobs with higher labour added-value. Hydrogen is most often obtained from a steam reforming methane (SMR), a process in which carbon dioxide is emitted. Green ammonia is produced from

hydrogen, which is produced by hydro electrolysis powered by electricity from RES. To date, potential consumers of green hydrogen in Bulgaria to replace the SMR process they use are LUKOYL Neftochim Burgas, the largest refinery in south-eastern Europe and the azo-torso industry (Agropolychim AD, Neochim AD), which accounts for 3 % of European production.

3. POLICIES AND MEASURES

3.1. Decarbonisation dimension

3.1.1. GHG emissions and removals

i. Policies and measures to meet the targets under Regulation (EU) 2018/842 referred to in point 2.1.1 and policies and measures to comply with Regulation (EU) 2018/841, covering all major sources and sectors for the enhancement of removals, with an idea of the long-term vision and goal of a low-emission economy and striking a balance between emissions and removals in line with the Paris Agreement

Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 provides for a national reduction target of 0 % compared to 2005. The adopted changes to Regulation (EU) 2023/857 make the target for[6] Bulgaria more ambitious and much more challenging, increasing it to – 10 %. To achieve the target, Bulgaria will use several measures already in place, such as new and additional policies, which will be put in place over time and which will require major efforts by the country.

The sectors responsible for greenhouse gas emissions covered by Regulation (EU) 2023/857 are: transport, buildings, non-ETS industry, waste, agriculture. Emissions from road and maritime transport as well as heating of buildings will be regulated in the context of the revision of the ETS Directive[7]. The national policies and measures set out for these sectors will therefore complement the cap and emissions trading mechanism provided for in the new ETS Directive.

Follow the main sectoral policies and measures to achieve the 2030 greenhouse gas reduction target.

[6] Regulation (EU) 2023/857 of the European Parliament and of the Council of 19 April 2023 amending Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement, as well as Regulation (EU) 2018/1999

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

Transport Sector

Bulgaria's main policy objectives for reducing greenhouse gas emissions in the transport sector are:

- Promoting the production of electric and other environmentally friendly vehicles;
- Encouraging the use/demand of new environmentally friendly vehicles;
- Accelerated deployment of charging infrastructure for electric and hybrid cars;
- Promoting research and development activities related to environmentally friendly vehicles;
- Promoting the production of sustainable aviation fuels (SAF) by introducing mandatory blending mandates under Annex I of Regulation (EU) 2023/2405 of the EP and of the Council of 18 October 2 023 on ensuring a level playing field for sustainable air transport (ReFuelEU Aviation);
- Promoting the supply and use of sustainable aviation fuels;
- Provision of refuelling infrastructure for sustainable aviation fuels at airports for public use;
- Promoting research and development activities related to the production of sustainable aviation fuels;
- Organise awareness raising campaigns, capacity building of stakeholders with regard to the development of sustainable mobility.

The priorities set for the **Transport Connectivity Programme 2021-2 027** are:

- Priority 1 "Development of railway infrastructure along the "core" and "comprehensive" trans-European transport network;
- Priority 2 'Road infrastructure development' on the core 'Trans-European Transport Network' and road connections;
- Priority 3 'Improving intermodality, innovation, modernised traffic management systems, improving transport security and safety';
- Priority 4 "Intermodality in urban environments".

They contribute to the implementation of the Green Deal, the EC Sustainable and Smart Mobility Strategy and the implementation of national transport policy.

The investments envisaged under the priorities of the Programme promote the use of environmentally friendly modes of transport and alternative fuels, improve the quality of road and rail infrastructure, promote intermodality and intelligent transport systems and thus contribute to reducing the harmful environmental impact of transport.

The envisaged investments under priority 1 will contribute to attracting passenger and freight traffic to rail by improving the quality of rail infrastructure.

Investments for the development of railway infrastructure are mainly concentrated along the Orient/East-Mediterranean corridor section running horizontally through the middle of the country.

Investments under Priority 3 will contribute to the development and extension of inland and maritime public transport ports for multimodal operations, modernisation and development of terminals and port facilities for combined transport, as well as to the development of the Gorna Oryahovitsa, Ruse and Varna railway nodes. Further investment is foreseen for the construction of alternative fuels infrastructure along the main strands of the Republican Road Network (RMP). Interventions are for road sections between some of the country's largest cities where transport is identified as an air pollutant. In addition, the construction of alternative fuels recharging infrastructure also in public transport ports will be supported.

Priority 3 sets out two main procedures as follows:

- **Intermodal Operators procedure, under** which a grant scheme with an intensity of up to 50 % is planned to support all intermodal operators for:
  - Purchase of equipment;
  - Construction/rehabilitation of railway/road infrastructure;
  - Cargo handling sites;
  - Deployment of IT systems and charging stations.

The investments will contribute to the development and expansion of intermodal combined transport terminals, thus creating the necessary conditions and preconditions for multimodal operations.

- **Alternative fuels procedure,** which will finance the construction of alternative fuels infrastructure under the LFS (TEN-T) as well as in TEN-T public transport ports (maritime and inland waterways).

The procedure aims at setting up a national scheme to support the construction of recharging infrastructure to enable the financing of the development of charging infrastructure for light-duty and heavy-duty electric vehicles, as well as in public transport ports/sea and inland waterway/TEN-T, to be launched in 2024.

Integrated Transport Strategy for the period up to 2030

The strategy outlines the main guidelines for the development of the national transport system in the period up to 2030.

The document sets out 3 strategic objectives, covering 9 strategic priorities, each containing a framework of specific objectives (targets). On this basis, measures have been identified that are most appropriate to achieve the relevant objectives.

The strategic objectives of transport policy until 2030 are to:

- Increasing the efficiency and competitiveness of the transport sector;

- Improving transport connectivity and accessibility (internal and external);
- Limiting the negative effects of the development of the transport sector.

The strategic priorities for transport development are:

- Efficient maintenance, modernisation and development of transport infrastructure;
- Improving the management of the transport system;
- Development of intermodal transport;
- Improving the conditions for implementing the principles of liberalisation of the transport market;
- Reducing fuel consumption and increasing the energy efficiency of transport;
- Improving the connectivity of the Bulgarian transport system to the Single European Transport Area;
- Ensuring quality and affordable transport in all areas of the country;
- Limiting the negative impact of transport on the environment and human health;
- Enhancing the security and safety of the transport system.

A National Transport Model has also been prepared within the scope of the Strategy Paper, which has been developed for passenger and freight transport and is applicable to individual modes of transport within the country, international transport and transit.

The main measures affecting greenhouse gas emissions in the transport sector are:

T1 – Increasing share of public electric transport – rail, trolleybus, tramway, metro

Scope: Increasing the share of public electric transport. Increasing the share of electric rail transport – improving infrastructure; Increasing the share of electric rail transport – renewal of rolling stock; Increasing the share of electric mass public transport – infrastructure improvements; Increasing the share of electric mass urban transport – vehicle renewal

Greenhouse gases directly concerned: CO2, CH4, N2O

Execution period: 2014 – 2030

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets

Scenario in which the measure is included: WEM

T2 – Increasing the share of biofuels

Scope: Biofuels are fuels produced from biomass and used in transport. They diversify the energy balance and reduce dependence on mineral fuels. The main types of biofuels are bioethanol, biodiesel, biogas, synthetic biofuels, biohydrogen, pure vegetable oils. In Bulgaria, ethanol and biodiesel production projects are the most promising. In the Energy from Renewable Sources Act (Article 47. (1)) steps are in place to achieve certain

percentages of biodiesel and bioethanol in the respective fuels, as well as biofuel type requirements and sustainability criteria to be met. Biofuels will continue to be used in the coming years and the share of new biofuels will be gradually increased.

Greenhouse gases directly concerned: CO2, CH4, N2O

Execution period: 2012 – 2030

Sources of funding: State and municipal budget

Scenario in which the measure is included: WEM

T3 – Introduction of Intelligent Transport Systems on the national and urban road network

Scope: Intelligent Transport Systems (ITS) cover a wide range of technical solutions designed to improve transport, improving mobility and improving road safety. Telematics (a combination of telecommunications and informatics) uses advanced technologies to meet transport needs. Intelligent transport systems and telematic solutions help improve road safety, promote the efficiency of existing infrastructure used and contribute to reducing environmental pollution by controlling traffic and managing traffic volumes.

Urban intelligent transport systems may include integrated management of public transport charges, enhanced customer relationship management, traffic forecasts, improved traffic management, passenger information and road charging. These systems apply modern technologies to collect more and better data to perform accurate analysis and connect them through more efficient networks. The result is more efficient and more citizen-oriented transport on urban traffic. European funds with public and municipal co-financing and, in some cases, the climate and private investment programme are the source of funding.

Greenhouse gases directly concerned: CO2, CH4, N2O

Execution period: 2014 – 2030

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets

Scenario in which the measure is included: WEM

T4 – Development and construction of intermodal combined transport terminals

Scope: The aim of the measure is to achieve a bilateral effect consisting, on the one hand, of increasing the usability of more environmentally friendly modes of transport and, on the other hand, of creating the right conditions to increase the added value of transport activity, with a general reduction in transport costs per unit of GDP.

Greenhouse gases directly concerned: CO2, CH4, N2O

Execution period: 2014 – 2030

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets

Scenario in which the measure is included: WEM

T5 – Promoting the use of hybrid and electric vehicles

Scope: In the framework of the Innovation Strategy for Smart Specialisation (ISS) 2021-2027, in the Thematic Area Clean Technologies, Circular and Low-Carbon Economy, one of the priority areas is the development and deployment of sustainable mobility technologies (batteries and hydrogen) based on hydrogen and other alternative fuels, connected infrastructure and eco-mobility.

One of the centres designated as a specific beneficiary is the HITMOBILL Competence Centre – Technology and systems for the generation, storage and consumption of clean energy. The Centre focuses on research, experimental development and knowledge transfer in the field of "Clean Energy generation, storage and consumption technologies and systems".

Greenhouse gases directly concerned: CO2, CH4, N2O

Execution period: 2014 – 2030

Sources of funding: Climate Investment Programme, Private Investment

Scenario in which the measure is included: WEM

T6 – Rehabilitation and modernisation of existing road infrastructure to ensure optimal speed and optimal driving modes for motor engines

Scope: Rehabilitation and modernisation of existing road infrastructure to ensure optimal speed and optimal driving modes for motor engines.

Greenhouse gases directly concerned: CO2, CH4, N2O

Execution period: 2014 – 2030

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets

Scenario in which the measure is included: WEM

T7 – Reducing the relative share of private motor vehicle travel by improving and developing urban public transport and by developing non-motorised transport

Scope: Improving urban public transport and the development of non-motorised transport.

Greenhouse gases directly concerned: CO2, CH4, N2O

Execution period: 2012 – 2030

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets

Scenario in which the measure is included: WEM

T8 – Developing and stimulating cycling

Scope: Project-oriented approach – concrete implementation – 1. Design and implementation of new infrastructure for cycling, 2. Development of systems for the use of municipal bicycles; 3. Training and campaigns.

Greenhouse gases directly concerned: CO2, CH4, N2O

Execution period: 2013 – 2030

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets

Scenario in which the measure is included: WEM

T9 – Fiscal policy to stimulate the economy and limit the consumption of conventional fuels

Scope: Financial policy through tax incentives for producers and users of electric vehicles and better application of the 'polluter pays' and 'user pays' principles.

Greenhouse gases directly concerned: CO2, CH4, N2O

Execution period: 2014 – 2030

Sources of funding: Tax reductions and charges laid down in the State and municipal budgets

Scenario in which the measure is included: WEM

New (planned) measures:

T10 – Establishment of a national scheme to support the construction of recharging infrastructure

Scope: Alternative fuels procedure, which will finance the construction of alternative fuels infrastructure under the LFS (TEN-T) as well as in TEN-T public transport ports (maritime and inland waterways).

The procedure aims at setting up a national scheme to support the construction of recharging infrastructure to enable the financing of the development of charging infrastructure for light-duty and heavy-duty electric vehicles, as well as in public transport ports/sea and inland waterway/TEN-T, to be launched in 2024.

Greenhouse gases directly concerned: CO2, CH4, N2O

Execution period: 2024 – 2030

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets

Scenario in which the measure is included: WAM

T11 – Promoting the development of combined transport

Scope: The Ministry of Transport and Communications developed a National Plan for the Development of Combined Transport in the Republic of Bulgaria by 2030 (approved by Decision No 504 of the Council of Ministers of 21.7.2022). It is a basic document for the implementation of a policy to support sustainable modes of transport. An implementation programme linked to the 2030 time horizon and potential funding sources has also been proposed. Three groups of measures have been identified: (1) organisational and administrative, (2) operational and service support and (3) infrastructure. Their

implementation is very important because it will increase the efficiency of the transport system by exploiting the advantages of combined transport (lower emissions of harmful substances, increased road safety, noise reduction due to reduced road transport, reduced use of conventional fuels in transport) over the use of road haulage only.

The plan will support projects to develop a network of modern intermodal terminals and identify incentives for business to implement more efficient and environmentally friendly transport solutions and chains. By 2030, the construction of intermodal terminals in Sofia and northern Bulgaria was planned, as well as a study on the need to build a terminal in Vidin. The document includes measures to develop logistics centres in Bulgaria and to improve the infrastructure connecting to existing port and rail-road terminals.

Greenhouse gases directly concerned: CO2, CH4, N2O

Execution period: 2024 – 2030

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets

Scenario in which the measure is included: WAM

T12 – Promoting the production and consumption of alternative renewable fuels, namely hydrogen, including by developing alternative fuels infrastructure

Scope: Developed and adopted in 2023, the National Roadmap to improve the conditions for unleashing the development potential of hydrogen technologies and hydrogen production and supply mechanisms sets the path for building a hydrogen industry. The aim of the Roadmap is to provide the basis for a coherent framework for the efficient, smooth and consistent uptake of hydrogen production, transport and use technologies in industry, energy, transport and household, to foster innovation and investment. The introduction of hydrogen electric transport is foreseen to start from urban bus transport under the responsibility of the municipalities. This approach is more cost-effective due to the possibility of scaling up with a large number of means of transport and recharging infrastructure with high regulated usability rates.

Greenhouse gases directly concerned: CO2, CH4, N2O

Execution period: 2025 – 2030

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets

Scenario in which the measure is included: WAM

T13 – National Recovery and Resilience Plan

Scope: Reforms envisaged: 1 – for sustainable urban mobility, 2- Green mobility – a pilot scheme to support sustainable urban mobility through measures to develop green, safe, functional and energy-efficient transport systems, 3- Ensuring effective access to integrated public transport, 4 – Electric mobility (Law on the promotion of electromobility).

Greenhouse gases directly concerned: CO2, CH4, N2O

Execution period: 2024 – 2026

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets

Scenario in which the measure is included: WAM

Measures with indirect effect on GHG emission reductions

T14 – Facilitate the informed choice of a transport vehicle to increase the number of vehicles purchased with lower emission levels (corresponding to Euro IV, V or VI).

T15 – Restructuring of urban streets;

T16 – Promoting sustainable driving;

T17 – Legislative provisions have been introduced to allow the establishment of Low-Emission Zones (LEZ) in cases where the type and extent of ambient air pollution significantly increases the risk to human health and/or the environment or failure to meet the standards for harmful substances (pollutants) in ambient air and the deposition of harmful substances (pollutants), approved by regulations of the Minister for the Environment and Water and the Minister for Health.

Adaptation measures from the Action Plan to the National Adaptation Strategy contributing to decarbonisation:

T18 – Development and implementation of a programme to strengthen the resilience of the road network to extreme weather events;

T19 – Development and implementation of a programme to strengthen the resilience of the rail network to extreme climatic events;

T20 – Regular update of the standards for the design of roads and railways.

Industry sector

The main measures to reduce greenhouse gases in the industrial sector are:

IP1 – Increasing energy efficiency in industry and reducing heat losses
Scope: Improving efficiency in industrial final consumption sectors.
Greenhouse gases directly concerned: CO2, N2O
Execution period: 2013 – 2030
Sources of funding: European funds with state and municipal co-financing, state and municipal budgets
Scenario in which the measure is included: WEM

IF2 – Increasing the use of natural gas in industry through new gas infrastructure
Scope: Improved transport infrastructure
Greenhouse gases directly concerned: CO2, N2O
Execution period: 2013 – 2020

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets
Scenario in which the measure is included: WEM

IY3 – Use of alternative fuels including the inclusion of renewable, bio and low-emission fuels in the energy mix of the gas grid
Scope: Improved transport infrastructure
Greenhouse gases directly concerned: CO2, N2O
Execution period: 2013 – 2030
Sources of funding: European funds with state and municipal co-financing, state and municipal budgets
Scenario in which the measure is included: WEM

IF4 – Introduction of incentives to encourage the private sector to invest in R & D and innovation of widely used production methods aimed at optimum resource efficiency
Scope: Improving efficiency in industrial final consumption sectors.
Greenhouse gases directly concerned: CO2, N2O
Execution period: 2013 – 2030
Sources of funding: European funds with state and municipal co-financing, state and municipal budgets
Scenario in which the measure is included: WEM

IF5 – Promoting the exchange of good practices between businesses on raw material efficiency in manufacturing
Scope: Improving efficiency in industrial final consumption sectors.
Greenhouse gases directly concerned: CO2, N2O
Execution period: 2013 – 2030
Sources of funding: European funds with state and municipal co-financing, state and municipal budgets
Scenario in which the measure is included: WEM

II6 – Industrial energy management systems
Scope: Reduction of greenhouse gases.
Greenhouse gases directly concerned: CO2, N2O
Execution period: 2013 – 2030
Sources of funding: European funds with state and municipal co-financing, state and municipal budgets
Scenario in which the measure is included: WEM

IK7 – Energy efficiency audits and implementation of prescribed measures
Scope: Improving efficiency in industrial final consumption sectors.
Greenhouse gases directly concerned: CO2, N2O
Execution period: 2013 – 2030

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets
Scenario in which the measure is included: WEM

II8 – Prohibitions, restrictions and obligations under Regulation (EU) No 517/2014 on fluorinated greenhouse gases and Directive 2006/40/EC on emissions from air-conditioning systems in motor vehicles
Scope: Reducing emissions of fluorinated gases and replacing fluorinated gases by other substances. Regulation (EU) No 517/2014 on fluorinated gases (which entered into force on 1 January 2015) establishes a timetable for the gradual reduction of fluorinated gases by 2030, to be implemented by implementing a system of authorised units and prohibitions/restrictions.
The most important measures to reduce fluorinated greenhouse gas emissions in Regulation (EU) No 517/2014 are:

- Bans on the placing on the market of certain new devices;
- A prohibition on servicing F-gases with a global warming potential of 2500 or more;
- Requirement to separate gases from decommissioned equipment;
- Obligation to certify gas companies.

Greenhouse gases directly concerned: HFCS
Execution period: 2015 – 2030
Sources of funding: European funds with state and municipal co-financing, state and municipal budgets
Scenario in which the measure is included: WAM

New measures to reduce greenhouse gas emissions in industry in the plan:

IY9 – Developing incentives for enterprises pursuing industrial symbiosis such as:
— use of by-products and/or waste products from one plant for the raw material of another;
— sharing utilities – energy, water or wastewater treatment to reduce costs and improve resource productivity and environmental performance;
— sharing services such as logistics, joint marketing (e.g. shared call centres) and counselling.
Scope: Improving efficiency in industrial final consumption sectors.
Greenhouse gases directly concerned: CO2, N2O
Execution period: 2021 – 2030
Sources of funding: European funds with state and municipal co-financing, state and municipal budgets
Scenario in which the measure is included: WAM

RI10 – Promoting through additional financial compensation the purchase of net-zero technology final products with a high contribution to economic resilience

Scope: Improving efficiency in industrial final consumption sectors.
Greenhouse gases directly concerned: CO2, N2O
Execution period: 2021 – 2030
Sources of funding: European funds with state and municipal co-financing, state and municipal budgets
Scenario in which the measure is included: WAM

RI11 – Provision of improved permitting procedures for the following strategic net zero technologies to enhance the interest of the investor:

- solar photovoltaic and solar thermal technologies;
- terrestrial and offshore renewable technologies;
- batteries and storage technologies;
- heat pumps and geothermal energy;
- electrolysers and fuel cells;
- use of hydrogen as raw material and/or process agent;
- sustainably sourced biogas and biomethane;
- carbon dioxide capture, storage and recovery;
- network technologies.

Scope: Improving efficiency in industrial final consumption sectors.
Greenhouse gases directly concerned: CO2, N2O
Execution period: 2021 – 2030
Sources of funding: European funds with state and municipal co-financing, state and municipal budgets
Scenario in which the measure is included: WAM

RI12 – Improving conditions for investments in net-zero technologies by:

- ensure equal access to all European and national financing opportunities (decarbonisation, modernisation and innovation fund, NRRP, etc.), including through State aid authorisation regimes for the decarbonisation of industry. Support for the provision of grants for decarbonisation and energy efficiency improvement projects for the energy intensive industry, including large companies participating in the Emissions Trading System;
- provide priority support for the deployment of new technologies with a low and medium technology readiness level (TRL) to decarbonise hard-to-decarbonise processes, including process emissions (CCSU, hydrogen, etc.);
- improving awareness among stakeholders;
- reducing the administrative burden to create projects in this area;
- simplifying and streamlining permitting processes.

Scope: Improving efficiency in industrial final consumption sectors.
Greenhouse gases directly concerned: CO2, N2O
Execution period: 2021 – 2030
Sources of funding: European funds with state and municipal co-financing, state and municipal budgets

Scenario in which the measure is included: WEM

RI13 – Promote the production and consumption of alternative renewable fuels, namely hydrogen, including by developing alternative fuels infrastructure
Scope: Developed and adopted in 2023, the National Roadmap to improve the conditions for unleashing the development potential of hydrogen technologies and hydrogen production and supply mechanisms sets the path for building a hydrogen industry. The aim of the Roadmap is to provide the basis for a coherent framework for the efficient, smooth and consistent uptake of hydrogen production, transport and use technologies in industry, energy, transport and household, to foster innovation and investment. The introduction of hydrogen electric transport is foreseen to start from urban bus transport under the responsibility of the municipalities. This approach is more cost-effective due to the possibility of scaling up with a large number of means of transport and recharging infrastructure with high regulated usability rates.
Greenhouse gases directly concerned: CO2, CH4, N2O
Execution period: 2025 – 2030
Sources of funding: European funds with state and municipal co-financing, state and municipal budgets
Scenario in which the measure is included: WAM

IY14 – Promotion of carbon capture and storage projects
Scope: Support for innovative low-CO2 technologies in energy-intensive industries
Greenhouse gases directly concerned: CO2, CH4, N2O
Execution period: 2028 – 2050
Sources of funding: Innovation Fund
Scenario in which the measure is included: WAM

IM15 – Ensuring access to decarbonised energy, infrastructure and raw materials

IY16 – Creating markets for low-carbon, circular products

IF17 – Increasing the use of natural gas in industry through new gas infrastructure

IP18 – Promoting the production of low-emission ammonia and its use as a raw material and energy carrier

IY19 – Introduction of an unobscured DAM ensuring a level playing field for all producers in relation to the pricing of greenhouse gas emissions

RI20 – Prioritising the application of circular economy principles, promoting the production of critical raw materials and deploying technologies to reduce scope 1 and scope 2 greenhouse gas emissions, including in hard-to-decarbonise processes

IY21 – Adaptation of legislation to promote the use of nuclear energy for the production of heat and electricity, hydrogen and other industrial applications, respecting the principles of ensuring nuclear safety, nuclear security and radiation protection and implementing good practices in radioactive waste management and spent nuclear fuel management.

In addition, public authorities should take into account sustainability criteria for zero-net technologies in public procurement or tenders.

In addition to the EU Emissions Trading System, European legislation on industrial emissions (integrated pollution prevention and control), reducing fluorinated greenhouse gases and controlling ozone depleting substances also contribute to reducing GHG emissions as well as emissions of harmful substances into the air.

Agriculture sector

The development of the agricultural sector and the implementation of the various measures are mainly governed by the Strategic Plan for Agriculture and Rural Development of the Republic of Bulgaria for 2023-2027 and the implementation of the sustainable agriculture component of the National Recovery and Resilience Plan of the Republic of Bulgaria.

The Strategic Plan for Agriculture and Rural Development 2023-2027 sets out 9 specific objectives (CSRs), including three objectives with a direct and indirect effect on climate and climate change:

JU 4 – Contribution to climate change mitigation and adaptation, including by reducing greenhouse gas emissions and enhancing carbon sequestration, as well as promoting sustainable energy;

OP 5 – Promoting sustainable development and efficient management of natural resources such as water, soil and air, including by reducing chemical dependency;

JR 6 – Contributing to halting and reversing biodiversity loss, improving ecosystem services and preserving habitats and landscapes.

To achieve the specific objectives, interventions are planned to support farmers in making voluntary commitments in farm management related to adaptation and mitigation of climate change and the protection and restoration of biodiversity and agricultural ecosystems.

Farmers are obliged to comply with basic standards in the areas of environment, climate change, public health, plant health and animal welfare. The basic standards cover certain statutory management requirements (SMRs) and standards for good agricultural and environmental condition of land (GAEC standards). These basic standards take greater account of environmental and climate challenges and the new environmental architecture of the Common Agricultural Policy, thus demonstrating higher environmental and climate ambition.
The environmental schemes for the climate, environment and animal welfare included in the Strategic Plan for Agriculture and Rural Development 2023-2027 contribute to

achieving the objectives and priorities of the decarbonisation dimension with direct or indirect effects.

The following eco-schemes are designed to respond to the emission reduction needs of the agricultural sector and the protection and restoration of biodiversity and soil and are accessible for implementation by farmers:

I.C.1 – Organic scheme (livestock);

I.C.2 – An scheme for maintaining and enhancing biodiversity and ecological infrastructure;

I.C.3 – Eco scheme to preserve and restore soil potential – promotion of green fertilisation and organic fertilisation;

I.C.4 – Eco pesticide use reduction scheme;

I.C.5 – Environmental maintenance scheme for permanent crops;

I.C.6 – An extensive maintenance scheme for permanent grassland;

I.C.7 – An scheme for maintaining and enhancing biodiversity in forest ecosystems;

I.C.8 – Eco crop diversification scheme.

To enhance farmers' knowledge and skills, the National Agricultural Advisory Service (NSPA) provides advice and individual advice to farmers on measures with an indirect and direct effect on greenhouse gas emission reductions for the following measures:

- Humus conservation activities (fertilisation – precision fertilisation, green fertilisation; liming; respectful tillage, crop rotation, anti-erosion activities, etc.);
- Water-saving and energy-saving irrigation technologies;
- Extensive grazing of the animals;
- Opportunities to exploit plant residues and threats from burning stubble.

Consultations on measures with a direct effect on greenhouse gas emission reductions shall cover the following areas:

- Improving manure storage and application;
- Low carbon manure processing practices (composting, anaerobic biogas processing, etc.).

The State Fund for Agriculture – Paying Agency (DFZ-PA) is a control body and makes payments on applications submitted by farmers applying for support. The intended use of the declared areas and their maintenance in good agricultural and environmental condition is established by checks by the Technical Inspectorate of the DFZ-PA. Non-compliance with the standards established by a check shall be penalised by reducing the payments to the farmer.

The measures in the Third National Climate Action Plan with a 2030 horizon and the National Air Pollution Control Programme 2020-2030 aim at reducing emissions from the sector's main sources. One of the main challenges faced by the CAP is to address the increasingly deteriorating agricultural production conditions due to climate change and the need for farmers to reduce their share of greenhouse gases, play an active role in mitigating climate change and providing renewable energy.

Based on the analysis of the main emission sources in agriculture, the following two main objectives are defined:

- Reducing and/or optimising greenhouse gas emissions from the agricultural sector;
- Raising awareness and knowledge of both farmers and administrations with regard to their actions and impact on climate change.

These main objectives are the following priorities:

- Reducing greenhouse gas emissions from agricultural land;
- Reducing methane emissions from organic fermentation in livestock farming;
- Improving manure management;
- Optimising the use of plant residues in agriculture;
- Improving rice field management and rice production technologies;
- Improving farmers' and administration's knowledge of reducing emissions from the agricultural sector.

The measures foreseen in the Third National Climate Action Plan, with a horizon up to 2030 and the National Air Pollution Control Programme 2020-2030, which continue to contribute to reducing greenhouse gas emissions are:

A1 – Stimulating the use of appropriate crop rotations, especially with nitrogen-fixing crops

Scope: Crop rotation means the scientifically justified sequential rotation of crops at a time and place on a given arable area. The period required for all crops to pass through all fields in the order defined by the rotation scheme is referred to as a rotation period or rotation. The introduction of sustainable crop rotation that includes vegetation cover in winter and leguminous crops (legumes, soya, lucerne, clover) will protect soils from erosion and maintain organic carbon sequestration, which is a potential means of reducing greenhouse gas emissions.

Greenhouse gases directly concerned: CH4

Execution period: 2013 – 2030

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets

Scenario in which the measure is included: WEM

A2 – Management of degraded agricultural land through biological recultivation with herbaceous species typical of the region and implementation of erosion control measures and soil tillage methods

Scope: Soil erosion is a process of mechanical demolition and spreading of the soil mass from the action of water and wind. Under its influence, the amount of nutrients and humus in the soil is gradually reduced. As a result of erosion, the soil structure and water/air regime deteriorate. The combination of the specific natural and economic conditions in Bulgaria creates a high risk of developing soil degradation processes used in agriculture. The most common soil degradation processes include: water and wind erosion, pollution, reduction of organic matter (humus) stocks, compaction, acidification, salinisation, loss of biodiversity.

Greenhouse gases directly concerned: CH4, CO2, N2O

Execution period: 2013 – 2030

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets

Scenario in which the measure is included: WEM

A3 – Introduction of irrigation technologies and water and energy saving, promotion of extensive farming

Scope: Irrigation of agricultural land will play an increasingly important role in the parallel impact of the development of the agricultural sector and the impact of climate change. Efficient and rational use of water is of the utmost importance both for soil health and for reducing the need to use additional energy when watering.

Greenhouse gases directly concerned: CH4, CO2, N2O

Execution period: 2013 – 2030

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets

Scenario in which the measure is included: WEM

A4 – Improving manure management and use

Scope: Manure production, treatment and management is one of the most significant sources of CH4 greenhouse gas emissions in agriculture. All activities aimed at manure storage and treatment must take into account both the type of manure, solid or liquid, as well as the collection and treatment technologies.

Investment support is essential to motivate farmers to build such expensive facilities.

Greenhouse gases directly concerned: CH4

Execution period: 2013 – 2030

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets

Scenario in which the measure is included: WEM

A5 – Introduction of low carbon manure handling practices, e.g. composting, conversion of manure to biogas under anaerobic conditions

Scope: By introducing low-carbon practices for manure processing, emissions from manure storage can be reduced. This requires considerable knowledge and experience at regional level, as the effectiveness of the implementation of the measure depends on the conditions under which it is applied. For this reason, it is advisable to build model farms in the various production areas of the country in order to gain practical experience that can be presented to farmers.

Given the resource intensity of such an investment and the need to change the production process, investment support is also advisable.

Investment support is essential to motivate farmers to build such expensive facilities.

Greenhouse gases directly concerned: CH4

Execution period: 2014 – 2030

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets

Scenario in which the measure is included: WEM

A6 – Improving farmers' awareness and knowledge about the possible use of plant residues and the threats posed by burning stubble

Scope: The use of plant waste in agriculture requires both a change in or adaptation of the production process and investment in new machinery and machinery. All of this requires a significant financial resource, which is why it is appropriate to support them.

Effective recovery of waste will reduce the need for burning the stubble.

Greenhouse gases directly concerned: CH4

Execution period: 2014 – 2030

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets

Scenario in which the measure is included: WEM

New measures to reduce greenhouse gas emissions in the plan:

A7 – Application of the Good Agricultural Practice Rules for the control of ammonia emissions into the air from agricultural sources on the basis of the UNECE Framework Code on Good Agricultural Practice for Reducing Ammonia Emissions: good practices for low-emission fertiliser/manure application, good manure management practices and strengthening the implementation of the Nitrates Directive).

Scope: Promoting the introduction and continued use of environmentally friendly nitrogen management methods in agriculture; Preventing and reducing nitrogen pollution of water from agricultural production; better management of organic fertilisers; reducing the use of fertilisers/manure on arable land; improved livestock management; actions to improve the management of arable land.

Greenhouse gases directly concerned: CH4, CO2, N2O

Execution period: 2023 – 2027

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets

Scenario in which the measure is included: WAM

A8 – Promotion of organic farming

Scope: The objective of the measure is to support and enhance the competitiveness of organic farming, to increase biodiversity and landscape diversity, and to maintain and improve soil fertility and water quality. The measure will contribute to reducing greenhouse gas emissions by using organic fertilisers instead of mineral fertilisers.

Greenhouse gases directly concerned: CH4, CO2, N2O

Execution period: 2023 – 2027

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets

Scenario in which the measure is included: WAM

A9 – The Strategic Plan for Agriculture and Rural Development 2023-2027 – Eco Crop Diversification Scheme

Scope: — The requirements of the intervention provide for a higher number of crops grown on the holding. The increased number of different crops contributes to minimising risks to the farm due to climate change (adaptation and mitigation) through crop diversification. The intervention aims to improve crop rotation, which increases the humus and nutrient content of the soil and protects against erosion by ensuring the presence of permanent soil cover to avoid soil drainage and compaction.

Greenhouse gases directly concerned: CH4, CO2, N2O

Execution period: 2023 – 2027

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets

Scenario in which the measure is included: WAM

A10 – Strategic Plan for Agriculture and Rural Development 2023-2027 – A scheme to preserve and restore soil potential.

Scope: The intervention provides for two main beliefs of the introduction of external organic matter into the soil: cultivation of suitable types of intermediate non-production crops with subsequent green fertilisation and introduction of external organic matter subject to circular economy products (organic matter treated from waste biomass). The intervention aims to reduce the use of artificial fertilisers, replacing them with natural nutrients formed as a result of the introduction of external natural organic matter.

Greenhouse gases directly concerned: CH4, CO2, N2O

Execution period: 2023 – 2027

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets

Scenario in which the measure is included: WAM

A11 – Strategic Plan for Agriculture and Rural Development 2023-2027 – Eco scheme for extensive maintenance of permanent grassland

Scope: The intervention will prevent the loss of the pastoral ecosystem by reducing the processes of sinking and erosion, ruiralisation and the development of atypical species, which significantly improves the capacity of grassland systems to absorb carbon and mitigate climate change.

Greenhouse gases directly concerned: CH4, CO2, N2O

Execution period: 2023 – 2027

Sources of funding: European funds with state and municipal co-financing, state and municipal budgets

Scenario in which the measure is included: WAM

Adaptation measures from the Action Plan to the National Adaptation Strategy contributing to decarbonisation:

AA1 – Development of suitable irrigation systems

AA2 – Maintenance of existing pasture

AA3 – Improving soil structure maintenance

AA4 – Development of insurance and risk management programmes

Waste management sector

Waste prevention is the most efficient way to improve resource efficiency and to reduce the environmental impact of waste.

The Waste Framework Directive 2008/98/EC introduces a waste management hierarchy for institutions, businesses and households to tackle waste and prioritises measures in the following order:

- Waste prevention;
- Preparing for re-use;
- Recycling;
- Other recovery, e.g. energy recovery;
- Disposal (controlled disposal, incineration without energy recovery, etc.).

The measures of the Third National Climate Action Plan 2013-2020 to be continued and upgraded until 2030 are:

Of 1 – Continuing and increasing separate collection of green waste in municipalities;

2 – biogas capture and incineration in all new and existing regional landfills;

Of 3 – Acquisition and incineration of biogas in recultivated municipal landfills;

Of 4 – Assessment of the energy potential of biogas from regional landfills that are planned to be re-cultivated;

Of5 – Introduction of anaerobic stabilisation of sludge with biogas capture and combustion in new installations and installations undergoing reconstruction in settlements with more than 20 000 population equivalents;

Of 6 – Construction of municipal facilities for the recovery of biodegradable waste, with energy production and compost;

Of7 – Introduction of differentiated charges for waste generated.

New policies and measures in the Waste sector

National Waste Management Plan 2021-2028

Regulatory, environmental, economic measures; implementation: 2021 – 2028
Plays a key role in the effective and efficient management of waste in the country. The main objectives of the Plan include reducing the harmful impact of waste by preventing and promoting re-use, increasing the amount of waste recycled and recovered, and reducing the amount and risk of landfilled municipal and other waste.
Five programmes have been developed to achieve the objectives as part of the Plan, namely:

- A waste prevention programme with a sub-programme on food waste prevention;
- A programme to achieve the preparing for re-use and recycling targets for municipal waste;
- A programme to achieve the targets for recycling and recovery of construction and demolition waste;
- A programme for the achievement of recycling and recovery targets for mass waste with a sub-programme on packaging waste management;
- A programme to reduce the quantities and risk of landfilled municipal and other waste.

The programmes contain both investment measures and non-investment – soft measures. Investment measures mainly include the construction of infrastructure. Soft measures include a diverse range of activities, including regulatory changes; the appointment of officers; training of staff; preparation of calls for projects; preparation of projects; development of methodologies, instructions and other administrative acts; implementation of control activities; conducting information campaigns; development and implementation of IT systems, etc.
The estimated value of the programmes quantified under this approach is BGN 1 428.51 million.
Investment measures account for 78 % of planned expenditure in the 2021-2028 NRMP, while soft measures account for 22 % respectively. The Programme to reduce the quantities and risk of landfilled municipal waste accounts for 51 % of the total planned investments in the NMSP 2021-2028, followed by the Programme to reach the preparing for re-use and recycling targets for municipal waste by 27.4 % of the investments.

Measures of direct and indirect relevance to reduce greenhouse gas emissions:

Completion/upgrading of regional municipal waste management systems

Description: Programme for reaching preparing for re-use and recycling targets for municipal waste. Performance indicator: share (%) of implemented funds; number of contracts completed; number of installations built. Responsible institutions: The MA of the AOC, municipalities; RMWS

Greenhouse gases directly concerned: CH4, N2O

Execution period: 2021 – 2030
Sources of funding: Environment Programme 2021-2027

Construction of municipal sites for the free delivery of separately collected household waste, including large waste, and other separately collected waste in all settlements with a population of more than 10 000 inhabitants

Description: Programme for reaching preparing for re-use and recycling targets for municipal waste. Performance indicator: Number of sites built. Responsible institutions: The MA of the AOC, municipalities, RMAs.

Greenhouse gases directly concerned: CH4, N2O
Execution period: 2021 – 2030
Sources of funding: Environment programme 2021-2027, municipal budgets.

Making composters available to households free of charge for green and other bio-waste

Described: Waste prevention programme with a sub-programme on food waste prevention. Performance indicator: Number of composters provided to households. Responsible institutions: municipalities, households.
Greenhouse gases directly concerned: CH4, N2O
Execution period: 2021 – 2030
Sources of funding: municipal budget, PEF 2021-2027, PUDOOS.

Reducing waste from paper and other office supplies by implementing national and sectoral e-government programming documents

Description: Waste prevention programme with a sub-programme on food waste prevention. Performance indicator: EGovernment projects implemented. Responsible institutions: MA of road 2021-2027, state and municipal administrations.
Greenhouse gases directly concerned: CH4, N2O
Execution period: 2021 – 2030
Sources of funding: Technical Assistance Programme 2021-2027.

Implementation of measures for PEs when issuing/updating integrated waste permits by the RIEW

Description: Waste prevention programme with a sub-programme on food waste prevention. Performance indicator: Number of permits in which a PO requirement is included. Responsible institutions: EEA, Business Organisations within the scope of the CoR.
Greenhouse gases directly concerned: CH4, N2O
Execution period: 2021 – 2030
Sources of funding: EEA.

Construction of waste recycling plants

Description: Programme for reaching preparing for re-use and recycling targets for municipal waste. Performance indicator: Number of waste recycling installations built. Responsible institutions: Ministry of the Environment and Water, municipalities, legal entities with a profit-making purpose.
Greenhouse gases directly concerned: CH4, N2O
Execution period: 2021 – 2030
Sources of funding: PUDOOS, Environment Programme 2021-2027, municipal budgets, private investment.

Separate collection and recycling of construction waste, including in industrial areas where proven necessary, Implementation Indicator: Number of projects implemented for separate collection and recycling of construction waste. Responsible institutions: Municipalities, legal entities with a profit-making purpose, the MA of the AOC.

Description: The programme to reach the targets for recycling and recovery of construction and demolition waste.
Greenhouse gases directly concerned: ML2, CH4, N2O
Execution period: 2021 – 2030
Sources of funding: InvestEU; municipal budgets.

Energy sector

For the energy sector, most of the measures impacting decarbonisation are included in the sections on renewable energy, energy efficiency, internal market and energy security, as the overall changes in these dimensions lead to GHG emissions reductions.
All listed measures of the Third National Climate Action Plan (2013-2020) have been extended until 2030 as follows:

- Upgrade of cogeneration plants and central heating boilers with natural gas turbines;
- Reduction of losses from distribution and transmission networks;
- Reduction of losses in heat networks;
- Fuel switching from coal to natural gas;
- Increase of high-efficiency cogeneration;
- Increase of the share of energy for heating and cooling from renewable energy sources;
- Improving production efficiency in existing coal-fired power plants.

The main aggregate measures of direct and indirect relevance to reduce greenhouse gas emissions are:

EN1 – Promoting and facilitating the development of renewable self-consumption and establishing renewable energy communities

EN2 – Promoting the use of high-efficiency heating and cooling systems, the introduction of innovative geothermal and solar technologies and the use of waste heat and cold

EN3 – Promoting the use of biomass for centralised and local heat production, subject to the requirements of Article 28 (2) to (7) and (10) of Directive (EU) 2018/2001.

EN4 – Promoting the production of advanced biofuels, renewable liquid and gaseous transport fuels of non-biological origin, recycled carbon fuels and renewable electricity, for road and rail transport, and for air transport, sustainable aviation fuels

EN5 – Creating offshore wind energy development

EN6 – Introduction of a planning process for priority areas for the accelerated development of wind power plants

EN7 – Introduction of requirements for the use of energy from renewable sources in buildings

EN8 – Optimising the regulatory framework for applying the increased requirements of Directive (EU) 2018/2001 with regard to sustainability criteria and GHG emissions reduction

EN9 – Introduction of obligations on fuel and electricity suppliers to meet the target in the transport sector

EN10 – Creating conditions for the development and use of advanced biofuels, renewable liquid and gaseous transport fuels of non-biological origin and recycled carbon fuels

EN11 – National Recovery and Resilience Plan of the Republic of Bulgaria (NRRP) under component 2.B.1 Low-carbon economy:

Scope: Investment 6 (C4.I6): 'Support for new renewable electricity generation and electricity storage capacity'; Investment 2 (C4.I2) 'Support for renewable energy for households; Investment 5: (C4.I5) 'Pilot support scheme for the production of green hydrogen and biogas'; Investment 3: Energy-efficient municipal outdoor artificial lighting systems; Investment 1: Energy efficiency of building stock

EN12 – Introduction of a national financing mechanism for energy efficiency – National Decarbonisation Fund

EN13 – National programme for energy efficiency in multi-apartment buildings

EN14 – Long-term national strategy to support the renovation of the national stock of residential and non-residential buildings by 2050

EN15 – Establishment of a mandatory energy efficiency scheme (reduction of fuel and energy consumption in final energy consumption);

EN16 – Households affected by the mandatory withdrawal of stoves to heat with natural gas (reconnection and new connections), district heating (reconnection and new

connections) or eco-design heating appliances), in accordance with the National Air Pollution Control Programme 2020-2030.

EN17 – Creating the transition from coal to low-carbon fuels by implementing the following projects:

It is appropriate to provide new gas transmission infrastructure for transmission to thermal power plants and other potential users in coal regions in order to create market conditions for the modernisation of thermal power plants and other energy consumers, to switch from coal to natural gas.

This will also create the necessary conditions for flexible and efficient operation of the installations after their modernisation, in line with the commitments to decarbonise the energy sector and transition to net carbon neutrality.

The use of fuels other than conventional fuels for primary energy production should be linked to the implementation of the following measures:

- Development and adoption of a national analysis of sustainable biomass potential from all sectors (including but not limited to forests and agriculture) and sustainability criteria, taking into account the sustainability criteria of Directive (EU) 2018/2001.

No similar national analysis has been carried out for the Gori sector. A similar analysis was developed in the National Forest Biomass Energy Action Plan 2018-2027.

- Synchronisation between strategic documents on forest management and use. When reviewing, updating and developing strategic documents, they must be consistent with each other and with the INECPs. Such strategic documents, which need to be revised, updated, aligned with the INECPs, may include: Forest Sector Report, Annex to the Action Plan of the National Strategy for Adaptation to Climate Change of the Republic of Bulgaria, National Strategy for the Development of the Forest Sector, National Action Plan for Forest Biomass Energy, National Renewable Energy Action Plan.

An evaluation was carried out on the implementation of the National Strategy for the Development of the Forestry Sector in the Republic of Bulgaria 2013-2020 (NSRGRB 2013-2020). In accordance with Article 9 (1) (1) of the Forests Act, a Strategic Plan for the Development of the Forestry Sector 2014-2023 (SDPFS 2014-2023) was drawn up, setting out the specific actions for the implementation of the strategic objectives, priorities and measures set out in the NSRGRB. In view of the expiry of the NSRGRB 2013-2020, a draft of the NFRGRB was prepared in 2022 and is due to be approved by the Council of Ministers in 2030. Monitoring and updating of the National Action Plan for Forest Biomass Energy, 2018-2027 is needed.

- Synchronisation between strategic documents related to the agricultural sector. When reviewing, updating and developing strategic documents, they must be consistent with each other and with the INECPs. The strategy papers, which will be reviewed, updated

and aligned with the INECPs, may include plans for the implementation of the Common Agricultural Policy for the period after 2020;

- Synchronisation between strategy papers in relation to biodiversity conservation. When reviewing, updating and developing strategic documents, they must be consistent with each other and with the INECPs. This includes the draft Biodiversity Strategy of the Republic of Bulgaria and the National Plan for the Conservation and Sustainable Use of Biological Diversity and Genetic Resources, to be approved by the Council of Ministers;

- A synchronisation of the INECPs with the water management strategy papers should be ensured. When reviewing, updating and developing strategic documents, they must be consistent with each other and with the INECPs. This includes the Flood Risk Management Plans (FRMPs) for the period 2022-2027, as well as the draft updated River Basin Management Plans (RBMPs) for the four river basin management areas. The activities set out in the Plan need to be consistent with the measures in the RBMPs and RBMPs in the four river basin management areas, throughout Bulgaria, and not only in Natura 2000 areas;

- Synchronisation between waste sector strategy documents.

The implementation of the above additional measures is considered to have a positive impact on both primary energy production and LULUCF sectors.

Adaptation measures from the Action Plan to the National Adaptation Strategy contributing to decarbonisation:

ENA1 – Inventarisation of strategies, policies, plans, standards, site selection requirements, energy infrastructure design norms, etc. to identify those in which climate sustainability considerations should be included;

ENA2 – Mainstreaming climate resilience considerations in the energy sector’s investment plans by identifying climate risks in terms of their likelihood and impact;

ENA3 – Including seasonal and long-term projections of climate change in seasonal and long-term forecasts of electricity demand;

ENA4 – Mainstreaming climate resilience into water resource management and related decisions affecting the operation of large hydropower plants;

ENA5 – Mainstreaming climate resilience in the design of new power plants;

ENA6 – Development of maps showing climate risk areas associated with transmission and distribution infrastructure to inform decisions on which parts of the pyr networks require climate resilience actions;

ENA7 – Continue monitoring of causes of misses of the pyr system and classify climate/weather causes in order to understand which climate risks lead to most interruptions and to identify trends in their frequency;

ENA8 – Developing a cost-benefit analysis to assess whether additional sections of the distribution system need to be replaced by underground cables, taking into account changes in frequency and severity of extreme events and consequent network damage.

Land use, land use change and forestry sector (LULUCF)

Forests are a major carbon dioxide (CO2) sink and are at the forefront of carbon sequestration through photosynthesis. They are an important link in the global carbon cycle due to their ability to capture CO2 from the atmosphere and retain it in their biomass, dead forest pools/MNE (and forest soil). Tree species growth is largely a net carbon accumulation, so assessing and forecasting forest condition and productivity is essential to analyse the evolution of carbon emissions. In addition, the growth of woody biomass in forests plays a role in reducing greenhouse gas concentrations in the atmosphere. For these reasons, an analysis of the condition of forest ecosystems and forest resource management methods is of interest in view of the possibility of increasing the potential of forests as sinks.

Bulgaria has a significant forest resource and its sustainable management and development is an important factor in reducing greenhouse gases. The country's forest areas account for one third of its area.

In the long term, it is necessary to further develop the idea of sustainable and multifunctional forest management aimed at maintaining or increasing timber stocks and thus carbon in forests, while ensuring sustainable annual harvesting of wood and wood products.

Forests Act

Forest planning is carried out at three levels and includes a National Strategy for the Development of the Forestry Sector in the Republic of Bulgaria and a Strategic Forest Development Plan, Regional Forest Development Plans and Forestry Plans and Programmes.

Forest plans and programmes shall determine the eligible amount of use of forest resources and the guidelines for achieving forest management objectives for a period of 10 years. The Forestry Act does not allow for the reduction of the existing loosness in the territory of the Republic of Bulgaria and in the territory of municipalities whose loosness is less than 10 % of the total percentage of forest land in Bulgaria. Land use change in forest areas is only possible in certain specific cases.

National Strategy for the Development of the Forestry Sector in the Republic of Bulgaria 2013-2020

The implementation of the National Strategy for the Development of the Forestry Sector in the Republic of Bulgaria 2013-2020 was finally monitored by an inter-ministerial working group with the participation of the non-governmental sector.

The National Strategy for the Development of the Forestry Sector in the Republic of Bulgaria for the period up to 2030 is to be approved by the Council of Ministers.

A new Strategic Plan for the Development of the Forest Sector will be drawn up on the basis of the approved document.

The process also includes the final monitoring of the implementation of the Strategic Plan for the Development of the Forest Sector 2014-2023.

Strategic Plan for the Development of the Forest Sector 2014-2023 (SPDP)

This plan was developed with the financial support of the European Social Fund under the project 'Strategic planning in Bulgarian forests – guarantor of effective management and sustainable development' under the Operational Programme 'Administrative Capacity'.

The implementation of the operational objectives with the corresponding budget, timetable, expected results, performance indicators, responsible institutions and stakeholders is regulated in specific sub-activities in the SDPSG as follows:

Operational objective 1: 'Increase of forest area, tree stocks and carbon stocks in forest areas';

Operational objective 2: "Improving forest management and use";

Operational objective 3: "Increasing the effectiveness of preventing and combating forest fires and illegal activities in forests";

Operational objective 4: "Increasing the resilience and adaptability of forest ecosystems to climate change".

The achievement of these objectives is also ensured by the implementation of the Programme of Measures for the Adaptation of Forests in the Republic of Bulgaria and the mitigation of the negative impact of climate change on them.

The existing provisions of the Law on the ownership and use of agricultural land provide that the decision of the municipal council determines the rules for the use of meadows and pastures each year. Their scope shall include:

- An action plan for grazing;
- Parts of grassland and pasture, mainly for mowing;
- Measures for the conservation, maintenance and improvement of pastures, such as shrub and other undesirable plant species, anti-erosion activities, fertilisation, temporary fencing;
- Parts of grassland and grassland for artificial grassland for planting with appropriate grass mixtures;
- Use, prohibitions and restrictions depending on landscape, soil, climate and other natural conditions.

With regard to arable land, Article 7 of the Agricultural Land Ownership and Use Act provides that erosifiable, contaminated, saline, acidic and water-underground agricultural land is restored and improved on the basis of a range of activities or technologies that

operate on the basis of pre-designed, coordinated and approved technologies and projects approved by the Council of Experts.

Valleys, quarries and other areas with impaired soil profile, ashes, tailings ponds, landfills and other landfills, old river beds, roads of abandoned canals, roads, railways and construction sites after dismantling engineering equipment, linings and superstructures are subject to recultivation. Recultivation is based on a pre-established, agreed and approved project, which is an integral part of the construction project. The procedure for using humus after removal, recultivation, land improvement and acceptance of recultivated areas are laid down in Regulation No 26 on land reclamation, improvement of low-productivity land, removal and utilisation of the humus layer.
To date, the report on the second mid-term monitoring and evaluation of the implementation of the Strategic Plan for the Development of the Forest Sector 2014-2023 has been validated.
One of the main strategic documents containing measures on land use, land use change and forestry is the third NCCP 2013-2020, whose measures will continue after 2020:

Measures contributing to the reduction of greenhouse gas emissions are:

LULUCF 1 – Use of 'unafforested areas for afforestation' in forest areas
Description: The realisation of the measure is important to achieve the objectives of the plan, as forests are a major carbon sink and a reservoir of 9095 % of the total carbon removals within the LULUCF sector. Increasing forest land plays an important role in offsetting greenhouse gas emissions in other sectors. With the uptake of unafforested areas for afforestation in forest areas in the long term, the capacity of forests as a greenhouse gas sink will also increase.

LULUCF 2 – Increase of area for urban and suburban parks and green areas
Description: The expansion of urbanised areas and intensive construction in recent years is a prerequisite for significant greenhouse gas emissions. Increasing the areas of urban and non-urban parks and green areas and maintaining them in good condition will contribute to increasing the absorption of greenhouse gases and improving the quality of the living environment. The implementation of the measure will also contribute to the gradual achievement of the rules laid down in the CAP for green areas.

LULUCF 3 – Restoration and sustainable management of wetlands. Protection and conservation of wetlands in forest areas, peatlands, marshes
Description: Wetlands are highly biodiverse and play an important role in carbon sequestration as they are among the most productive ecosystems. The restoration and conservation of wetlands in forest areas and their appropriate management will also increase their effectiveness as carbon pools. The NSPRZSR 2023-2027 provides for intervention for the construction or renovation of areas for widespread public use.

LULUCF 4 – Restoration and maintenance of protective forest belts and new anti-erosion afforestation
Description: In addition to the direct carbon absorption effect of afforestation in these belts, there is a significant indirect effect related to the prevention of wind erosion after reclamation.
No such measure has been implemented under the RDP 2014-2020. The NSPRZSR 2023-2027 provides for the implementation of intervention II.D.10 – Allocation and Recovery.

LULUCF 5 – Increasing density in listed natural and artificial plantations
Description: Activities to increase density in the listed plantations by supporting their natural regeneration or by other means.

LULUCF 6 – Introduction of a new measure/activity related to the creation of crops of fast-growing tree species for the production of wood for energy purposes (short rotation plantations)

The Action Plan of the National Strategy on Adaptation to Climate Change provides for the following adaptation measures in the Forests Sector:
GA1 – Modelling the potential behaviour of the most important tree species at present and those species that may have potential in Bulgaria in a future changing climate, throughout the country and under different climate change scenarios and different timeframes and taking into account different topographical parameters
DA2 – Developing spatially linked models for the risk of natural disturbances from wind, fires, insects and diseases, etc.
GA3 – Strengthening the existing forest resource through enrichment and proactive management of risky plantations
GA4 – Restoration of forest areas severely affected by natural disturbances or drying and afforestation to improve forest protection functions with regard to water and soil
DA5 – Creation of short rotation plantations to produce biomass
GA6 – Conservation of highly biodiverse sites, plots of old-age forests and plots with available habit (biotope) trees

Biodiversity and ecosystems
BEA1 – Development and adoption of the new Biodiversity Strategy and its Action Plan and a new Green Infrastructure Strategy for ecosystem-based management, conservation, restoration and CCA
BEA2 – operationalising ecosystem-based environmental impact monitoring and assessment
BEA3 – Creation of environmental carbon accounts
BEA4 – Linking of carbon and environmental accounts
BEA5 – Regional/local red lines to prevent the loss of ecosystem services vital for ACIs
BEA6 – Restoring ecosystems – a long-term business opportunity

ii. Where appropriate, regional cooperation in this field

In the area of Decarbonisation, the sharing of good practices, consolidated actions to implement EU legislation, as well as the strengthening of cross-border cooperation, in individual initiatives and/or fora, at regional and European level, is encouraged.

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

Not applicable

3.1.2. Energy from renewable sources

Existing and additional policies and measures will be implemented to achieve the national target of 34.96 % share of RES in gross final energy consumption by 2030.

The policies and measures take into account the priorities and guidelines of the new energy and climate policy of the EU and are in line with the experience and results of the policies and measures implemented in the area of RES energy production and consumption to date. The policies and measures are also in line with Reform 6 'Boosting RES electricity production' of the National Recovery and Resilience Plan of the Republic of Bulgaria. Theaim is to achieve cost-effective development of RES as an important part of the Union's decarbonisation policy by 2030.

In the period 2022-2030, the development of the electricity sector took into account the possibility of maximising the integration of electricity produced from renewable sources into the electricity market, taking into account decentralised electricity generation and providing renewable electricity consumers at the lowest possible price.

An enabling framework has been established to promote and facilitate the development of renewable self-consumption and the creation of renewable energy communities.

For the wider and yearly increasing consumption of renewable energy in the heating and cooling sector, priority shall be given to the use of high-efficiency heating and cooling systems, the introduction of innovative geothermal and solar technologies, and the use of waste heat and cold.

The use of biomass for centralised and local heat production will take into account the need to comply with the higher requirements regarding the sustainability and greenhouse gas emissions saving criteria of Article 29 of Directive (EU) 2018/2001.

To achieve a 29.93 % share of renewable energy in final consumption in transport, the uptake of advanced biofuels, renewable liquid and gaseous transport fuels of non-biological origin, recycled carbon fuels and renewable electricity supplied to the road and rail transport sectors and sustainable aviation fuels for air transport will be promoted. The consumption of these fuels and energy should contribute to the policy objectives of energy

diversification and decarbonisation of the transport sector. For the use of electricity from renewable sources in transport, efforts will focus on deploying electric mobility, developing and stimulating the use of public electric transport, as well as accelerating the integration of modern technologies in rail transport.

In order to implement the requirements of Directive (EU) 2023/2413, changes will be made to national legislation by 21 May 2025. The changes made to Directive (EU) 2018/2001 relate to the wider and rapid deployment of renewable energy in all areas of public life and cover different sectors and areas, concern different pieces of legislation from the relevant specialised legislation and competent institutions.

In this context, the transposition of Directive (EU) 2023/2413 will involve and directly involve the various institutions concerned, in accordance with their respective competences.

i. Policies and measures to implement the national contribution to the binding Union-level target for 2030 for renewable energy and trajectories referred to in Article 4(a) (2) and, if applicable or where available, the elements presented in point 2.1.2, including sectorial and technology-specific measures

1) Schemes of support

Support in the form of preferential prices under contracts already concluded for the purchase of electricity from renewable sources produced by plants with a total installed capacity of less than 2 035 kW will continue to be provided until 500. The aid will continue to be granted until the expiry of the time limit laid down in the purchase agreements.

The production of electricity from renewable sources by plants with a total installed capacity of 500 kW and more than 500 kW for which long-term purchase contracts have been concluded at preferential prices will be incentivised by granting a premium for the quantities of electricity they produce up to the level of their fixed net specific electricity production, on the basis of which their preferential price is determined. The aid will continue to be granted until the expiry of the time limit laid down in the purchase agreements.

New long-term contracts for the purchase of electricity at preferential prices shall be concluded only for sites with a total installed capacity of up to and including 30 kW, which are intended to be built on roofs and façade structures of buildings connected to the electricity distribution network and on real estate in urbanised areas.

The residual budget for aid for the production of electricity from renewable sources for the period from 1 January 2023 until expiry of the time limits laid down in the purchase agreements at preferential prices and premium compensation amounts to EUR 2 925 486.8

[8] State aid SA.44840 (2016/NN) – Bulgaria Support for the production of energy from renewable sources in Bulgaria

The construction of new wind, solar and biomass plants will take place on a market basis and without the provision of investment or operational financial support.

The annual implementation of the target for the share of energy from renewable sources in gross final energy consumption will be analysed in the biennial reports of the INECPs and, in the event of non-compliance, and the need for new energy facilities may be the subject of a procedure for launching a support scheme through auctions.

2) *Easing of administrative and connection procedures for the construction of energy facilities for the production of electricity from renewable sources*

Streamlining administrative procedures and speeding up accession procedures is a key factor in accelerating the use of renewable energy in all sectors, including industry and buildings. In this direction, action has been taken to amend the legislation governing the construction and integration of energy facilities using energy from renewable sources. In compliance with the requirements of Article 7 (2) (17) ZEVI, the Executive Director of the Agency for Sustainable Energy Development shall prepare an assessment of the existing unjustified barriers and the potential for the development of self-consumers and renewable energy communities. The assessments carried out are submitted for approval by the Minister for Energy and contain proposals to remove unjustified regulatory and administrative barriers.

3) *Enabling offshore wind energy development*

Legislative changes are under development to regulate the conditions for exploring the potential of the energy resource, the suitability of selected areas for investment projects and the construction of offshore energy sites with a view to effectively absorbing wind potential and enabling future joint projects with other Member States to be carried out.

Cross-border cooperation initiatives have been launched with Romania and Greece to support and promote the exploration and development of the sustainable exploitation of offshore wind potential in the Black Sea and Aegean Seas.

(4) introduction of a planning process for priority areas for accelerated development of wind power plants

A Plan for the identification of priority areas for the development of wind power generation sites is under development. Priority will be given to artificial built-up areas such as areas with existing transport infrastructure, parking areas, waste sites, industrial areas, industrial parks, urbanised areas, degraded land, pastures, tailings, landfills and degraded land that cannot be used in agriculture. Short deadlines will be introduced in the priority areas for administrative permits for the construction, reconstruction and commissioning of energy facilities, as well as for carrying out an environmental impact assessment. All necessary administrative permits relating to the envisaged requirements for the construction, reconstruction and commissioning of renewable energy production sites and for the construction, extension and reconstruction of facilities to connect them to the electricity transmission or distribution network shall be issued within one year.

It also includes the deadline for carrying out an environmental impact assessment of investment proposals under Article 92 of the Environmental Protection and Compatibility Assessment Act under Article 31 (1) of the Biological Diversity Act.

The deadlines for carrying out the procedures will be in line with the requirements of Article 16a of Directive (EU) 2023/2413 amending Directive (EU) 2018/2001 as regards the promotion of energy from renewable sources.

5) *Establishment of administrative service centres*

In order to facilitate the investment process, administrative service centres shall be set up for each municipality to provide instructions and information and organise the procedures for issuing building permits and/or use permits or certificates for the commissioning of energy facilities and facilities for the production of energy from renewable sources and of facilities for their connection to the relevant grid, including the reconstruction and modernisation of existing energy and renewable energy facilities.

An extension of the administrative services provided by the centres is planned to ensure easy access to rational administrative services, facilitating the investment process and increasing the production and consumption of renewable energy.

(6) requirements for the use of energy from renewable sources in buildings

The Renewable Energy Act sets out requirements for the use of energy from renewable sources for the construction of new buildings or for the reconstruction, major renovation, overhaul or refurbishment of existing buildings, where technically possible and economically viable. Provision is made for at least 15 % of the total heating and cooling needed by the building to be produced from renewable sources by introducing:

- Central heating using biomass or geothermal energy;
- Individual facilities for the incineration of biomass with a conversion efficiency of at least 85 per cent for residential and commercial buildings and 70 per cent for industrial buildings;
- Solar thermal installations;
- Heat pumps and geothermal systems.

In accordance with the requirements of Regulation No RD-02-20-3 of 9.11.2022 on the technical requirements for the energy performance of buildings, all new buildings shall be designed with nearly zero-energy use as of 1 January 2024.

7) *Enabling guarantees of origin for renewable energy,* biogas and green hydrogen

A new Regulation (Regulation No E-RD-04-2 of 2.4.2024 on guarantees of origin for energy from renewable sources, published in SG No 32/9.04.2024) was adopted laying down the conditions and procedure for establishing and maintaining the system for issuing guarantees of origin, including the establishment and maintenance of a single electronic register of guarantees of origin. The Regulation will introduce the requirements of standard

CEN-EN 16325 when issuing, transferring and cancelling guarantees of origin and will provide the possibility to issue a guarantee of origin for biogas and green hydrogen.

Activities of SEDA related to its full membership of the European Association of Issuing Bodies (AIB) are also planned. At present, SEDA has observer status.

(8) optimising the regulatory framework for applying the increased requirements of Directive (EU) 2018/2001 with regard to sustainability criteria and GHG emissions reduction

Changes have been made to the Renewable Energy Act (ZEVI) introducing the requirements of Directive (EU) 2018/2001 with regard to sustainability criteria and GHG emissions saving criteria.

Changes have been made to the regulatory framework of the Renewable Energy Act (ZEVI) in order to fully transpose the requirements of Directive (EU) 2018/2001 with regard to the sustainability and GHG emissions reduction criteria. It is planned to introduce measures aimed at ensuring compliance with the sustainability and greenhouse gas saving criteria and the provision of reliable information in line with the amendments introduced by Directive (EU) 2023/2413.

9) *Introducing obligations on fuel and electricity suppliers to meet the target in the transport sector*

Specific obligations on fuel and energy suppliers that should market conventional biofuels, advanced biofuels, liquid and gaseous fuels of non-biological origin, renewable electricity, recycled carbon fuels and sustainable aviation fuels will be regulated in order to achieve the new more ambitious targets.

10) *Enabling the development and use of advanced biofuels, renewable liquid and gaseous transport fuels of non-biological origin and recycled carbon fuels*

Ensuring the necessary quantities of advanced biofuels, renewable liquid and gaseous transport fuels of non-biological origin and recycled carbon fuels at affordable prices will require integrated measures related to both their consumption and production, for the purposes of the revised Directive (EU) 2018/2001.

In this underdeveloped and at the same time cutting-edge area, efforts will focus on applied research and wider demonstration activities related to the uptake of new energy sources and the introduction of technologies for their valorisation. It is necessary to establish an integrated research and innovation chain covering elements of applied research, from production to market uptake of the above mentioned fuels.

Local authorities will also develop and implement schemes to promote the use of energy from renewable sources, advanced biofuels, renewable liquid and gaseous transport fuels of non-biological origin and recycled carbon fuels, depending on the specific circumstances of the municipality, in the framework of programmes promoting the use of renewable energy and biofuels and in line with the priorities in national programmes and strategic documents for promoting the use of these fuels in transport.

(11) *stimulate the development and deployment of electric mobility and the use of energy from renewable sources in transport*

In order to stimulate the development and deployment of electric mobility, responsibilities for local authorities are laid down in their long-term programmes to introduce their own specific measures on their territory to increase the attractiveness of using this transport. Those programmes should provide for measures to promote the development and use of rail and urban electric transport by the population, through measures for the use of energy from renewable sources in municipal transport, as well as renewable liquid and gaseous transport fuels of non-biological origin and recycled fuels in transport, and support schemes for such projects.

12) *Introducing requirements for the integration of renewable energy at regional and local level when planning, designing, building and upgrading urban infrastructure, industrial, commercial or residential areas and transport and energy infrastructure, including district heating and cooling, gas and alternative fuels networks*

Local authorities are an important factor in the integration and development of renewable energy, including renewable self-consumption or renewable energy communities, and the use of unavoidable waste heat and cold in planning, including early spatial planning, the design, construction and upgrading of urban infrastructure, industrial, commercial or residential areas and energy and transport infrastructure, including electricity networks, district heating and cooling networks, gas networks, as well as alternative fuels networks, as specified and required in the region concerned.

The ZEVI regulates the competences of regional governors, mayors of municipalities and municipal councils in carrying out state management in the field of renewable energy.

13) *Promoting the use of geothermal energy*

In order to exploit the potential of this type of renewable energy source, small-scale heat generation projects in centralised and local systems will be encouraged.

Technological developments relating to the recovery of energy stored in the form of underground heat are evolving dynamically and require adequate and timely solutions, with a view to their efficient and cost-effective use, while respecting national specificities and respecting environmental protection requirements, with a focus on water management legislation.

On the promotion of the use of geothermal energy by means of the Act amending the Energy from Renewable Sources Act (ZEVI) (On. SG No 86/13.10.2023) amended and supplemented the ZEVI.

The Renewable Energy Act lays down shorter deadlines for issuing building permits for the installation of geothermal heat pumps for the production of heating and cooling and electricity, applying the conditions set out in Article 7 of Council Regulation (EU) 2022/2577 of 22 December 2022 laying down a framework to accelerate the deployment of renewable energy. When issuing permits for the installation of geothermal heat pumps with an

installed capacity of less than 50 MW, the permit-granting process for the installation shall not exceed three months.

Priority will be given to the connection of heat generation sites from geothermal to the heat transmission network and the purchase by the heat transmission company of the geothermal energy produced.

More detailed definitions have been introduced, taking into account the depth of the geothermal resource, providing legal certainty as regards the authorisation and regulatory regime applicable to the exploration and exploitation of geothermal resources.

In relation to the requirements of Directive (EU) 2023/2413, efforts will be made to introduce efficient infrastructure in district heating and cooling systems to promote heat and cooling production from geothermal energy. It will also seek to implement measures and policies to promote the development of renewable district heating and cooling systems in renewable energy communities.

Preparations for the preparation of amendments to Regulation No 15 of 28.7.2005 on technical rules and regulations for the design, construction and operation of facilities for the production, transmission and distribution of heat have been launched, which will regulate the specific requirements for the production of heat from geothermal energy.

14) *Drawing up and making available for use a manual of procedures for the construction or reconstruction of energy sites and facilities for the production of energy from renewable sources*

The Renewable Energy Act introduces an obligation for the Executive Director of the Agency for Sustainable Energy Development to develop a manual of procedures for the construction or reconstruction of energy facilities and renewable energy production facilities and to publish it on the Agency's website. The handbook should be made available to the mayors of municipalities. The administrative service centres set up for each municipality shall provide, in an appropriate manner, the manual for use by interested parties.

(15*) promoting hydrogen consumption in transport and industry*

A National Roadmap has been adopted to improve the conditions for unlocking the development potential of hydrogen technologies and hydrogen production and supply mechanisms. The measure is in the implementation of Reform C4.R7 'Unleashing the potential of hydrogen technologies and hydrogen production and supply' in the National Recovery and Resilience Plan of the Republic of Bulgaria. The aim of the roadmap is to provide the basis for a coherent framework for the efficient, smooth and consistent uptake of hydrogen production, transport and use technologies in industry, energy, transport and household, to foster innovation and investment.

To provide the necessary conditions for the rapid uptake of hydrogen in transport and industry, the necessary regulations will be developed to regulate the requirements related to the production, storage, transport and use of hydrogen and hydrogen products in transport, industry and household.

Currently, Regulation No RD-02-20-2 of 2020 on the conditions and procedure for the design, construction, commissioning and control of refuelling stations for hydrogen-fuelled vehicles (published) has been introduced into national law. SG No 86/2020).

16) *Implementation of investments under the National Recovery and Resilience Plan of the Republic of Bulgaria (NRRP) under component 2.B.1 'Low-carbon economy' related to the promotion of the use of energy from renewable sources and energy storage systems*

→ Investment C4.I4: "Digital transformation of the electricity grid"

The investment shall include a comprehensive programme for the overall digital transformation of the energy system operator's systems and processes, covering the automated management of substations, the upgrade of the supervisory control and data collection system (SCADA) with the introduction of remote booking, expansion and upgrading of the telecommunication network, including a comprehensive cybersecurity system and the modernisation of the systems for administering electricity markets.

As a result of these actions, the conditions and requirements for the technical feasibility of the electricity transmission system have to be fulfilled in order to integrate a cumulative new 4 500 MW renewable electricity generation capacity into the electricity system by 31 March 2026. Furthermore, a cumulative additional net interconnection capacity of 1 200 MW with Romania and Greece compared to the existing available capacity will be made available to the market by 30 June 2025.

The total budget of the investment is BGN 611 million, of which BGN 370 million is funds under the Recovery and Resilience Facility and BGN 241 million is financing from ESO EAD's own resources.

The activities envisaged in the investment are being implemented and the deadline for the implementation of the investment is 31 March 2026.

→ Investment 6 (C4.I6): Support for new renewable electricity generation and electricity storage capacity

The main objective of the investment is to contribute to increasing the share of clean energy in Bulgaria's energy mix on the path to climate neutrality by providing support for the construction and integration into the electricity grid of an additional 1 425 MW of solar and wind power generation capacity together with 350 MW of local electricity storage facilities. Financial support will only be granted to energy storage systems.

Support is envisaged for a wide range of energy storage systems, including energy storage facilities at the point of consumption without discharging into the grid or with a system for self-consumption and sale of electricity generation, energy storage facilities to an electricity producer and energy storage facilities as an independent object of consumption and production.

The total budget of the investment is BGN 2 billion, of which the grant under the Recovery and Resilience Facility is BGN 663 432 375. The funds will be made available on the basis of tenders.

→ Investment 2 (C4.I2) 'Support for renewable energy for households'

The investment is expected to support at least 10 000 households with inefficient solid fuel heat sources to install the best equipment for solar hot water and photovoltaic systems up to 10 kWp, including electricity storage systems.

The total budget allocated to the investment is BGN 240.00 million and BGN 140 million is the grant provided under the Recovery and Resilience Facility and BGN 100 million is the national public and private co-financing.

→ Investment 5: (C4.I5) "Support scheme for pilot projects for the production of green hydrogen and biogas"

Thescheme foresees the construction of 55 MW of electrolysers, the production of 7 800 tonnes of green hydrogen per year, the construction of infrastructure suitable for the transport of hydrogen and low-carbon gaseous fuels. The total planned budget of the investment is BGN 136.9 million (BGN 68.5 million at the expense of the Recovery and Resilience Facility and BGN 68.5 million of private co-financing) with implementation period 2022-2026.

ii. Where appropriate, specific measures for regional cooperation as well as, if desired, the expected surplus of renewable energy production that can be transferred to other Member States in order to meet the national contribution targets and trajectories presented in point 2.1.2

The implementation of the ambitious 2030 national renewable energy target implies the use of the cooperation mechanisms provided for in Directive (EU) 2018/2001. In this regard, in the event of a surplus or shortage of renewable energy, Bulgaria will benefit from the statistical transfer mechanism.

Bulgaria considers it possible to include in initiatives related to the implementation of joint projects with other Member States and/or third countries as an opportunity to meet its national target for the share of energy from renewable sources in gross final energy consumption.

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

In order to stimulate the wider deployment of renewable energy, Union funds will be used to promote and use renewable energy for heating and cooling.

The Renewable Energy, Energy Efficiency and Energy Security Programme, financed by the Financial Mechanism of the European Economic Area and having a total budget of nearly EUR 33 million will finance projects relating to the improvement of energy efficiency and the use of energy from renewable sources.

As a result of the implementation of these measures, projects for the production of electricity, heating and cooling from renewable sources are planned to be implemented at 46 000 MWh/year and annual CO2 emission$_{\text{reductions}}$ of 54 280 TCO 2.

In the period 2021-2030, Bulgaria will benefit from the investment support to be provided under the "Modernisation Fund" and will consider financing projects related to the production of electricity from renewable sources, including self-sufficiency, energy efficiency improvement, energy storage and modernisation of energy networks. The Fund will be established on the basis of Article 10d of Directive (EU) 2018/410 of the European Parliament and of the Council of 14 March 2018 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814. Between 2021 and 2030, 2 % of the total EU quantity of allowances will be auctioned and the funds go to the Modernisation Fund, pursuant to Article 10(1) of Directive (EU) 2018/410 of the European Parliament and of the Council amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814.

iv. Where applicable, assessment of support for electricity from renewable sources to be carried out by Member States pursuant to Article 6(4) of Directive (EU) 2018/2001

Not applicable

v. Specific measures to introduceone or more contact points, streamline administrative procedures, provide information and training, and facilitate the uptake of power purchase agreements

Summary of policies and measures under the enabling framework to be put in place by Member States in accordance with Article 21(6) and Article 22(5) of Directive (EU) 2018/2001 to promote and facilitate the development of renewable energy self-sources and renewable energy communities

The amendments adopted to the ZEVI provide that municipalities are to act as contact points, with a deadline of 4 months from the entry into force of the law (13 October 2023) for the mayors of municipalities to organise the activities of the administrative service centres.

To support the activities of the SEDA centres, prepare a manual of procedures for the construction or reconstruction of energy facilities and facilities for the production of energy from renewable sources in compliance with the requirements of the Spatial Planning Act,

the Energy Act, the Environmental Protection Act, the Biological Diversity Act and their implementing regulations.

Ensuring the necessary awareness and adequate training is an important factor in promoting a wider uptake of renewable energy.

Support shall be given to regional development measures in these areas that promote the exchange of best practices in renewable energy production between local and regional development initiatives, training programmes to strengthen regulatory, technical and financial expertise and to improve knowledge of available funding opportunities.

To achieve effective results in this direction, stakeholders and potential participants in the process of disseminating adequate information and conducting training procedures have been identified. The relevant institutions and local authorities are particularly active in these processes to carry out comprehensive initiatives on information campaigns, forums, awareness-raising programmes and training programmes for citizens on the benefits and opportunities of using energy from renewable sources. Information campaigns are addressed to citizens and make it possible to familiarise themselves with practical issues in the development and use of energy from renewable sources.

Information on the use of renewable energy sources shall be disseminated in the framework of the activities carried out by the relevant ministries and their executive agencies, including on implemented projects funded under international and European programmes.

In order to increase citizens' awareness and interest in the use of energy from renewable sources, information shall be provided by suppliers of equipment and systems, by the competent authorities, on the net profit, cost and energy efficiency of equipment and systems for the use of electricity, heating and cooling from renewable sources. The information will be provided in an effective and easily accessible manner.

Pursuant to Directive 2018/2001/EC on the qualification of installation and maintenance activities for biomass, solar photovoltaic, solar thermal, heat pumps and related information, qualification schemes are being implemented for installers of small-scale biomass boilers and equipment, solar photovoltaic and solar heating systems, geothermal systems.

The provision of public information on persons qualified to carry out the installation and maintenance of such facilities is organised.

vi. Assessment of the need to build new district heating and cooling infrastructure from renewable sources

The assessment of the potential for using high-efficiency cogeneration of heat from conventional fuels and renewable energy is based on the current annual heat consumption. The introduction of high-efficiency technologies would be socially and economically justifiable over the next 10 years if the current heating systems are replaced where

technically and commercially possible. New district heating networks and extensions of existing district heating networks are intended to meet the needs of public sector buildings and services that are not connected to district heating. This is expected to result in savings of 52 000 tonnes of$_{CB}$ per year 2. One option is to exploit the potential of high-efficiency solutions such as gas turbines, small to large open or closed loop gas turbines, biomass steam turbines, heat pumps, etc. Potential to increase the share of renewable energy in district heating and cooling offers the recovery of biomass with a focus on biomass from waste and residues from industrial plants and households, as well as geothermal energy. The energy efficiency potential of district heating and cooling infrastructure lies in the rehabilitation of heat transmission networks and the replacement of outdated district heating stations with advanced high-efficiency automated indirect stations, which will reduce heat transmission and distribution losses and reduce $CO2_{emissions}$.

The application of best practice solutions involving the use of pre-insulated pipes for district heating systems achieves heat loss reductions of up to 3 %. A similar level of loss [reduction] can be achieved for high-density power systems. In the context of prevailing conditions in Bulgaria, it is assumed that the average power density of district heating systems will allow heat loss reductions of up to 10 % to be achieved through the use of best available technology. The development of electricity production from high-efficiency cogeneration contributes to a decrease in the fuel used, the achievement of higher efficiency of electricity generation and better protection of the environment.

vii. If applicable, specific measures on the promotion of the use of energy from biomass, especially for new biomass mobilisation taking into account:

— availability of biomass resources, including sustainable biomass: both domestic potential and imports from third countries

— other uses of biomass in other sectors (agriculture and forestry); as well as measures for the sustainability of biomass production and use

Solid biomass is the most widely used renewable energy in the country, which is mainly used in the heat and cooling sector. The consumption of other biomass, including waste, remains negligible.

Burning wood is the main type of biomass consumed in the country, with increased use of wood and plant waste. The positive trend towards improving waste management practices continues, with the achievement of national targets for recycling of municipal waste, recovery and recycling of packaging waste, and not least the recycling targets for widespread waste. Biogas production from anaerobic fermentation of biomass and sewage sludge is still negligible. Biogas is used for electricity and heat production, in the agriculture and other sectors.

In this respect, the use of biomass for energy purposes has a wide potential for development. Efforts are aimed at wider recovery of waste (municipal solid waste, sewage

sludge, etc.) and residues from industrial plants, without adversely affecting the health and quality of life of the population in the areas where biomass energy installations are located.

In order to be taken into account for the purposes of increasing the share of energy from renewable sources, forest biomass, biofuels, bioliquids and biomass fuels are subject to regulatory requirements to minimise the risk of using biomass derived from unsustainable production. Regulatory requirements are also laid down for the sustainable production and consumption of biomass fuels when used for the production of electricity, heating and cooling from biomass with a total rated thermal input equal to or exceeding 20 MW for solid biomass fuels and with a total rated thermal input equal to or exceeding 2 MW for gaseous biomass fuels.

This ensures the use of wood meeting certain quality requirements.

3.1.3. Other elements of the dimension

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

Bulgaria will make use of the possibility of free allocation of GHG emission allowances to installations for the production of electricity in the period 2021-2030 for the modernisation of the energy sector in accordance with Article 10c of Directive (EU) 2018/410 of the European Parliament and of the Council of 14 March 2018 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments and Decision (EU) 2015/1814.

Provides for the development of:

- Selection criteria for projects with a total planned investment of less than EUR 12.5 million, on the basis of which a list of investments financed through free allocation of GHG emission allowances over the period 2021-2030 will be established.

- Rules for competitive bidding for the selection of projects with total planned investments above EUR 12.5 million to be financed through free allocation of greenhouse gas emission allowances in the period 2021-2030.

- Changes to the Energy Act.

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

Not applicable

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

One of the main priorities of national transport policy is the development of rail transport. It is one of the most sustainable and safe modes of transport. The construction and modernisation of the railway infrastructure will continue until 2030, the construction of railway connections with airports, the development of railway nodes, the reconstruction of key station complexes, and the construction of intermodal terminals. The deployment of the European Rail Traffic Management System (ERTMS) on tracks will continue.

The National Recovery and Resilience Plan (NRRP) provides for the supply and maintenance of railway rolling stock (35 single-deck electric multiple units, 7 double-deck electric multiple units, 20 single deck electric 'push – pull' trains and 18 electric shunting locomotives), the supply of on-board equipment for 108 electric locomotives and multiple units, the construction of an intermodal terminal in Ruse and the deployment of ERTMS Nevo 2 on the Ruse – Kaspichan section.

The extension of the Sofia Metro will also continue.

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

Not applicable

3.2. Dimension energy efficiency

Planned policies, measures and programmes to achieve the indicative national energy efficiency target for 2030 as well as other objectives presented in 2.2, including planned measures and instruments (also of financial nature) to promote the energy performance of buildings, in particular as regards the following:

i. EE obligation schemes and alternative measures under Articles 7a and 7b of Directive 2012/27/EU [version amended in accordance with proposal COM (2016) 761] (to be prepared in accordance with Annex II))

1) Setting the overall cumulative target by 2030

In order to support the implementation of the national energy efficiency target and to meet the requirements of Articles 8, 9 and 10 of Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2 023 on energy efficiency and amending Regulation (EU) 2023/955 (recast), Bulgaria has introduced:

- Energy savings obligation scheme and
- Alternative measures,

to ensure that the overall cumulative end-use energy savings target is met by 31 December 2030.

The total cumulative target for the period from 2021 to 2030 is set in compliance with the requirements of Directive 2023/1791 and amounts to 6 227.39 ktoe. Data on average energy sales to final consumers for the period 2016-2018 are presented in the following table.

Table 9: *Average final energy consumption 2016-2018, ktoe*

	2016	2017	2018
Final energy consumption	9 649.4	9 896.5	9 921.3
Average consumption 2016-2018	9 822.4		

The allocation of the total cumulative target by year for the period from 2021 to 2030 complies with the requirement of Article 8 (1). 1 (b) the cumulative end-use energy savings shall be at least equal to:

- 0.8 % of annual final energy consumption from 1 January 2021 to 31 December 2023, averaged over the most recent three-year period preceding 1 January 2019;
- 1.3 % of annual final energy consumption from 1 January 2024 to 31 December 2025, averaged over the most recent three-year period preceding 1 January 2019;
- 1.5 % of annual final energy consumption from 1 January 2026 to 31 December 2027, averaged over the most recent three-year period preceding 1 January 2019;
- 1.9 % of annual final energy consumption from 1 January 2028 to 31 December 2030, averaged over the most recent three-year period preceding 1 January 2019.

Table 10: *Breakdown of total cumulative target by year 2021-2030, ktoe*

Year	Annual energy savings in final consumption										Total
2021	78.58										78.58
2022	78.58	78.58									157.16
2023	78.58	78.58	78.58								235.74
2024	78.58	78.58	78.58	127.69							363.43

2025	78.58	78.58	78.58	127.69	127.69						491.12
2026	78.58	78.58	78.58	127.69	127.69	147.34					638.46
2027	78.58	78.58	78.58	127.69	127.69	147.34	147.34				785.79
2028	78.58	78.58	78.58	127.69	127.69	147.34	147.34	186.63			972.42
2029	78.58	78.58	78.58	127.69	127.69	147.34	147.34	186.63	186.63		1 159.04
2030	78.58	78.58	78.58	127.69	127.69	147.34	147.34	186.63	186.63	186.63	1 345.67
Total cumulative savings 2021-2030											6 227.39

Energy efficiency obligation scheme until 2030

To support the achievement of the national energy efficiency target, an energy savings obligation scheme as well as alternative measures to ensure that an overall cumulative energy end-use energy savings target for the period from 31 December 2030 to 1 January 2021 is in place until 31 December 2030.

The difference between the overall cumulative target and the estimated energy savings resulting from the implementation of the alternative measures shall be allocated as individual energy savings targets to the following obligated persons operating in the territory of the Republic of Bulgaria:

1. End suppliers, suppliers of last resort, traders with a license for trading in electricity which sell more than 20 GWh of electricity per year to final customers;

2. Heat transmission companies and heat suppliers which sell more than 20 GWh of heat per year to final customers;

3. End suppliers and natural gas traders which sell more than 1 million cubic metres per year;

4. Liquid fuel traders which sell more than 2 000 tonnes of liquid fuel per year to final customers;

5. Liquid fuel traders which sell more than 13 tonnes of solid fuels per year to final customers.

The expected new annual energy savings in final energy consumption achieved through the Obligation Scheme, broken down by year, are:

11.85 ktoe/year (2023-2024)

20.43 ktoe/year 2025

23.57 ktoe/year (2026-2027)

29.86 ktoe/year (2028-2030)

Alternative measures

1) Alternative measure 1

Funds for energy efficiency and renewable measures under programmes (Environment Programme 2021-2027, Competitiveness and Innovation in Enterprises Programme 2021-2027, Regional Development Programme 2021-2027 and Transport Connectivity Programme)

1.1 "environment 2021-2027" programme

The Managing Authority of the Environment Programme 2021-2027 (AOC) is the Directorate-General for the Operational Programme Environment of the Ministry of Environment and Water.

The Programme shall promote the consistency of the interventions that will be supported with the objectives of the European Green Deal and the transition to climate neutrality and in particular the transition to a circular and resource-efficient economy. Among the priorities with a direct energy saving effect is the 'For cleaner air' priority, which supports the transition to green heating of households by replacing inefficient heating appliances with efficient ones. The main objectives of the measure are the replacement of solid fuel stoves and boilers which do not comply with the Ecodesign Regulations and the introduction of alternative heating measures. The final result of the measure is to reduce PM10 emissions in order to achieve the established ambient air quality standards.

1.2 programme "Competitiveness and Innovation in Enterprises 2021-2027" Managing Authority of the Programme "Competitiveness and Innovation in Enterprises 2021-2027" (PIPP) is the Directorate-General for European Funds for Competitiveness at the Ministry of Innovation and Growth.

The programme provides support for activities aimed at implementing energy efficiency measures in enterprises on the basis of recommendations from an energy audit (energy audit): introduction and certification of energy management systems and implementation of systems for monitoring and controlling energy consumption.

1.3 programme "Development of the Regions 2021-2027"

Managing Authority of the Regional Development Programme 2021-2027 (RDP) – Directorate General for Strategic Planning and Regional Development Programmes at the Ministry of Regional Development and Public Works. The programme provides support for energy efficiency improvement measures in residential and public buildings, including student and student hostels: awareness-raising campaigns and all types of energy efficiency measures in buildings, including structural (and seismic) reinforcement, heating and air-conditioning systems, integrated on-site renewable energy systems, electrical charging equipment, digitalisation of buildings, green infrastructure, etc. Improved energy efficiency of the building stock will lead to lower energy consumption, which also contributes to reducing air pollutant emissions. To improve the housing conditions and

energy performance of buildings, the PRD will support the renovation of the building stock in line with the Long-term National Strategy to support the renovation of the national stock of residential and non-residential buildings by 2050, with more than 3 % of the total financial resources needed for building stock renovation and energy efficiency investments, which is expected to achieve 10 % of the targets for reducing annual energy consumption by 2030 under the INECPs.

1.4 transport Connectivity Programme

The managing authority of the Transport Connectivity Programme 2021-2027 (TTS) is the Coordination of Programmes and Projects Directorate of the Ministry of Transport and Communications.

The PTS include measures for intermodality in urban environments and the construction of recharging stations for electric cars along the national road network. The Transport Connectivity Programme provides funding of BGN 92 million for charging infrastructure for alternative fuels along the national road network and in ports. The aim is to promote the phase-out of high-emission cars and their replacement by electric vehicles.

Measures are also foreseen to increase the energy efficiency of public spaces, the introduction of intelligent modern management systems for passive and active heating, air-conditioning, lighting, information, etc.

Table 11

Type of policy measure	**Financial instrument**
Short description of the political measure	The operational programmes are co-financed by the European Union through the European Regional Development Fund and by the state budget of the Republic of Bulgaria. The grant intensity ranges from 50 to 100 %.
Planned or estimated budget	The estimated budget for the two programmes for the period 2021-2030 is BGN 1 398.579 million.
Expected cumulative savings in final consumption	712.32 ktoe
Expected new annual energy savings in final energy consumption	11.31 ktoe/year (2021-2022) 12.12 ktoe/year (2023-2024) 15.03 ktoe/year (2025-2030)
Implementation of public authorities, parties involved or entrusted and their responsibilities for implementing the policy measure	Managing Authority of the Environment Programme – General Directorate for Operational Programme Environment at the Ministry of Environment and Water Managing Authority for the Competitiveness and Innovation in Enterprises Programme – Directorate-General for European Funds for Competitiveness at the Ministry of Innovation and Growth Managing Authority of the Regional Development Programme 2021-2027 – Directorate General for Strategic Planning and Regional Development Programmes at the Ministry of Regional Development and Public Works

	Managing Authority of the Transport Connectivity Programme 2021-2027 – Coordination of Programmes and Projects Directorate of the Ministry of Transport and Communications
Sectors targeted	Households, Industry, Services.

(2) alternative measure 2

Introduction of a national financing mechanism for energy efficiency – National decarbonisation fund

Table 12

Type of policy measure	**National decarbonisation fund (NDF)**
Short description of the political measure	The creation of a National Decarbonisation Fund (NDF) is envisaged as the main financial scheme to support the renovation of the building stock in Bulgaria. The Fund will adapt financial instruments or structure additional ones as identified, referring to the same possible sources and appropriate funding schemes to dynamically address energy efficiency barriers. The creation of the NFD is also included as one of the main reforms in the Green Bulgaria part of the National Recovery and Resilience Plan of the Republic of Bulgaria – C4.R1: "Establishment of a National Decarbonisation Fund". For the successful implementation of Reform C4.R1: 'Establishment of a National Decarbonisation Fund' by Protocol Decision No 52 of 14.12.2022, the Council of Ministers agreed to take the necessary actions in connection with the transformation of the Energy Efficiency and Renewable Sources Fund into the National Decarbonisation Fund by amending and supplementing the Energy Efficiency Act. The objectives of the Facility are in line with the objectives of European financial institutions to increase access to competitive finance by: • Supporting the process of mobilising private finance, and • Support the effective use of grants. The national facility provides for financing through various mechanisms and financial instruments, including credit lines, guarantees or a combination thereof, etc. The NIFFE also provides for technical assistance for energy efficiency projects. It is envisaged that both complex measures will be financed and appropriate financing instruments will be developed for single energy efficiency measures. Support will target buildings in different sectors, such as: • Industry; • Transport and infrastructure; • Public sector; • Residential and non-residential buildings. The necessary financial resources are foreseen to come from different sources, including the European Structural and Investment Funds, the European Investment Bank, the European Bank for Reconstruction and Development, the Just Transition Fund, InvestEU, etc. Involving local banks and international financial institutions in this financial initiative is a key component for success in the implementation of the Facility, as their involvement can significantly simplify the lending process.

Planned or estimated budget	The estimated budget of the measure for the period 2021-2030 is BGN 11 286 million.
Expected cumulative energy savings in final energy consumption	2 948.02 ktoe
Expected new annual energy savings in final energy consumption	46.8 ktoe/year (2021-2022) 50.1 ktoe/year (2023) 81 ktoe/year (2024) 86 ktoe/year (2025) 110 ktoe/year (2026) 111 ktoe/year (2027) 150 ktoe/year (2028-2030) 62.3 ktoe/year (2025-2030)
Sectors targeted	Households, Industry, Services, Transport

(3) alternative measure 3

National Recovery and Resilience Plan of the Republic of Bulgaria (RRP)

Investment 3: Energy-efficient municipal outdoor artificial lighting systems

The objective of the investment is to increase energy efficiency, reduce energy costs for outdoor artificial lighting and improve the living conditions of the country's population through technological renewal and modernisation of outdoor artificial lighting systems. The total amount of aid provided to the final recipients is foreseen to amount to 50 % of the project value, with the remaining 50 % to be granted to the project in the form of an interest-free loan to be repaid in a 5-year period of contributions to the National Decarbonisation Fund, following its institutionalisation. The total planned resource is BGN 180.0 million, of which BGN 149.0 million from the Recovery and Resilience Facility and BGN 31 million of national co-financing in the form of VAT expenditure, with implementation period 2022-2025.

The expected cumulative energy savings for the period 2021-2030 amount to 71.11 ktoe. The distribution of new annual savings is as follows: 5.13 ktoe/year for 2024 and 5.87 ktoe/year 2025

4) Alternative measure 4

National Recovery and Resilience Plan of the Republic of Bulgaria

Investment 1: Energy efficiency of building stock

The measure provides for the implementation of three components to increase energy efficiency. A mandatory requirement is to achieve primary energy savings of 30 % for each

site once all the measures have been implemented, with the energy parameters achieved being assessed on the basis of an energy audit report.

Under the first component, energy efficiency improvement measures in the residential building stock of the country are foreseen to be financed.

The Recovery and Resilience Plan for the Republic of Bulgaria, approved by Council Implementing Decision ST 8091/22 of 4.5.2022, provides for funding for the renovation of multi-apartment buildings through the sub-measure 'Support for sustainable energy renovation of the residential building stock' under investment C4.I1 'Support for the renovation of the building stock'. In order to implement the investment, a model for granting financial aid with a decreasing intensity is envisaged for the renovation of multi-apartment buildings in co-ownership, divided into two application stages. For Phase 1, the submission of a 'proposal to implement the investment' by 31 May 2023 is 100 % grant for all eligible activities. For Phase 2, the application deadline runs from June 2023 to January 2024, with 80 % grants for renewal activities and 20 % self-participation of associations.

The focus of the investment sub-measure is on multi-apartment buildings throughout the country. Following the objective set out in the Long-term National Strategy to support the renovation of the national stock of residential and non-residential buildings (with a 2050 horizon) to renovate more than 19 million m² of residential area by 2030, the investment shall support economy-appropriate renovation of buildings achieving a minimum energy class B and at least 30 % primary energy savings for renovated buildings. The implementation of the sub-measure is expected to achieve the following results:

- 3 688 900 m² of improved floor area in multi-dwelling buildings;
- 405 GWh/year reduction of primary energy consumption;
- 79 ktCO_2per year reduction in greenhouse gas emissions (kilotonnes of CO_2eq);
- Achieving a minimum of 30 % primary energy savings per building in compliance with the 'do no significant harm' principle (2021/C58/01 within the meaning of Article 17 of Regulation (EU) 2020/852);
- Reaching energy consumption class 'B' or higher for each building subject to intervention following the implementation of energy-saving measures;
- Contribution to the objectives of the long-term national strategy to support the renovation of the national stock of residential and non-residential buildings by 2050 by 2030;
- Ensuring better air quality, living conditions and working environments in line with sustainable development criteria;
- Improvement of performance to extend the lifecycle of buildings.

Activities under the sub-measure are carried out throughout the country, in 28 districts and 265 municipalities. The allocation of funds is based on a selection procedure for the implementation of the investment, with the evaluation criteria relating to the amount of

primary energy and carbon emissions saved, the number of stand-alone sites in the applicant building, the efficiency of the energy efficiency investment, the level of engagement of the members of the condominium, etc.

The financing agreed for the implementation of the sub-measure 'Support for sustainable energy renovation of the residential building stock' is limited to a maximum amount of BGN 1 189 503 129.00 from the Recovery and Resilience Facility under the National Recovery and Resilience Plan of the Republic of Bulgaria and up to BGN 236 226 509.00 for national public funding for non-refundable tax in accordance with the Law on value added tax due for the implementation of the activities under the sub-measure.

At this point in time, procedures for the recruitment of project proposals BG-RRP-4.023 'Support for sustainable energy renovation of the residential building stock – Phase I' and BG-RRP-4.024 'Support for sustainable energy renovation of the residential building stock – Stage II' have been announced and the assessment of the project proposals has not been completed and grant agreements have not been concluded. Once the grant contracts have been concluded, information on expected savings of primary non-renewable energy and greenhouse gas emissions reductions will be available.

The second and third components provide for financing measures for the energy renovation of non-residential buildings, including public buildings and buildings in manufacturing, trade and services, as well as buildings in the tourism sector. Eligible beneficiaries under the third component shall cover micro/small, medium and large enterprises throughout the country with a maximum grant intensity of 50 %. The planned resource is 617.7 million at the expense of the RRF, complemented by national and private co-financing.

Application procedures with project proposals have been announced:

— BG-RRP-4.020 Support for sustainable energy renovation of public building stock for administrative services, culture and sport. Covers measures for the energy renovation of state and municipal administrative, cultural and artistic public service buildings and sports buildings. The procedure is under evaluation;

— BG-RRP-4.021 – Support for the energy renovation of buildings in manufacturing, trade and services – measures for the energy renovation of buildings in manufacturing, trade and services, including buildings in the tourism sector. The procedure is in the process of applying with project proposals;

— BG-RRP-4.022 Enhancing energy efficiency in public buildings of the Bulgarian Academy of Sciences. Energy renovation of part of the building stock owned by the Bulgarian Academy of Sciences. The procedure is in the process of applying with project proposals.

The cumulative savings expected for the period 2021-2030 amount to 243.68 ktoe. The distribution of new annual savings is as follows: 7.10 ktoe/year 2023 and 10.38 ktoe/year 2024-2026

5) Alternative measure 5

National programme for energy efficiency in multi-apartment buildings

In 2015, the Bulgarian government adopted a National Programme for the Energy Efficiency of Multi-Family Residential Buildings (NEEMEZ) aimed at renovating multi-apartment buildings by implementing energy efficiency measures.

The main objective of the Programme is to ensure, by implementing energy efficiency measures, better living conditions for citizens in multi-apartment buildings, thermal comfort and higher quality of living environment. Under the Programme, financial and organisational support is provided to associations of owners registered under the Condominium Management Act in multi-apartment buildings to improve the energy efficiency of the buildings in which they live.

Associations of owners whose buildings comply with the defined eligibility criteria shall receive assistance and support. Owners' associations apply to the municipality for financial support. The selection criteria shall provide that all those eligible shall receive, on a first-come, first-served basis, a 100 % grant and organisational support for the implementation of renewal until the financial resources allocated under the Programme have been exhausted.

Municipalities carry out the acceptance of application documents, evaluation, approval and monitoring of the implementation of energy efficiency measures in buildings. The mayor of each municipality is responsible for carrying out the entire renovation process for residential buildings on its territory and for selecting contractors under the ZOP to carry out the individual works on the buildings.

All 265 municipalities on the territory of the Republic of Bulgaria are eligible for participation under the Programme and activities are carried out within 143 municipalities.

The programme is implemented with a financial resource of BGN 2 billion – national funds, part of which was received from loans from the Bulgarian Development Bank with State guarantees. Where additional resources are made available, the financial resources of the Programme may be increased.

In addition, an additional BGN 52 million will be made available for the completion of 92 buildings for which the NEMAP has not reached resources under the budget of the MRDPW.

The following results are expected after the implementation of the measures for the renovation of all buildings under NEMEMS:

Table 13

PERFORMANCE INDICATORS *(classification code and title of the budget programme)*	**Target value**			
Performance indicators	**Measurement unit**	***Project 2024***	***Forecast 2025***	***Forecast 2026***

1. Buildings put into service after implementation of measures under the NEMJS (*)	number	1970		Completion of the implementation of NECEMUS
2. Buildings put into operation after implementation of measures financed by budget transfer to municipalities (* *)	number		52	
3. Improved housing infrastructure for 1970 buildings under NEEMEN (*)	sq.m TFA	11 151 384		
4. Improved housing infrastructure following implementation of measures financed by budget transfer to municipalities (* *)	sq.m TFA		389 891	
5. Estimated energy savings from renovated residential buildings – annual for 2022 buildings, under NEEMEN (* * *)	MWh/y		975 226	
6. Estimated annual greenhouse gas emissions savings (CO_2 and equivalent) – 2022 NEEAW buildings (* * *)	$ktCO_2/y$		327	

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

A long-term national strategy to support the renovation of the national stock of residential and non-residential buildings by 2050 has been developed to achieve a highly energy efficient and decarbonised building stock (the Strategy). The Strategy aims to substantially contribute to a highly energy efficient and decarbonised building sector by renovating the national stock of residential and non-residential buildings by 2050 and supporting the modernisation of all buildings with smart technologies.

The strategy foresees that 60 % of the residential building stock and nearly 17 % of the non-residential building stock will be renovated by 2050, resulting in energy savings of 7 329 GWh/year. Energy savings are expected to reduce greenhouse gas emissions by 3 274 453 tonnes of CO 2. In addition to saving energy and reducing CO_2 emissions, the implementation of the Strategy will lead to the creation and maintenance of 17 600 new jobs and an additional annual GDP growth of BGN 557 million by 2030 for the period 2021-2030.

The strategy foresees measures to build new buildings and transform existing buildings into nearly zero-energy buildings, improve the energy performance of residential and non-residential buildings and promote the introduction of smart technologies in the building sector.

The establishment of a National Decarbonisation Fund is envisaged as the main financial scheme to support the Strategy. The Fund is intended to consist of three separate sub-funds, according to the type of final beneficiaries: Sub-fund Public Sector, Commercial Companies Sub-Fund and Residential Buildings Sub-Fund.

The Strategy sets out a roadmap setting out the milestones for the renovation process of the building stock of the Republic of Bulgaria for the following periods: 2021-2030, 2031-2040 and 2041-2050

Table 14

Indicator		**2021-2030**	**2031-2040**	**2041-2050**
Total energy savings	**GWh/y**	**2 917**	**6 502**	**7 329**
Residential buildings	GWh/y	2477	5694	6294
Non-residential buildings	GWh/y	440	808	1035
Renovated area	**m^2**	**22 203 509**	**49 570 668**	**55 823 015**
Residential buildings	m^2	19 026 656	43 735 175	48 343 297
Non-residential buildings	m^2	3 176 852	5 835 493	7 479 718
Renovated area of existing housing stock	%	8 %	18 %	20 %
Saving CO2 emissions	**tone**	**1 306 435**	**2 891 610**	**3 274 453**
Residential buildings	tone	1 065 184	2 448 461	2 706 441
Non-residential buildings	tone	241 251	443 149	568 012

In order to reach the national target in the period up to 2030, additional efforts are needed to renovate the national building stock, leading to the achievement of additional energy savings of 2 568 GWh. Achieving additional savings is also in line with the requirements of the amended Energy Performance of Buildings Directive and the introduction of new, increased building renovation standards, as well as strengthening policy measures to achieve the decarbonisation of the sector. With the preparation of the national building renovation plan, a detailed analysis of the building stock and an update of the 2030, 2040, 2050 roadmap will be carried out to ensure that the additional energy savings in residential and non-residential buildings are achieved.

In order to achieve the necessary indicators in the 2030 roadmap, it is necessary to strengthen existing policies and formulate new ones in the building sector. Details of regulatory and financial measures to support national policies will be prepared in the framework of the establishment of the national building renovation plans.

Policies to achieve updated indicators in a Long-term Renovation Strategy:

Multi-family residential buildings

1. Providing sustainable financial instruments for accelerating the renovation of multi-apartment buildings and moving from a socio-administrative to market-oriented model;

2. Effective implementation of the organisational and regulatory framework for energy renovation of multi-apartment buildings, co-ownership management and reduction of administrative burden;

3. Engagement of the condominium as an equal participant in the renovation process for multi-apartment buildings;

4. Introducing systematic monitoring of the results of building renovation support programmes;

5. Building the administrative and professional capacity of the public administration and local authorities, as well as the actors involved in the investment process;

6. Raising awareness among citizens and stakeholders through an active and long-term communication campaign at national level, including regular and coordinated local initiatives.

Single-family residential buildings

1. Promoting the comprehensive renovation of single-dwelling buildings;

2. The promotion of single measures in single-family residential buildings when introducing minimum component requirements and building renovation roadmaps;

3. Reducing energy poverty among occupants of single-dwelling buildings;

4. Raising awareness of the benefits of energy efficiency;

5. Stimulating investment in individual and shared renewable energy installations.

Public buildings

1. Reduction of energy needs in public buildings, including through energy renovation of buildings;

2. Enhancing the capacity of local authorities to develop and implement their own long-term climate and energy policies in order to achieve energy independence and climate neutrality;

3. Highlighting the "Energy Efficiency First" principle in order to play an exemplary role for citizens and businesses.

Privately-owned buildings for public use

1. Increasing energy efficiency by introducing minimum requirements for private urban buildings, with all buildings in the categories 'Retail and wholesale (supermarkets and moles)' and 'Hotels and restaurants' above 250 m² having an energy performance corresponding at least to energy consumption class D on the relevant building type;

2. In order to increase the efficiency of building systems and reduce energy losses, where technically and economically feasible, all non-residential buildings with an effective rated output of more than 70 kW for heating systems, air-conditioning systems, combined space heating and ventilation or combined air-conditioning and ventilation systems shall be equipped with the following building automation and control systems by 31 December 2029;

3. In order to improve the indoor climate and hygiene conditions in buildings, all buildings owned or occupied by private childcare facilities and healthcare facilities, as well as in homes for the elderly and deprived of parental care, must be equipped with mechanical ventilation systems with high efficiency recovery of energy from exhaust air by 2030;

4. In order to incentivise the use of renewable energy in buildings, where technically appropriate and economically and functionally feasible, suitable solar energy installations must be deployed within a timeframe set by changes in the legal and regulatory framework.

Horizontal policies

1. Establishing a single digital system for collecting information (database) on the existing building stock in the different categories of buildings at municipal level, including information for the purposes of social policies for energy-vulnerable populations;

2. Increase the effectiveness of the National Information System on the state of energy efficiency in the Republic of Bulgaria by providing aggregated anonymised data and ensuring connectivity between the databases of municipalities and the various institutions collecting data on the building stock;

3. Introducing updated energy performance certificates for buildings and making them a mandatory element of the property disposal package, such as purchase, sale and rental;

4. Digitalisation of technical passports and creation of databases of municipalities in connection with systems connectivity;

5. Introduce the optional common Union Smart Readiness Indicator scheme and adapt the European methodology established by the EC to calculate it according to national specificities;

6. Promoting the application of building automation and control systems, including the implementation of mandatory monitoring schemes for actual energy savings for different types, buildings, households and income groups (where applicable), for all programmes supporting building renovation;

7. Introducing additional provisions and requirements to ensure optimal performance of technical building systems, including ventilation where technically and economically feasible;

8. Promote and promote upskilling with training programmes covering key professions and specialties according to the roadmap developed under the BUILD UP Skills European initiative. Creating a link between secondary school and university curricula and current trends and practices in energy efficiency and supporting the development of facilities in cooperation with manufacturers and suppliers of appropriate building materials and products Special provisions for the training and qualification of installers and consultants;

9. Encouraging the establishment of continuing professional training and expanding the scope of training programmes on energy efficiency and renewable energy for planners (architects and engineers) and construction professionals and workers, with the relevant industry organisations playing a leading role Establishment of registers of qualified construction professionals and workers and an effective system for the recognition of professional qualifications obtained in the workplace;

10. Broadening the scope and increasing the intensity of training for energy efficiency advisors to obtain qualifications for energy efficiency audits and building certification and entry in the register in accordance with Article 44 of the Energy Efficiency Act;

11. Software update for certification and training for energy auditors;

12. Enabling the uptake of innovative ESAC business models in the field of energy efficiency at regional and national level.

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

Theprovision of energy efficient services is regulated in the Energy Efficiency Act. Under the Energy Efficiency Act, energy efficient services aim at combining the supply of energy with an energy efficient technology and/or with action that covers the operation, maintenance and management necessary to provide the service and results in verifiable, measurable or estimable energy efficiency gains and/or primary energy resource savings. Energy efficient services shall be performed on the basis of written contracts concluded with final energy consumers. The Energy Efficiency Act also identifies persons who can provide energy-efficient services – natural or legal persons – traders within the meaning of the Commerce Act or the legislation of a Member State of the European Union or of another State party to the Agreement on the European Economic Area.

The implementation of performance contracts (EPCs) has an essential role to play in stimulating the market for energy efficient services. Under these contracts, the repayment of the investments made and the payment of the outstanding remuneration to the suppliers (ESCOs) are made at the expense of the energy savings achieved. They give a guarantee of their performance or of the savings that will be made after the implementation of the project.

Bulgaria has adopted the European Professional Code for Performance Contracts. The Code was established in the framework of the project 'Enhancing the Transparency of Energy Services Markets (Transparense)', funded by the EC under the Intelligent Energy for Europe Programme. It is a set of values and principles necessary for the successful preparation and implementation of projects in the field of the ESCO Treaty in the European countries and sets out the principles of conduct of, in particular, the ESCO contract providers. The two European ESCO associations (eu.ESCO and EFIEES) have formally approved the Code and supported its implementation. Documents related to the Code can be found on the website of the National Administrator of the Code.

In the framework of a project funded under the Operational Programme Innovation and Competitiveness 2014-2020, a standard ESCO contract for the industry sector was developed, guidelines for the preparation of ESCO contracts in order to facilitate the contracting parties to an ESCO treaty with a minimum set of standard clauses. The model contract was also accompanied by a model contract and a methodology for estimating the

energy saved under the ESCA contract, an indicative quantitative account and a repayment plan. All documents produced are published on the SEDA website.

In order to promote energy efficient services, changes to the Energy Efficiency Act regulate the possibility of collecting and repaying the value of energy efficiency services provided to final customers through the energy or natural gas supplier.

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 (such as measures to encourage public buildings to lead by example for energy efficient public procurement, measures to promote energy audits and energy management systems, consumer information and training measures, and other measures to promote energy efficiency)

Under Component 8 'Sustainable Transport' of the NRRP, Investment C8.I7 'Green mobility – Pilot scheme to support sustainable urban mobility', procedure BG-RRP-8.013 'Green mobility' – Measures to support sustainable urban mobility to develop green, safe, functional and energy-efficient transport systems; creating public transport with less energy consumption, which will save public resources; effective urban-rural connectivity, through partnerships with identified projects/priorities in the Integrated Municipal Development Plans (IPDPs) and in the Integrated Territorial Strategies for the development of NUTS level 2 regions, as well as compliance with the Sustainable Urban Mobility Plans (integrated in PRI or updated in accordance with the PRI). The procedure is in the process of applying with project proposals.

The procedures closed for applications are currently undergoing an evaluation of the project proposals received. Contracts should be concluded and implemented in accordance with the preconditions of the procedures. The aim is to achieve the indicators and results underlying the investments and the contribution of their implementation to the objectives of the NRRPs.

To achieve the national energy efficiency targets set for 2030, existing and additional policies and measures will be implemented:

- **Encouraging public buildings to lead by example**

According to the provisions of Directive 2010/31/EU and Directive 2012/27/EU, public authorities at national, regional and local level should lead by example in terms of energy efficiency. In this regard, the Republic of Bulgaria has set a more ambitious target for the renovation of buildings owned and occupied by the central administration, with the legal requirement laid down in Article 23 (1) of the Energy Efficiency Act (ZEE) for all heated and/or cooled state-owned buildings used by the state administration to take measures to improve the energy performance of at least 5 % of the total PPR each year. In addition to the need to reduce energy consumption in buildings due to its long-term impact, but also the stimulating role of buildings owned by public bodies, as they represent a significant

share of the building stock and have a high level of visibility in public life, the rationale behind a more ambitious target.

In addition, the following measures will be taken to support the objectives of achieving a highly efficient and decarbonised building stock:

- Periodic review of minimum energy performance requirements for buildings using cost-optimal costs and harmonisation of technical requirements for the design, construction and operation of stable, healthy, high-tech and energy-efficient buildings complying with European standards and legislation in this field. Improving the lifecycle of buildings for the period 2015-2030;

- Research on energy efficiency in buildings, through applied research to provide a scientific basis for energy efficiency standards in buildings, for the period 2015-2030;

- Improving the conditions for the inclusion in construction activities of products ensuring the fulfilment of essential requirements under Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2 011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC Text with EEA relevance and Regulation (EU) 2019/515 of the European Parliament and of the Council of 19 March 2 019 on the mutual recognition of goods lawfully marketed in another Member State and repealing Regulation (EC) No 764/2008. Developing national requirements for construction products harmonised with European technical legislation, including energy saving and heat storage, sustainable use of natural resources, recycling and reuse of construction products, for the period 2015-2030;

- Improving the functionality of the Construction Products Contact Point (CCSP) under Regulation (EU) No 305/2011 and Regulation (EU) 2019/515 and improving the conditions for free movement of construction products by upgrading and maintaining the CCSP information platform, in the period 2015-2030;

- Launch and implementation of the digital reform of the Bulgarian construction sector, 2021-2030:

  - Implementation of the National Strategy for the Digitalisation of the Construction Sector with a horizon of 2030 and a roadmap for its implementation, approved by Council of Ministers Decision No. 270 of 6.4.2023. The vision of the National Strategy and its Roadmap is linked to achieving the transformation of the construction sector through a new generation of digital technologies into a resource-efficient economic sector and enabling digitalisation and management of the built environment to achieve European and national environmental protection and climate neutrality objectives;

  - Introduction of building information modelling or BIM at national level. BIM is a methodology that includes new and technological ways of designing, building, operating and managing buildings, software products, coordination between actors in the construction process, data exchange and building information management. It is a methodology that contributes to achieving digital transformation for the construction sector

and provides the necessary information and digital environment to manage the built environment as a prerequisite for achieving European and national climate targets;

- Implementation of Investment C10.I6 "Supporting a pilot phase for the introduction of Building Information Modelling (BIM) in investment design and construction as a basis for digital reform of the construction sector in Bulgaria" under the National Recovery and Resilience Plan. The investment is a pilot phase aimed at increasing the preparedness for the introduction of BIM in investment design and construction in Bulgaria, creating regulatory conditions and IT infrastructure for the introduction of BIM in the design, approval, implementation, control and operation of construction works. The investment will contribute to modernising the construction sector in line with European priorities, enabling long-term and sustainable development by deploying means of automation of approval and control processes using BIM capabilities. Optimising the design process will have the long-term effect of increasing the quality of construction, reducing the cost of construction products, reducing energy consumption, protecting the environment and improving the quality of life. The implementation of the investment will also contribute to increasing the efficiency of government and the quality of public services in the field of construction, as well as to preparing the administration at central and regional level to implement the reform of the construction sector, enhancing the capacity of the actors involved in design and construction.

- Renovating the existing building stock to an energy optimised level with a view to achieving nearly zero-energy building standards for the period 2021-2030;

- Implement the optional common Union scheme for defining the smart readiness of buildings for energy efficiency and adapt the methodology established by the EC for its calculation, taking into account national specificities, including an assessment of existing national certification schemes for the energy performance of buildings, in the period 2021-2030;

- Increasing the capacity and expanding the activities of the National Council of Experts to promote and coordinate the increase in the number of nearly zero-energy buildings in an efficient manner, in the period 2021-2030.

- **Energy efficient public procurement**

Under Article 30a of the Energy Efficiency Act, public procurers purchase only products, services and buildings with high energy efficiency performance, including:

1. Products meeting the criterion of belonging to the highest possible energy efficiency class;

2. Office equipment designated and meeting the requirements of Annex B to the Agreement between the Government of the United States of America and the European Union on the coordination of energy-efficiency labelling programmes for office equipment (OJ L 63/7 of 6 March 2013);

3. Tyres that meet the criterion of the highest fuel energy efficiency class as defined in Regulation (EC) No 1222/2009 of the European Parliament and of the Council of 25

November 2009 on the labelling of tyres with respect to fuel efficiency and other essential parameters (OJ, L 342/46 of 22 December 2009), hereinafter referred to as 'Regulation (EC) No 1222/2009';

4. Buildings that meet the minimum energy performance requirements certified by an energy performance certificate.

- **Energy audits and management systems**

The following enterprises shall be subject to the mandatory energy audit:

- Production enterprises which are not small and medium-sized within the meaning of Art. 3 of the Small and Medium-Sized Enterprises Act;
- Enterprises, which provide services which are not small and medium-sized within the meaning of Art. 3 of the Small and Medium-Sized Enterprises Act;
- Industrial systems (US) with an annual energy consumption of more than 3 000 MWh;
- Outdoor artificial lighting systems located in a settlements with a population exceeding 20 000 inhabitants.

The survey shall be carried out at least once every 4 years.

Enterprises and owners of VUs implementing an energy or environmental management system subject to certification by an independent body for compliance with European or international standards shall be exempted from the mandatory energy audit, provided that the management system they implement includes an energy audit of the enterprise or industrial system concerned.

The implementation of an energy or environmental management system and evidence that the management system applied by them complies with the minimum requirements for energy audits shall be submitted to the SEDA within one month of the acquisition of the certificate.

Owners of enterprises, vehicles and outdoor artificial lighting systems are obliged to carry out energy efficiency management. Energy efficiency management is carried out by maintaining databases on monthly production and consumption by type of energy, annual analysis of energy consumption and implementation of other measures that lead to energy savings. For energy efficiency management, obligated parties shall draw up annual reports based on a template drawn up by the SEDA, which shall be submitted to the Agency no later than 1 March of the year following the reporting year.

A system for energy efficiency audits and certification of buildings in operation with a total floor area (UAA) of more than 250 m^2 has been put in place in the Republic of Bulgaria, in compliance with the provisions of Directive 2010/31/EU. The energy performance certificate of a building in operation shall be updated when carrying out the following activities leading to a change in the energy performance of the building:

- Conversion;

- Reconstruction, major renovation or overhaul where more than 25 % of the surface area of the building envelope and building elements is covered.

Owners of buildings above 250 m^2 shall be required to implement the measures to achieve the minimum required energy consumption class prescribed by the first audit within three years of the date of acceptance of the results of the audit.

Owners of public service buildings – state and municipal administrations – are obliged to carry out energy efficiency management. Management shall be carried out by implementing energy efficiency improvement programmes, activities and measures and by carrying out analyses of energy consumption on an annual basis. For energy efficiency management, like business owners, building owners also prepare and send annual reports to the SEDA using a template.

- **Reporting and invoicing**

Electric energy accounting

According to the provisions of the ZE, electricity supplied to final customers is measured using commercial metering devices owned by the transmission system operator or the distribution system operator, located up to or at the customer's property border. Electricity users do not pay a charge for commercial metering.

The electricity market design and the conditions for participation in the electricity market are laid down in the Electricity Trading Rules issued by the KEVR.

Heat accounting

One of the main methods of accounting for heat consumed by households is the heat accounting system introduced in Bulgaria in 1 999 in the Energy Act, as one of the energy efficiency measures laid down in the conditions for Bulgaria's accession to the EU. Thanks to allocators (allocators, water meters, apartment heat meters), the total energy for the heating and heating of water may be shared between individual properties. The distribution of thermal energy in a condominium building is carried out in accordance with the methodology set out in the Annex to Regulation No E-RD-04-1 of 12.3.2020 on district heating. The substations in Bulgaria are equipped with heat meters, which are recorded at the end of each month. The reported heat is distributed among customers on the basis of the consumption of each property in the previous heating season, and every month the district heating company sends consumers invoices reflecting these data. After reading the appliances at the end of the heating season, the heat accountant shall draw up a balancing bill. It is calculated on the basis of actual consumption for each individual property.

As a result of the introduction of this measure, individual heaters and appliances have been installed to regulate heat for virtually all heating bodies.

With regard to the availability in most buildings of a common heating system and a domestic hot water system, legislation provides, in addition to transparency and accuracy in accounting for individual consumption, transparent rules for the allocation of the costs

of heat and hot water consumption in multi-apartment buildings supplied from a central heat source.

Customers are connected to the heat transmission network by means of a connecting heating main and a subscriber sub-station. When a new building is connected to each individual property in the building, an individual heat meter is installed at a competitive price. Where an existing building is connected, after major renovation and reprocessing of building heating systems from vertical to horizontal distribution, an individual heat meter shall be installed in each individual property in the building at a competitive price.

Article 9c(1) of Directive (EU) 2018/2002 of the European Parliament and of the Council of 11 December 2 018 amending Directive 2012/27/EU on energy efficiency (Directive 2018/2002) provides that meters or heat cost allocators installed after 25 October 2020 are remotely readable devices.

Article 9c(2) of Directive 2018/2002 provides that, until 1 January 2027, meters and heat cost allocators already installed but not remotely readable must be either redesigned to read remotely or replaced by remotely readable devices, unless the Member State concerned demonstrates that it is economically inefficient.

The Directive has been transposed in the Act amending and supplementing the Energy Efficiency Act (published. SG No 21/12.03.2021), and § 75 of the Transitional and Final Provisions of the Act introduced a provision according to which, by 1 January 2027, the means installed under Article 140 (1) of the Energy Act (individual heat meters, individual water meters, individual distributors) which are not remotely readable are to be adapted to enable remote reading or are replaced by remotely readable means.

Accounting for energy from natural gas

The quantities of natural gas transported through the transmission network shall be taken into account at the gas metering points owned by the transmission undertaking, located on the transmission network, in accordance with the regulatory requirements for its design, construction and operation.

The quantities of natural gas transported through the distribution network shall be measured on the gas meter placed before the consumer but owned by the gas distribution undertaking. Operation of the means of commercial measurement of the transmission and distribution network is the responsibility of the operator of the network concerned, in accordance with the regulations on commercial metering: Act on Metering and Rules on the Trade in Natural Gas

Invoicing

The methods and conditions for the billing of final consumers are laid down in the Energy Act. Energy companies shall provide their energy service users with information on:

- Methods of payment, charges for suspension or recovery of supply, maintenance service charges and other prices of services related to the licensed activity;

- The procedure for switching suppliers and the information that energy service users are not liable for additional charges in the event of switching suppliers;
- The quantities actually consumed and the costs incurred without any additional payment obligation for this service;
- The establishment of a final regularisation account whenever there is a change of supplier;
- The share of each energy source in the total energy supplied by the supplier in the previous calendar year, in a comprehensible and clearly comparable manner;
- Existing sources of publicly available information on the environmental impact, as regards at least carbon dioxide emissions and radioactive waste resulting from electricity production from different energy sources, in the total energy supplied by the supplier in the preceding year;
- The means of dispute settlement.

This information shall be provided on the invoices or together with them in information material and on the websites of the energy companies. In this way, energy and gas suppliers also provide energy service consumers with a checklist adopted by the Commission containing practical information on their rights.

The Energy Act also obliges the final supplier to inform the customer, together with the invoice for the last month of each semester, where the reported electricity or natural gas consumption of final customers for this semester is more than 50 % higher than the reported consumption for the corresponding semester of the previous calendar year.

In addition, a large number of energy suppliers maintain detailed information on the content of invoices to the end user on their websites, and some of them take further steps, such as sending letters (electronic and paper) to their customers, explaining the content of the invoice for energy consumed.

- **Improving energy efficiency in the transport sector**

The main measures through which Bulgaria seeks to improve energy efficiency in the sector can be summarised as follows:

a) Increasing the share of public electric transport

The measure shall include:

- Improvement of railway infrastructure;
- Renewal of electric rail rolling stock.

b) Training of drivers in economical driving

The Ministry of Transport and Communications will encourage and facilitate special training for drivers to improve economic driving. Such courses will include a driving module which, based on safety requirements, includes topics to increase the ability to optimise fuel consumption through better use of vehicle design and efficient driving.

c) Increasing the share of electric and hybrid vehicles and deploying charging infrastructure for electric and hybrid cars in urban areas

Recharging infrastructure for electric vehicles is mainly carried out by private investors.

Bulgaria's recharging infrastructure sector is developing at a fast pace and the total number of installed recharging points in Bulgaria crossed the border of 1 000 at the beginning of 2023. As of the beginning of December 2023, there were 1 586 recharging stations located at 1 126 locations.

In Bulgaria, 15 networks with charging stations of different operators are in operation: Fines Charging, Eldrive, eCars/Vsichkotok, AutoBOX/VoltSpot, KIA Hypercharge/ELBUL, EVPoint, Pro Credit Bank, Kaufland, Varna Charging, Gigacharger, Travel By Electric, Wink Charging, GPStation, Bullcharge, EVN.

Appropriate financial incentives and administrative means as well as support schemes for the installation of charging infrastructure need to be put in place.

Shared mobility services are increasingly available in Bulgaria. The development of these services can completely change the model of ownership and use of cars, from owning a product (car) to using a service (mobility).

Since 2017, a SPARK fully electric car sharing service has been offered in Sofia and since 2 021 in Plovdiv.

Spark is a new generation service that offers flexible rental of electric cars through a mobile application. Consumers can rent a car according to their needs. In the app, users can see both the areas in which a car can be rented and released and all about 1 000 electric cars of 14 different models are available for rent.

Development in Bulgaria is also provided with bike-sharing services and e-scooters, which address a number of problems in large urbanised territories.

Since 2016, a pilot scheme has been launched to promote the purchase of electric and hybrid vehicles in the state administration of the National Trust Ecofund by granting a subsidy.

For the period 2016-2022, a subsidy of BGN 1 391 146 was paid for the supply of a total of 72 electric and rat hybrid vehicles.

Table 15

2016		2017		2018		2019		2020		2021		2022	
Number of CP	Amount	Number of CP	Amount	Number of CP	Amount	Number of CP	Amount	Number of CP	Amount	Number of CP	Amount	Number of CP	Amount
5	90 000	14	250 000	6	120 000	8	134 004	6	130 000	22	435 159	11	231 983

The National Policy Framework for the development of the market for alternative fuels in the transport sector and the deployment of relevant infrastructure provides for a number of potential measures to promote the uptake of electric vehicles:

- Setting standards for energy consumption in circulation (applicable not only for the first registration but also for the subsequent sale/registration of vehicles);
- Setting emission standards for road vehicles (applicable not only for the first registration but also for the subsequent sale/registration of vehicles);
- Introduction of access areas (especially in central urban areas) with energy-efficient and low-emission vehicles only;
- Applying progressive taxation promoting the use of energy-efficient and low-emission vehicles;
- Providing direct subsidies for the purchase of new zero-emission vehicles (valid for a limited number/time, until a minimum number of such vehicles is reached);
- Provision of tax credits for the purchase and use of zero-emission vehicles (valid for a limited number/time, until a minimum number of such vehicles is reached);
- Provide access to bus lanes for zero-emission vehicles (valid for a limited number/time until a minimum number of such vehicles is reached);
- Use of electric vehicles for the needs of public administration and local authorities;
- Promoting the entry of zero-emission vehicles for shared use;
- Stimulate the transition of taxi companies and public transport operators to the use of zero-emission vehicles.

Year-on-year on 1 December 2023, the number of electric vehicles increased by 65 % from 8 791 to 14 517 and hybrid vehicles by 52 % from 30 774 to 46 779.

Municipalities need to develop their investment programmes for electric transport.

Increasing the share of hydrogen fuel cell vehicles and deploying hydrogen recharging infrastructure

The availability of recharging infrastructure is a critical need to start hydrogen transport in Bulgaria. A parallel construction of the charging stations ecosystem and incentives for the purchase of hydrogen vehicles are most economically justified.

Two approaches to the introduction of hydrogen electromobility in Bulgaria are outlined: through the direct purchase of hydrogen transport vehicles and refuelling infrastructure and through retro-conditioning (conversion).

Bulgaria currently has no centralised hydrogen production nor hydrogen recharging station infrastructure, therefore the forecasting of hydrogen recharging stations, both by location and by type and capacity, will be subject to changes to increase efficiency and reduce costs. It is envisaged that the first recharging stations will produce hydrogen on-site by electrolysis with renewable energy.

The first National Hydrogen Demonstration Project, funded by the MOH, relates to transport, for the retro-conditioning of a trolleybus with a mileage extension.

The introduction of hydrogen electric transport is foreseen to start from urban bus transport under the responsibility of the municipalities. This approach is more cost-effective due to the possibility of scaling up with a large number of means of transport and recharging infrastructure with high regulated usability rates. For the time being, 4 municipalities are interested in introducing hydrogen bus transport in Bulgaria: Sofia, Stara Zagora, Burgas and Ruse.

Another niche for hydrogen transport that will grow strongly is international truck transport, where Bulgaria has a strong position. This will require the provision of the relevant national infrastructure and the construction of recharging stations on motorways. For Bulgaria, and in particular for the Danube municipalities, there is another promising niche for rero-phyting – water transport.

- **Consumer information and training programmes**

The measure aims to ensure that consumers are more aware of their use of electricity, heat and natural gas and of the benefits of implementing energy efficiency measures. Energy traders publish information on how to save energy on their pages and keep an online archive of electronic invoices. Companies have energy efficiency advisors to help customers reduce their energy consumption without costly investments and complex repairs.

Besides the measure being implemented by energy traders in the country as part of their information campaigns and initiatives, its implementation is further supported by the county and municipal administrations in the country. Various initiatives to raise consumer awareness are included in the programmes for improving the energy efficiency of regional and local authorities, drawn up in order to fulfil their obligations under Article 12 of the Energy Efficiency Act. Initiatives include the creation of consumer councils, the organisation of a consumer day, as well as numerous campaigns in county and municipal centres where customers can learn about how to save energy.

Information campaigns and the implementation of various behavioural measures are included as eligible measures in Regulation No E-RD-04-3 of 4 May 2016 on the measures eligible for energy savings in final consumption, the means of proving the energy savings achieved, the requirements for the methodologies for their evaluation and the means of confirming them.

In order to support the implementation of the measure, specialised methodologies for assessing energy savings are developed following the application of various behavioural measures in accordance with Regulation No E-RD-04-3 of 4 May 2016. The methods are drawn up in accordance with the model laid down in the Regulation and are subject to discussion by expert groups specifically established by the AUER, again in accordance with the procedure laid down in that Regulation.

- **Availability of qualification, accreditation and certification schemes**

The conditions and procedures for obtaining and recognising qualifications to carry out energy audits on buildings and industrial systems and the certification of buildings are regulated in the Energy Efficiency Act. Energy audits, certification of buildings, conformity assessment of investment projects and energy savings assessments are carried out by persons registered in public registers maintained by the SEDA. The Energy Efficiency Act lays down the requirements to be met by the persons concerned, these requirements being detailed at the level of Regulation No E-RD-04-1 of 3.1.2018 concerning the circumstances to be entered in the registers under the Energy Efficiency Act, the registration and receipt of information from these registers, the conditions and procedures for obtaining qualifications from energy efficiency consultants.

Persons registered in the public register of the SEDA shall hold a certificate of successful completion of the qualification examination for the activities of audits and certification of buildings and energy audits of industrial systems.

- **Mandatory phase-out of solid fuel heating appliances that do not comply with Ecodesign Regulations (EU) 2015/1185 and (EU) 2015/1189 and their replacement by other means of heating**

The National Programme for the Improvement of Ambient Air Quality 2018-2024 includes a measure in the field of domestic heating – mandatory phase-out between 2020 and 2024 of solid fuel stoves and boilers that do not comply with the Ecodesign Regulations. The introduction of alternative heating measures will contribute to the expected reduction of PM10 emissions from the domestic heating sector. The final result of the measure is to reduce PM10 emissions in order to achieve the established ambient air quality standards by phasing out inefficient solid fuel appliances.

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

Some of the latest amendments to the EA are aimed at developing citizen energy communities, which are key to reducing fossil fuels (coal and wood) in the country, promoting local economies and revitalising local communities. It is envisaged to remove unjustified regulatory and administrative barriers, implement regulatory requirements for the sale of energy and other energy services and ensure cooperation with the relevant distribution system operator and/or heat transmission company for community energy transmission.

The policy and measures in this area shall provide for fair, proportionate and transparent administrative procedures to ensure that all users apply regulated prices for network services, apply non-discriminatory treatment to communities with regard to their activities, rights and obligations as end-users, accessibility to all consumers to participate in communities, including households in situations of energy poverty or vulnerable customers. Facilitating access to finance and information, providing regulatory support and

capacity building assistance to public authorities in facilitating the establishment of energy communities and facilitating their direct participation, as well as putting in place rules to ensure equal and non-discriminatory treatment of consumers participating in the citizen energy community.

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

For the efficient use of energy in production, transmission and distribution, the Energy Act lays down requirements which the KEVR takes into account when setting the prices of electricity, heat and natural gas. In the exercise of its powers under the same Act, the KEVR shall:

- Set maximum technological costs for the production, transmission and distribution of electricity, the production and transmission of heat and the transmission, distribution and storage of natural gas, which may be recognised in price setting in accordance with a methodology or guidelines adopted by the Commission;

- Asks electricity and gas network operators to carry out an assessment of the energy efficiency potential of the respective networks by reducing technological costs, including analysis of transmission, distribution, load management, efficient operation of networks and possibilities for connection of decentralised energy production installations;

- An obligation for network operators, when developing network development plans, to include measures and plan relevant investments to improve energy efficiency in gas and electricity networks, as well as a timetable for their implementation.

The KEVR is also responsible for assessing the economic viability of introducing intelligent metering systems proposed by the network operators. If the introduction is economically justified, the KEVR shall draw up timetables for their implementation, ensuring the interoperability of smart metering systems, taking into account appropriate standards, best practices and their importance for the development of the internal market in electricity and natural gas.

In addition, the Energy Act stipulates that, in the exercise of its regulatory powers in the field of energy efficiency, the KEVR is guided by the following general principles:

- Promoting increased energy efficiency in the production, transmission, distribution and final consumption of energy and natural gas, and

- The creation of incentives for transmission and distribution system operators to provide system services to final customers enabling energy efficiency improvement measures with the roll-out of smart grids, taking into account the costs and benefits associated with each measure, while ensuring system security.

Guided by the above principles, in carrying out price regulation, the KEVR aims to ensure that electricity transmission and distribution prices do not limit the increase in energy efficiency in energy generation, transmission and distribution and the integration of

demand response into balancing markets and the provision of ancillary services. The KEVR also aims to reflect in network tariffs the reduction of network costs achieved by consumers, the optimisation of energy consumption, the decentralisation of production, the reduction of supply costs or network investments and the optimisation of network operation.

With regard to price regulation, the KEVR aims to ensure that electricity transmission and distribution prices do not limit the increase in energy efficiency in the generation, transmission and distribution of energy and the integration of demand response into balancing markets and the provision of ancillary services, and to reflect in network tariffs the reductions in network costs achieved by consumers, demand response, the decentralisation of generation, lower supply costs or network investments and network optimisation.

With regard to demand response, the KEVR is guided by the principle that electricity transmission and distribution prices allow for increased participation of final customers in improving the efficiency of the electricity system through demand response. The KEVR also seeks to encourage transmission and distribution system operators to offer system services for electricity demand response, demand management and decentralised generation within organised electricity markets, and to improve efficiency in network design and operation, in particular:

- Shifting the load from peak to off-peak hours by final customers, taking into account the availability of energy from renewable sources, cogeneration and decentralised generation;
- Energy savings by demand response from decentralised sources of production through a combination of supply of energy efficiency services and participation in the balancing electricity market;
- Demand reduction through energy efficiency measures undertaken by providers of energy efficiency services;
- Connection and dispatchability of energy facilities for the production of electricity of medium and low voltage levels;
- Connection of energy facilities for the production of electricity located closer to consumption;
- Granting access to networks of energy storage facilities.

Another objective is to introduce dynamic pricing for electricity demand response measures by final customers by:

- Prices recording the period of consumption;
- Critical peak pricing;
- Real-time pricing;
- Discounts on reduced consumption during peak periods.

Measures in gas distribution companies

The energy efficiency measures applied by gas distributors are as follows:

1. Measures related to the control and diagnosis of the technical status of the networks:

- Grouping gas pipelines by age since the start of operation, with a shorter monitoring period for natural gas leakage to be introduced in older sections;
- Grouping of pipelines by frequency of penetration and leakage;
- Carrying out an analysis of the entry/exit balance of the gas distribution network.

2. Locating the leakage of natural gas.
3. Measures relating to the prevention of damage caused by third parties: analyse and prevent third party actions related to network integrity leading to the leakage of natural gas – restricting access and security of sites.
4. Measures during the construction and filling of gas distribution networks – use of certified materials and contractors.
5. Operational measures:

- Pressure management;
- Odorisation of natural gas;
- Regular crawling of the gas distribution network;
- Setting up a system for remote monitoring of the values of the electrochemical protection of metallic gas pipelines;
- In order to reduce technological losses, the inclusion of new subscribers will be achieved through pressure cutting;
- Deployment of smart metering systems in gas distribution networks.

Measures in electricity distribution companies

With regard to measures to reduce the technological costs of transmission and distribution of electricity through the electricity distribution network, the following shall be carried out by system operators:

1. Reducing technical losses in the transmission and distribution of electricity by:

- Increasing the cross-section of medium and low voltage wires in cable and air networks;
- Construction of new transformer stations reducing the water lengths for low-voltage grids and/or redistributing electrical loads;
- Replacement of installed power transformers, with new ones, with lower losses of energy at idle and short circuit;
- Thermo-vision audit of transformers, medium voltage and low voltage systems to

detect fever hotspots.

2. Increasing the reliability of measuring the quantities of electricity entering or leaving the electricity distribution system and limiting the possibility of unauthorised use by:

- Replacement of commercial measuring instruments;
- Securing and exporting commercial border measuring devices;
- Development of SMART GRID-Networks.

Measures for district heating companies

The energy efficiency potential of district heating and cooling infrastructure lies in the rehabilitation of heat transmission networks and the replacement of outdated district heating stations with advanced high-efficiency automated indirect stations, which will reduce heat transmission and distribution losses and reduce GHG emissions. Best practices related to the use of pre-insulated pipes for heat transmission networks achieve a reduction in heat loss of up to 3 %. A similar level of losses can be achieved for high heat load density systems.

Promoting high-efficiency cogeneration based on useful heat demand is a priority for EU Member States given the potential benefits of cogeneration in terms of primary energy savings and emission reductions.

In order to reduce losses to 10 % (current average losses of 23.7 %), district heating networks must be upgraded so that annual losses are reduced from 2.77 TJ/km to 1.17 TJ/km. As the length of the heat transmission network (1 898 km) is closely linked to the value of transport losses, it can be assumed that the requirement to reduce losses per kilometre from the network to 1.17 TJ/km should apply to all district heating systems in the country. The potential resulting from improving the energy efficiency of district heating systems is estimated at 1.6 TJ, representing 30.3 % of the heat currently lost during the transport of the heat carrier.

vii. Regional cooperation in this area, if applicable

In the area of the energy efficiency dimension, the sharing of good practices, consolidated actions to implement EU legislation, as well as the strengthening of cross-border cooperation, in individual initiatives and/or fora, at regional and European level, is encouraged.

viii. Financial measures, including EU support and use of EU funds at national level

The envisaged changes to the EEOS will require that, when designing schemes and mechanisms to promote energy efficiency in buildings, account be taken of projected or achieved energy savings, taking into account one or more of the following criteria:

- The energy performance of equipment or materials used in the implementation of energy efficiency measures in the building, installation of equipment or materials by persons with the necessary professional qualifications to do so, obtained under the conditions and in accordance with the procedure laid down in the Vocational Education and Training Act;
- Standard values for calculating energy savings in buildings;
- A comparative analysis of the energy performance certificates issued before and after the improvement of the energy performance of the building.
- The results of the energy audit or any other appropriate, transparent and proportionate method showing an improvement in energy performance.

The implementation of policies and measures in the INECPs will be ensured within the budgets of the ministries, departments and other government departments concerned for the year concerned. Energy efficiency improvement measures will be supported by well-designed and effective financial instruments, and cooperation between public and private stakeholders to develop large-scale investment programmes and financing schemes will be encouraged. To this end, Union funds as well as other financing schemes for energy efficiency improvement measures will be used:

1. Structural Funds 2021-2027

For the next Multiannual Financial Framework 2021-2027, Bulgaria intends to use the Structural Funds to finance energy efficiency improvement measures.

In this regard, the following investment priorities have been identified:

- Support for increasing the energy efficiency of public, industrial and residential buildings through full renovation;
- Support for the implementation of energy efficiency improvement measures for small and medium-sized enterprises, large enterprises and local authorities.

2. The Invest EU programme;
3. The Modernisation Fund;
4. Energy Efficiency and Renewable Sources Fund;
5. National programme for energy efficiency in multi-apartment buildings;
6. National Climate Investment Programme Trust Ecofund;
7. The Renewable Energy, Energy Efficiency, Energy Security Programme funded under the European Economic Area Financial Mechanism 2014-2021;
8. National Recovery and Resilience Plan of the Republic of Bulgaria.

3.3 energy security dimension

i. Policies and measures related to the elements referred to in points 2.3 and 2.4

Security policies and measures in the field of the country's energy sector can be summarised in the following priority axes: diversification of natural gas supply sources and routes, efficient use of indigenous energy resources, increasing interconnection and increasing the flexibility of the national energy system, energy storage and network and information security.

Diversification of natural gas supply sources and routes by implementing the following projects:

- LNG terminal project to Alexandroupolis;
- Expansion of the capacity of UGS Chiren;
- Rehabilitation, modernisation and extension of the Bulgarian gas transmission system – Phase 3;
- Increase the technical capacity to transfer from Greece to Bulgaria in IP Kulata/Sidirokastro;
- Increase the technical capacity to transfer from Bulgaria to Romania in IP Negru Voda/Cardam;
- New LNG terminal projects in the region.

The VIth list (I of the new Regulation (EU) 2022/869) of projects of common interest adopted by the European Commission on 25.11.2023.

The first list of projects of common interest and projects of mutual interest under the revised TEN-E Regulation (Regulation (EU) 2022/869 of the European Parliament and of the Council on guidelines for trans-European energy infrastructure) includes two projects with Bulgarian participation: to build a hydrogen interconnector Bulgaria – Greece and Carmen (Bulgaria, Romania) – Carpathian modernised energy network.

- "H2 Interconnection Bulgaria-Greece"

The project for hydrogen interconnector Bulgaria – Greece, organised by Bulgartransgaz EAD, is part of the thematic area 'Hydrogen and electrolysers'.

The infrastructure on Bulgarian territory is linked to a project by the Greek operator DESFA S.A. for a hydrogen transmission network on Greek territory in group 'H2 Interconnection Bulgaria-Greece'.

The project will make an important contribution to the realisation of the South-East Priority Corridor, which will provide a route for the transport of green hydrogen from South East to Central Europe, from both local production and import. Its inclusion in the PCI list will allow the implementation of fast-track permitting procedures and apply for grants during all stages of implementation. The project is an example of Bulgaria's efforts towards decarbonising the gas system and the uptake of low-carbon gases.

The project envisages the construction of infrastructure dedicated to the transport of 100 % hydrogen. It includes a pipeline of DN 1000 and a length of approximately 250 km and two compressor stations. The expected time for the infrastructure to be put into operation is by the end of 2029.

Bulgartransgaz EAD's project is the first phase in the implementation of the concept for the development of new infrastructure for the transport of clean hydrogen on the territory of the Republic of Bulgaria, including the hinterland of the country and for connectivity with neighbouring countries. As a next step, it is envisaged to continue its expansion both within Bulgaria and to cross-border interconnection points with neighbouring countries.

The implementation of the project will provide capacity for bi-directional cross-border hydrogen transport between Bulgaria and Greece at a new connection point in the Kulata/Sidirokastro area. The project is planned to subsequently develop in a northern and eastern direction and thus provide further cross-border connectivity to Romania and the countries of the region at a later stage.

The project represents an important milestone in the development of the H2 network in the region. The planned infrastructure is intended to stimulate the process of large-scale deployment of hydrogen both in Bulgaria and in the South East Europe region.

The planned H2 infrastructure is expected to contribute to sustainable economic growth, the decarbonisation of the economy and energy, employment and industrial competitiveness in Bulgaria and the region.

The project meets all relevant technical, general and specific criteria for project proposals in the field of hydrogen transmission stemming from Regulation (EU) 2022/869 for trans-European energy infrastructure.

The inclusion of the project proposed by Bulgartransgaz EAD in the list is essential for its successful and timely implementation in an effective manner and for the realisation of the priority South-East hydrogen corridor.

- Investment C4.I4. Digital transformation of the electricity grid, National Recovery and Resilience Plan

The implementation of the Investment will achieve: (1) increase grid connection capacity by at least 4 500 MW to integrate new renewables into the electricity system and (2) cross-border capacity increase of at least 1 200 MW to optimise the use of existing assets. The implementation of the investment is essential to ensure national energy security, as the integrated implementation of the SASP is an integral part of the overall modernisation of Bulgaria's electricity network planning, management and maintenance activities, by introducing state-of-the-art digital means and methods to provide the necessary manoeuvrability, security and speed in managing the electricity system in a low-carbon generation environment.

- Project "Sustainable adaptation of the national electricity grid to fully integrate the renewable energy production potential – GREENABLER". The proposed investment will provide the technical possibility to connect around 4 500 MW of

new RES to the national network after 2 026 year. The project is divided into two main groups of investments:

— First group – investment in the reconstruction of approximately 720 km of existing power lines to increase their nominal voltage from 220 kV to 400 kV and synchronised reconstruction at their adjacent substations from 220/110 kV to 400/110 kV. The CID 110/15.02.2024 approved this investment pool for funding from the Modernisation Fund;

— Second group, investments in the reconstruction of the Hemus-Stara Mountain Pipeline from 220 kV to 400 kV, reconstructing 888 kilometres of 110 kV power lines and doubling 92 km of 110 kV power lines to increase the capacity of existing overhead lines. This investment group is to be included for funding from the National Recovery and Resilience Plan, chapter REPower EU.

- Project of Common Interest (PCI) 12.2 Carmen/Carmen (Bulgaria, Romania)

The project is for deeper cross-border cooperation between transmission system operators (TSOs) and data sharing, for deeper cooperation between TSOs and distribution system operators (DSOs), for investing in grid expansion and increasing capacity to integrate new renewable energy sources, and for improving grid stability, security and flexibility. PCI 12.2 Carmen is included in the list of projects of common and common interest of the Union for the construction of trans-European energy infrastructure in the priority thematic area Smart Grid Deployment by EC Delegated Regulation of 28.11.2023 amending Regulation 2022/869.

ESO EAD's participation in the project consists of investments to enhance the capabilities of the Bulgarian electricity transmission system to exploit the identified high renewable energy potential at national and regional level, in the following main areas:

1. Comprehensive digitalisation and automation of the transmission network, including, but not limited to, by: installing a dynamic monitoring system for transmission capabilities by extending the existing recording system to new PMUs; deployment of flexible AC solutions (FACTS); and enabling more efficient demand-side management (DSR), in cooperation with national distribution system operators.

2. Modernisation, strengthening and increasing the capacity of the transmission system in Northern Bulgaria with a view to making it ready to integrate and transfer significant amounts of renewable energy from the large RES in Northern Bulgaria to consumption centres, both in the country and at regional level, along the North-South priority corridor, in particular to and through Romania. This planned extension is driven not only by the massive deployment of RES, but also by the expected development of electric and hydrogen recharging infrastructure throughout Bulgaria to accommodate and catalyse the transition to underground mobility.

Digitalisation, strengthening and increasing the capacity of the transmission system in Northern Bulgaria will enable the integration and transmission of significant amounts of renewable energy from the large RES in Northern Bulgaria to the consumption centres in

the country, but also at regional level along the priority corridor North-South, in particular to and through Romania. This planned expansion and smartness of the grid is required not only by the massive deployment of RES, but also by the expected development of electric and hydrogen recharging infrastructure on the territory of Bulgaria, which will boost and catalyse the transition to emission-free mobility.

Efficient use of indigenous energy resources

There are prerequisites for local natural gas extraction, allowing the country to reduce the risk of increasing its energy dependency on imported energy resources for the first stage of the strategic horizon under consideration until 2050.

Gas fields with a total geological or commercial potential of a total of 45 bcm have been registered in Bulgaria. From the time of authorisation for the extraction of natural gas, a period of 12 to 18 months is necessary, so that indigenous natural gas resources can play an important role in the medium-term sustainable development horizon.

The development of local production on the land territory of the Republic of Bulgaria will provide the necessary local resource for the period of transition to a carbon-neutral economy. It will stimulate even faster development of gas infrastructure, which after 2035 will meet the need to transport green hydrogen in pure state or in a mixture with biogas.

Diversification of the supply of fresh nuclear fuel

Nuclear energy is currently part of the energy mix for many EU Member States, including Bulgaria.

Nuclear power plants provide a baseload capacity that ensures a reliable supply of virgin electricity and plays an important role in energy security.

An important aspect for the development of nuclear energy is the pursuit of the Euratom policy on diversification of the supply of fresh nuclear fuel, based on the European Energy Security Strategy adopted on 28.5.2014, which requires an overall diversified portfolio of fresh nuclear fuel supplies. This policy is based on the following four pillars:

1) Diversification in the purchase of natural uranium, its conversion and enrichment;
2) Diversification of nuclear fuel producers (fuel assemblies);
3) Maintaining sufficient fuel reserves at NPP sites;
4) The conclusion of long-term contracts for the supply of fresh nuclear fuel.

In order to implement this European policy and in order to reduce the dependence of Bulgarian energy on one supplier, a process is under way to diversify the supply of fresh nuclear fuel to Kozloduy EAD and future new nuclear capacity, with the highest priority being to respect nuclear safety. In implementing diversification policy, better financial and economic conditions will be important advantages.

At the end of 2022, NPP Kozloduy EAD signed a 10-year contract with Westinghaus Elektrick Sweden AB for the supply of fresh nuclear fuel for Unit 5. Following the successful completion of the licensing process, the new fuel was loaded in May 2024.

At the same time, in March 2023, NPP Kozloduy EAD also concluded a contract with Framatom for the supply of fresh nuclear fuel for the 6th unit of the plant. Under its terms, the first delivery of fuel assemblies is expected in November 2025.

Through the implementation of these key activities, Bulgaria has taken an important step towards achieving the priorities and objectives of its nuclear fuel diversification programme by establishing two new independent and competitive SNF suppliers.

Extension of the lifetime of Units 5 and 6 of Kozloduy EAD

Kozloduy EAD, as the base plant, plays a key role in maintaining the sustainability of the electricity system. It provides about 33 % of the country's electricity production and is a guarantor of Bulgaria's energy security.

Units 5 and 6 of the Kozloduy nuclear power plant with VVER-1000 reactors, model B-320, were put into operation in 1987 and 1991 respectively.

During the period 2014-2018, measures were successfully implemented under the programme to extend the lifetime of Units 5 and 6 of the Kozloduy Nuclear Power Plant, the results of which suggest that the two units can operate in compliance with the safety requirements until 2047 for Unit 5 and until 2051 for Unit 6.

In accordance with national legislation, the Nuclear Regulatory Agency has extended the operating licences of the two units, respectively for Unit 5 until 2027 and for Unit 6 by 2029. At present, the priority objective is to prepare for re-evaluation of Unit 5 and Unit 6 by developing a programme that reflects the current commercial and technological aspects of their operation.

Priority is also given to the construction of new nuclear capacity at the Kozloduy site of 2 400 MW. To this end, the process of adapting the Westinghaus Ar1000 project to the Kozloduy NPP site for the realisation of Unit 7 and Unit 8 is being accelerated.

Exploiting the potential of indigenous coal in the country while respecting environmental requirements

Bulgaria uses the existing potential of indigenous coal in the country while respecting environmental requirements.

The use of indigenous coal reserves has a future as a stabilising energy source. Indigenous coal plants are a major service provider for balancing the electricity system, which is why they are a major factor in the country's electricity security.

The available coal reserves in the country are a secure energy source that can be extracted in sufficient quantities to secure energy supply.

This defines the role of indigenous coal as a strategic energy resource in terms of the country's energy and national security.

Network development and increased flexibility of the electricity system

To increase the flexibility of the electricity system through energy demand response, Bulgaria envisages creating the right conditions, for which legislative measures have been taken, for the creation of active consumers, opportunities for aggregates through aggregators or energy communities, as well as their active participation in demand response in the different market segments.

During the period under review, Bulgaria envisages the introduction of interim measures to enable the implementation of the following reforms:

- Creating the right conditions and enhancing the participation of demand response, individually or through aggregators, in the wholesale electricity market as well as in the balancing market;
- Upgrade the transmission network to alleviate internal congestion and increase interconnection capacity.

The guiding principles for the development of the electricity network development plan stem directly from the objectives of the European Union's energy policy, namely:

- Security of supply to consumers;
- Integration of internal and external electricity markets;
- Reducing the harmful environmental impact through the development of the renewable energy sector;
- Increasing the efficiency of the electricity transmission network.

The Bulgarian electricity network is part of the integrated transmission system of the countries of continental Europe and its development is closely linked to the development of the networks of neighbouring countries.

The results of market calculations based on each electricity system operator's forecast of the development of electricity generation and consumption show significant differences from the previous regional plan. For the first time, the development of the plan takes into account Türkiye's influence on the region. The Turkish operator forecasts a large growth in new generation sources (over 140 GW of installed capacity by 2040), with low electricity costs and year-round export opportunities. At the same time, investments in new large-scale electricity sources, which are available 24 hours a day and that do not emit greenhouse gases, are foreseen in Bulgarian EU law. This will increase transit flows of electricity through our transmission grid in the east-west direction and could make the Bulgarian-Turkish and Bulgarian-Serbian borders narrow places that would limit free trade. The transit of electricity through our country will be even greater with the possible closure of generation capacity in the Maritza-East complex.

The construction of a new 400 kV interconnector between the Republic of Bulgaria and the Republic of Serbia is expected to take place after 2030.

A concept was adopted that the 220 kV transmission network would no longer be developed for general system needs, at the expense of 400 kV and 110 kV networks, with the exception of the construction of a second district electricity supply in the city of Ruse.

The development of the 110 kV voltage network is predominantly local and is determined by:

- Improving the security of supply to users;
- Improving the exchange of electricity with distribution networks;
- Joining direct customers under the required category of assurance;
- Connection of generating modules – direct and in distribution networks.

Energy storage

Bulgaria plans to develop several electricity storage projects in order to ensure balance and flexibility of the system, strengthen Bulgaria's position as exporter and ensure cross-border flexibility of the system. These projects will also facilitate the further development of renewable energy sources and their integration into the national energy system, given the variability of such energy sources. In this regard, the following projects are envisaged:

- Increasing the operational potential of PAVPP Chaya through the construction of the Yadenitsa dam, which will make it possible to optimise the structure of the generation capacity. Investment needs are expected to amount to around EUR 220 million;

- Construction of the Batak and Dospat pumped storage plants in the case of dams from the 'Batachki Water Road' cascade, each of which will add to the system around 800 MW of new installed capacity in generation and pumping storage by connecting and using the Greater Beglik and Shiroka Polyana dams as an upper reservoir and as a lower reservoir Batak dam;

- Ensuring a long-term sustainable energy solution and improving the balancing capabilities of the energy system allowing flexible 24-hour and weekly management, rapid replacement of emergency capacity and additional balancing services through the construction of pumped storage hydropower plants "Dospat" and "Batak";

- Approximately EUR 200 million of investments in frequency control batteries, with a total capacity of around 180 MW;

- Around EUR 200 million of investments to promote the combination of new renewable energy with local electricity storage facilities, depending on the appropriate technological solution for the projects concerned (around 200 MW in total);

- The conversion of AES Galabovo into a large-scale energy storage facility is also envisaged through a proven technology deployed in concentrated solar plants (CSP) using molten salts. They capture and store solar energy in the form of heat. The salt is heated by sunlight reflected by mirrors on a receiver where it absorbs the energy and is heated. The hot salt is then pumped to a heat exchanger where it transmits its heat to a liquid that produces steam. The steam drives a turbine which generates electricity with a capacity of

345 MW, one unit/steam turbine. Energy storage is foreseen for 5 to 10 hours. It is expected to be commercially operational in mid-2026.

Exploration and exploration for the extraction of oil and natural gas in the deep Black Sea

According to various estimates, Bulgaria has significant extractable natural gas reserves both on land and in the Black Sea sea. In neighbouring countries, new gas fields are being developed on a market basis. There are conditions for effective development of natural gas extraction projects in Bulgaria, including in the form of a partnership of the State or public undertakings with international companies.

Appropriate measures shall include updating the existing legal framework in the field in order to accelerate and stimulate market-based implementation of natural gas extraction projects, subject to applicable environmental, biodiversity and human health protection requirements.

With regard to the oil and gas exploration permits granted by the Ministry of Energy, there is an expectation that the share of local production will increase and the country's dependence on natural gas imports will be reduced.

As of 1.2.2023, there was an existing authorisation for the prospection and exploration of oil and natural gas in the exclusive economic zone of the Republic of Bulgaria in the Black Sea – Block 1-21 Han Asparuh. The authorisation holder is the companies Total Energy E § P Bulgaria b.B and Ofshor Bulgaria GmbX.

By Decision No 578 of 25 August 2023, the Council of Ministers opened a procedure for granting authorisation for the prospection and exploration of oil and natural gas – underground natural resources under Article 2 (1) (3) of the ZPB in a new area 'Block 1-26 Hahn Tervel' located in the exclusive economic zone of the Republic of Bulgaria in the Black Sea. The Decision was published in State Gazette No 75 of 25 August 2023.

Storage of oil and fuels

European legislation requires Community countries to store oil and fuel covering at least 90 days of average daily imports or 61 days of average daily consumption, whichever is greater. The second method of calculating stocks is applicable only to countries with their own oil production, the Netherlands and Denmark. Some of these reserves can also be held in another EU country. In the community, only five countries store all fuels for urgent needs – Greece, Hungary, Poland, Slovakia and Finland. As of June 2 021, EU countries have maintained 112.5 million tonnes of petroleum products in crisis reserve, of which 47 million tonnes are oil stocks. Data for Bulgaria show that the oil stocks in the warehouses reach 962 kt, with a small proportion of them stored in another EU country.

Bulgaria is currently in the phase of replacing emergency oil stocks with those of non-Russian origin. Information was also provided on the significant risk that Bulgaria would not have significant quantities of crisis oil stocks until they were replaced by non-Russian oil stocks. The Bulgarian administration has taken measures and actions. Institutions responsible for monitoring the import of oil and petroleum products are designated. The

Bulgarian central stockholding entity monitors both the quantities of oil and petroleum products imported in Bulgaria and their origin. The volumes of emergency stocks are determined by the regulations and their level is relatively stable. However, commercial fuel stocks are much more conducive to market trends.

Network and information security (cybersecurity)

Network and information security of the energy system is the security of communication electronic networks and energy system management information systems. It is an essential element of national security. Managing energy networks to ensure a constant match between energy consumption and production requires an ever-increasing degree of digitalisation. This is also linked to new risks, as digitalisation increasingly exposes the energy system to cyber-attacks and incidents that may threaten the security of energy supply.

The Republic of Bulgaria will continue its efforts to enhance network and information security of the energy system through strategic cooperation and exchange of information with other Member States. Under Directive (EU) 2016/1148 concerning measures for a high common level of security of network and information systems across the Union, transposed into national law by the Cybersecurity Act, energy undertakings for electricity and natural gas and digital service providers have an obligation to implement measures to ensure the level of network and information security and measures to prevent and reduce the impact of incidents affecting their network and information security. In this regard, on the basis of the Cyber Security Act, by decision of the Council of Ministers of April 2019, the Minister for Energy has been designated as the administrative body to which a national competent authority for network and information security for the energy sector is established. The national competent authority is responsible for the organisation, coordination and control of network and information security activities and measures for the Ministry of Energy and the designated operators of essential services in the energy sector resulting from the Cybersecurity Act.

Directive (EU) 2022/2555 of the European Parliament and of the Council on measures for a high common level of cybersecurity across the Union, amending Regulation (EU) No 910/2014 and Directive (EU) 2018/1972, and repealing Directive (EU) 2016/1148 (NIS 2022 Directive), adopted at the end of 2 with a transposition deadline by October 2024, aims to address the shortcomings related to the differentiation between operators of essential services and digital service providers, as it does not reflect the relevance of sectors or services to societal and economic activities in the internal market. Given the rapid development of digital technologies and the uptake of artificial intelligence in business processes, cybersecurity needs to be extended to a larger part of the sectors of the economy in order to ensure full inclusion of sectors and services vital for key societal and economic activities in the internal market.

The growing interdependencies are the result of an increasingly cross-border and interdependent network of service provision using key infrastructures across the Union in sectors such as energy, transport, digital infrastructure, drinking water and waste water,

health, certain aspects of public administration, as well as space in so far as the provision of certain services depending on ground-based infrastructures that are owned, managed and operated either by Member States or by private parties is concerned, therefore not covering infrastructures owned, managed or operated by or on behalf of the Union as part of its space programme. This interdependence means that any disruption, even one initially confined to a single entity or sector, may have lock-in effects more broadly, potentially leading to far-reaching and lasting negative effects on the provision of services in the internal market.

Cybersecurity awareness and cyber hygiene are essential to enhance the level of cybersecurity within the Union, in particular in light of the growing number of connected devices that are increasingly used in cyberattacks. Efforts should be made to enhance the overall awareness of risks related to such devices, while assessments at Union level could help ensure a common understanding of such risks within the internal market.

Given the crucial importance of cybersecurity for the management and functioning of the energy sector, it is envisaged to be further deployed in the country's energy system, the necessary high-tech solutions at the level of licensed hardware and software for monitoring and active cyber protection of network and information systems to manage and operate the energy system, and to speed up the process of periodic training of staff and provision of the necessary human resources.

Protection of critical infrastructure

The energy security of each EU Member State is directly linked to the energy infrastructure of its neighbouring countries, as energy infrastructures are for the most part international and the security of energy transmission or supply routes is essential to determine the level of vulnerability and risk assessment in the event of a future threat or terrorist act. In order to build mutual cooperation and support in the protection of critical infrastructure, a number of forms of international cooperation are being developed, in which the Republic of Bulgaria is actively involved.

In 2004, the EU adopted a Communication entitled 'Critical Infrastructure Protection in the Fight against Terrorism', which launches the process of preparing a Single European Critical Infrastructure Protection Document. (COM, 2004). The process was finalised in 2008, when Council Directive 2008/114/EC of 8 December 2 008 on the identification and designation of European critical infrastructures and the assessment of the need to improve their protection was adopted. This Directive establishes a procedure for the identification and designation of European Critical Infrastructures ('ECI') as well as a common approach to assessing the need to improve the protection of such infrastructures in order to contribute to the protection of the population.

The Thematic Network on Critical Energy Infrastructure Protection (TNCEIP) is an initiative of DG Energy of the European Commission (EC) and consists of owners and operators of European energy infrastructure in the electricity, gas and oil sectors. The network was created in 2010 and is unique in nature and positions on supporting policies and legislative initiatives related to Europe's energy security. At the heart of the initiative is the

importance of energy infrastructure in terms of its strategic importance for Europe, the European economy and the well-being of European citizens. The main philosophy of the TNCEIP network on the protection of European critical energy infrastructure comprises the following three points:

- A common and holistic approach to protecting infrastructure of strategic cross-border importance in Europe;
- The creation of a network through which all TNCEIP members face a steady increase in attacks on their critical energy infrastructure, notably in the form of theft, vandalism and cyber-attacks, to help each other;
- "a level playing field for security at European level", meaning that owners and operators share the same objective (ensuring "efficient and secure operations at all times across Europe") without exceptions. This requires openness and equal sharing of information between operators, owners and public authorities.

One of the EU's main priorities is to ensure that all Europeans have access to secure, clean and affordable energy. Europe supports diverse and often cross-border energy infrastructure projects that produce, store and distribute energy efficiently. This support contributes to a more integrated energy system, which is essential for the achievement of energy and climate objectives. In addition to interconnecting the energy infrastructure and further integrate renewables and clean technologies into the EU energy system, these projects help to reduce the EU's dependence on third-country energy imports.

An evaluation of the implementation of the guidelines of Directive 2008/114/EC was launched in 2018, and the energy sector could be given significant leadership in the identification and identification of sites from critical infrastructure.

Given the growing links between different sectors of the economy and activities for the development of societies, an initiative has been launched to change critical infrastructure protection policies. The aim is to better protect systems from disruptions due to natural disasters or man-made threats (e.g. terrorism, cyber-attacks, disinformation, hostile foreign ownership). The Commission's EU Security Union Strategy and the EU Counter-Terrorism Agenda underline the importance of ensuring the resilience of critical entities in the face of physical and digital risks. Measures and policies to ensure security for the public relate to strengthening security at the EU's external borders, investing in security research and innovation, new technologies and techniques to counter and anticipate threats, as well as skills and awareness-raising so that businesses, administrations and individuals are better prepared

A new Directive (EU) 2022/2557 of the European Parliament and of the Council of 14 December 2022 on the resilience of critical entities and repealing Council Directive 2008/114/EC was adopted at the end of 2 022. This Directive is part of a package of legislative measures to improve the resilience and incident response capacities of EU public and private entities in the field of cybersecurity and critical infrastructure protection.

It aims to address in a comprehensive manner the issue of resilience of entities that are critical for the proper functioning of the internal market by establishing a comprehensive framework addressing the resilience of critical entities to all hazards, whether natural or anthropogenic, accidental or intentional. The implementation of the Directive's provisions will reduce vulnerabilities and strengthen the physical resilience of critical entities in the European Union (EU) to ensure the uninterrupted provision of services and increase the resilience of critical entities that provide these services. In the new Directive (EU) 2022/2557, the scope of EIC has been significantly extended in line with the provisions of a number of European documents concerning activity and Swazim-related relations in the energy sector.

In order to comply with the requirements of Directive (EU) 2022/2557 of the European Parliament and of the Council of 14 December 2 022 on the resilience of critical entities and repealing Council Directive 2008/114/EC transposing its provisions into national law by October 2024, an interdepartmental working group has been established to develop and propose for approval the necessary amendments to the Disaster Protection Act and other applicable legislation in order to achieve the necessary harmonisation. According to the national legislation in force, the protection of established European and national critical infrastructures and their sites is carried out by the competent authorities, in accordance with the provisions of the Defence and Armed Forces of the Republic of Bulgaria Act and the Ministry of the Interior Act. The Bulgarian contact authority for the protection of European Critical Infrastructure is the Minister of the Interior or an official authorised by it.

Disaster protection and crisis management shall be carried out at national, regional and municipal level and shall be implemented through preventive action, disaster preparedness and response activities, assistance and recovery, resource provision and aid delivery and acceptance.

The protection of critical infrastructure shall be implemented by drawing up the necessary national strategic documents, preventive plans and action plans for identified critical infrastructures and their sites.

When carrying out a risk assessment, operators of critical infrastructure sites shall draw up an Operator Security Plan and Emergency Plans to reduce identified disaster risks and protect the population. The developed disaster protection plans have been updated periodically and special procedures have been developed in the event of low-level accidents on the Danube (concerning Kozloduy NPP) and systems of dams and technical facilities have been set up to maintain the water level for sites for which it is applicable, where there is an identified risk of drought affecting a specific site of critical infrastructure.

ii. Regional cooperation in this area

As an EU Member State, our country is actively working to build a resilient Energy Union and increase the potential of regional cooperation. The Bulgarian State has traditionally maintained good relations with the other countries of the region, both bilaterally and within

the EU and various international initiatives such as: The South East Europe Cooperation Process, the Stability Pact and its successor, the Regional Cooperation Council, the Central and South-Eastern Europe Gas Interconnection High Level Group (CESEC).

For the long-term and mutually beneficial development of energy relations between the countries of the region, a common regulatory framework for EU energy legislation is also a high priority.

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

Funding from the European Connecting Europe Financial Facility, the new financing mechanisms for low carbon innovation and modernisation of the energy sector foreseen in the fourth phase of the EU's greenhouse gas emissions trading system, as well as other programmes with EU and national funding, is foreseen to finance key **electricity infrastructure** projects.

The financing of key **gas infrastructure** projects is partially implemented through: European Energy Programme for Recovery, Operational Programme "Innovation and Competitiveness" 2014-2020, OP "Development of the Competitiveness of the Bulgarian Economy", "Connecting Europe Facility" programme.

By Decision No C (2023) 9266 final of 20.12.2023, the Commission approved a new version **of the Regional Development Programme** (RDP) for the period 2021-2027, including priorities and funding from the Just Transition Fund (JTF) of approximately BGN 2.9 billion in EU and national resources.

The programme also includes the 3 Territorial Just Transition Plans (TJTPs) of the provinces of Pernik, Kyustendil and Stara Zagora, together with 10 adjacent municipalities. In the coming decades, these territories will face a profound economic transformation as a result of the transition to climate neutrality.

The TJTPs also take into account Bulgaria's Recovery and Resilience Plan (RRP), according to which electricity production from coal is to be phased out by 2038 at the latest.

To discuss and map the path towards energy transformation, just transition and development of low-emission energy, an Energy Transition Commission was established in 2022. The Report prepared by the Commission was finalised in September 2023 and approved by Council of Ministers Decision No 618/13.09.2023.

On 26 January 2024, the Council of Ministers, by Decision No 59 of the Council of Ministers, proposed to the SC an updated Climate Neutrality Roadmap, based on the Report referred to in point 1 of Decision No 618 of the Council of Ministers of 2023 and updated by Decision No 702 of the Council of Ministers of 2023. The update of the Climate Neutrality Roadmap reflects stated intentions to invest in new low-emission energy capacity by some of the operators of lignite-fired installations, with the result that existing capacities will be phased out in the coming years. An important new element in the updated Roadmap is the

development of a "future-proof" gas infrastructure in the East Marshal Region (2026) and an increase in natural gas transmission capacity at an IP Kulata/Sidirokastro interconnection point (2027). The new infrastructure is planned to be "future-proof" (fit for 100 % hydrogen). In addition, the updated Roadmap provides for the restoration of degraded sites and their preparation for new economic activities, providing an appropriate financial mechanism for the viable implementation of these measures. This approach is also in line with discussions with the social partners. The adoption of the Climate Neutrality Roadmap, approved by a resolution of the National Assembly, and setting the final date for coal shutdown by 2038 at the latest, is a key commitment under phase 114 of the RRP (15837/23 ADD 1).

In line with Europe's decarbonisation objective, electricity demand is projected to increase by 2050 due to electrification of heating, transport and industry, as well as the production of green hydrogen.

The 2021-2027 RDP funds will focus on activities and investments identified in the approved territorial plans, contributing to mitigating the negative socio-economic consequences for the three regions and supporting the people in them. This includes measures to upskill and upskill the affected workers in the coal and mineral electricity sectors, financing energy efficiency with a focus on vulnerable households, developing industrial parks and zones, developing components and renewable electricity production, supporting the diversification of the economy through new businesses, regeneration of mining land for industrial needs.

Support for measures is also planned in 10 municipalities in the Mariski Basin – Nova Zagora, Yambol, Simeonovgrad, Harmanli, Topolovgrad, Dimitrovgrad, Haskovo, Elhovo, Sliven and Tundzha, along three main lines, as follows:

Strand 1: Sustainable Energy Solutions Industry – measures promoting the development and implementation of new sustainable energy solutions in line with the objectives of the transition and supporting economic diversification/job creation. It is planned to restore the sites damaged by the mining activity in accordance with the polluter-pays principle (outside the scope of the activities, commitment of the concessionaire) and prepare them for alternative economic activities (development of industrial/logistical areas, construction of RES capacity). The activity will involve the directly affected workforce due to the specific qualifications and skills they possess. The land does not constitute any other form of environmental damage for which national law would provide for the liability of operators (mining companies).

Strand 2: Social and employment support – support social transition and support workers and entrepreneurship, including vocational education and training for the qualification and career development of the existing workforce and transition to alternative, better jobs. The Protocol provides for a mapping of the skills of the affected workforce and reskilling and upskilling measures, as well as the development of a methodology and an assessment of the skills and competences of 15 000 employees at TPP and coal mines under the Human Resources Development Programme.

The strand provides for support for EE activities in the building stock, including for the reduction of energy poverty and vulnerable electricity customers, support for the establishment of energy communities and the promotion of active consumers. This will contribute to reducing consumption, electricity bills and emissions, as well as improving living conditions. Unlike EE under Priorities 1 and 2, under the Just Transition Fund (JTF), support in the implementation of measures and the identification of beneficiaries will use the national definition of energy poor households and vulnerable electricity customers under the Energy Act.

Strand 3: Diversification of the local economy – support for economic diversification, development of new economic sectors, creation of new jobs and start-ups and business development, including R & D for the transition to new jobs following the phasing-out of sectors related to mining and coal energy.

The RDP 2021-2027 and its plans have been developed in close dialogue with all stakeholders at national and regional level, including social partners, operators of mines and combustion plants and the general public in the regions concerned. Support under the Programme will be provided on the basis of open and transparent competitive procedures and following an expert evaluation of the proposed investments and activities and in strict compliance with national and European legislation in the field of European funds under shared management.

One of the main priorities of the Ministry of Labour and Social Policy is investment in people that contribute to better economic growth. The targeted activities undertaken put a strong focus on adapting the workforce to the changes resulting from the green and digital transitions. Under the Human **Resources Development Programme 2021-2027** (HDP) and the NRRPs, a wide range of investments aimed at skilling and reskilling the workforce in line with new labour market needs have been launched. A wide range of training opportunities for vocational training and training for the acquisition of key competences are supported. Training will also be provided to upskill and reskill employees at risk of job loss due to economic restructuring (as a result of globalisation, introduction of new technologies, closure of non-environmental industries, pandemics, climate transitions, etc.).

Particular attention is focused on acquiring competences and supporting the labour market of the future, which will require new skills. At this point in time, measures are supporting an increase in the level of digital skills of the workforce. Funded trainings are delivered through flexible upskilling and reskilling opportunities for all workers, as needed. Support is foreseen for new skills needed for new and intensely developing sectors, as well as for new and green jobs in different economic areas. For management staff at different levels, support is foreseen for training in business skills for organising and optimising business processes, in the context of the circular economy and the green transition, etc.

The envisaged support focuses on skills development for unemployed, inactive and employed people.

Under the 2021-2027 RDP, over 212 thousand employed, unemployed and inactive people are expected to be involved in new skills training during the programming period, of which 161 thousand will be prepared for the digital transition of the economy through new or improved digital skills. The actions foreseen in the National Recovery and Resilience Plan will create the necessary conditions for more than 500 employed and unemployed people to be included in digital skills training and for around 100 people who do not have a digital skills certificate to be able to certify them.

At present, any unemployed and employed person wishing to take part in training to acquire digital competences for a basic level (DigComp level 1-2) and medium level (DigComp level 3-4) can do so by submitting an application published on the Employment Agency's website. These trainings were financed under the NRRP and the value of the support was BGN 327 455 849.81.

In parallel, under the Human Resources Development Programme, the following measures aimed at workforce training are currently being implemented:

Training support for unemployed and inactive people:

— 'I am taking up a job', which provides comprehensive support for the integration into the labour market of unemployed and inactive people, including young people. Part of the funding provided (Component 2) is aimed at acquiring new skills, upgrading professional qualifications and enabling anticipatory training of future workers based on identified needs from employers and sectors where shortages have been identified. The allocation for training is BGN 42 million and at least 14 000 unemployed and inactive persons are planned to improve their competences and qualifications by obtaining training vouchers from the Employment Agency.

Digital skills – aims to improve the overall digital skills of inactive and unemployed people, including young people, under the European DigComp framework. BGN 40 million is planned for the operation. 80 000 persons from the target group are expected to participate in digital skills training by issuing vouchers by the Employment Agency.

Support for training of employees:

The aim of the procedure 'Qualification, skills and career development of employed persons' is to provide flexible training opportunities to improve the professional qualifications and skills of employed persons and self-employed persons, for which a budget of BGN 50 million has been earmarked. The employment agency will finance, through the voucher mechanism, training for the acquisition of professional qualifications, transferable and soft skills needed for modern working methods, as well as high-level general digital skills, according to the individual needs of those seeking training. More than 14 000 employees are planned to be trained through the implementation of the procedure.

— New skills procedure to be launched for project applications by employers and companies. Employers will have to plan and justify training, retraining or new specific skills for their employees, in order to adapt to the current requirements of the company and work processes. The budget of the operation is BGN 74 million. The planned funding is

expected to include at least 53 200 employees in different types of training. Any employer will be able to apply for a training grant of up to BGN 5 867 400.

With funding from the Human Resources Development Programme, MLSP has launched the implementation of **the project "Addressing labour market challenges"** The project will contribute to increasing the effectiveness and targeting of employment promotion policy. The aim is to improve the process of planning and managing changes in the labour market, taking into account the dynamics in emerging and disappearing occupations and jobs, and trends in the green and digital transitions. A key activity in the project is to conduct a study to identify and map the skills available and attitudes to develop employees at TECs and coal mines affected by the transition to climate neutrality in the regions of Stara Zagora, Kyustendil and Pernik. The mapping of skills and attitudes will provide the necessary information to plan, develop and provide appropriate measures for career support, upskilling/reskilling and skills development of the workforce affected by the transition to climate neutrality. The information gathered will serve employers seeking labour in the three districts of Pernik, Kyustendil and Stara Zagora and future investors to make business investments.

The mapping of available skills, qualifications and attitudes for employee development in the TECs and coal mines in the regions of Stara Zagora, Kyustendil and Pernik will provide information on the scoping and thematic linkage of future measures under the Just Transition Fund related to skilling and reskilling of the workforce, training for new skills, as well as early targeting of suitable jobs. The implementation of the action shall include:

- Development of a toolkit to conduct research and mapping available skills and attitudes for the development of employees at the TECs and coal mines in the regions of Stara Zagora, Kyustendil and Pernik – Maritsa East Mini; TPP Maritsa Iztok 2; TPP ConturGlobal Maritsa Iztok 3; TPP "E I I – 3 C Maritsa Iztok I"; TPP Maritsa 3 – Dimitrovgrad; Bobov dol mines; Bobov dol TPP; Brikel TPP; Pernik mines; Toplofikatsia Pernik EAD;
- Conducting a survey involving an individual survey of 15 100 employees and conducting a minimum of 20 focus groups – 10 focus groups with employees and 10 focus groups with management representatives from TPP and coal mines in the regions of Stara Zagora, Kyustendil and Pernik, with a total of at least 160 participants.

The survey aims to gather individual information on each employee's professional status, demographic and social characteristics, educational characteristics and attitudes for future development and new skills and upskilling needs. The implementation of focus groups will provide in-depth information on the green transition processes related to the phase-out of coal and coal-fired power generation, the future plans of the investors and management of TPP and coal mines for business development and the preservation/creation of jobs, ideas and attitudes of employees and managers about the challenges.

Through the mapping of skills and attitudes for the development of employees directly affected by the low-carbon transition, labour market institutions, line ministries involved

in the green transition as well as social partners will improve their awareness and capacity with a view to developing effective measures to ensure a just transition.

The project "Addressing labour market challenges" also plans to produce forecasts of labour market developments. The aim is to identify labour demand and expected changes in the labour market, also taking into account the impact of the twin transitions.

A national representative survey of employers in the country by economic sector and region/area is also foreseen. The study will provide information on expectations with a horizon of up to 1 for newly created and lost jobs. Information will also be provided on the new skills needed related to the green and digital transitions. The results will be used to carry out vocational training and skills training in accordance with identified needs.

The period of implementation of the project is 2024-2027. The financial resources made available under the Human Resources Development Programme is BGN 3.7 million.

3.4 dimension "Internal Energy Market"9

3.4.1 electricity infrastructure

i. Policies and measures to achieve the target level of interconnection referred to in Article 4 (d)

In accordance with Article 16 (1) 8 of Regulation (EU) 2019/943 on the internal market for electricity, transmission system operators are not to limit the volume of interconnection capacity that must be available to market participants as a means to address congestion in their own bidding zone or as a means of managing flows resulting from transactions that are internal to bidding zones. This requirement is met when a minimum threshold of 70 % of transmission capacity between trading areas is reached, respecting safety standards for secure network operation, including compliance with the emergency security standard (N-1). To date, Greece, Bulgaria and Romania have direct obligations under this Regulation, which have taken the appropriate technical and organisational measures to implement it. However, there is uncertainty with non-EU third countries with which the relevant additional contracts need to be concluded to implement Article 16 (1). 8 from Regulation (EU) 2019/943.

See project information included in Parts 2.4.1 and 4.5.1.

ii. Regional cooperation in this area

Bulgaria fully recognises the role of projects of common interest under Regulation No 347/2013 on trans-European energy infrastructure in completing the European internal energy market and achieving the EU's energy policy objectives in order to ensure the security of electricity supply to the country and the South East Europe region.

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[9] Policies and measures must reflect the energy efficiency first principle

It is essential to continue actions to expand and upgrade energy infrastructure, including the development of necessary cross-border connections, to support the transmission, storage and integration of regional energy systems. A good example of a sustainable solution for the South East Europe region is the Vertical Corridor Initiative to diversify and ensure security of energy supply.

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

Financing of key projects for the modernisation and extension of Bulgaria's electricity transmission infrastructure:

Funding from the European Connecting Europe Financial Facility, the new financing mechanisms for low carbon innovation and modernisation of the energy sector foreseen in the fourth phase of the EU's greenhouse gas emissions trading system, as well as other programmes with EU and national funding, is to be used to finance key electricity infrastructure projects.

3.4.2 energy 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

The Bulgarian electricity network is part of the united transmission network of the countries of continental Europe and its development is closely linked to the development of the networks of neighbouring countries.

In the context of the European objectives of building an interconnected and single pan-European gas market, the development of infrastructure in the Republic of Bulgaria is directly linked to the country's positioning as one of the gas hubs in Eastern Europe, in synergy with the development projects of the Southern Gas Corridor and in line with the gas infrastructure development plans in the region and Europe. The strategic objectives of improving security of supply and diversification of natural gas supply sources also feature prominently in European energy policy.

In order to achieve these objectives, a number of measures are envisaged for the effective implementation of major projects for the development of electricity and gas transmission infrastructures.

ii. Regional cooperation in this area10

The development of energy infrastructure is a key factor in achieving the climate targets set at European level, with the Republic of Bulgaria participating in a number of regional organisations. Proof of a form of successful dialogue for the South East Europe region is the strategic concept of the Vertical Corridor under the CESEC initiative.

The Black Sea Economic Cooperation Organisation (BSEC) is one of the main organisations in which Bulgaria is actively involved. The key priorities for the activity of BSEC in the field of energy are defined by Goal 4 "Sustainable energy and development of the Black Sea Energy Market" set by the BSEC Economic Programme "Towards a sustainable future of the wider Black Sea area" adopted in 2023. The main activities are carried out by the BSEC Energy Working Group established to promote regional energy cooperation. Three projects in the field of energy were implemented and financed by the BSEC Project Development Fund. Another project was funded through a grant from the Black Sea Project Promotion Facility (BSPPF) and implemented by the United Nations Economic Commission for Europe. The working group focused on common approaches and projects. The objective is to develop a competitive regional energy market by supporting investment in energy infrastructure, with a view to enhancing energy security, interconnection and further diversification of energy sources and routes. The Working Group also organises joint programmes between the energy authorities of the BSEC Member States and commits to the exchange of experience and best practices.

A key area of action in this regard is the development of BSEC regional cooperation in green energy. In the framework of the Energy Working Group, the BSEC Green Energy Strategy has been developed, endorsed by the Council of Foreign Affairs Ministers of the BSEC member states. The development and promotion of green energy projects of interest to BSEC Member States is one of the priority areas for action.

Bulgaria is also a member of the Energy Community. The Energy Community Treaty provides for the creation of an integrated energy market (electricity and gas) between the EU and third countries. The members of the Energy Community are the EU, Albania, Bosnia and Herzegovina, the Republic of North Macedonia, Montenegro, Serbia and the United Nations Interim Administration Mission of Kosovo, pursuant to United Nations Security Council Resolution 1244.

The objectives of the Energy Community are to:

- To create a stable legal and market framework capable of attracting investment in order to ensure a stable and uninterrupted supply of electricity;
- Create a single regulatory space for trading in network energy;
- To enhance security of supply for this area and the development of cross-border relations;

[10] *Other than the PCI Regional Groups established under Regulation (EU) No 347/2013.*

- Improve energy efficiency and the environmental situation in relation to grid energy and the development of RES;
- Develop market competition for grid energy.

An important part of the Energy Community activity relates to the implementation of part of Community legislation, or acquis communautaire, in all States Parties in the fields of energy, environment, competition and RES, as well as compliance with certain common European standards relating to technical systems, such as those relating to cross-border transmission or relations. The Treaty establishes a mechanism for the operation of regional energy markets covering the territory of the countries and participating EU countries. This system provides a framework of measures related to transport of grid energy, security of supply, provision of energy to citizens, harmonisation, promotion of RES and EE as well as in the event of a sudden crisis in the grid market in the territory of an Energy Community member. Furthermore, the Treaty establishes an energy market without internal frontiers between countries where customs duties and restrictions on imports and exports of a quantity of energy, as well as all measures having equivalent effect, are prohibited between the Parties except in exceptional circumstances (relating to public policy, public safety, the protection of human and animal health, plant protection, the protection of industrial and commercial property). The Treaty also contains provisions on relations with third countries and mutual assistance in case of malfunction. The Commission set up under the contract shall act as coordinator of these activities.

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

Under the 2021-2027 financial framework, Bulgaria intends to benefit from structural funds to finance investment needs to decarbonise the energy sector, ensuring climate adaptation and a just transition. According to Annex D to the Bulgaria Country Report, priority investment needs have been identified to promote energy efficiency measures, improve resource efficiency and waste management and promote the transition to a circular economy.

Projects of Common Interest (PCIs) are key infrastructure projects whose ultimate objective is to complete the European internal energy market in order to meet the EU's energy and climate objectives, namely: ensuring affordable, secure and environmentally sustainable energy with a view to achieving a climate-neutral economy by 2050. Following the revision of the TEN-E Regulation, which ends support for fossil fuel infrastructure and focuses on the cross-border energy infrastructure of the future, a first PCI list has been drawn up, which includes over 85 electricity projects, including energy storage projects, smart grids and offshore infrastructure. In the context of green corridors, it is appropriate to allow for a combination of projects of common interest and projects of mutual interest, as well as to take into account more complex initiatives and green corridor projects when granting access to EU financial assistance through the CEF Regulation.

The South-East European region is in turn extremely attractive for energy investments, despite the difficulties that are still slowing down its development. To date, there are still significant differences between the stated objectives and the actual progress on the topics of decarbonisation, RES penetration and regional cooperation. At the same time, SEE countries have high levels of energy poverty due to low incomes, high energy needs stemming from energy-inefficient housing and limited access to different energy sources. On the other hand, until recently, energy efficiency has not been the focus of key priorities in all South-East European countries. Therefore, further efforts are needed to introduce energy efficiency as an integral part of national energy planning in each South East European country.

The 2021 crisis has shown the need for solidarity and synergies to ensure secure energy supply, so regional cooperation is key to energy security in the region. With this in mind, one of the main priorities for Bulgaria is also the accelerated development of energy connectivity at national and regional level, as well as electricity transmission and distribution networks, to be able to cope with the energy transition, by modernising, digitalising and implementing flexible solutions, with a view to providing balancing services and flexibility.

The need for regional solidarity is also key for the development of infrastructure with a view to achieving the REPowerEU objectives in the Central, Eastern and South-Eastern Europe area.

3.4.3 market integration

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

In order to implement the provisions of Directive 2019/944 on the electricity market, legislative amendments have been made to the Energy Act and its secondary legislation. These changes also regulate the process of full liberalisation of the electricity market. This process starts in 1.7.2025. Price deregulation for household consumers is planned progressively, with the liberalisation process taking about 6 months.

Policies and measures will focus on:

- Promoting local energy communities to incentivise energy consumers to participate more actively and effectively in the market and to enable an easy transition of active customers to an open and fully liberalised electricity market;
- Granting the right to enter into a dynamic electricity price contract and a demand response aggregation contract in order to encourage energy consumers to participate more actively and effectively in the market, as well as to enable an easy transition of active customers to an open and fully liberalised electricity market;
- Ensuring access to comparison tools for suppliers' offers to support the active participation of consumers in the market, the choice of service aggregation contracts and transparency of relationships in citizen energy communities;

- Joining an initiative to manually activate a Pooling Reserve (MARI) on the Bulgarian electricity market;

- Joining the international coordination initiative for automated frequency restoration and stable operation of the system (Picasso) to connect the balancing market;

- Coordinated management of imbalances (IGCC) – The electricity transmission operator is a full member of this platform and takes action to actively participate in it.

In order to integrate the electricity market into the common European energy market, the country's stock market was brought together with the stock markets of neighbouring EU Member States;

- Merging markets between Bulgaria and North Macedonia in the 'Day ahead' time segment, by joining the European Single Market 'Day-ahead' SDAC, Bulgaria and North Macedonia, launched a local market integration project in the 'Day ahead' time segment. Prerequisites for the launch of this project in real life are the launch of an operational local 'Day ahead' market, which is expected to take place in 2024 and the introduction of a package of European regulations in North Macedonia.

The integration project was frozen until the launch of a local market and the introduction of the necessary European legislation in North Macedonia.

Expected start in 2024

- Integration of markets between Bulgaria and Serbia in the 'Day ahead' time segment, by joining the European Single Market 'Day-ahead' SDAC – In 2018, negotiations for tripartite reunification between Bulgaria, Serbia and Croatia were launched. In 2019, the Parties developed an analysis of the prerequisites and feasibility of the project. The project activities are ongoing, as part of the necessary follow-up steps are related to legislative changes in Serbia's legal framework to ensure market organisation in line with Regulation 2015/1222. In June 2022, the Government of the Republic of Serbia officially designated SEEPEX as the Serbian nominated electricity market operator (NEMO). Serbia already has a functioning local market day ahead. A prerequisite for the successful implementation of the project is the implementation of a legislative framework, reciprocal to the European one adopted in December 2022.

The effective functioning of a single internal market in Europe requires that the organisation and functioning of the "Day ahead" and "Intraday" markets of MS and Energy Community countries take place under the same rules and market organisation. Bulgaria, which is also bordering non-EU countries, is interested in creating common rules to contribute to the effective integration of markets.

Intraday market

There is currently one intraday market alliance project in Europe – XBID.

Market integration of intraday markets takes place through Local implementation projects (LIP).

The Electricity Transmission Operator and the Market Operator participated in the LIP 15 local project, which was part of the second wave of intraday alliance, which covered two local LIP 15 and LIP 16 projects. The exchange and transmission system operators of Bulgaria, Romania, Hungary, Croatia, Slovenia, Czechia, Poland, Austria, Germany participated.

Since the launch of the second wave of 19.11.2019, Bulgaria is now part of the Single Intraday Coupling (SIDC) via a Bulgarian-Romanian border.

Bulgaria is part of the regional LIP 14 project, which aims to join the Italian borders and the border between Bulgaria and Greece to SIDC, as part of the third wave of accession to SIDC. The integration project was successfully completed on 29.11.2022.

Demand response

With the 17.11.2023 amendments to the Energy Act, Bulgaria created the right conditions for the development of so-called active consumers and opportunities for aggregators or energy communities, with a prerequisite for their active participation in demand response in the different market segments.

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

- Introducing smart meters to encourage electricity consumers to participate more actively and effectively in the market;

- Aiming to modernise the energy sector in the country and in line with Article 10c of Directive (EU) 2018/410 in order to enhance cost-effective emission reductions and low-carbon investments and Decision (EU) 2015/1814, Bulgaria will also make use of the possibility to allocate allowances free of charge for greenhouse gas emissions to installations for the production of electricity in the fourth phase of the EU ETS for the transitional period from 2021 to 2030. To this end, the implementation of the National Investment Framework 2021-2030 is envisaged, which enables operators to receive free emission allowances for their investments in the modernisation of the energy sector.

During the period under review, Bulgaria envisages the introduction of interim measures to enable the implementation of the following reforms:

- Creating the right conditions and enhancing the participation of demand response, individually or through aggregators, in the wholesale electricity market as well as in the balancing market;

- Upgrading the transmission network to alleviate internal congestion. Increase of interconnection capacity.

The implementation of the Yadenitsa project to increase the volume of the lower counterpart of PAVPP Chira and a reversible irrigation tunnel for connection to the Paraya dam provides balancing capacity in the country's electricity system and will allow further development of electricity production from renewable energy sources in line with the long-term energy development strategies in Bulgaria and the European Union.

iii. Where applicable, measures to ensure non-discriminatory participation of renewable energy, demand response and storage, including through bundling, in all energy markets

Develop a regulatory framework to ensure that consumers have the right to consume electricity from their own production from renewable sources. The framework should ensure that consumers of that electricity, individually or through aggregators, have the right to produce renewable energy, including for their own consumption, to accumulate and sell their surplus renewable electricity, including through renewable power purchase agreements, electricity suppliers and peer-to-peer trade agreements, without subjecting them to any assessment of upcoming or disproportionate procedures and charges.

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

A measure to support the most vulnerable persons and families meeting the defined income and asset criteria is currently in place. According to the Social Assistance Act and Regulation No RD-07-5 of 16.5.2008 on the conditions and procedure for granting targeted heating aid, targeted heating aid is granted to socially vulnerable groups during the heating season. The scope of the targeted assistance shall include persons and families meeting the conditions and requirements laid down by law. 5 risk groups have been defined with different sizes of differentiated minimum income for heating, depending on the level of risk and priorities set. To date, around 320 000 individuals and families benefit from this assistance.

The electricity market in Bulgaria is partially liberalised, with a regulated share of 40 %. In line with the Commission's Third Liberalisation Package, Bulgaria has taken steps towards full liberalisation of the electricity market. Phasing out regulated prices for final consumers will lead to increased competition between electricity suppliers, but at the same time exposes consumers to greater price volatility. Bulgaria aims to provide adequate protection for vulnerable household consumers of electricity. In this regard, based on a detailed analysis, policies and measures have been developed to ensure a smooth and gradual transition for household consumers towards a liberalised retail electricity market. This transition will take place at the outset by partially regulating the price for household consumers until the regulated component in this price is completely removed. Before the start of the process of full liberalisation of the electricity market, a protection mechanism

for vulnerable electricity customers will be put in place, including criteria for identifying these customers, as well as financial and non-financial measures to protect them. This mechanism to support vulnerable electricity consumers is to ensure that minimum electricity needs are covered throughout the year beyond heating needs.

The Energy Act obliges the Council of Ministers to designate or establish a body (body) to draw up the National Social Climate Plan and at the same time to build and maintain an information system on the number of households in energy poverty and vulnerable electricity customers.

In addition to these short-term measures, long-term measures are being sought that relate to investments in energy efficiency or a reduction in the need and amount of energy needed for home heating and cooling. Energy efficiency measures will reduce the number of consumers included in the definition of 'energy poor'. Improving energy efficiency has several positive effects, among which it helps to reduce energy poverty. In the long term, the EU building stock needs to be (deeply) renovated, converted into nearly zero-energy buildings, and national renovation strategies need to facilitate a cost-effective transformation, taking into account that some households are in energy poverty. National action plans or other appropriate frameworks to address energy poverty must be developed and Member States must ensure the necessary energy supply for vulnerable customers by adopting social policies or energy efficiency improvements in housing.

v. Description of measures to enable and develop demand response, including those addressing tariffs to support dynamic pricing11

The enter-exit method under European regulation has been introduced to determine natural gas transmission tariffs, which enables tariffs to be set.

3.4.4 energy poverty

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

Policies and measures to achieve national targets on energy poverty:

- Ensuring adequate protection for the energy poor, including by providing targeted heating aid for those who meet the requirements of the Regulation laying down the criteria, conditions and procedures for determining the status of a household in energy poverty and the status of vulnerable customer for the supply of electricity;
- Implement a mechanism to protect vulnerable customers when starting the process towards full liberalisation of electricity prices for final customers, including household customers;

[11] In accordance with Article 15(8) of Directive 2012/27/EU

- Renovation of the building stock;
- Increasing energy efficiency by introducing to the national target referred to in Article 8 of Directive (EU) 2023/1791 the requirement to implement energy efficiency improvement measures as a priority among vulnerable customers, including households affected by energy poverty and, where appropriate, in social housing.

In addition to measures to promote the active participation of consumers in the electricity market, measures to protect them will also apply. In this regard, the policy of full liberalisation of the electricity market includes measures to ensure a smooth and gradual transition of household customers. With this smooth transition, retail electricity market prices will gradually move from regulated prices, to partial regulation until their regulation is fully phased out.

In the long term, in addition to the measures mentioned above, measures to improve the energy efficiency of energy poor consumers' homes will also be implemented in order to reduce their energy costs and increase their living comfort.

Measures and programmes to protect energy poor and vulnerable customers will be further developed and implemented through the national Social Climate Plan.

Since 2008, a measure has been implemented to support the most vulnerable persons and families meeting the defined income and asset criteria. Under the Social Assistance Act and Regulation No RD-07-5 of 16.5.2008 on the conditions and procedure for granting targeted heating aid, the most risky groups are entitled to targeted heating aid during the heating season. The scope of the targeted assistance shall include persons and families meeting the conditions and requirements laid down by law. 5 risk groups have been defined, with different amounts of differentiated income for heating, depending on the level of risk. To date, around 324 000 individuals and families benefit from this assistance.

It aims to support low-income people to provide heating during the winter period.

In accordance with the conditions laid down in the Regulation, persons and families whose average monthly income for the previous six months preceding the month in which the declaration is submitted is less than or equal to differentiated heating income (DTC) are eligible for targeted heating allowance. These persons and families must also meet the conditions of Articles 10 and 11 of the Implementing Regulation of the Social Assistance Act.

Declarations for the granting of targeted heating aid for the respective heating season shall be submitted to the Social Assistance Directorate between 01 July and 31 October of the year concerned, with targeted aid being granted for a period of 5 months.

3.5 dimension "Research, innovation and competitiveness"

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

The national objectives and targets for funding public and/or private research and innovation in relation to the work of the Energy Union, including the development of plans to achieve the objectives, relate to:

- The Innovation Strategy for Smart Specialisation of the Republic of Bulgaria 2021-2027;
- Upskilling and creating a skilled workforce to support the manufacturing of net-zero technologies, including the creation (or participation) of net-zero academies;
- Establishment of industrial parks within the meaning of the Industrial Parks Act.

Over the last decade, research and innovation have become a top priority of European policy. This is why Bulgaria also sees research and innovation as a real opportunity to improve the competitiveness of the economy, generating economic growth and jobs. As regards research, innovation and competitiveness, Bulgaria's energy and energy resource policy focuses on:

- Deployment of high-efficiency energy technologies;
- Smart grids and energy storage;
- Nuclear energy research;
- Explore the possibilities of deploying electrochemical sources of energy such as batteries, hydrogen technologies and fuel cells.

The following measures will be taken to implement innovation policies:

- Achieving the objectives of the EU's 'Fit for 55' package by 2030, as well as developing a low-carbon economy in the long term;
- Increasing the number of innovative firms (introduction and development of innovation) in high-tech and intensive sectors, in line with the Smart Specialisation Strategy;
- Enhancing the competitiveness and efficiency of the research system by focusing on results and creating incentives (such as improving working conditions, international cooperation and mobility, cooperation with business) in order to attract qualified research teams;
- Developing skills in universities and research institutions to increase the commercial viability and market relevance of their research projects and the ability to participate in research consortia;
- Supporting cooperation between research and business, technology transfer and the application of research results;
- Encouraging business investment in research and in the uptake of industrial and household innovation.

It is envisaged to develop a pilot project on hydrogen with a total installed capacity of 20 MW. On the basis of this project, further development of hydrogen capacity beyond 2030 will be analysed.

Participation is also planned in the following areas of research and development, in which the independent transmission operator plays a key role:

- Crossbow – Cross-border management of renewable energy sources and energy storage installations, which will allow greater flexibility of the energy system to produce renewable energy. The project was successfully completed in 2021;
- FLEXITRANSTORE – An integrated platform for increased flexibility in smart data networks with renewable energy storage sites, which will increase the flexibility of the internal energy market system. The project was successfully completed in 2021;
- INTERRFACE – User Interface Architecture to deliver innovative network services for a more efficient energy system, which will increase the flexibility of the internal energy market system. The project was successfully completed in 2022;
- SDN-microSENSE – SDN – Micro-transmission grid flexibility in the electricity system. This will increase the security of the internal energy market system. The project was successfully completed in 2022;
- Foresight, an advanced cybersecurity simulation platform for training in aviation, maritime and energy readiness, to enhance the security of the internal market system. The project was successfully completed in 2023;
- X-FLEX – Integrated energy solutions and new market mechanisms for extended European grid flexibility to increase the flexibility of the internal energy market system. The project was successfully completed in 2023;
- FARCROSS – Facilitating cross-border electricity transmission through innovation, increasing the flexibility of the IEM system, increasing regional cooperation, increasing system security. The project was successfully completed in 2023;
- Trinity – Increasing transmission capacity at regional borders through smart market technologies, increasing the flexibility of the IEM system to increase regional cooperation. The project was successfully completed in 2023;
- Smart5Grid – Demonstration of fifth generation solutions for smart grids of the future;
- ENFLATE – Ensuring flexible supplies by all actors and sectors through markets and digital technologies;
- ZAHYR – Sustainable hydrogen region Zagora; The project will demonstrate and protect a business model where hydrogen reaches a competitive price, as well as a wide range of applications where hydrogen can improve people’s quality of

life, including the reduction of carbon emissions and air pollution by replacing natural gas with industrial hydrogen and consumption of inferior energy;

- iDesignRES – Integrated modelling of energy system components for planned deployment of renewables: An open-source toolbox that will allow public authorities and network operators to plan and optimise the use of low- and zero-emission energy sources on a regional, national and European scale;
- TwinEU – developing a Digital Twin for Europe to facilitate all aspects of business and operational coordination for system operators and market participants;
- A financial compensation mechanism to support the competitiveness of industries at risk in order to reduce their harmful emissions;
- National scientific programmes of the Ministry of Education and Science – Low-carbon energy for transport and life – EPLUS and "Protection of the environment and reduction of the risk of adverse events and natural disasters" to create expertise focusing on the storage and transformation of renewable energy, hydrogen – based technologies and eco-mobility, conducting basic and applied research. The programmes will be implemented for a period of 3 to 5 years.

PRIIDIT provides support for the development of European Digital Innovation Hubs (EDIC) in the form of synergy funding under Priority 1 'Sustainable development of the Bulgarian research and innovation ecosystem', Priority strand 4 'Synergy with Horizon Europe and Digital Europe' programmes.

Under the synergy funding, the following procedures are foreseen under PRIDIT:

- Direct award procedure "Complementary funding of European Digital Innovation Hubs selected by the EC", which aims to provide complementary funding to build a national network of EDIC and develop the capacity of the selected national digital and innovation hubs to provide digital and green technology services to small and medium-sized enterprises and public organisations for their non-economic activities. This procedure was open until 8 November 2023. The indicative budget of the procedure is BGN 13 586 742.33, allocated to the four EDIHs, which are direct beneficiaries of the procedure;

- Direct award procedure 'Funding the ECHI awarded a Seal of Excellence', the procedure was open for application until 4 April 2024 and aims to support 8 ECHs awarded a Seal of Excellence national network for the provision of digital and green technology services to micro, small and medium-sized enterprises, small mid-cap companies and public organisations for their non-economic activities. The implementation of the procedure will achieve a link and a coordinated approach of the work of digital and innovation hubs with other Digital Europe Programme (DEP) projects that focus on capacity building in High Performance Computing, artificial intelligence, cybersecurity and trust, advanced digital skills and deployment and best use of digital capacities and interoperability. The total budget of the procedure is BGN 51 838 742.50, broken down into the individual EDIC;

- Direct award procedure "Participation of Bulgarian organisations in institutionalised European Partnerships". This procedure will provide funding for the participation of

Bulgarian enterprise networks, including in partnership with research organisations and higher education institutions in calls for project proposals under the relevant European (institutionalised) partnerships under the Horizon Europe FP, covering the priority strands of the Innovation Strategy for Smart Specialisation 2021-2027 (ISIS).

Priority strand 3 "Transfer of technology and knowledge" of Priority 1 of PRIDIT includes support for the following measures:

- Small innovative grants for SMEs to foster cooperation with CoLC, CCPs, NCRI sites, UTPs Laboratory Complex and other research organisations and laboratories. The main objective of the procedure is to encourage business to make greater use of the capacity of research organisations in the processes of introducing innovative solutions, solving the various technological problems of the enterprise, digitalisation, the introduction of new business models, prototyping, etc.;

- Smart Bulgaria scheme, which will support joint projects of enterprises and a team of a scientific organisation or higher education institution that can protect significant potential to gain market share, generate economic impact and export through ideas for a completely new product, service or process or new use of existing ones that significantly expands the company's capabilities;

- Collaborative programmes for innovation and knowledge and technology transfer in the areas of European value chains. Joint programmes between industry, SMEs and research organisations and higher education institutions to build long-term cooperation and make significant progress and contribution to the regional economy, such as in the field of hydrogen valleys. Programmes can be twofold, focused on specific priority areas and horizontal, and are ambitious plans for cooperation between all actors in the innovation ecosystem for deep transformation in smart specialisation sectors with potential for systemic change;

- Mobility programmes between industry, research organisations and higher education institutions to further develop the practical capacity and develop the innovation and technological potential of the enterprise concerned. The programmes will promote inter-sectoral mobility of scientists in enterprises; returning scientists from abroad and attracting them to work in businesses;

- Development of innovation clusters. The intervention focuses mainly on innovation clusters already established, operating in the thematic areas of the ISIS 2021-2027 and aims to support viable innovation clusters that work effectively at regional level and can demonstrate concrete results in supporting, promoting, representing and protecting regional capacity to introduce and develop innovation by enhancing cooperation between business and research organisations, universities, local authorities and other stakeholders.

In pursuit of the policy objective 'A more competitive and smarter Europe by promoting innovative and smart economic transformation and regional ICT connectivity', PRIDIT supports the development of skills for smart specialisation, industrial transition and entrepreneurship. The main objective of this support is the development of human capital

and such knowledge, skills and competences in companies, the absence of which would lead to a loss of staff due to the digital and green transformation of the economy.

In the Framework of Priority 1, Priority 1 'Sustainable development of national research and innovation capacities', a direct award procedure is open for application. "Sustainable development of Centres of Excellence and Centres of Competence, including specific infrastructures or groupings thereof by the NCRI". The aim of the procedure is to support the sustainable development of the CoC and CCPs set up under OPINION in order to move them into an operational phase, stimulate their cooperation with business through technology transfer, fully integrate them into the country's research and innovation ecosystem and increase their contribution to smart economic transformation. Support will also be provided for a limited number of (up to 2) infrastructures from NPMIs or their groupings and the Sofia-Teh Park Science and Technology Park Laboratory Complex (SSTP), which meet the priority strands of the ISIS 2021-2027 and make a unique contribution to the fulfilment of Bulgaria's strategic commitments under the Green Deal, the blue, low-carbon and circular economy, marine research and make a clear contribution to the development of underdeveloped areas.

All the innovation measures implemented under the OPIC and planned to be implemented under the ITP of the NRRP and under the IPP 2021-2027 are in line with the Innovation Strategy for Smart Specialisation.

In the coming years, the country's efforts will be aimed at deploying new energy-saving technologies that make a significant contribution to reducing carbon emissions in the atmosphere, reducing the greenhouse effect and overheating of buildings. The use of modern innovative technologies that significantly reduce the penetration of ultraviolet and infrared radiation harmful to human health through glazed surfaces in buildings will be encouraged. The aim is to achieve better living and working conditions for Bulgarian citizens through a tangible reduction in energy costs, with a relatively quick return on investment.

A low-carbon economy is an essential factor that will contribute to the objective of reducing harmful substances released into the atmosphere. In this context, action will be taken to reduce toxic emissions from transport, agriculture and industry. To this end, innovative suction and purification systems meeting the highest European requirements for the capture of more than 90 % of harmful gases, vapours and particulate matter emitted in energy production, metallurgical production and processing, in the extraction and processing of aggregates/cement, lime, asphalt, marble and others, pharmaceutical industry, chemical industry/acid gases, hydrogen sulphide, hydrogen cyanide, hydrochloric acid and dride (food industry/nitrous oxide, carbon monoxide, formaldehyde, etc.) will be deployed. Technologies and innovative products can also be applied, ranging from separate industrial portable systems for temporary recovery of pollutants to centralised systems of large sectors and manufacturing. Bulgaria will support the deployment in a real-life environment of innovations that contribute to saving energy and reducing harmful emissions into the atmosphere (particulate matter) in order to ensure healthier and safer working and living conditions for people. The study on the deployment and use of

electrochemical energy sources such as batteries, hydrogen energy and fuel cells will continue.

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

Given the importance of innovation for the future development of clean and high-efficiency energy, Bulgaria's attention and efforts are focused on possible implementation of energy innovation projects, which will be based on the European Strategic Energy Technology Plan. Changes to the overall energy model, namely the uptake of smart grids, energy storage, the deployment of high-efficiency energy technologies and systems in the economy and household, are under discussion to reduce energy costs for consumers. Passive design of a green living environment will require a new holistic approach, which will include finding a balance between building orientation, glazing, ventilation, as well as providing highly efficient insulation technologies, systems and materials. The deployment of new high-efficiency new generation energy technologies and systems for buildings and glazed surfaces will lead to significant reductions in energy costs for final customers, help address decarbonisation challenges and improve people's quality of life and working conditions. In order to stimulate the cost-effective development of low-carbon technologies in the country, Bulgaria will also benefit from the SET Plan developed at European level, which promotes cooperation on innovation across sectors and from the European Innovation Fund.

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

Regarding investment "Programme for public support for the development of industrial districts, parks and similar territories and for attracting investment ("AttractInvestBG")" on 2.6.2023, the Ministry of Innovation and Growth announced the procedure by selecting proposals for the implementation of investments by final recipients BG-RRP-3.007. By Order No 403/20.09.23 of the Minister for Innovation and Growth, DG EFC was designated as Monitoring and Reporting Structure for the implementation of Investment C14.I3: "Public support programme for the development of industrial districts, parks and similar territories and for attracting investment ("AttractInvestBG")". Within the deadline for applications, 20 proposals were received for the implementation of investments with a total amount of funding of BGN 383 915 652.11. Grants will support the construction of technical, environmental and innovative infrastructure. With regard to the construction of "Green Infrastructure", it is foreseen (in case enterprises in the park/area need it) to finance activities for the construction and connection of newly built charging points, as well as the purchase, supply and installation of solar battery charging stations for electric vehicles (with a total budget: BGN 1 500 000 or EUR 766 938).

With regard to the investment, Economic Transformation Programme from Component 3 Intelligent Industry was launched in 2023 for the award of funds to final recipients BG-RRP-3.006 "Construction of new RES for own consumption in combination with local energy storage facilities in enterprises". The purpose of the procedure is to award grants for the construction of renewable energy sources (RES) for self-consumption to companies combined with local energy storage facilities, thereby fostering the transition of the private sector to green activity. The measure focuses solely on solar photovoltaic energy and has as a mandatory element the acquisition of battery technologies and storage facilities, contributing to the balance of output and helping to overcome one of the disadvantages of renewable sources, namely intermittent production. The initial budget of the procedure is BGN 200 000 000 (EUR 102 258 376,24), subsequently adjusted to BGN 120 000 000 (EUR 61 355 025,74). Taking into account the maximum duration of a project (18 months), the actual implementation of the investments is expected to be completed in 2024 and 2025. The implementation of the procedure will result in a minimum of 54 096 kW operational capacity of the installed storage facilities.
Under Component 6 'Sustainable Agriculture', investment C6.I1 'Fund to promote the technological and ecological transition of agriculture of the RRP', implementation is foreseen under the following strands:

1. "Investments in technological and environmental modernisation";
2. "Preparation for the marketing and storage of fruit and vegetables".

An Operational Agreement for the implementation of Investment C26.09.2023.I6. under the NRRP was signed between the Ministry of Agriculture and Food and the Ministry of Finance on 1.

Following two public consultations, a first procedure was launched on 28.9.2023 under the investment number BG-RRP-6.004 under the strand 'Investments in technological and environmental modernisation', with a deadline for application of 20.12.2023.

The procedure aims to provide timely support to Bulgarian farmers, in the form of grants, for a swift recovery from the effects of the COVID-19 pandemic, addressing the problems hampering the competitiveness and sustainability of the agricultural sector and accelerating its adaptation to climate change, greening of production, digital transformation, improving genetic resources.

The Fund to promote the technological and green transition shall provide support to farmers for the implementation of targeted investments, the purchase of tangible and intangible assets for the implementation of activities ensuring the protection of the environmental components and the mitigation of the effects of climate change, introducing innovative production, digital, production and organisation technologies in agriculture, for the automation of work processes.

On 24.10.2023, a second investment procedure was launched with reference BG-RRP-6.006 under the strand 'Preparation centres for the marketing and storage of fruit and vegetables'. Deadline for applying for the 22.12.2023 procedure

The main objective of the procedure is to support the marketing process of agricultural products covered by the fruit and vegetables sector by financing investments contributing to the supply of products whose quality, condition and type meet the needs of the final consumer. In this way, the support will provide an opportunity to increase the competitiveness of producers of agricultural products in the fruit and vegetables sector, including in particular those farms that have been affected by the consequences of the SARS-CoV-2 pandemic. The creation of short supply chains, modernisation and automation of collection, market preparation and storage of fresh fruit and vegetables will be encouraged.

The implementation of the 'Investments related to water efficiency on agricultural holdings' strand has not been launched to date. The specific strand has a total public resource of BGN 119.7 million, including BGN 99.7 million from the Recovery and Resilience Facility and BGN 20 million for non-recoverable VAT from the State budget. A discussion on this strand is still ongoing with the EC services on part of the regulatory framework related to its implementation.

With regard to the fourth strand 'Investments for the construction and equipment of livestock holdings for breeding and evaluation of male breeding animals', the Ministry of Agriculture and Food has prepared and sent to the Ministry of Finance, respectively, a reasoned request for its implementation to be abolished and the corresponding budget to be released from the Recovery and Resilience Facility up to BGN 4.6 million and national public funding for non-refundable tax under the Value Added Tax Act (ZDDS). To date, the submitted amendments have been approved by the EC and are expected to be formally approved following a Council decision in November 2023.

According to the Indicative Annual Work Programme 2023 of the Competitiveness and Innovation in Enterprises Programme 2021-2027 (PIPP), two R & D and innovation procedures are planned: the 'Development of innovation in enterprises' procedure and the 'Increase of innovation in enterprises' procedure. The first procedure is aimed at supporting in-house development/innovation and the second (open on 2.11.2023) for innovation by SMEs, both of which should be implemented in the thematic areas of the Innovation Strategy for Smart Specialisation 2021-2027 (ISIS). One of the areas of the ISIS is 'Clean technologies, circular and low-carbon economy' and a total of BGN 146 687 250 has been earmarked under the two procedures for carrying out activities in this area.

In the Indicative Annual Work Programme 2024 of the Research, Innovation and Digitalisation for Smart Transformation Programme 2021-2027 (PRIDIT), a complementary funding procedure is planned to support Bulgaria's participation in the European Clean Hydrogen Partnership for a hydrogen valley project approved by the European Commission. The procedure aims at implementing a synergistic approach with Horizon Europe and supporting innovative technologies for regional transformation towards a green and digital economy, as well as building a long-term partnership between business, science and all regional stakeholders. The total amount of the project budget from PRINIDIT is BGN 16 000 000.

Under REACT-EU under Priority Axis 6: SME recovery under OPIC 2014-2020 was implemented under grant procedure BG16RFOP002-6.002 'Recovery of SMEs through energy efficiency improvements' announced in April 2022. The procedure provided support to SMEs to recover from the economic consequences of the COVID-19 outbreak by improving their energy efficiency. The aim of the procedure is to provide focused support to Bulgarian SMEs to recover from the economic consequences of the COVID-19 outbreak by improving their energy efficiency. Under the procedure, 842 contracts were concluded, with a total grant value of BGN 83 586 313.55, of which 16 contracts had been successfully concluded by February 2023, with a total grant value of BGN 1 426 176.69. The activities supported included various types of energy-efficient equipment such as boilers, burners, radiant heating, heat pumps, solar systems, recuperators, chips, pumps, energy-efficient insulation systems in buildings, automated systems for monitoring energy consumption, etc.

As regards the construction of additional possibilities for connecting our national gas transmission network with those of other countries, a project has been implemented which directly connects the national gas transmission networks of the Hellenic Republic and the Republic of Bulgaria. Project No BG2014RFOP2020-16-002-C4.002 'Construction of the Greece-Bulgaria gas interconnector' was implemented under OPIC 0001-01 with the beneficiary: Ai Si Zhi Bi AD. The total budget of the project is BGN 559 292 262.64, of which a grant of BGN 76 277 370 (EUR 39 000 000). The project was completed on 21.12.2022 and, as a result of its implementation, a gas pipeline was built with an entry point in the area of the town of Komotini (Greece) and a point of departure in the area of Stara Zagora (Bulgaria). The total length is 182 km, of which 31.6 km are located on the territory of Greece and 150.9 km on the territory of Bulgaria. 29.6 km of the pipeline in Bulgaria was built with funds from the OPIC 2014-2020. The interconnector was put into commercial operation.

The strategy document, which creates the baseline for the use of funds under European research, innovation and competitiveness programmes, is the Innovation Strategy for Smart Specialisation 2021-2027 (ISS 2021-2027). The strategy is the thematic enabling condition for specific objectives for innovation and skills under Policy Objective 1: "A more competitive and smarter Europe by promoting innovative and smart economic transformation and regional ICT connectivity" for the resources from the European Regional Development Fund, the European Social Fund and the Cohesion Fund for the 2021-2027 programming period. The strategy adequately reflects the uptake of hydrogen technologies and acts as the baseline programming document to identify the whole set of measures to finance innovation in the 2021-2027 programming period.

The innovation strategy for smart specialisation of the Republic of Bulgaria is a strategic framework for sustainable development based on research and innovation, the territorial capacities and ambitions of the regions and the broad involvement of stakeholders. The strategy is at the forefront of strengthening regional innovation ecosystems so that they can sustain and stimulate economic growth. The ISIS 2021-2027 defines five thematic

areas where Bulgaria has a competitive advantage and smart specialisation capacity and should focus its efforts on their accelerated development.

The thematic areas of the ISIS 2021-2027 are:

1. *Topic area Informatics and ICT;*
2. *Thematic area "Mechatronics and microelectronics";*
3. *Thematic area "industries for healthy living, bioeconomy and biotechnology";*
4. *Thematic area "New Technologies in Creative and Recreative Industries";*
5. *Thematic area "Clean Technologies, Circular and Low-Carbon Economy".*

In the ISIS 2021-2027, under the Thematic Area Clean Technologies, Circular and Low-Carbon Economy, the following sub-areas are prioritised:

- ✓ Innovation in production, storage, saving, efficient distribution and consumption of energy, including from different renewable energy sources;
- ✓ Setting up modern information sets for autonomous energy systems;
- ✓ Hydrogen – based technologies: hydrogen production with a focus on green hydrogen, storage, transport and use of hydrogen in industry, energy, transport and household;
- ✓ Development and deployment of technologies related to sustainable mobility (battery and hydrogen) based on hydrogen and other alternative fuels, connected infrastructure and eco-mobility;
- ✓ Technologies for resource efficiency, for reducing the content of hazardous substances, for the use of alternative raw materials and materials, for extending the life of products and their use in other industries;
- ✓ Non-waste technologies and methods for integrating industrial waste products and materials into other industries;
- ✓ Capture and utilisation of CO_2 from the atmosphere;
- ✓ Develop digital solutions for circular economy approaches.

The Thematic Area "Clean Technologies, Circular and Low-Carbon Economy" will be a priority area of smart specialisation in all 28 areas of the country at NUTs III level.

Under Priority 3 'Transfer of Technology and Knowledge' of Priority 1 'Sustainable development of the Bulgarian research and innovation ecosystem' of PNIDIT, the procedure 'Complementary funding to support Bulgaria's participation in the European Clean Hydrogen Partnership for the construction of a hydrogen valley in the municipality of Stara Zagora under project proposal Zagora sustainable Hydrogen Region (ZAHYR)' is foreseen. The project aims to build a long-term partnership between business, science and all regional stakeholders.

Under the same strand, a measure is foreseen to develop green and digital partnerships for smart transformation. The measure targets strategic projects addressing a specific problem of a business partner or transferring knowledge and experience to a business

partner to enable sustainable solutions by providing green and/or digital services, creating market advantage through the introduction/development of green and digital solutions and eco-innovation.

Under the Economic Transformation Programme (EPP) of the NRRP, a procedure for granting grant BG-RRP-3.004 'Technological modernisation' is under implementation. The procedure provides for the acquisition of new technologies with a focus on the digitalisation of production processes with a view to expanding production capacity and/or diversifying the products/services offered by companies.

The ITP under the NRRP provides for the implementation of equity financial instruments (FIs) for innovation aimed at enhancing the innovation capacity of businesses, accelerating their productivity improvements and the transition to a knowledge economy, thereby improving Bulgaria's current position as a modest innovator in the EU (European Innovation Scoreboard 2020). The FI is currently being structured.

The Competitiveness and Innovation in Enterprises Programme 2021-2027 (PIPP) provides support measures for the development and uptake of innovation by enterprises in the thematic areas of the ISIS 2021-2027, including in the area of Clean Technologies, Circular and Low-Carbon Economy. At the end of 2023, the second grant award procedure in the field was launched for the deployment of innovation in enterprises. Support through financial instruments for venture capital investments is also envisaged for the creation of new businesses and the development of innovative enterprises and priority will be given to support enterprises with a core activity in the high-tech or medium-tech sectors of manufacturing and knowledge-intensive services that are not linked to technology transfer.

Under Priority Axis 6 Reimbursement of SMEs under OPIC 2014-2020, under grant procedure BG16RFOP002-6.002 'Recovery of SMEs through energy efficiency improvements' announced in Aprile 2022, support was provided to SMEs in recovering from the economic consequences of the outbreak of the COVID-19 pandemic by improving their energy efficiency.

Under the ITP, the NRRP announced a procedure for grant BG-RRP-3.008 'Supporting the transition to a circular economy in enterprises', which aims to contribute to accelerating the transition to a circular economy by providing grants to companies in the manufacturing sector to introduce circular resource use models and deploy climate-neutral methods and technologies for the production and consumption of their products.

Under the same programme under the NRRP, a guarantee FI for energy efficiency and renewable energy is being structured to address Bulgaria's challenges in providing support for investments in energy efficiency and renewable energy. The guarantee instrument shall target SMEs, small mid-cap companies and individuals.

Under the EIP, Priority 2 'Circular Economy', SO 2.1 Promoting energy efficiency and reducing greenhouse gas emissions, support is provided for activities aimed at energy efficiency measures in enterprises, including the introduction and certification of energy management systems, as well as systems for monitoring and controlling energy

consumption. Companies will be incentivised to use electricity, heat and cooling from renewable sources for their own consumption.

The support will be implemented through combined financing between debt FIs and grants.

Under the same priority of the EIP, SO 2.6 "Fostering the transition to a circular and resource-efficient economy" provides support for the uptake of greener manufacturing practices, promoting activities in product design, production processes and waste management. The creation of partnerships between businesses to achieve industrial symbiosis and the creation of sectoral platforms for the exchange of good practices will be encouraged.

Under the ITP, the procedure for grant BG-RRP-2023 'Construction of new RES for own use in combination with local energy storage facilities in enterprises' was announced in Fevruari in 3.006. The purpose of the procedure is to award grants for the construction of renewable energy sources (RES) for self-consumption combined with local energy storage facilities (batteries) to foster the transition of the private sector to green activity.

Under Priority 1 'Sustainable development of the Bulgarian research and innovation ecosystem', Specific objective: 1.1. "Developing and strengthening research and innovation capacities and the deployment of advanced technologies", Priority strand H: "Technology and knowledge transfer" of PRIDIT provides for the use of financial instruments to increase the amount of investment by implementing new funding models in research and innovation. Although the support is not targeted towards innovative industries with high added value, support through FIs is foreseen for knowledge and technology transfer, active commercialisation of research results, intellectual property and its management as a key tool for knowledge transfer and revenue generation. The Technology Transfer Fund will provide support to spin-off companies, high-tech start-ups and knowledge-based businesses as part of industrial start-up systems, the transformation of scientific development into marketable products and technologies, commercialisation and intellectual property management. It will also stimulate the deployment and start-up of start-ups around developed industries and clusters, to share the benefits in R & I high efficiency and to benefit the economic development of the given sector and regions in the country.

Under EIP 2021-2027, Priority 1 'Innovation and growth', SO 1.3 Strengthening sustainable growth and competitiveness of SMEs and job creation in SMEs, including through productive investments, support is provided to promote entrepreneurial activity, through equity FIs, the so-called Entrepreneurship Fund family. The Funds will provide investments for start-ups and existing businesses at all stages of their development, depending on their growth potential and in line with market needs and funding gaps.

In the context of the implementation of the innovation development policy, the Ministry of Innovation and Growth, in partnership with the Ministry of Education and Science, is preparing a new Law on the Promotion of Research and Innovation, which will reward the existing legislative framework with aspects of the public-private relationship between actors in the country's research and innovation ecosystem, so as to create the conditions

for realising their full potential and increase the economic and social impact of investments in research and innovation. The law will define the bodies and procedures for shaping the national policy for the promotion of research and innovation, regulate the role of each of the institutions involved in the process of policy creation, implementation, monitoring and evaluation, and indicate how the policy will be financed. With regard to technology transfer policy, the law will set out the principles and rules governing the financing of technology transfer, the role of the institutions involved in the process of drafting, implementing, monitoring and evaluating the technology transfer policy. The law will set out the principles and rules that will regulate the financing of technology transfer, the role of institutions involved in the preparation, implementation, monitoring and evaluation of technology transfer policy. The design of the new SIRD is in line with efforts to improve innovation policy.

According to the functions allocated to the departments, the MER is responsible for preparing the draft Act on the Promotion of Electric Mobility, which is milestone No 178 of the Annex to the Council Implementing Decision on the approval of the assessment of the Recovery and Resilience Plan for Bulgaria. The aim is to develop a new legal framework to promote the deployment of recharging infrastructure and zero-emission vehicles and to limit the use of the most polluting vehicles. This includes: simplification of procedures for the construction and connection of recharging stations to the electricity grid; a statutory obligation for municipalities to provide charging points; a regulatory incentive for electric utilities to provide easy access to the power grid; introducing preferential financial instruments for small and medium-sized enterprises investing in the construction and management of recharging infrastructure, etc.

The reform is extremely ambitious and has to be agreed by the end of 2026. These are very detailed, but basically envisage:

- A significant increase in low-emission cars, up to 30;
- Massive installation of recharging infrastructure – 10 thousand charging stations, covering all municipalities;
- Measures to limit pollution from road transport and others.

The law must introduce incentives for the market uptake of electric vehicles (EVs) and comply with the polluter pays principle, including specific measures: subsidies for zero-emission vehicles; differentiation of registration/property fees/taxes depending on the level of emissions and scrapping schemes for the most polluting vehicles.

Unlocking the potential of hydrogen technologies and hydrogen production and supply is a key prerequisite for meeting the objectives of the Green Deal and the decarbonisation of the economy, given the potential of hydrogen to replace fossil energy sources in the economy of the future.

The participation of research collectors in international partnerships with European co-funding supported by the SETPlan, such as the European Joint Programme on Radioactive Waste Management (EURAD), shall be encouraged.

A national upgrading programme in the field of nuclear technology and nuclear engineering is being developed, with national funding, through the budget of the Ministry of Education and Science. The beneficiaries will be higher education institutions and research organisations that carry out research and are accredited for training in the field of nuclear energy and directly related nuclear sciences. The programme aims to support research in the country and increase the research capacity of academic institutions.

SECTION B: ANALYTICAL BASIS

4. CURRENT SITUATION AND PROJECTIONS OF EXISTING POLICIES AND MEASURES

In line with the contractual agreement between the Bulgarian Ministry of Energy and E3-Modelling S.A. on Updating the projected scenarios for the development of the national energy system for the purposes of the Bulgarian INECPs, two WEM scenarios (with existing policies and measures) and WAM (with additional policies and measures) were developed. In order to meet the requirements, a comprehensive overview of the scenarios developed under the project for the purposes of the updated NECP of the Republic of Bulgaria has been provided. The projection horizon was set until 2050 with a particular focus on 2030. The WEM is considered a reference case against the alternative policy scenario. The WEM scenario reflects the continuation of the current trends of Bulgaria's energy system on the basis of a pre-defined macroeconomic outlook to 2050, includes the policies and strategic objectives for energy efficiency and RES (within the previous INECP targets) adopted since the end of 2022 and the projects already under preparation follow the country's main strategic orientations, have no specific long-term climate objective and serve as a basis for assessing and quantifying the effects of alternative pathways towards carbon neutrality.

EU legislation that could be relevant for the updated INECPs (e.g. EU Regulation 2019/631 on CO2 emission performance standards, etc.) has also been taken into account. The additional measures scenario (WAM) has a long-term vision aligned with the EU's climate target – net zero greenhouse gas emissions by 2050. It looks at existing – but increased – and additional policies and projects (RRP, Climate Neutrality Roadmap, etc.), as well as new EU legislation and REPowerEU measures (envisaged after 2022). The framework conditions considered in the draft scenario include the evolution of macroeconomic and climate indicators (GDP, population, heating and cooling data, base fuel price forecasts, etc.), feasibility and economic cost projections, policies, EU-ETS trajectory, etc. Quantification of policy options is made using the model (B) EST.

Using the model, an analysis of the energy system was carried out and results were presented on the sectoral demand for energy by fuel, the electricity mix, electricity prices, CO2 emission levels from fuel combustion, greenhouse gas emissions from non-energy related processes, as well as impact on security of energy supply. The simulation of

emissions in other carbon sources/sinks (agriculture, waste, LULUCF) was also carried out using accounting methods and MAC curves.

(B) EST is a fully-fledged energy planning model tailored to the specificities of the Bulgarian energy system and designed by E3-Modelling to provide detailed projections of the energy system, forecasting of energy demand, energy sector planning, as well as impact assessments of national climate and energy policies with a 2 070 horizon. The model uses General Algebraic Modeling System (GAMS), a high-level programming system for mathematical modelling, widely used in energy and economic modelling. (B) EST succeeded key mechanisms for mathematical modelling of PRIMES, a large-scale applied energy system model, also developed by E3-Modelling, which is widely used by the EC to support impact assessment studies supporting the main EU policy initiatives, e.g. Winter Package, Green Deal, Fit for 55, Rehabilitation. The methodological model is user-driven and market-oriented, in the sense that it presents individual actors' solutions for energy demand and supply and balancing their solutions in simultaneous, price-free energy markets. The model is structured in a modular way and consists of two (2) key components: (I) a demand module, (ii) a supply module (electricity/heat, electronic fuels, bioenergy). The modules are performed sequentially by performing user-induced replicates. The balancing and reporting modules produce the results of the model and report them in user-friendly adaptive excel based files. The model includes a separate module flexibly linked to the key modules that simulates and calculates GHG emissions from all carbon sources and sinks.

(B) EST combines microeconomic bases with engineering details compatible with long-term time scale and sectoral resolution of available statistics for Bulgaria. The model horizon for this plan is until 2050, projections for a 5-year time scale and include: detailed energy balances, energy demand by sector, different energy saving options in terms of energy efficiency and the design of heat recovery of the electricity system and other fuel supply, investment and technology deployment, sectoral costs, total costs, consumer prices, emissions, as well as key energy and climate policies implemented at national level, such as: price signals, e.g. taxation, subsidies, emissions trading system (ETS); policies to promote technology; standards; infrastructure; RES and policies to support efficiency; environmental policies.

Table 16: *Types andnon-dictative inputs embedded in the model*

Sectoral projections
Fuel availability restrictions (e.g. RES potential by species, indigenous fossil fuel reserves available, import restrictions)
Taxes and subsidies
Amount of discounts
Technology Parties
Emissions, RES and EE
Emission targets, RES and EE

Visible or hidden costs (change)
External investment, decommissioning or retrofitting of plants

Source: (B) EST model

Energy price projections are derived from minimisation of energy supply costs and pricing behaviour in energy demand. When supply and demand curves are crossed at a certain price, this price is called an equilibrium price because it reflects market equilibrium; namely, the amount that consumers demand is equal to the quantity that producers offer. To model different energy system sectors, (B) EST uses modules that operate consistently and are repeated until they reach market equilibrium.

The modelling framework (B) EST has been calibrated to the latest available data using publicly available sources. The analysis is based on data from 2 022, as the latest available energy balance of the NSI is that of 2022. The data cover the state of play and past trends, future potential and existing and planned energy and climate policy initiatives.

4.1 projected evolution of the main externalities affecting the development of the energy system and greenhouse gas emissions

i. Macroeconomic forecasts (GDP and population growth)

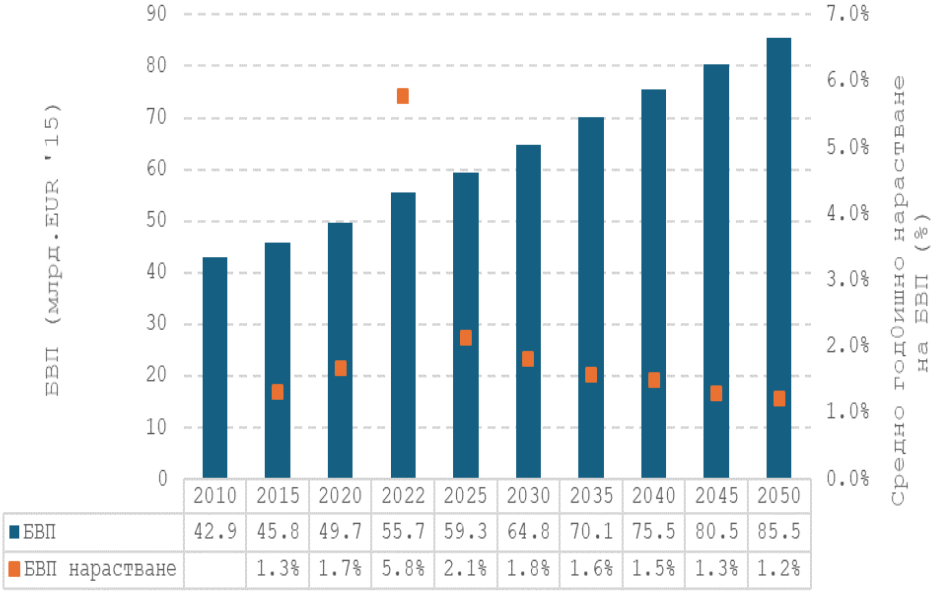
The macroeconomic forecast provides framework projections for Bulgaria's demographic and economic developments over the coming decades. This is a consistent set of projections for population development, GDP growth according to DG ECFIN's latest forecasts and the expected evolution of sectoral growth. Physical activity (industrial production, etc.) is similarly extracted on the basis of historical data and forecasts. The decoupling of value added growth from physical production, which is assumed, stems from the expectation that higher value-added products will be developed. The macroeconomic outlook provides a vision of the future structure of sectors and activities of the national economy and population dynamics. It is based on the latest demographic and economic forecasts provided by EUROSTAT and DG ECFIN. More specifically, the projections used until 2032 follow the 'very high' sensitivity scenario for migration from Ukraine according to EUROSTAT t + 10 forecasts (online data code: PROJ_STP22), whereas from 2033 onwards the annual growth rates of EUROSTAT EUROPOP2019 apply to the population level of the previous year in absolute terms.

Table 17: *GDP (billion EUR' 15) and average annual GDP growth (%), historical data (2010-2022) and forecast data (2025-2050)*

	2010	**2015**	**2020**	**2022**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
GDP	42.9	45.8	49.7	55.7	59.3	64.8	70.1	75.5	80.5	85.5
GDP growth		1.3 %	1.7 %	5.8 %	2.1 %	1.8 %	1.6 %	1.5 %	1.3 %	1.2 %

Source: (B) EST model, E3 Modeling

Figure 29: *GDP (billion EUR' 15) and average annual GDP growth (%), historical data (2010-2022) and forecast data (2025-2050)*



Source: Eurostat; (B) EST model, E3 Modeling

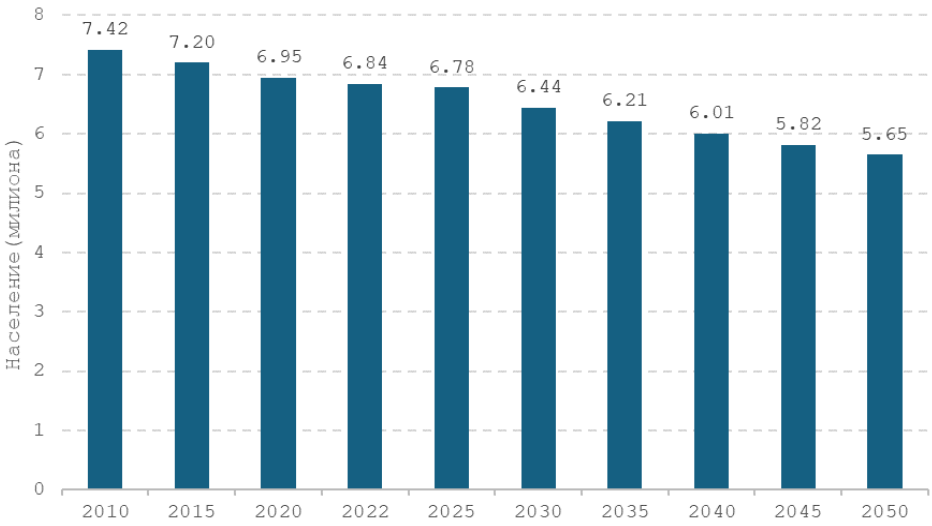
Table 18: *Population in Bulgaria, historical data (2010-2022) and estimated (2025-2050), (million inhabitants)*

2010	2015	2020	2022	2025	2030	2035	2040	2045	2050
7.42	7.20	6.95	6.84	6.78	6.44	6.21	6.01	5.82	5.65

Source: (B) EST model, E3 Modeling

The country's population projections follow a downward trend of – 0.68 % as an average annual growth rate. These population projections apply to both scenarios.

Figure 30: *Bulgarian population in Bulgaria, historical data (2010-2022) and estimated (2025-2050), (million inhabitants)*



Source: Eurostat; (B) EST model, E3 Modeling

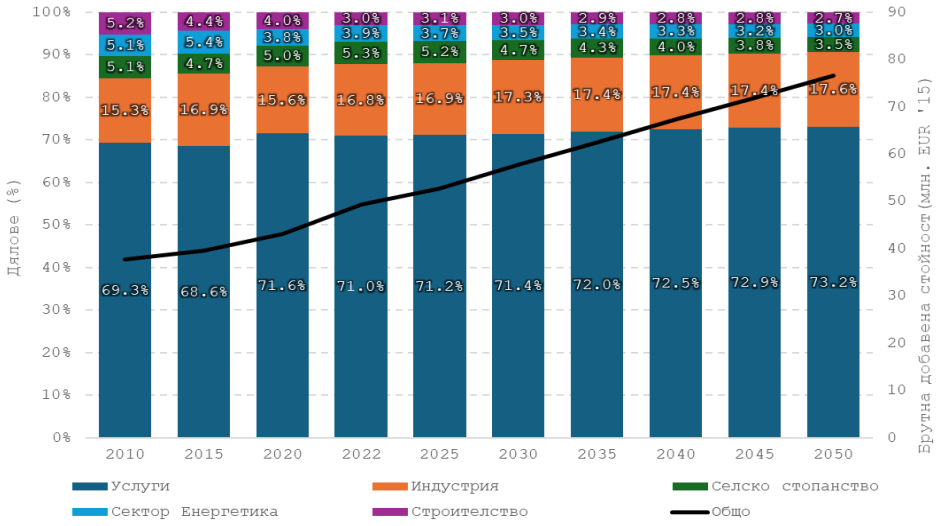
Short-term GDP projections (2023-2025) are derived from DG ECFIN's latest winter economic forecast for 2024 and for the longer term (2026-2050) from DG ECFIN's Ageing Report 2024. The economy contracted by – 4.0 % in 2020 as a result of the COVID-19 pandemic and recovered rapidly in 2021. The GDP growth rate is projected to be 1.93 % for the period 2023-2030 and 1.39 % for 2030-2050. Out of EUR 55.7 billion '2 015 in 2022, the Bulgarian economy is projected to grow to approximately EUR 64.8 billion' 2 015 in 2030, reaching an overall growth rate of EUR 85.5 billion in 2015. These GDP growth rates are valid for both WEM and WAM scenarios. Bulgaria's GDP per capita is expected to reach EUR 15 143 '2015 in 2050.

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

The projections for sectoral value added and the structure of the economy are based on current national economic trends, historical data as well as global economic trends (shifting towards more value-added services and products such as machinery, engineering, etc.) over the longer term and are common to both scenarios in the plan.

As shown in the following figure, no major structural changes are expected. Construction continues to some extent, while the agricultural sector has fallen from 5.3 % to 3.5 %. The services sector remains the dominant economic sector, generating 73.2 % of gross value added in 2050. Finally, industry slightly increased its share by 0.8 percentage points, with a slight shift from heavy industries to more knowledge-intensive and technology-intensive sub-sectors within manufacturing, such as engineering, etc.

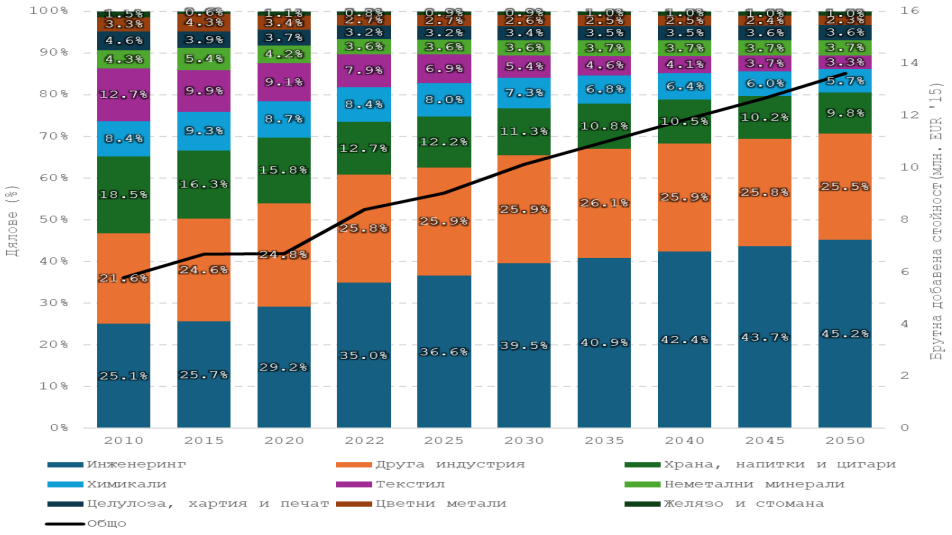
Figure 31: *Value added**structure, historical data and forecasts (EUR million' 15 and shares in%)***



Source: Eurostat; (B) EST model, E3 Modeling

Construction industries have seen minor improvements in sectoral activity over time. Non-metallic minerals form part of the materials used in buildings. Engineering has the highest share of value added in the manufacturing sector. Its output grew by 2.2 percentage points by 2050.

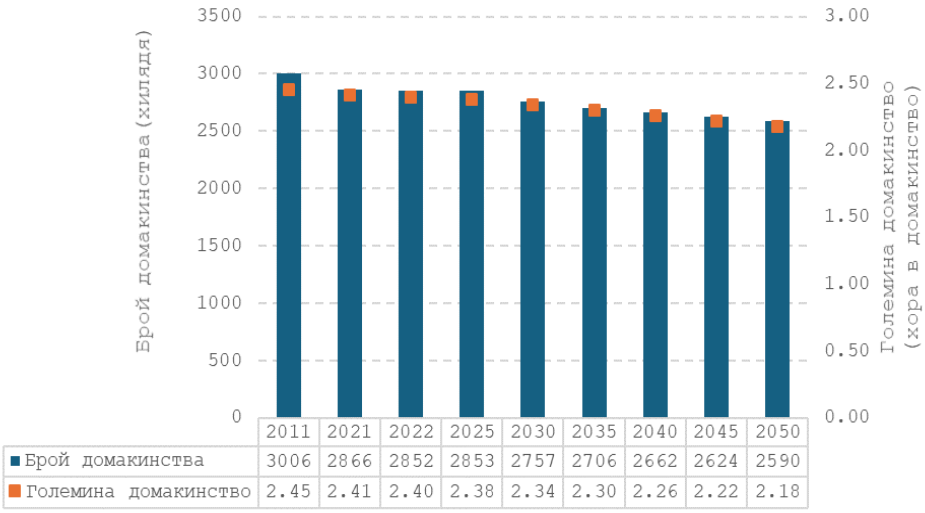
Figure 32: *Sectoral added value and structure of production sectors, historical data and forecasts (EUR million' 15 and shares in%)*



Source: Eurostat; (B) EST model, E3 Modeling

As of 2021, there were approximately 2 867 households in Bulgaria. The average size of a household decreased from 5.6 in 1900, to 2.9 in 2005 and to 2.4 in 2022. The decline in household size persists, resulting in 2.18 persons per household in 2050. The number of households will continue to decline after population decline, coupled with negative growth in household size.

Figure 33: *Household structure, historical data (2011-2021), valuation (2022) and projections (2025-2050)*

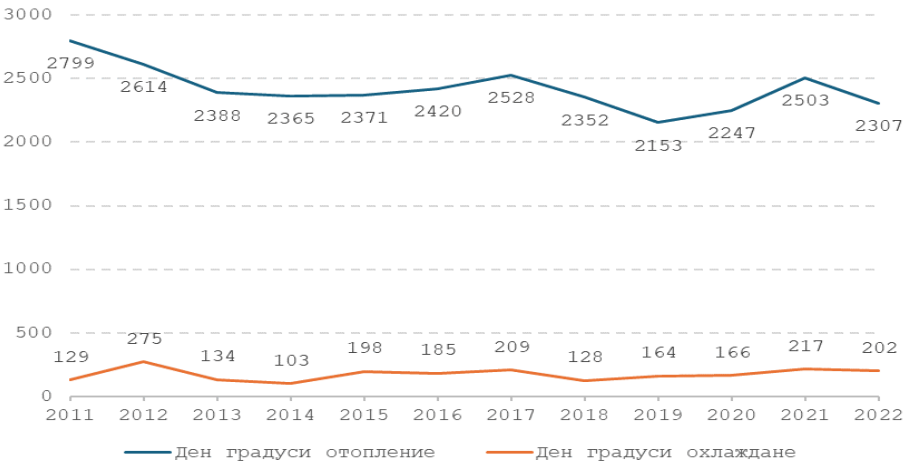


	2011	2021	2022	2025	2030	2035	2040	2045	2050
Брой домакинства	3006	2866	2852	2853	2757	2706	2662	2624	2590
Големина домакинство	2.45	2.41	2.40	2.38	2.34	2.30	2.26	2.22	2.18

Source: NSI, (B) EST model, E3 Modeling

The heating days trajectory shall be used as an indicator of the heating load arising from the outdoor temperature. The downward trend is projected to continue until 2050, leading to a decrease in heating needs and therefore useful energy for space heating. Conversely, the number of cooling days is assumed to increase, leading to higher air cooling requirements.

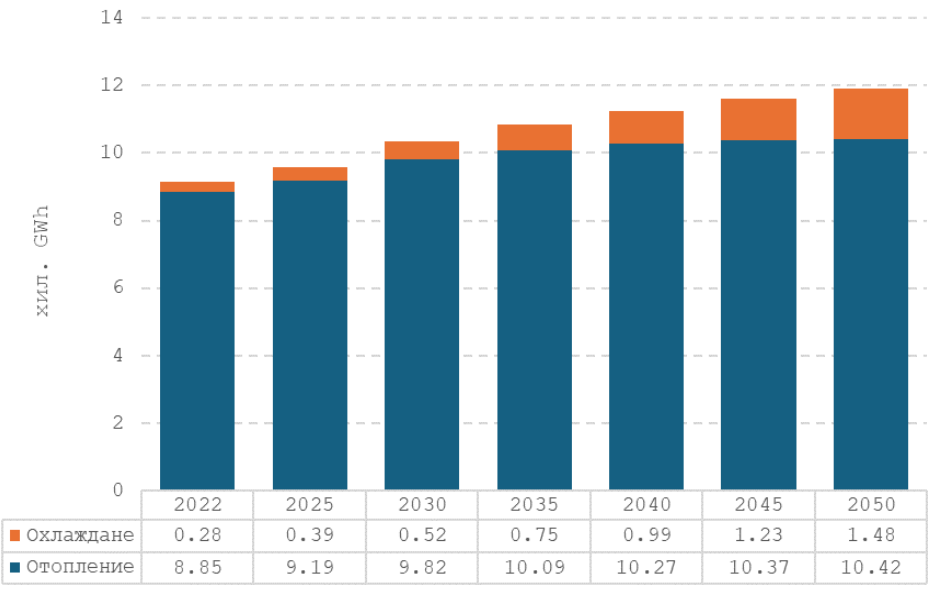
Figure 34: *Day degrees heating and cooling (number), 2011-2022*



Source: Eurostat; (B) EST model, E3 Modeling

Empirically, the useful energy for space heating has been reduced and useful air cooling energy has been increased in parallel.

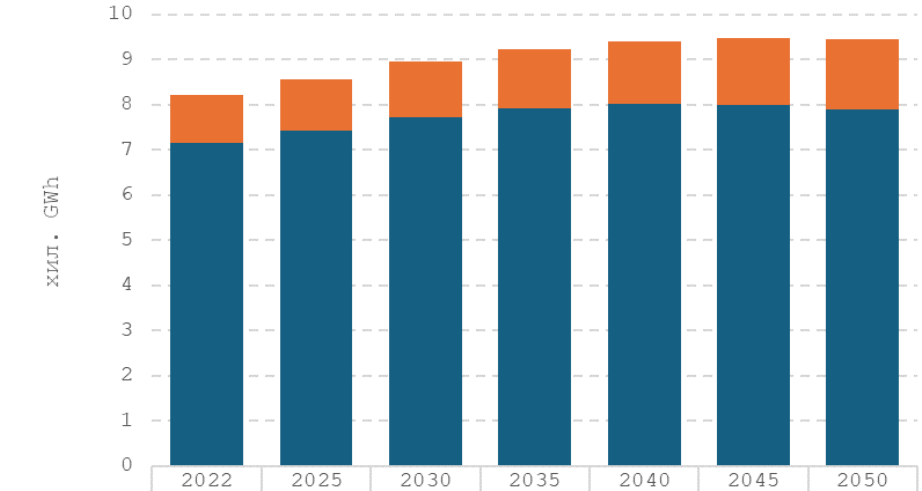
Figure 35: *Estimated energy consumption (thousand GWh) for residential heating, 2022-2050*



	2022	2025	2030	2035	2040	2045	2050
Охлаждане	0.28	0.39	0.52	0.75	0.99	1.23	1.48
Отопление	8.85	9.19	9.82	10.09	10.27	10.37	10.42

Source: (B) EST model, E3 Modeling

Figure 36: *Energy consumption (thousand GWh) for heating and cooling in the service sector, 2022-2050*



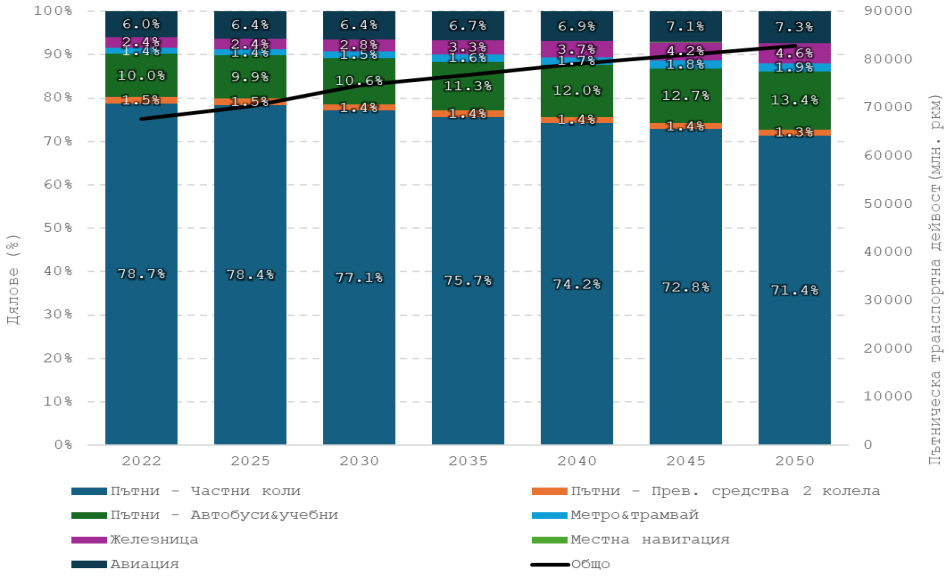
	2022	2025	2030	2035	2040	2045	2050
Охлаждане	1.05	1.14	1.24	1.31	1.36	1.47	1.55
Отопление	7.15	7.42	7.71	7.90	8.03	7.99	7.90

Source: (B) EST model, E3 Modeling

The main driver behind transport forecasts is the convergence of activity (pkm/chapter, tkm/EUR) with mobility trends in the EU. Passenger transport activity is expected to increase by 22.5 %, mainly due to private road transport, representing 78.7 % in 2022 and 71.4 % in 2050 of total passenger activity. This assumption takes into account the trend of increasing public transport activity, from 13.8 % in 2022 to 19.9 % in 2050, as a result of improvements and expansion of transport infrastructure. Aviation's share of activity is increasing in the long term. The growth of private passenger transport and

domestic aviation activity is mainly driven by both income growth and new infrastructure projects. Growth tends to stagnate after 2045. Motorisation factor (currently approximately 420 private cars per 1 000 inhabitants) is expected to rise to 529 cars per 1 000 inhabitants.

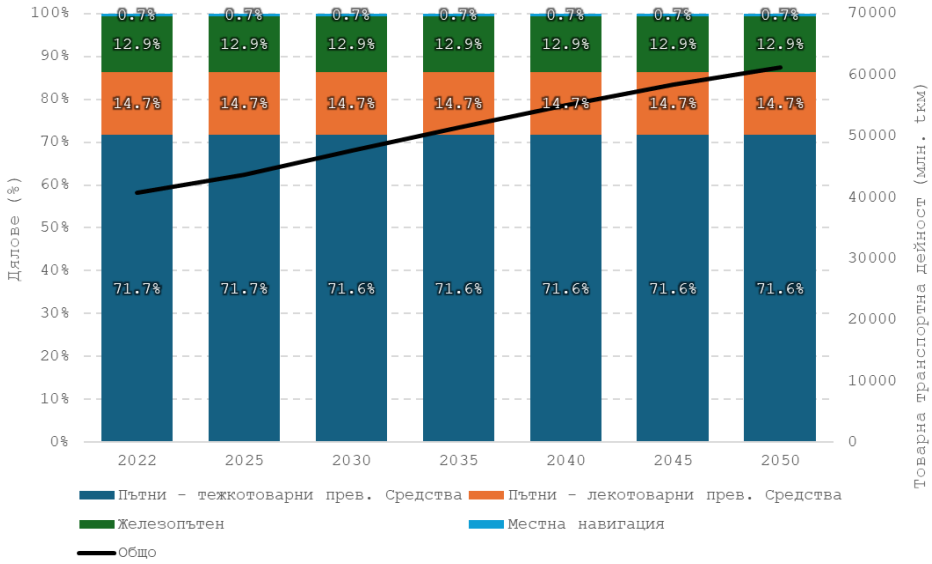
Figure 37: *Passenger transport, historical data and forecasts (million RMF and shares in%)*



Source: (B) EST model, E3 Modeling

Similarly, freight transport is projected to grow by 2050 due to high economic activity and demand for goods transport. Road transport remains the dominant mode, representing more than 85 % of total freight transport activity over the whole forecast period. It follows rail transport with close to 13 % and shipping with a 0.7 % share.

Figure 38: *Freight transport, historical data and forecasts (million tkm and shares in%)*



Source: Eurostat; (B) EST model, E3 Modeling

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

Alongside socio-economic projections, the model (B) EST uses international energy price projections. The projections are based on the REPowerEU projections for crude oil and hard coal, while for gas in the short term TTF Netherlands gas futures (lower than those in REPowerEU published earlier) were used. In the long term, the growth rates of the REPowerEU gas trajectory have been applied.

Long-term forecasting of fossil fuel prices depends on several variables, such as future global economic growth rates, development of new technologies, global climate change policies, resource owners' strategies, etc. In modelling fossil fuel prices are mainly the result of the balance between supply and demand in global or regional markets. They constitute an important marker at macroeconomic level as well as for the future of the energy system: any transition process from fossil fuels will have to be based on a comparative economic analysis of alternative pathways.

As shown in the following graph, fossil fuel prices are expected to return to pre-pandemic levels by 2030. After 2030, the trend continues to increase, albeit at a much slower pace until 2050, driven by assumed lower demand due to increased efficiency standards and gradual electrification in certain key sectors. The long-term increasing trend reflects the following:

1. The increasing production costs of these fuels, including the addition of new capacities and constraints, unconventional oil and gas resources, the development of new supply routes, as well as geopolitical parameters including OPEC countries' market strategy, transport costs, etc.;

2. In the long term, the balance of supply and demand in a context of increasingly expensive resources will be the main driver behind the price of oil. The price reduction

reduces investment in the exploration and development of new stocks as well as in the reorganisation of the upstream sector.

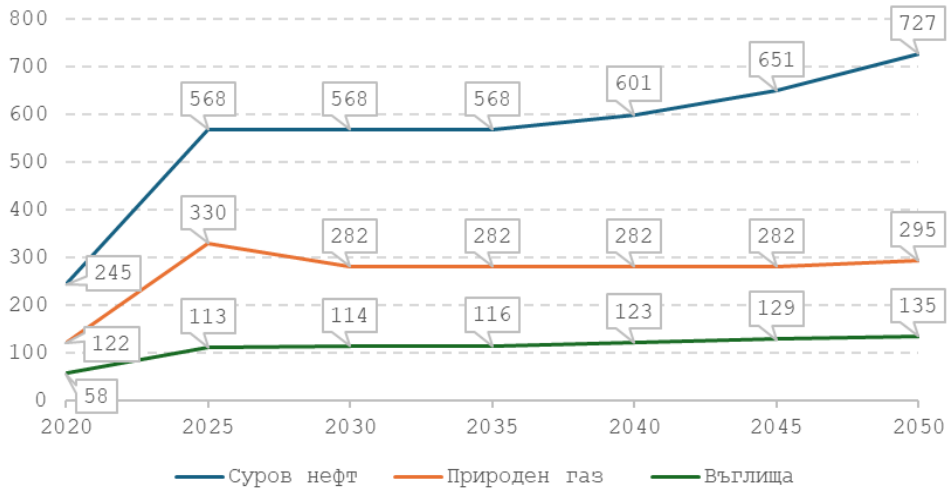
3. In the case of natural gas and pricing principles, they depend mainly on the price of competitors (e.g. oil) or on the output for which it is used (e.g. electricity). The pricing of imported gas is based on oil indexation of long-term contracts, while long-term price projections are based on a gradual development of market dynamics preceding recent developments in this sector.

Table 19: *International oil, natural gas and coal prices (EUR '15 per toe)*

	2020	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Crude oil	245	568	568	568	601	651	727
Natural gas	122	330	282	282	282	282	295
Coal	58	113	114	116	123	129	135

Source: Eurostat; (B) EST model, E3 Modeling

Figure 39*: International oil, natural gas and coal prices (EUR '15 per toe)*



Source: Eurostat; (B) EST model, E3 Modeling

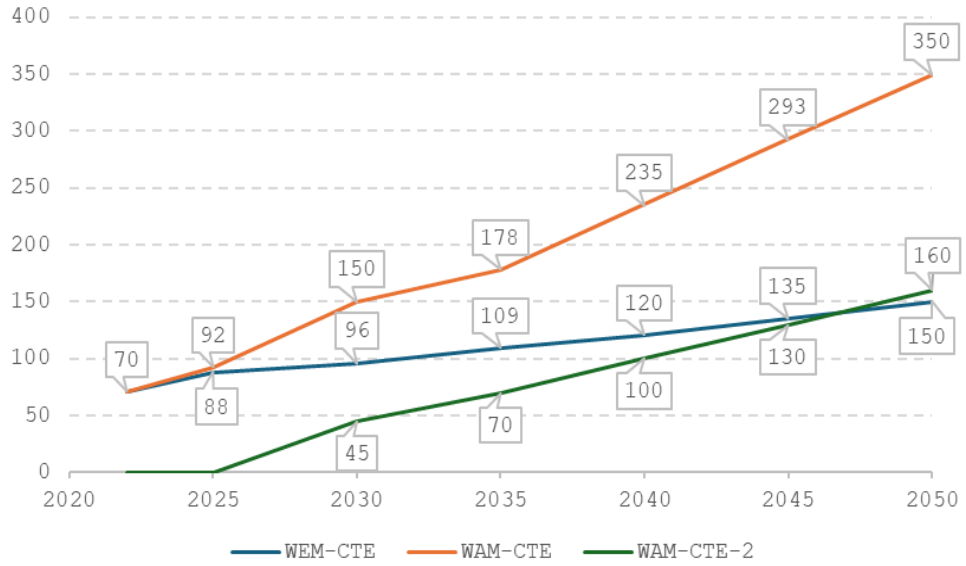
With regard to the price levels of *the EU ETS*, the WEM scenario follows the EUA price trajectory in the EU Reference Scenario 2020 over the long term, while in the medium term it takes into account current prices close to EUR 60-80 per tonne CO_2. For the WAM scenario, the ETS price projections follow an upward trend, reaching EUR 350 per tonne CO_2, leading to carbon neutrality in the future. The ETS price is treated in the model as an implicit equivalent emission reduction target. The ETS 2 scheme is assumed to be operational from 2027 onwards in the WAM scenario covering the construction sector and road transport.

Table 20: *Carbon prices in the EU ETS (EUR '15/тон EUA)*

2022	2025	2030	2035	2040	2045	2050
70	88	96	109	120	135	150

Source: Eurostat; (B) EST model, E3 Modeling

Figure 40: *EU**ETS emission price (EUR '15/тон EUA)***



Source: EU Reference 2020; EEX, Eurostat; (B) EST model, E3 Modeling

iv. Technology cost developments

As regards technologies in the energy sector, the table below includes the main power plant types included in the model (B) EST and the assumed development of overnight capital costs* until 2050. The evolution of technology costs is derived from the EU Reference Scenario 2020 and the ASSET study. For stationary energy uses, technologies are characterised by performance (simple, improved, advanced and best technologies), which have increasing capital costs and efficiency. The characteristics of the ordinary technology change over time, taking into account the expected technological progress.

* Overnight capital expenditure includes design, delivery and construction without taking into account financial costs during construction, site preparation and network development costs and other owner- https://acee.princeton.edu/wp-content/uploads/2015/06/Andlinger-Nuclear-Distillate-Article-6.pdf

Table 21: *Energy technologies, EUR' 15/kW*

Technologies in the energy sector	2020	2025	2030	2035	2040	2045	2050	2055
PUMPED	1000	950	900	898	895	893	890	888
NPP	5050	4913	4775	4700	4625	4613	4600	4600
Coal	1675	1675	1675	1675	1675	1675	1675	1675
Lignite	1900	1900	1900	1900	1900	1900	1900	1900
Lignite CHP	2240	2240	2240	2240	2240	2240	2240	2240
Lignite CCS	3550	3465	3380	3315	3250	3213	3175	3175
Lignite CCS	3974	3878	3783	3710	3638	3596	3554	3554

Coal CCS	3500	3405	3310	3261	3213	3163	3113	3113
CCS Coal – CHP	3970	3863	3755	3700	3644	3588	3531	3531
Conventional fuel steam turbine	1200	1200	1200	1200	1200	1200	1200	1200
Advanced gas system (peaks)	350	350	350	350	350	350	350	350
Advanced combined gas turbines	710	692	675	668	662	661	660	660
Advanced gas turbines, combined	932	908	885	877	869	868	866	866
CCGT CCS	1750	1688	1625	1563	1500	1500	1500	1500
CCGT CCS – CHP	2296	2214	2132	2050	1968	1968	1968	1968
Open cycle steam turbine solid conventional biomass	2000	1900	1800	1750	1700	1700	1700	1700
Solid conventional CCS steam turbine biomass	3925	3744	3563	3380	3198	3150	3103	3103
Steam turbine solid conventional biomass – CHP	2265	2152	2039	1982	1926	1926	1926	1926
Steam turbine solid conventional biomass with CCS – CHP	4446	4240	4035	3828	3622	3568	3514	3514
Advanced biogas system	500	483	465	461	458	454	450	447
Advanced biogas system CHP	643	621	598	594	589	584	579	575
Small waste incineration plants	1840	1827	1814	1810	1806	1802	1799	1799
Storage/commercial batteries (EUR '15/kWh)	1200	980	760	740	720	700	680	660
CH plant plants – solid fuels	1932	1932	1932	1932	1932	1932	1932	1932
CHP oil/gas mills	756	756	756	756	756	756	756	756
CHP plant – biomass	3300	3131	2962	2815	2668	2574	2480	2403
Mill boilers – coal/lignite	373	391	409	409	409	409	409	409
Factory boilers – oil/gas	168	176	184	184	184	184	184	184
Factory boilers – biomass	737	772	807	807	807	807	807	807
Factory boilers – electricity	344	338	333	333	333	333	333	333
Hydrogen production capacity	1271	938	605	552	500	447	395	342
Gas production capacity	2782	2132	1483	1359	1235	1110	986	861
Fluid production power	2777	2171	1566	1448	1330	1212	1094	976

Source: EU Reference Scenario 2020; (B) EST model, E3 Modeling

Table 22: *Capital expenditure of key heat technologies in EUR' 15/kW*

Technologies in the heat sector	2020	2025	2030	2035	2040	2045	2050	2055
District heating boilers – lignite	419	451	483	483	483	483	483	483
Heating boilers – fuel oil	229	246	264	264	264	264	264	264
District heating boilers – gas	137	148	158	158	158	158	158	158
District heating boilers – biomass	791	852	913	913	913	913	913	913
Toplofikatsia-electricity	850	850	850	850	850	850	850	850
Toplofikatsia – Solar	700	675	650	625	600	550	500	500
Toplofikatsia – geothermal	1625	1581	1538	1528	1519	1509	1500	1500

Source: EU Reference Scenario 2020; (B) EST model, E3 Modeling

Table 23: *Capital expenditure on key demand – side technologies of building equipment (EUR '15/kW)*

Side-technologies	Usually	Improved	Surgeon	Future
Households				
Lighting	34	45	77	89

Machinery*	163	205	260	424
White goods* *	555	685	1063	1356
Cooking – electric stoves	183	188	201	231
Cooking – gas stoves	191	196	210	240
Cooking – biomass stoves	209	215	230	264
Heating – fuel oil/gas boilers	159	183	202	250
Heating – wood stoves	287	333	378	413
Heating – heat pumps	1000	1322	1674	1877
Heating – electric convectors, etc.	60	76	78	80
Heating – district heating	91	105	120	131
BC – solar collectors	254	292	330	356
DWU – Electric	110	139	144	147
DWU – fuel oil/gas boilers	191	219	243	264
DWF – wood	492	570	648	708
DWU – district heating	85	89	91	92
Air heating/cooling	450	540	594	653
Services				
Lighting	9	12	21	24
Electricity	1344	1392	1584	2201
Heating – fuel oil/gas boilers	119	137	152	165
Heating – wood stoves	308	356	405	443
Heating – heat pumps	700	912	1121	1220
Heating – electric convectors, etc.	518	675	830	903
Heating – district heating	73	84	96	105
BC – solar collectors	203	234	264	284
DWU – Electric	88	111	115	118
DWU – fuel oil/gas boilers	143	165	182	198
DWF – wood	369	428	486	531
DWU – district heating	68	71	73	74
Air heating/cooling	518	675	830	903

Source: EU Reference Scenario 2020; (B) EST model, E3 Modeling

** Machinery is most ICT-connected appliances such as laptop, TV, vacuum cleaner, etc.*

** * white goods includes washing machines, refrigerators, freezers, dryers and dishwashers*

Table 24: *Capital expenditure on key transport equipment technologies (EUR '15/автомобил)*

Technology of transport machinery	Usually	Improved	Surgeon	Future
Private cars – diesel	19 974	23 581	33 739	79 677
Private cars – petrol	17 324	17 912	21 159	80 321
Private cars – gas	20 911	21 583	35 186	88 126
Private cars – Hybrid Diesel	27 007	28 230	56 152	95 773
Private cars – hybrid petrol engine	24 416	24 649	46 209	86 391

Private cars – electric only	29 923	33 026	36 365	43 750
Private cars – fuel cell	45 747	47 422	49 138	49 653
Two-wheel gasoline	4 073	4 352	4 455	4 719
Two-wheel – electric	5 525	5 855	5 944	6 031
Light lorries – diesel	21 231	26 917	36 867	111 419
Light lorries – petrol	17 408	24 328	32 775	108 233
Light lorries – gas	19 214	22 289	34 581	101 396
Light lorries – Hybrid Diesel	29 234	32 298	72 498	110 253
Light lorries – hybrid petrol engine	25 953	37 090	61 369	99 214
Light lorries – electric only	30 262	33 408	36 793	44 277
Light lorries – fuel cell	46 397	50 381	51 497	52 016
Heavy lorries – diesel	91 547	96 460	121 762	229 482
Heavy lorries – gas	108 716	113 629	138 931	246 650
Heavy lorry – electric	193 760	208 128	222 496	270 681
Heavy lorries – fuel cell	323 035	334 602	337 123	338 250
Buses – diesel	285 454	295 140	324 190	397 390
Buses – gas	307 117	314 954	345 854	419 054
Buses – Electric	437 007	459 423	482 466	502 852
Buses – Fuel Cell	621 765	625 638	626 412	627 187
Passenger rail – diesel	8 519 858	9 500 629	13 032 208	33 803 144
Passenger rail – electric	11 629 606	13 438 234	30 819 532	44 583 806
High speed passenger rail	27 182 773	30 705 644	41 248 474	90 072 904
Passenger rail – fuel cell	13 791 767	15 037 837	18 310 923	40 016 551
Rail freight transport – diesel	8 800 783	11 965 881	17 917 028	48 188 061
Rail freight transport – electric	11 584 030	14 432 619	20 621 684	49 938 085
Rail freight transport – fuel cell	15 160 900	18 101 728	24 320 677	55 953 907
Passenger water – fuel oil	6 455 251	7 819 269	10 727 520	20 957 265
Passenger water – gas	7 515 615	9 288 630	11 787 884	22 017 629
Passenger water – electric	9 081 146	9 516 043	9 950 940	16 734 969
Passenger water – fuel cell	12 549 344	12 786 960	13 910 785	15 034 610
Freight water – fuel oil	7 015 484	9 499 713	14 141 124	18 782 536
Freight water – gas	10 553 001	14 141 124	16 461 830	18 782 536
Freight water – electric	15 889 616	16 427 667	16 965 719	23 133 960
Freight water – fuel cell	16 512 313	16 742 329	18 230 102	19 717 874
Aviation – kerosene	109 132 560	121 410 976	155 192 658	288 102 025
Aviation – HybridElectric	125 797 532	148 859 080	187 765 103	215 141 235
Aviation – Electric only	191 636 992	203 335 445	226 935 204	308 771 871

Source: EU Reference Scenario 2020; (B) EST model, E3 Modeling

4.2 decarbonisation

4.2.1 greenhouse gas emissions and sinks

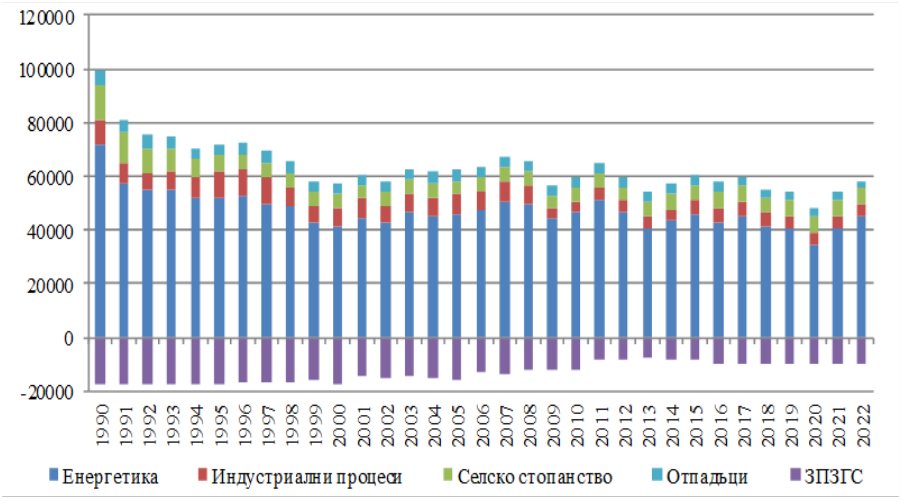
i. The current share of energy from renewable sources in gross final consumption of energy, as well as in the different sectors (heating and cooling, electricity and transport), as well as for each technology in each of the sectors

In 2022, Bulgaria's greenhouse gas emissions amounted to 58 421 Gg CO_2, not taking into account the LULUCF sector. Emissions decreased by 48.59 % compared to the base year (1988) and increased by 1.08 % compared to 2021 emissions.

The main reasons for reducing greenhouse gas emissions in Bulgaria are:

- Structural reforms in the economy due to the transition from a planned to a market economy;
- Reducing electricity production from thermal power plants and increasing the share of hydropower and nuclear power;
- Structural changes in industry (including a decline in the production of energy-intensive businesses and improvements in energy efficiency);
- The introduction of energy efficiency measures in the housing sector;
- Switching from solid and liquid fuels to natural gas in energy consumption;
- Decline in cattle and sheep populations and fertiliser use.

Figure 41: *Total Bulgarian emissions by sector 1988-2022, Gg CO_2 eq*



Source: National Greenhouse Gas Inventory Report

The energy sector (GHG emissions from fuel combustion) accounted for the largest share of total GHG emissions in 2022, at 74.0 %. The agriculture sector ranks second with 10.2 %, the industrial processes and solvent use sector ranks third with 7.8 % and the Waste sector at 4.8 %.

The share of emissions in the ETS in total GHG emissions was 53.5 % in 2022, while the share of non-ETS emissions was 46.5 %.

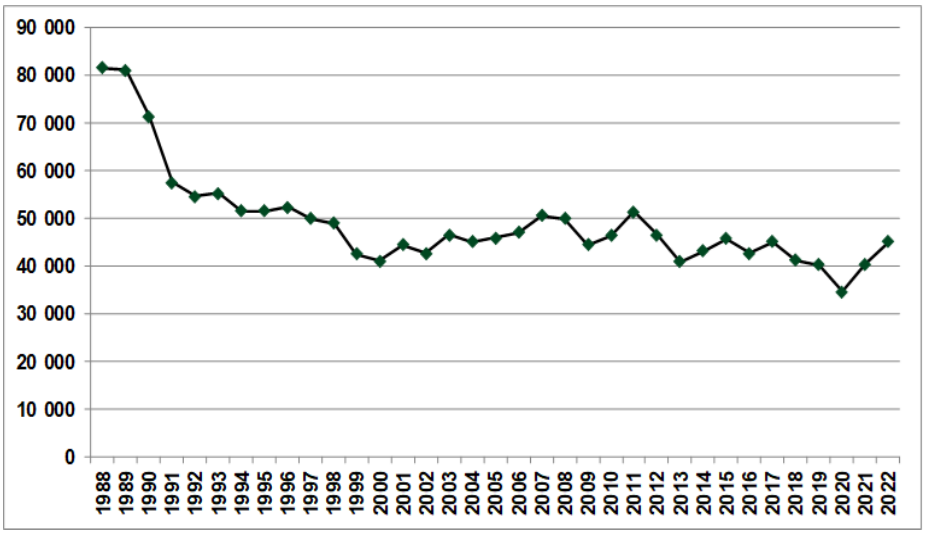
Energy sector

In 2022, emissions from the Energy sector decreased by 44.71 % compared to the base year (45 094 Gg CO_2eq in 2022 compared to 81 562 Gg CO_2eq in 1988). Compared to the previous year, emissions in 2021 increased by 16.6 %.

The main source of emissions in the sector is the combustion of solid fuels, accounting for 50.5 % of the sector's emissions in 2022, followed by liquid and gaseous fuels with 49.5 %.

GHG emissions between 1988 and 2022 are determined by a significant reduction in emissions from fuel combustion in energy sectors (45.5 %) and energy use in manufacturing and construction (75.08 %) and other sectors (commercial, residential, forestry) of 76.8 %, as well as a clear increase in greenhouse gas emissions from transport of 40.7 %).

Figure 42: *GHG emissions from the Energy sector 1989-2022, Gg CO2eq*



Source: National Greenhouse Gas Inventory Report

Energy industries

The fuel consumption of the following subsections is included in this section:

- Electricity generation and transmission, including cogeneration;
- Production and transport of heating and cooling for public use;
- Natural gas transport (maintenance of compressor station pressure).

For 2022, the overall trend in category 1.A.1 is a 37.1 % reduction in emissions compared to the base year and an increase of 22.2 % compared to 2 021.

Table 25: *Emission trend in the energy industry sub-sector, Gg CO2 eq*

Year	1988	1990	2022
Aggregated emissions, Gg CO_2 eq	42 167	36 526	27 021

Manufacturing or construction

The manufacturing and construction sub-sector comprises the following groups*:*

- Iron and steel;
- Non-ferrous metals;
- Chemicals;
- Pulp, paper and printing services;
- Processing of food, beverages and tobacco products;
- Non-metallic minerals;
- Other.

Following the restructuring of the industrial sector in the country, the overall trend in this category shows a reduction in emissions of 75.1 % compared to the base year and a decrease of 5.6 % compared to 2 021.

Table 26: *Emission trend in manufacturing and* construction subsector, Gg CO2 eq

Year	1988	1990	2022
Aggregated emissions, Gg CO_2 eq	17 495	17 757	4 360

Transport

Fuel consumption in the transport sector decreased by 49 % between 1988 and 1991 as the economy collapsed. Fuel consumption (diesel) has steadily increased since 1991, mainly due to road transport. Although there has been a decrease in 2013, the use of fuel (diesel) for road transport has started to increase again since 2014.

Table 27: *Emission trend in the transport subsector, Gg CO2 eq*

Year	1988	1990	2022
Aggregated emissions, Gg CO_2 eq	7 066	6 516	9 940

Other sectors

Other sectors include the following categories:

- services and public buildings;
- residential;
- agriculture, forestry, fishing.

Table 28: *Emission trend in Other sectors, Gg CO2 eq*

Year	1988	1990	2022
Aggregated emissions, Gg CO_2 eq	6 934	8 146	1 606

Industrial Processes and Solvent Use Sector

A constant downward trend in emissions in this sector has been observed since 1988. Emissions in 2022 decreased by 65.28 % compared to the base year 1988.

In 2022, the IFSD sector accounted for 7.83 % of total national greenhouse gas emissions (excluding LULUCF), compared to 11.6 % in base year 1988. In 2022, the RFSD GHG emissions were 4 575 Gg CO2, compared to 13 177 Gg CO2 in 1988 base year.

In 2022, the most important category was mineral products (mainly clinker and lime production), which accounted for 57.95 % of total IFSD emissions. The second category is the chemical industry (production of ammonia and nitric acid) with 21.77 %, followed by the use of products used as substitutes for ozone depleting substances with a share of 15.34 % and finally with 3.31 % production of metals (steel).

GHG emissions from the IFSD sector vary over time and reach the lowest level in 2009. The reduction in 2022 for the whole sector was 65.28 % of the base year, while the largest decrease was observed in the metal manufacturing sector, at 96.2 %.

This was mainly due to the economic crisis and in particular the global economic crisis in 2009. After 1996, a privatisation process started, leading to a reduction in the production of enterprises. This process is followed by the restructuring and modernisation of production, while at the same time some of the companies are no longer operating.

The overall reduction in emissions over the years is also influenced by the introduction of better technologies at company level.

Table 29: *Emission trend in industrial processes and solvent use sector, Gg CO_2 eq*

Year	1988	1990	2022
Aggregated emissions, Gg CO_2 eq	13 177	9 814	4 575

Agriculture sector

The overall reduction in emissions in the sector has been 56.36 % since 1988. In 2022, agriculture contributed 11.60 % of total GHG emissions in Bulgaria (excluding LULUCF).

The reduction in emissions until 2000 was mainly due to a systematic reduction in the area of agricultural land due to abandonment of arable land and the decline in livestock population. Another driver for reducing emissions is the reduction of fertiliser use.

Table 30: *Emission trend in the agriculture sector, Gg CO_2 eq*

Year	1988	1990	2021
Aggregated emissions, Gg CO2 eq	13 619	12 362	5 943

Land use, land use change and forestry sector (LULUCF)

The LULUCF sector acts as a GHG sink for Bulgaria through two categories – Forests and Passiasts – which absorb CB_2. All other categories (arable land, Places, Water areas) are emission sources of CO_2. The net removal of CB_2 from LULUCF decreases by 46 % compared to the base year 1988. The main reason for the overall reduction in the removals of CO_2 emissions from LULUCF is due to the reduction in removals from the category Forests and the slight increase in emissions from the categories of arable land, Settled sites, Water area.

The main reason for the decline in forest uptake was the observed decline in forest growth rates, as the average age of forests increased steadily over the reporting period. Despite a decrease, the share of removals in total GHG emissions (in CO_2ff) is still significant. The reason for this is that emissions in other sectors have also decreased significantly. The base year removal share is 15.6 % of total CO_2 emissions, while in 2022 the share is 16 %.

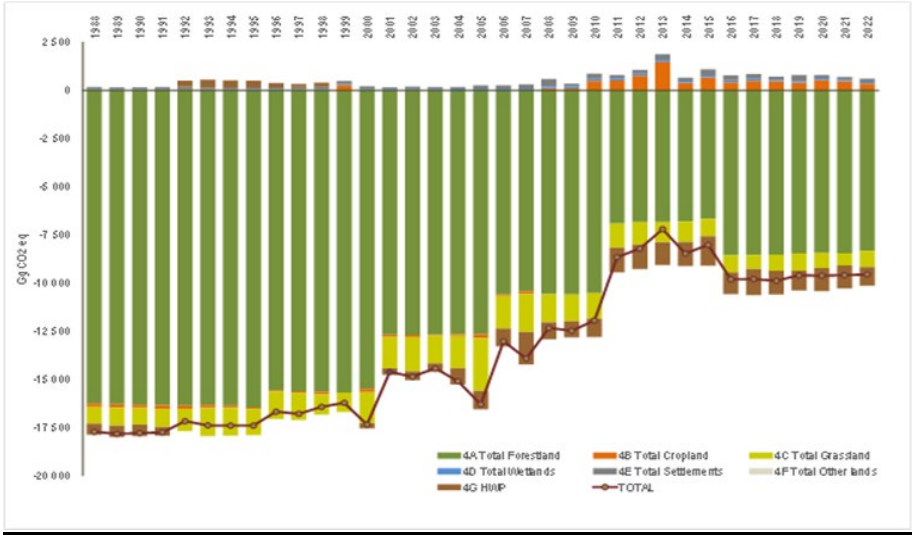
Compared to the base year, there has been an increase in emissions in cropland, settlements and wetlands. Total emissions from cultivated land fluctuate throughout the period. Urban emissions have been increasing over the last few years due to changes from other land uses to settlements in line with increased infrastructure activities since Bulgaria's accession to the EU.

Arable agricultural land decreases compared to the base year. The total arable area is 16.23 % lower than in the base year, ranging from 4 363 kha in 1988 to 3 655 kha in 2022. Non-annual crops account for 95 % of the total arable land area and the remaining 5 % refer to permanent crops. As the land representation calculations for submission of information for 2020 change the whole time series concerning some of the issues related to methodological changes in agricultural statistics (between, before and after 2000) and there are some differences in definitions addressed by interpolation between data in 1988 (before the land reform that started in 1991) and 1998 (which is the first year of new BANCIK statistics), this presentation and conclusions on arable land includes only used (managed) arable land, with all secondary grassland and marginal arable land reported in another category.

A major problem in presenting the land use model is limited information on land-use changes between certain categories. Activity data providers identify the total area for each individual land use category, but do not provide detailed information on changes in area between each category. Thus, a combination of approaches under the 2006 IPCC Guidelines was used for the calculations. Where data are not available to complete the information, information from available statistics as well as probabilistic assumptions about the known land-use change model are possible.

The estimation of emissions/removals from the arable land category shall be based on estimates of carbon stock changes in living biomass and soil. Changes in biomass stocks shall only be estimated for permanent crops. For annual crops, the increase in biomass stocks in one year is assumed to be equal to biomass losses from harvest and mortality in the same year – therefore there is no net accumulation of carbon stocks of biomass. The area with immature perennial crops accumulates carbon at a rate of approximately 0.43 t C/ha/y for orchards and 0.28 t C/ha/y for vineyards.

Figure 43: *Emissions and sinks in LULUCF 1988-2022, Gg CO_2 eq*



Source: National Greenhouse Gas Inventory Report

Waste sector

The GHG emissions emitted by the waste sector are CO_2, COP_4 and N_2O. The main share of CH_4 in the sector is due to landfilling of municipal solid waste. N_2O is released from waste water treatment and treatment and biological treatment and incineration of waste. Co_2 is released during waste incineration.

Trends take into account the current state of waste management in line with current legislation, which aims at reducing landfilling and follows the waste management hierarchy.

The measures implemented to reduce GHG emissions in the sector are mostly related to the management of municipal solid waste.

The basic principle of waste management, which is included in the Bulgarian waste management policies, is compliance with the waste hierarchy:

Prevention – > Prepare for re-use – > Recycling – > Other use – > Depot

Good waste management reduces the pressure associated with the "disposal" of waste, especially the consequences of landfilling. The EEA assesses that improved waste management significantly reduces annual net GHG emissions, with a significant part of this reduction achieved since 2000. The main contributors to this are reducing methane emissions from landfills and avoiding emissions through recycling. As an additional tool to increase recycling practices, the fact that recycled materials meet a significant part of the demand for some materials. Waste represents a loss of material resources (through metals and other recyclable materials) and at the same time has potential as energy sources. The challenges in waste management are high. The implementation of waste treatment activities such as reuse and recycling is environmentally sound, leading to waste being diverted from landfills.

Emissions from the waste sector decreased by 46.85 % in 2022 (2 808 Gg CO_2 eq. in 2022 compared to 5 284 Gg CO_2 eq. in 1988) compared to the base year.

Table 31: *Emission trend in the Waste sector, Gg CO2 eq*

Year	1988	1990	2022
Aggregated, Gg CO_2 eq	5 284	4 882	2 808

Summary of historical trends in GHG emissions

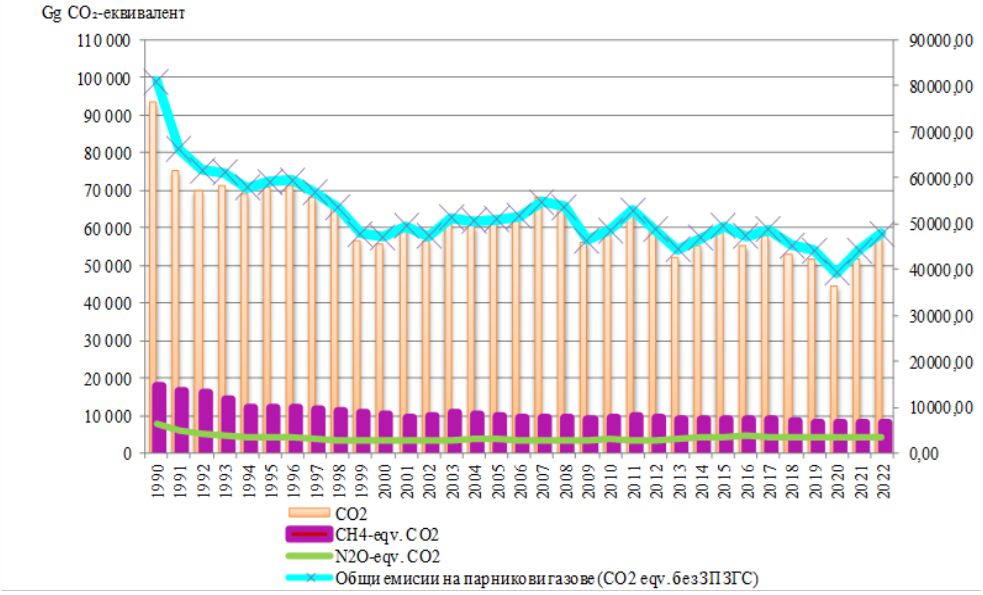
The country's total GHG emissions reduction from base year to 2021 is 52.55 %.

Table 32: *Bulgaria's emissions and sinks by sector, Gg CO_2eq*

Sectors	1988	1990	1995	2000	2005	2010	2022	Change 1988/2022 %
Energy	81562,45							
IFSD		71512,07	51667,70	41081,50	45991,28	46371,11	45094,11	— 44,71
Agriculture	13176,76	9813,72	10270,42	7172,18	7509,51	4087,85	4574,92	— 65,28
LULUCF	13618,74	12362,04	5829,84,	5063,97	4964,27	5172,66	5943,22	— 56,36
Waste	— 17708,03	— 17777,62	— 17394,06	— 17341,96	— 16294,58	— 11937,08	— 9540,04	— 46,13
Total (excluding LULUCF)	5284,33	5258,26	4443,13	4194,27	3882,38	3732,32	2808,40	— 46,85

By 2021, more than 70 % of GHG emissions come from the energy sector, the transition of this sector plays the main role in reducing GHG overall.

Figure 44: *Total GHG emissions, 1988-2022 CO_2 eq*



Source: National Greenhouse Gas Inventory Report

ii. Sectoral projections under existing national and EU policies and measures until 2040 (including 2030)

Projections of greenhouse gas emissions in the Energy sector

The projections for greenhouse gas emissions for the energy sector are based on an analysis of the change in the country's energy balance until 2030, based on existing measures planned by Bulgaria and provided as underlying assumptions.

Projections shall take into account all existing greenhouse gas emission reduction measures and existing measures to achieve the RES and energy efficiency targets provided in detail in the relevant sections of this plan.

The energy industries sub-sector comprises the following activities:

- Electricity generation and transmission, including cogeneration;
- Production and transport of heating and cooling for public use;
- Natural gas transport (maintenance of compressor station pressure).

The energy industries sector consists of large scale electricity, heating and cooling generation facilities. This is the sector responsible for the highest amount of GHG emissions. This sector is projected to continue to emit most of its emissions.

Manufacturing and construction subsector

Forecasts for this sub-sector are based on economic development expectations and forecasts, the share of individual sub-sectors, forecasts for fuel use, as well as general projections for the use of some of the main energy sources.

Transport Sector

The forecast for the development of the transport subsector has been prepared in line with the forecast of fuel use in the sector.

Projections of CO_2 emissions from the transport subsector shall be calculated on the basis of projections of energy consumption in the transport sector. The transport sector is divided into four sub-sectors: road traffic, air traffic, rail traffic and shipping.

Projections of greenhouse gas emissions and sinks in the LULUCF sector

The main category contributing to GHG absorption is the category Forests. All other land categories (arable land, Places, Water areas) are sources of CO_2 emissions. The main reason for the overall reduction in the removal of CO_2 emissions from LULUCF is due to the reduction of removals by the category Forests and the slight increase in emissions from the categories of cultivated land, Settled sites, Water areas.

The decline in forest uptake is the observed decline in forest growth rates and the average age of forests.

The increase in biomass use is expected not to affect land use and thus the LULUCF sector, as land earmarked for energy crops is not expected to increase significantly. It is assumed

that Bulgaria will use the untapped potential of biomass for the production of biomass, which includes biodegradable fractions of products, waste and residues of biological origin from agriculture (including vegetal and animal substances), forestry and related industries, including fisheries and aquaculture, as well as biodegradable fractions of waste, including industrial and municipal waste of biological origin, complying with the sustainability criteria set out in Article 29 of Directive (EU) 2018/2001.

Overall, land use is not projected to undergo significant changes in the next 10 years.

Forest ecosystems contribute most to the uptake of GHG by all ecosystems.

Projections of greenhouse gas emissions in the Waste sector

The main GHG emissions emitted by the Waste sector are CO_2, COP_4 and N_2O. The main share of AN_4 in the sector is due to landfilling of municipal solid waste. N_2O is released from waste water treatment and treatment and biological treatment and incineration of waste. The forecasts take into account the current state of waste management in accordance with the legislation in force.

For INECPs, the relevant measures of the National Waste Management Plan and the Third National Climate Change Action Plan are scheduled to continue until 2030 to be updated and built upon the progress of their implementation.

The NMSP plays a key role in achieving resource efficiency and sustainable waste management, as the current situation shows that there is significant potential in Bulgaria to improve waste prevention and management, better use of resources, open up new markets and create new jobs, while reducing harmful impacts of waste on the environment.

The fourth NMA is a plan for the transition from waste management to efficient use of waste as a resource and sustainable development by preventing its generation as far as possible. The successful implementation of the plan is envisaged to prevent and reduce the harmful impact of waste on the environment and human health and to reduce the use of primary natural resources.

The continued implementation of the measures of the National Waste Management Plan as well as the Third National Climate Change Action Plan will reduce greenhouse gases.

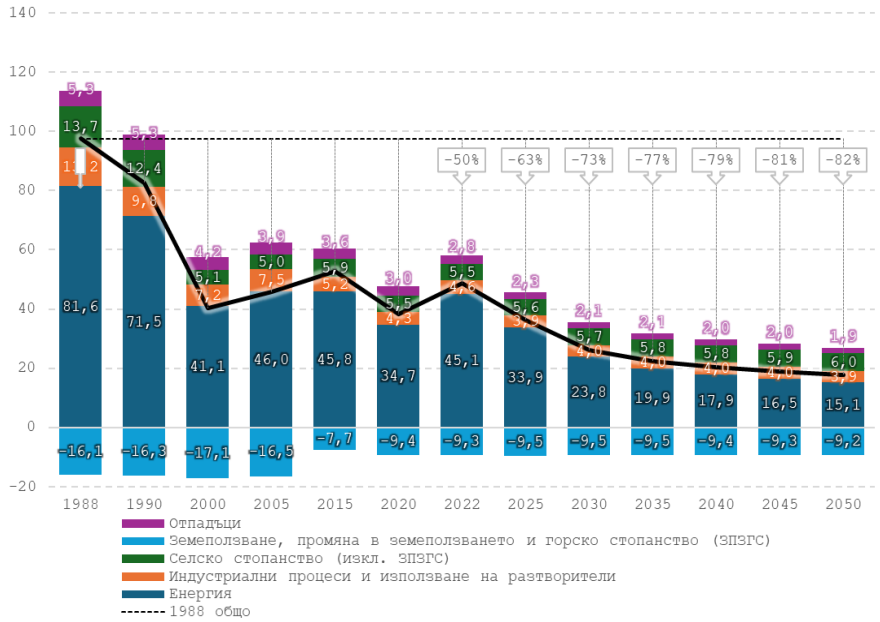
Projected emissions in the sector imply the implementation of the programme to reduce the amount of biodegradable waste to landfills as well as the capture and incineration of methane in landfills. But good practices can also ensure that about 50 % of the gas generated is captured and incinerated.

Projections of greenhouse gas emissions under scenarios with existing measures

In 2030, the WEM scenario projects a 46 % reduction in net greenhouse gas emissions compared to 2022 levels or a 73 % reduction compared to 1998, reaching 26.19 MTN CO_2eq. This reduction is mainly due to the energy sector, which historically accounts for more than 84 % of Bulgaria's net greenhouse gas emissions. By 2030, greenhouse gas emissions from the energy sector are projected to decrease by 47 % compared to 2022 (or 71 % compared to 1988), reaching 23.84 Mt CO2-eq. This transition originates from

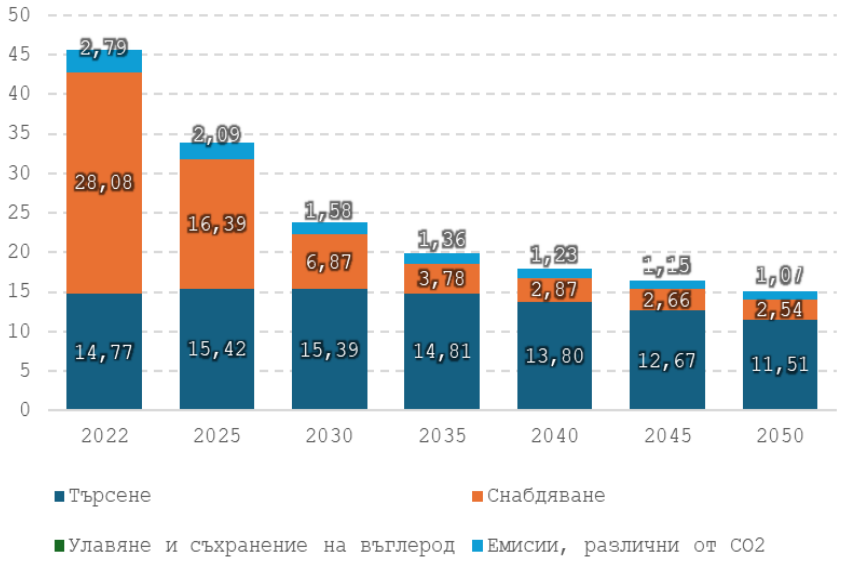
the supply sector and the reduction of CO_2 emissions due to the increased penetration of variable RES (see also sections 6.2 and 6.3). Under this scenario, the country's net greenhouse gas emissions are projected to decrease at an average annual rate of 3.5 % from 2022 to 2050, eventually reaching 17.73 Mt CO 2-eq by the end of the projection horizon, a reduction of 82 % compared to 1988 levels.

Figure 45: *GHG emissions by GHG sources and removals in Bulgaria, historical data (1990-2022) and projections (B) EST WEM (2025-2050) (ktn CO_2-eq)*



Source: MOEW; (B) EST model, E3-Modelling

Figure 46: *Energy related greenhouse gas emissions in Bulgaria (2022) and projections (B) EST WEM (2025-2050) (MTN CO2-eq)*



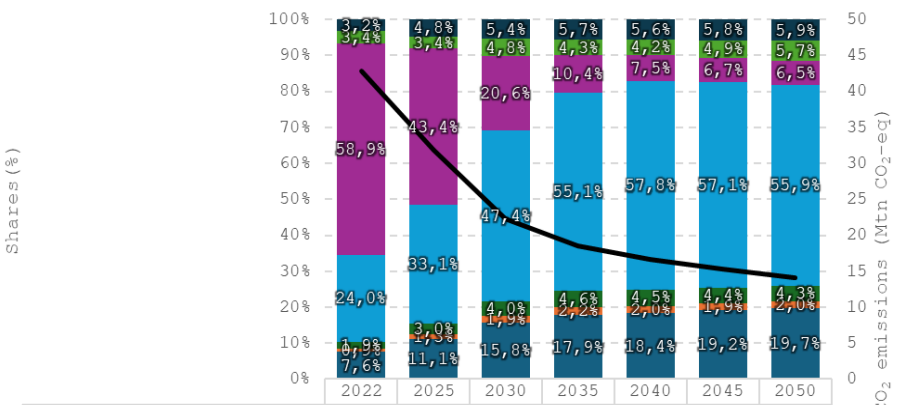
Source: MOEW; (B) EST model, E3-Modelling

The breakdown of CO2 emissions in the energy sector shows that under the WEM scenario,

all sectors, both on the demand side and on the supply side, are ultimately changing and thus moving to lower emission levels by 2050. However, by 2030, at projected carbon prices, the electricity sector alone reduces CO2 emissions from energy by 20,66million tonnes of CO_2– eq, or a 82 % reduction compared to 2022 levels.

The continuation of carbon pricing in the electricity sector further reduces CO2 emissionsin the sector by an additional 3.67 million tonnes of CO_2– eq by 2050. In the absence of a specific long-term objective, existing policies, combined with technological progress and expected improved cost competitiveness of cleaner technologies, lead to reduced CO_2 emissions in all other energy sectors, albeit at a slower pace than the electricity sector: the average annual rate of reduction of CO_2 emissions in these sectors between 2022 and 2050 ranges from 0.6 % to 1.2 %

Figure 47: *Energy CO2 emissions by sector in Bulgaria historical data (2022) and projections (B) EST WEM (2025-2050) (MTN CO2-eq)*



	2022	2025	2030	2035	2040	2045	2050
Емисии, различни от CO2	-	-	-	-	-	-	-
Остатък от енергията	1,39	1,51	1,21	1,05	0,93	0,89	0,82
Индустриални предприятия	1,44	1,07	1,08	0,80	0,69	0,75	0,80
Производство на ел. енергия	25,25	13,80	4,59	1,93	1,25	1,02	0,92
Снабдяване	10,30	10,54	10,55	10,24	9,64	8,76	7,86
Транспорт	0,81	0,95	0,90	0,85	0,76	0,68	0,60
Услуги	0,40	0,41	0,42	0,40	0,33	0,30	0,28
Домакинства	3,26	3,52	3,52	3,32	3,07	2,94	2,77
Общо	42,85	31,81	22,26	18,59	16,67	15,33	14,05

Source: MOEW; (B) EST model, E3-Modelling

4.2.2 renewable energy

i. The current share of renewable energy in total final energy consumption, as well as in different sectors (heating and cooling, electricity and transport), as well as for each technology in these sectors[12]

The use of renewable energy in the country is becoming increasingly important in all sectors – electricity, heating and cooling and transport.

[12]According to SHARES tool 2018.

The following table presents the energy consumption from renewable sources for the period 2018-2022, with calculations for 2018, 2019 and 2020 following the methodology of Directive 2009/28/EC and for 2021 according to the methodology of Directive (EU) 2018/2001.

Directive (EU) 2018/2001 introduced requirements for sustainability and greenhouse gas emissions criteria for the consumption of solid and gaseous biomass fuels. The later introduction of the requirements of European legislation in this area led to a failure to take into account some of the solid and gaseous biomass fuels used in the electricity and heating and cooling sectors. In this context, a lower share of renewable energy in the country's gross final energy consumption was achieved in 2021 and 2022, by 19.45 % and 19.1 % respectively.

Table 33: *Gross final consumption of energy from renewable sources in the heating and cooling sector, ktoe*

	2017	2018	2019	2020	2021	2022
Брутно крайно потребление на енергия от ВИ	**2 038.20**	**2 237.05**	**2 321.73**	**2 430.73**	**2 176.62**	**2 090.05**
Брутно производство на електрическа енергия	635.89	736.54	759.30	736.01	700.28	656.54
Крайно потребление на топлинна енергия и енергия за охлаждане	1 229.65	1 349.22	1 404.39	1 523.64	1 300.24	1 263.22
Крайно потребление на транспорта	172.66	151.29	158.03	171.08	176.10	170.30
Брутно потребление на енергия в страната	**10 902.56**	**10 869.52**	**10 775.93**	**10 423.76**	**11 192.68**	**10 945.38**
Дял на енергията от ВИ в брутното крайно потребление на енергия	**18.69%**	**20.58%**	**21.55%**	**23.32%**	**19.45%**	**19.10%**

Source: Shares tool 2020 and SHARES tool 2022, Eurostat

The distribution of renewable energy by sector is as follows:

- *Electricity sector*

In 2022, gross final consumption of electricity from renewable sources was 665.94 ktoe (7 743.54 GWh), achieving a 20.24 % share of renewable energy in the country's gross final consumption of electricity. Electricity production from photovoltaic plants increased by 30 % in 2022 compared to 2021. In fact, the production of electricity from renewable sources in 2021 and 2022 was higher, but due to the late introduction of sustainability and greenhouse gas emissions criteria, part of electricity produced from biomass was not accounted for. The quantities of electricity not accounted for in 2021 amounted to 1 435 GWh (123 ktoe) and in 2022 to 2 116 GWh (182 ktoe).

Table 34: *Total actual contribution (expressed in terms of installed capacity and gross electricity production) of each electricity generation technology from renewable sources in*

the Republic of Bulgaria towards the achievement of the indicative trajectory for renewable energy shares in the electricity sector for 2021 and 2022, ktoe

	2017	2018	2019	2020	2021	2022
ВЕЦ	368.07	373.09	367.37	352.47	349.09	353.55
ВтЕЦ	122.76	121.14	120.96	121.59	135.16	121.38
ФЕЦ	120.63	115.46	124.03	127.33	126.10	180.04
ЕЦ на биомаса	34.05	135.25	156.56	146.12	99.26	10.98
Брутно крайно потребление на електрическа енергия от ВИ	**645.52**	**744.94**	**768.92**	**747.51**	**709.62**	**665.94**
Брутно крайно потребление на електрическа енергия	**3 393.60**	**3 332.26**	**3 270.71**	**3 169.27**	**3 314.00**	**3 291.03**
ВИ-Е, %	**19.02%**	**22.36%**	**23.51%**	**23.59%**	**21.41%**	**20.24%**

Source: Shares tool 2020 and SHARES tool 2022, Eurostat

- *Heat and cooling* sector

The gross final consumption of energy from renewable sources achieved in 2022 was 1 263 ktoe (14 686.05 GWh), achieving a 31.67 % share of the country's gross final consumption of heating and cooling.

In the composition of final energy consumption from renewable sources in this sector, solid biomass is the largest contributor to 78.3 %. Between 2017 and 2022, there was a steady increase in the energy consumption of heat pumps (aerothermal and hydrothermal) in final heating and cooling consumption, which increased by 43 % compared to 2 022 in 2017, due to a change in sustainability and greenhouse gas emissions criteria of 214 ktoe in 2021 and 174 ktoe in 2022 respectively.

Table 35: *Gross final consumption of energy from renewable sources in the heating and cooling sector, ktoe*

	2017	2018	2019	2020	2021	2022
геотермална енергия	34.63	34.63	35.11	35.71	36.10	36.59
слънчева енергия	23.47	24.93	26.08	27.40	29.18	32.02
биомаса	1 054.53	1 160.94	1 189.22	1 307.39	1 061.59	998.30
твърда биомаса	1 043.39	1 148.02	1 176.67	1 296.17	1 049.91	988.79
газообразна биомаса	11.14	12.92	12.55	11.22	11.68	9.51
термопомпи	87.41	92.40	105.54	111.60	130.89	153.86
аеротермални	67.96	71.29	84.18	89.99		
хидротермални	19.45	21.10	21.36	21.61		
Възобновяеми отпадъци	29.61	36.31	48.45	41.53	42.48	42.44
Брутно крайно на топлинна енергия от ВИ	**1 229.65**	**1 349.22**	**1 404.39**	**1 523.64**	**1 300.24**	**1 263.22**
Брутно крайно потребление на топлинна енергия	**4 118.82**	**4 057.75**	**3 964.59**	**4 098.19**	**4 330.62**	**3 988.93**
ВИ-ТЕ ЕО, %	**29.85%**	**33.25%**	**35.42%**	**37.18%**	**30.02%**	**31.67%**

Source: Shares tool 2020 and SHARES tool 2022, Eurostat

- Transport *Sector*

In 2022, final energy consumption from renewable sources in the transport sector was 192.46 ktoe, achieving a 7.67 % share of final energy consumption in this sector. The target was achieved by 2.25 percentage points below the 9.92 % planned in the INECPs. The slower increase in the consumption of advanced biofuels and the still low use of electricity from renewable sources in road and rail transport, combined with the increase in energy consumption in this sector, are major reasons for not achieving the target.

Table 36: *Final consumption of energy from renewable sources in the transport sector, ktoe*

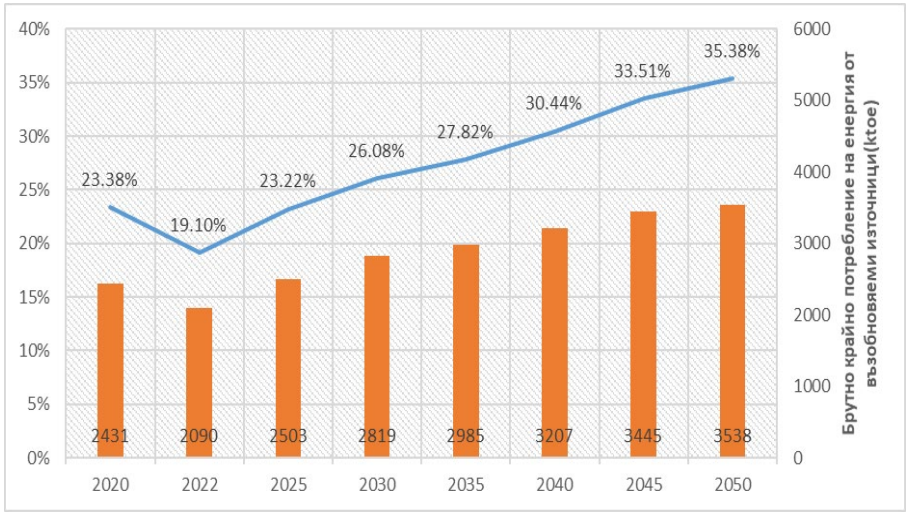
	2017	2018	2019	2020	2021	2022
биоетанол	**26.65**	**28.59**	**31.82**	**26.51**	**20.75**	**20.90**
биодизел (FAME)	**136.38**	**60.79**	**65.78**	**77.25**	**74.67**	**95.27**
биогорива от ново поление - Анекс IX, част А		**11.25**	**5.97**	**16.63**	**9.09**	**9.55**
биогорива от ново поление - Анекс IX, част Б		**42.26**	**44.85**	**39.20**	**62.25**	**57.34**
Електрическа енергия от ВИ	**9.63**	**8.40**	**9.61**	**11.50**	**9.34**	**9.41**
потребена в автомобилен транспорт	1.34	0.93	0.95	1.01	0.82	0.95
потребена в железопътния транспорт	7.76	7.03	8.33	10.19	8.28	8.20
потребена в други транспортни сектори	0.52	0.44	0.33	0.30	0.24	0.26
Крайно потребление на енергия от ВИ в траспорта	**172.66**	**151.29**	**158.03**	**171.08**	**176.10**	**192.46**
Крайно потребление на енергия от ВИ в траспорта, с прилагане на коефициенти за биогорива от ново поколение и електрическа енергия	**189.67**	**219.05**	**225.16**	**246.22**	**234.09**	**232.44**
Крайно потребление на енергия в траспорта	**2 607.95**	**2 712.54**	**2 852.57**	**2 705.59**	**3 075.12**	**3 029.24**
ВИ-Т, %	**7.27%**	**8.08%**	**7.89%**	**9.10%**	**7.61%**	**7.67%**

Source: Shares tool 2020 and SHARES tool 2022, Eurostat

ii. Indicative projections of developments under existing policies for 2030 (forecast up to 2040)

Between 2022 and 2030, the share of renewable energy in gross final energy consumption will increase from 19.10 % to 26.08 % in 2030. The increase is due to both the construction of new renewable energy capacity and measures to increase energy efficiency in final energy consumption. Developments are expected beyond 2030, with the share of energy from renewable sources expected to be 30.44 % in 2040.

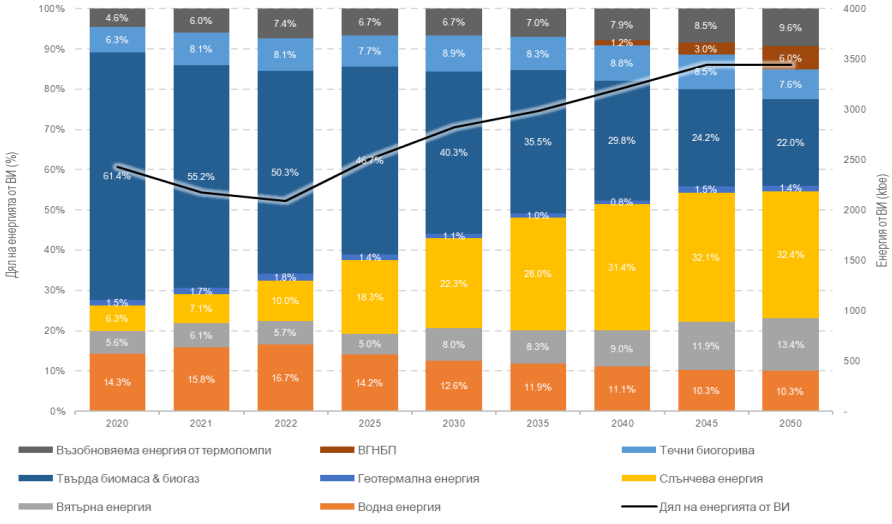
Figure 48: *Indicative trajectory for the share of renewable energy in final energy consumption 2020-2050*



Source: (B) EST model, E3-Modelling

In 2030, solar energy production more than doubled its share of energy from renewable sources in gross final consumption, rising from 10.0 % in 2022 to 22.3 % in 2030, reaching 629 ktoe. During this period, the use of wind energy and liquid biofuels in transport is gradually increasing. By contrast, it reduces the share of solid biomass, biogas and hydropower. In the period up to 2050, solar energy consumption continued its upward trajectory, reaching a share of 31.6 % and followed by wind energy (13.1 %), renewable energy from heat pumps (9.3 %) and renewable fuels of non-biological origin (RFNBO) (5.8 %).

Figure 49: *Indicative trajectory for energy from renewable sources in gross final consumption of energy (ktoe) and by type of renewable energy in 2020-2050*



Source: (B) EST model, E3-Modelling

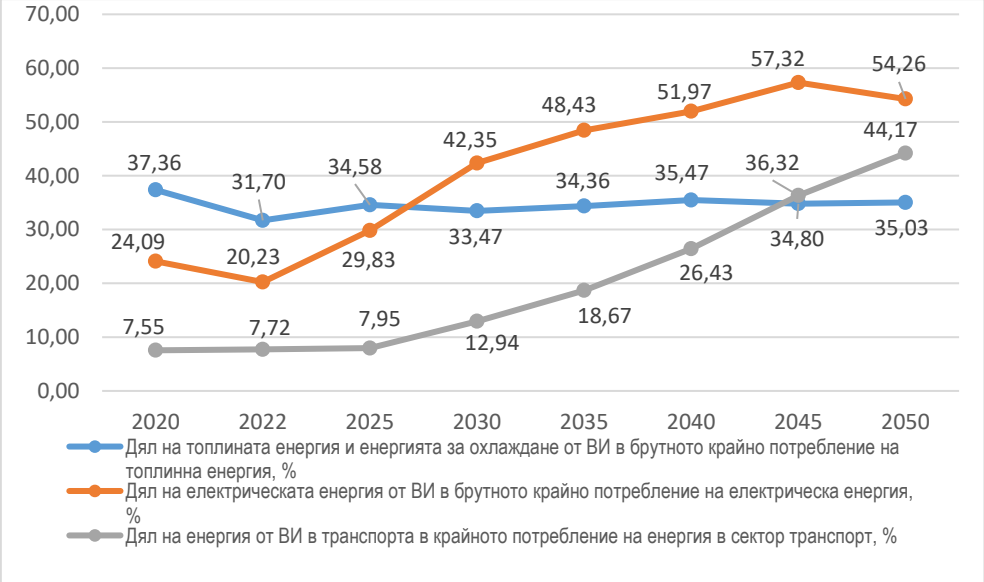
Current policies and measures have a positive impact on increasing the share of energy from renewable sources in all sectors. The largest increase is expected in the *electricity sector,* where the share of electricity from renewable sources, according to the WEM scenario, is expected to reach 42.35 % in 2030 and 51.97 % in 2040.

Current policies and measures achieve an increase in the share of renewable energy in the *heat and cooling* sector from 31.67 % in 2022 to 33.47 % in 2030, which is approximately 0.23 percentage points (calculated as the difference between the share of renewable energy over the period 2022-2030 divided by the number of years), which is lower than the requirements laid down in Directive (EU) 2023/2413.

Directive (EU) 2023/2413 introduces two approaches, allowing each Member State to choose between achieving at least a 29 % share of renewable energy in final energy consumption in transport or reducing greenhouse gas intensity by at least 14.5 % by 2030, compared to the baseline set out in Article 27. 1 (b), in accordance with the indicative trajectory set by the Member State. The Republic of Bulgaria has chosen to aim to reach a 29 % share of renewable energy in gross final consumption of energy in transport. The projection of current policies and measures indicates that a share of 12.94 % will be achieved in 2030, which does not lead to the targets of the Directive being met.

Therefore, further policies and measures need to be taken to promote the energy consumption of renewable energy pursuant to Directive (EU) 2023/2413.

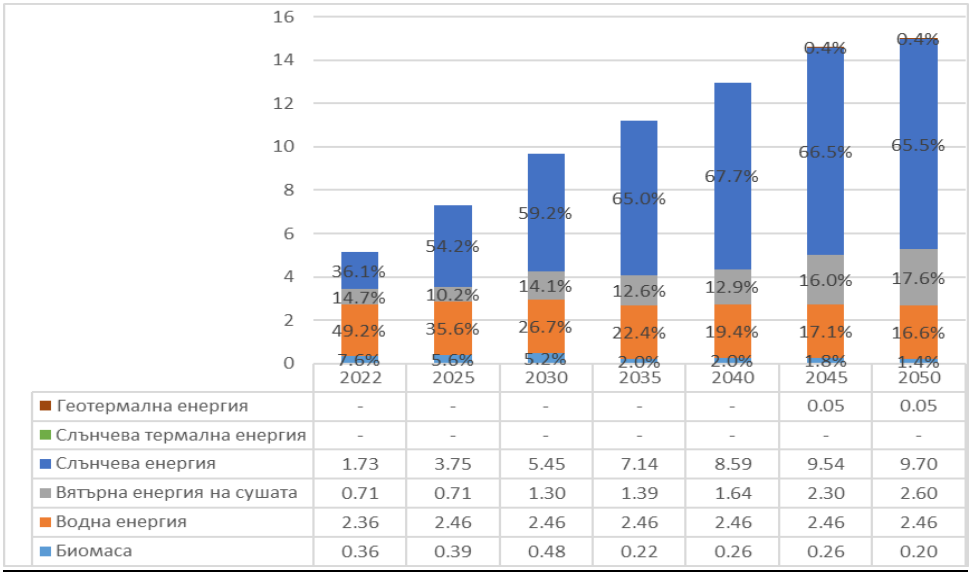
Figure 50: *Indicative trajectory for the share of energy from renewable sources in final energy consumption in the electricity, heating and cooling and transport sectorsfor the period 2020-2050 (%)*



Source: (B) EST model, E3-Modelling

With existing policies and measures, the installed electricity generation capacity for the period 2022-2030 shows an increase, which is the highest for FPP and II. The installed capacity of biomass plants increased to 0.48 GW in 2030, compared to 0.36 GW in 2022.

Figure 51: *Indicative gross installed capacity (GW) trajectory for renewable electricity generation by type, historical data (2022) and projections (2025-2030) by scenario (B) EST WEM,%*



	2022	2025	2030	2035	2040	2045	2050
Геотермална енергия	-	-	-	-	-	0.05	0.05
Слънчева термална енергия	-	-	-	-	-	-	-
Слънчева енергия	1.73	3.75	5.45	7.14	8.59	9.54	9.70
Вятърна енергия на сушата	0.71	0.71	1.30	1.39	1.64	2.30	2.60
Водна енергия	2.36	2.46	2.46	2.46	2.46	2.46	2.46
Биомаса	0.36	0.39	0.48	0.22	0.26	0.26	0.20

Source: (B) EST model, E3-Modelling

With regard to the production of heat from renewable sources, an increase is expected, with the ratio between combined heat and power plants and heating plants remaining stable (approximately 70 % for combined plants and 30 % for heating plants) by 2030. In the period 2022-2030, heat production from combined plants using biomass from 45 GWh to 713 GWh is expected to grow. For heating plants, renewable heat production is expected to grow by 43.15 % over this period, reaching 345 GWh, with a contribution from biomass use and solar and geothermal energy after 2025.

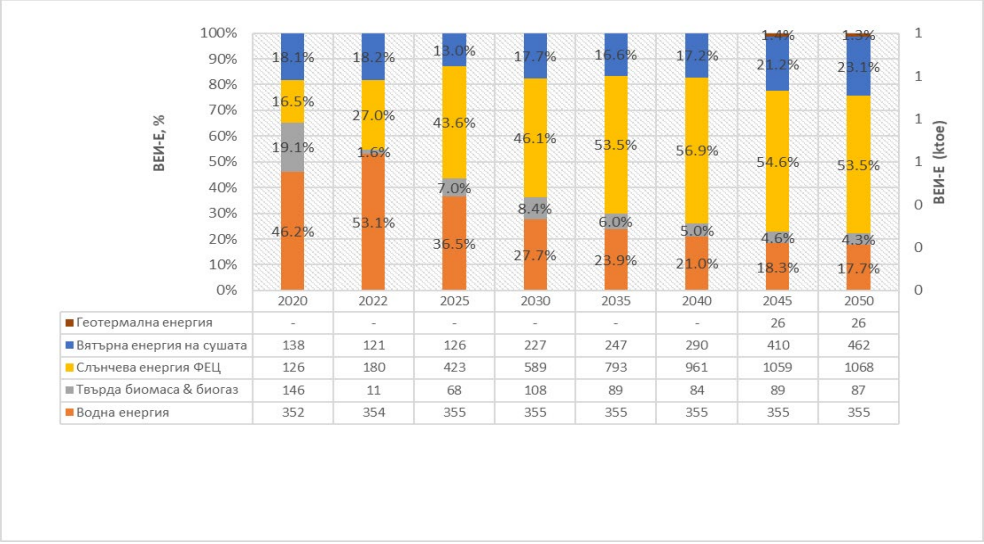
Final energy consumption by sector and use of energy from renewable sources

Gross electricity production is forecasted under the following conditions:

- Electricity consumption in the country is increasing to almost 32 GWh in 2030;
- Reduction of transmission and distribution losses resulting from the implementation of energy efficiency measures;
- Increase in storage and demand management losses, which are expected to increase by 12 % in 2030 compared to the 2020 level;
- Reduction of power plants' own needs as a result of energy efficiency measures;
- The installed capacity to convert energy into hydrogen in 2030 amounted to 0.02 GW.

With regard to the use of electricity from renewable sources, the current policies and measures are expected to build new PPPs and FPPs by 2030. This will bring about 18 % of the gross production of electricity from renewable energy sources to the CHP, while the FPP will be above 46 %. In addition, new biomass capacity is expected to be introduced, reaching 2 030 GWh of electricity by 1 256. Power generation from hydropower is expected to remain unchanged until 2030. After 2030, in the perspective of 2040, the development of CHP and FPP is expected, while installed hydropower capacity is maintained and biomass capacity is decreasing.

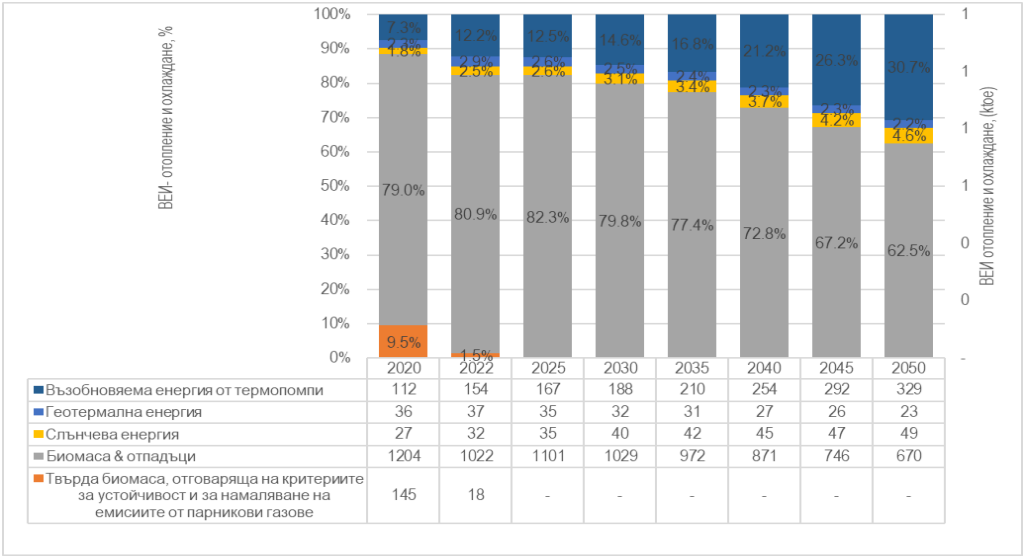
Figure 52: *Generation of electricity from renewable sources (ktoe) and distribution by technology (%) in Bulgaria, historical data (2005-2022) and scenario projections (B) EST WEM (2025-2050)*



Source: (B) EST model, E3-Modelling

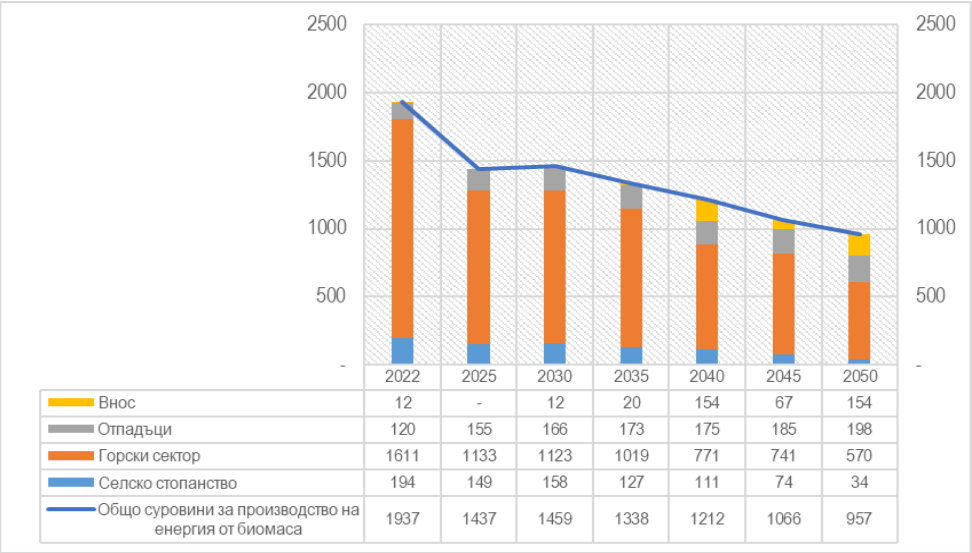
Under current policies and measures, energy consumption in the heating and cooling sector is expected to increase by around 2022 percentage points between 2030 and 2. Solar use is expected to increase, yet the share of solar energy remains low (around 3.1 % in 2030 and 3.7 % in 2040). After 2030, a reduction in energy consumption from biomass is expected to reach 72.8 % in 2040 and 62.5 % in 2050. The use of heat pumps for heating and cooling will continue to evolve and consumption will reach 2 186 GWh in 2030 and 2 954 GWh in 2040.

Figure 53: *Renewable energy in the heat and cooling sector (ktoe) and distribution by type of source (%) in Bulgaria, historical data (2005-2022) and scenario (B) EST WEM projections (2025-2050).*



Source: (B) EST model, E3-Modelling

Figure 54: *Biomass**energy feedstock by origin (ktoe) in Bulgaria, historical data (2022) and projections (2025-2050) by (B) EST WEM***

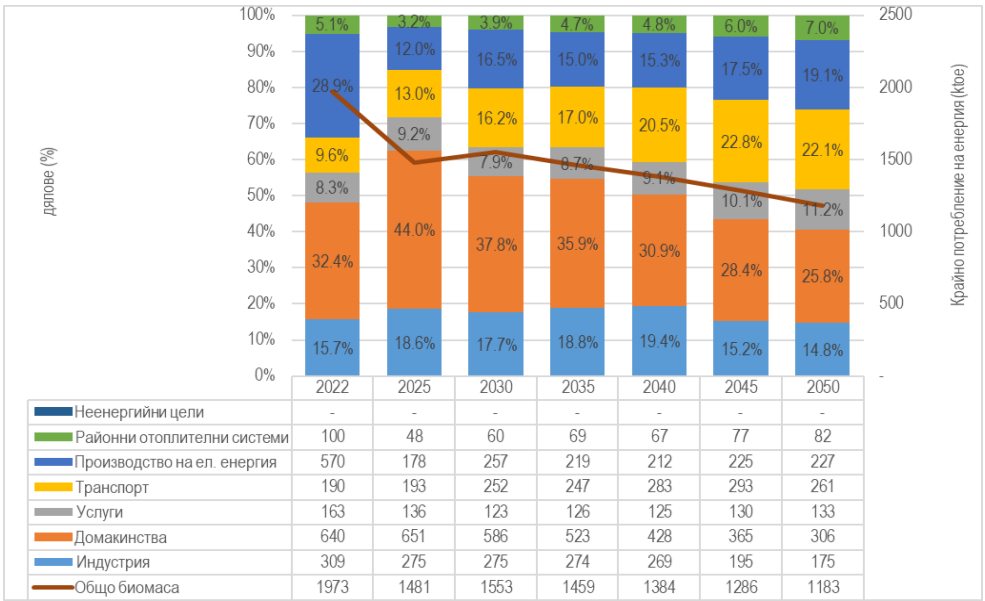


	2022	2025	2030	2035	2040	2045	2050
Внос	12	-	12	20	154	67	154
Отпадъци	120	155	166	173	175	185	198
Горски сектор	1611	1133	1123	1019	771	741	570
Селско стопанство	194	149	158	127	111	74	34
Общо суровини за производство на енергия от биомаса	1937	1437	1459	1338	1212	1066	957

Source: (B) EST model, E3-Modelling

In the period 2022-2030, energy demand from biomass is expected to decrease from 1 937 ktoe in 2022 to 1 459 ktoe in 2030 and 957 ktoe in 2050 due to a reduction in final consumption. After 2030, biomass imports are projected to increase from 12 ktoe in 2022 to 154 ktoe in 2040. In the period 2022-2050, a gradual reduction in the use of solid biomass from forestry and agriculture is foreseen.

Figure 55: *Final energy consumption from solid biomass, biogas and waste by sector in Bulgaria, historical data (2022) and projections (B) EST WEM (2025-2050) (ktoe and shares in%).*



	2022	2025	2030	2035	2040	2045	2050
Неенергийни цели	-	-	-	-	-	-	-
Районни отоплителни системи	100	48	60	69	67	77	82
Производство на ел. енергия	570	178	257	219	212	225	227
Транспорт	190	193	252	247	283	293	261
Услуги	163	136	123	126	125	130	133
Домакинства	640	651	586	523	428	365	306
Индустрия	309	275	275	274	269	195	175
Общо биомаса	1973	1481	1553	1459	1384	1286	1183

Source: (B) EST model, E3-Modelling

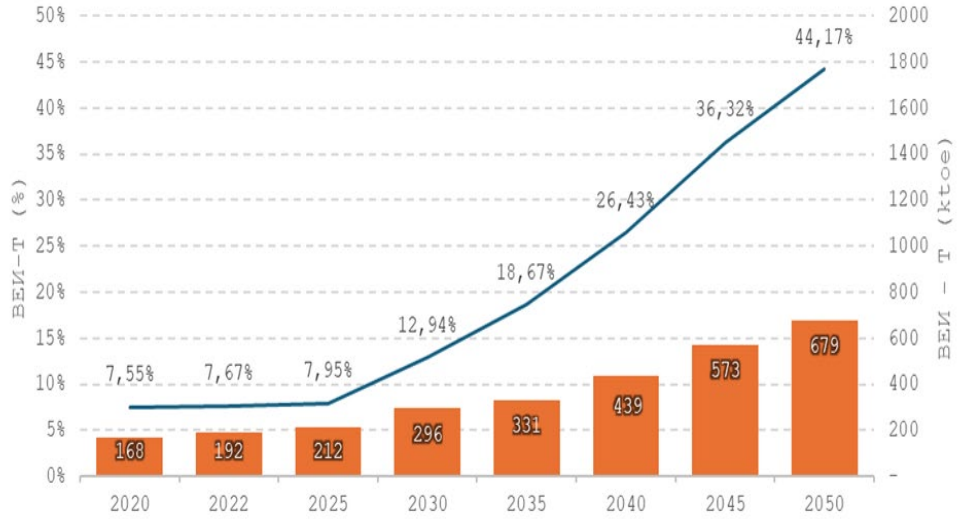
In the period 2020-2030 and subsequently by 2050, final energy consumption from biomass is expected to decrease quantitatively in all sectors except Transport due to increased demand for biofuels. The most notable is the reduction of energy consumption from biomass in industry, electricity production and households.

Transport Sector

Between 2022 and 2030, an increase of 13 % in final energy consumption in the transport sector is projected due to expected increased activity in all transport modes. Between 2022 and 2030, the largest increase of 36 % is expected for rail, almost 20 % for air transport and 7 % for private road transport. After 2035, the sector's final energy consumption will decrease, despite the increase in activity in all modes of transport, as a result of the implementation of energy efficiency measures.

Current policies and measures are expected to achieve a 12.94 % share of renewable energy in final energy consumption in transport in 2030.

Figure 56: *Final consumption and share of renewable energy in the transport sector (ktoe and%), historical data (2020-2022) and scenario projections (B) EST WEM (2025-2050)*

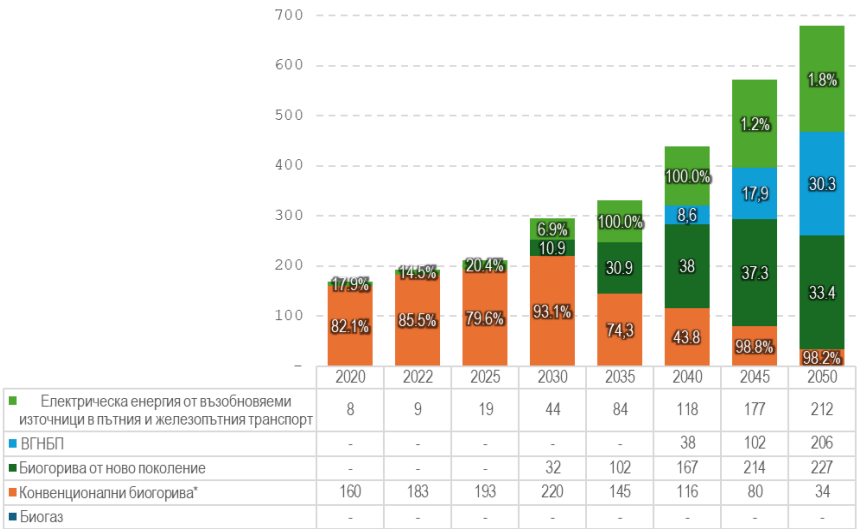


Source: (B) EST model, E3-Modelling

Conventional biofuels (93.1 %) are expected to make a major contribution to final energy consumption from renewable energy in transport by 2030, followed by advanced biofuels with a share of 10.9 % and electricity with a share of 6.9 %.

After 2040, consumption of SNBPs is also projected to contribute 30.3 % of final energy consumption from renewable sources in the transport sector in 2050.

Figure 57: *Renewable energy in the transport sector (ktoe) by fuel type in Bulgaria, historical data (2005-2022) and scenario projections (B) EST WEM (2025-2050)*



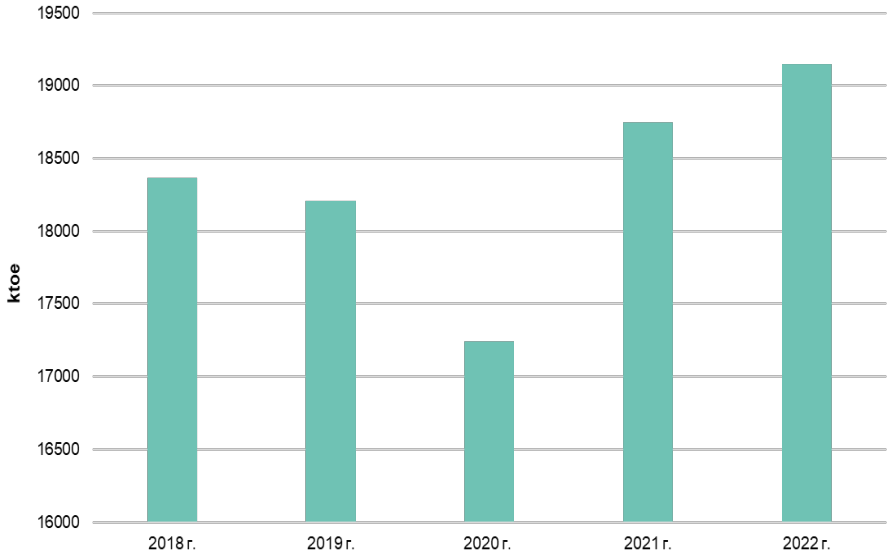
	2020	2022	2025	2030	2035	2040	2045	2050
Електрическа енергия от възобновяеми източници в пътния и железопътния транспорт	8	9	19	44	84	118	177	212
ВГНБП	-	-	-	-	-	38	102	206
Биогорива от ново поколение	-	-	-	32	102	167	214	227
Конвенционални биогорива*	160	183	193	220	145	116	80	34
Биогаз	-	-	-	-	-	-	-	-

Source: (B) EST model, E3-Modelling

4.3 energy efficiency dimension

i. Current primary and final energy consumption in the economy and by sector (including industry, housing, services and transport)

Figure 58: *Primary energy consumption 2018-2022, ktoe*



Source – according to NSI data

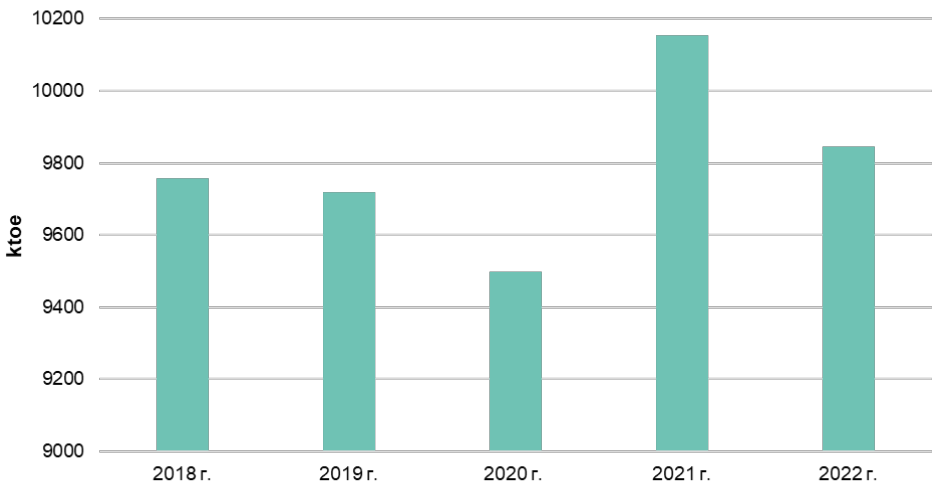
Between 2018 and 2022, primary energy consumption was uneven and reflected the impact of the Covid pandemic in the country. The lowest SMP was recorded in 2020 (17 243.44 ktoe), due to a decrease in coal consumption of 917.3 ktoe compared to 2019 and of oil and petroleum products by 439.7 ktoe.

The amount of electricity exported also decreased from 917 ktoe to 862 ktoe. An increase was observed for RES of 80 ktoe (an increase of 50.5 % compared to 2012).

With the exception of 2016, when the SMP decreased due to a decrease in coal consumption, the SMP increased to 2018 ktoe in 18 450. Compared to 2012, the SMP increased by 3.2 % in 2018.

Final energy consumption followed the development of PEC also for the period 2018-2022. The lowest FEC was recorded in 2020 (9 499.66 ktoe), due mainly to a decrease in oil consumption of 319 ktoe (a decrease of 11 % compared to 2012), of heat by 78 ktoe (a decrease of 8 % compared to 2012) and of coal and coal fuels by 46 ktoe (down by 11 % compared to 2012). An increase in that year was observed for renewable energy of 47 ktoe (an increase of 4 % compared to 2012).

Figure 59: *Final energy consumption 2018-2022, ktoe*

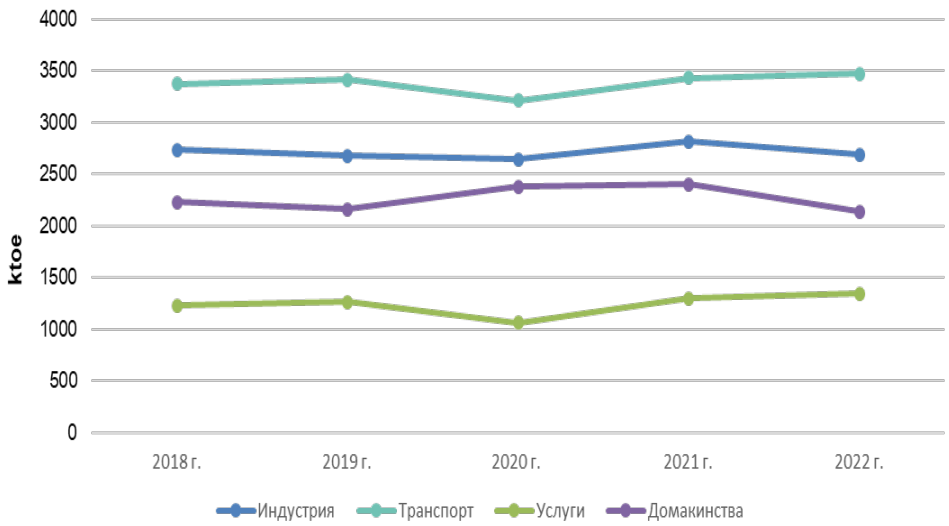


Source: according to NSI data

Final energy consumption by sector

The breakdown of final energy consumption by sector is presented in the following figure.

Figure 60: *Final energy consumption by sector 2018-2022, ktoe*



Source: according to NSI data

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

The development of high-efficiency cogeneration (HEP) production potential should be in line with the requirements of the new Energy Efficiency Directive 2023/1791.

The transposition of the Directive requires that new or substantially refurbished cogeneration installations, the direct emissions of carbon dioxide resulting from fossil fuel cogeneration, are below 270 g CO_2 per 1 kWh of energy.

Those in service before 10 October 2023 may derogate from this requirement until 1 January 2034, provided that they have a gradual emission reduction plan to reach the threshold of less than 270 g CO_2 per 1 kWh by 1 January 2034.

These requirements of the Directive will determine the gradual change of the fuel base of district heating companies from coal to natural gas or biofuels.

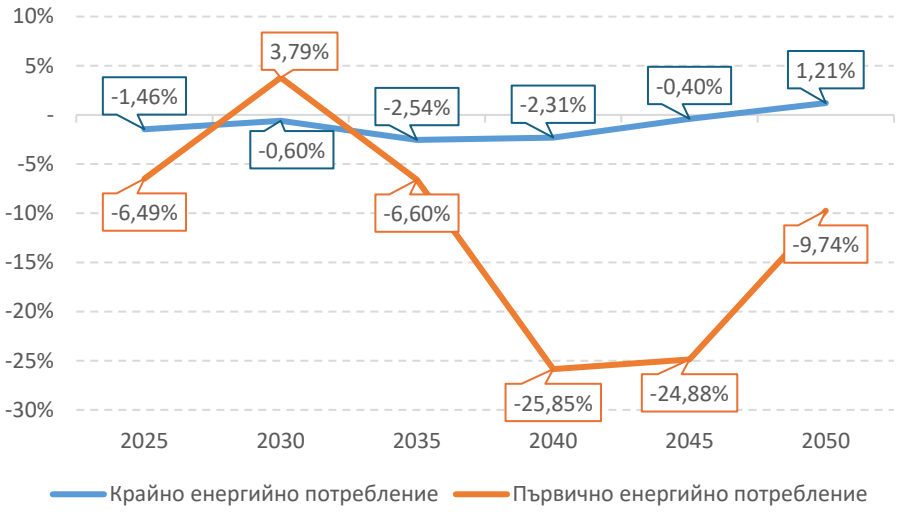
The potential for RES in existing district heating mainly consists of the following measures:

- Increase heat load density levels by connecting new buildings to the existing heat distribution networks, installation of pipelines and heat substations in the yards of residential properties;
- Modify the technological structure of the heat source with a view to:
  - Switching from heat generation to high-efficiency cogeneration;
  - Intensify the existing cogeneration by maximising the ratio between electricity output and useful heat.

iii. Projections of 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 2030)

In 2030, the WEM scenario projects 15.00 Mtoe of primary energy consumption, reducing from the PRIMES 2020 baseline projection of 3.79 % in 2030 and – 25.85 % in 2040 compared to 2022.

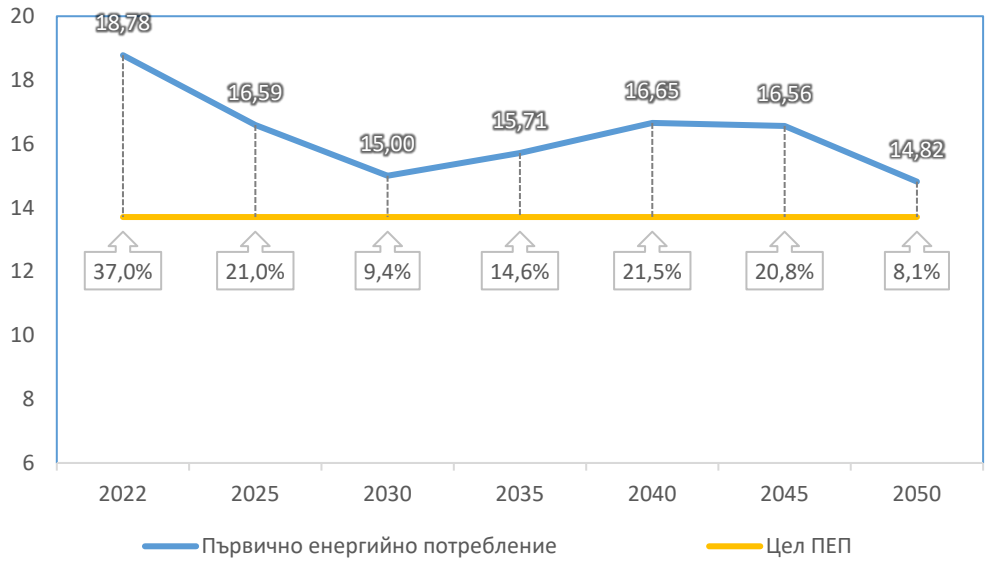
Figure 61: *Energy savings in primary and final energy consumption relative to the value of the respective year PRIMES 2020 Reference projections (%) by scenario (B) EST WEM projections*



Source: (B) EST model, E3-Modelling

The difference between the envisaged SMP in 2030 and the estimated target of 13 707 ktoe for 2030, in accordance with the formula set out in Annex I to Article 4 (1). 4 of the Energy Efficiency Directive (EU) 2023/1791 is 9.4 % and decreased from 37 % to 9.4 % in 2022 and 8.1 % in 2030 for the period 2050.

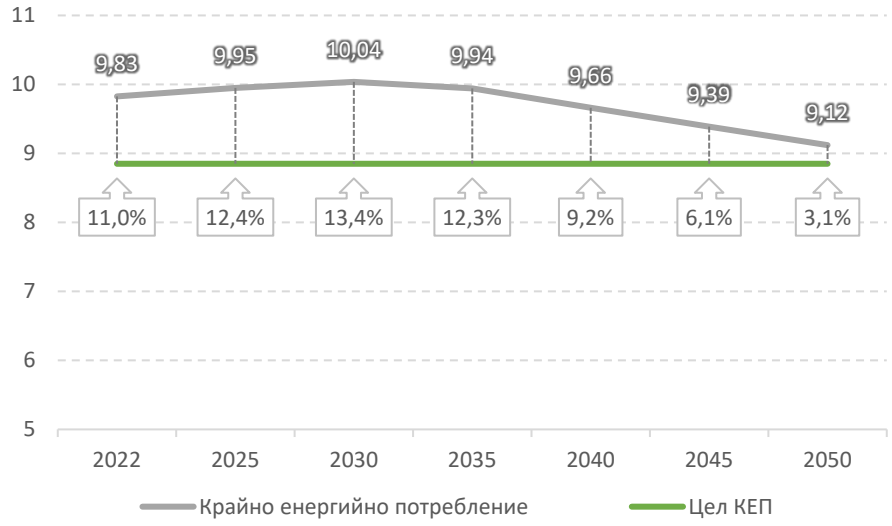
Figure 62: *Primary energy consumption (Mtoe) by scenario (B) EST WEM*



Source: (B) EST model, E3-Modelling

Final energy consumption reaches 10.04 Mtoe, which is 0.6 % higher than the PRIMES 2020 baseline forecast. The difference between the projected FEC in 2030 under the WEM scenario and the estimated target of 8.85 Mtoe for 2030, according to the Energy Efficiency Directive formula, is 13.4 % and then decreases to 9.2 % in 2040 and 3.1 % in 2050.

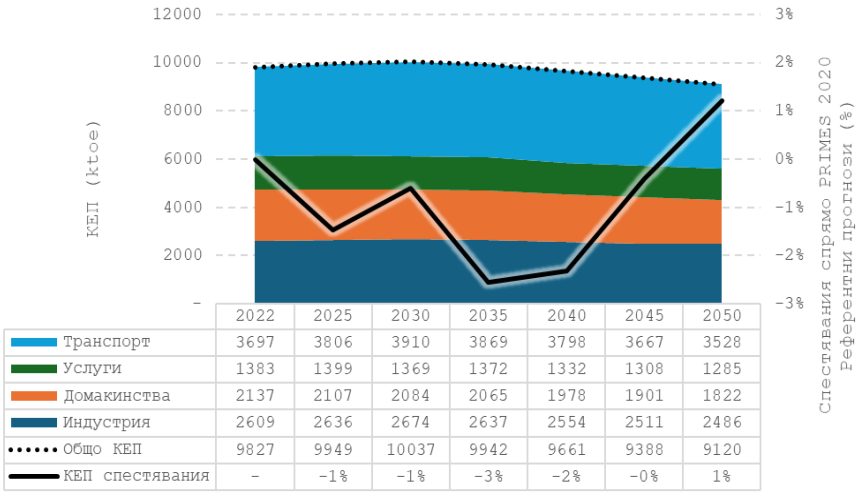
Figure 63: *Final energy consumption (Mtoe) by scenario (B) EST WEM*



Source: (B) EST model, E3-Modelling

In the period up to 2030, final energy consumption increased by 2.1 % compared to 2022, despite decreases in the Household and Services Sector by 2.5 % and 1.0 % respectively. Significant energy savings are projected after 2035, with final energy consumption falling on average by 0.6 % per year until 2050. This reduction is attributable to all sectors, with households recording a 0.8 % reduction per year, while the industry, services and transport sectors achieve reductions ranging between 0.2 % and 0.6 % per year.

Figure 64: *Final energy consumption by sector (ktoe) and savings relative to the respective year's PRIMES 2020 Scenario (B) EST WEM*



	2022	2025	2030	2035	2040	2045	2050
Транспорт	3697	3806	3910	3869	3798	3667	3528
Услуги	1383	1399	1369	1372	1332	1308	1285
Домакинства	2137	2107	2084	2065	1978	1901	1822
Индустрия	2609	2636	2674	2637	2554	2511	2486
Общо КЕП	9827	9949	10037	9942	9661	9388	9120
КЕП спестявания	-	-1%	-1%	-3%	-2%	-0%	1%

Source: (B) EST model, E3-Modelling

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

Pursuant to Article 5 (2) of Directive 2010/31/EU on the energy performance of buildings and Article 6 of Commission Delegated Regulation (EU) No 244 supplementing Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings by establishing a comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements, a Report on the calculation of cost-optimal levels of minimum energy performance requirements for buildings in Bulgaria has been developed. The report sets out reference buildings for different categories of existing buildings. Bulgarian legislation defines the types of public service buildings in Regulation No 1 of 2003 of the MRDPW on the nomenclature for types of construction works. The public service buildings are grouped into nine groups:

1. For education and science;
2. In the field of health and veterinary medicine;
3. In the field of social services;
4. In the field of culture and the arts;
5. In the field of religion;
6. For administrative support; commercial, catering, service and gambling buildings;
7. In the field of transport and electronic communications and sports buildings and facilities.

The administrative service building group includes administrative buildings, banking and non-bank financial institutes serving buildings at production sites, representative buildings,

postal buildings, central and territorial government buildings, government buildings, conference and congresses centres, court buildings, public prosecutor's offices, etc.

Directive 2010/31/EU, Article 4 (1) allows Member States to decide whether to distinguish between new and existing buildings and between different categories of buildings. In Bulgaria, this distinction has not been made. Reference buildings are also not defined for new buildings, as required by Delegated Regulation (EU) No 244/2012 and its instructions. The reason for this is that, under national legislation, the only difference between new and existing buildings is the energy consumption class to which buildings must comply. The criteria defined for the selection of each reference building are: type of construction system, storey, age of buildings and type of district heating system. The approach used to define reference buildings is by combining a virtual model with representative parameters of existing buildings in the given category.

Energy efficiency measures are defined for reference buildings. Packages of measures are proposed, applying a combination methodology based on a matrix model of possible measures for a reference building.

The primary energy demand resulting from the application of measures and/or packages of measures to the reference buildings has been calculated. The report states that the method applied in Bulgaria for calculating the energy performance of buildings is based on a European model, introduced as a Bulgarian standard, and supplemented by models that take into account also humidity, as the European only treats clear heat, which does not make it possible to assess the energy required for cooling when air exchange is present in the cooling area. For the purposes of calculating the cost-optimal energy performance of buildings and developing a national definition of nearly zero-energy buildings in Bulgaria, the technical standards have been set as the baseline from 1999. The results of the calculation of the energy demand of the reference buildings are presented in an annex to the report.

The report presents global cost calculations based on a life-cycle cost analysis for each reference building only at financial level. The input parameters used to calculate global costs and the types of costs involved (initial investment costs, operating costs and waste disposal costs) have been defined. The optimal energy performance levels have been calculated for all defined reference buildings, following a system level approach – in this case based on an analysis of the influence of thermal passage factors through building envelope structures and elements on energy consumption.

To assess the reliability of key input parameters, a sensitivity analysis of the net present value of real interest factors, product and energy price escalation has been carried out.

The setting of minimum requirements for energy consumption in buildings with aggregated scales with numerical values of energy consumption classes was transposed into national law in 2016 by Regulation No E-RD-04-2 of 22.1.2016 on energy consumption indicators and energy performance of buildings. The Regulation lays down the conditions and uniform methodology for establishing energy consumption and energy performance indicators for buildings, the parameters of a scale of energy consumption classes for different categories

of buildings and the numerical limit values for the integrated energy indicator 'specific annual primary energy consumption' in kWh/m² determined by the scale of energy consumption classes for different categories of buildings.

On the basis of continuity in national energy efficiency legislation dating back to 2004, an update of the national methodology for calculating the energy performance of buildings and a review of technical standards in line with the update of the Common Framework for the calculation of the energy performance of buildings set out in Annex I to Directive 2010/31/EU, as amended by Directive (EU) 2018/844, was carried out in the period 2021-2023.

In application of Article 5 (2) of Directive 2010/31/EU on the energy performance of buildings and Article 6 of Commission Delegated Regulation (EU) No 244 supplementing Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings by establishing a comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements, a Second Scientific National Review of the technical standards for energy performance of buildings was carried out in 2022 and the European Commission presented the periodically required LYFE CYCLE Costing/ANALYSIS Report on the calculation of cost-optimal minimum energy performance requirements for buildings in the Republic of Bulgaria. The report shall include a scientific study, analysis and assessment of the impact of the calculation algorithms of the new package of European standards (EPB-standards) for the calculation of the energy performance of buildings developed under CEN Mandate M/480 on the results of existing national calculation rules and norms, as well as updating the boundaries of the energy consumption classes of ten building categories and developing a new energy consumption scale for single-dwelling buildings as a sub-category of residential buildings. On the basis of the results of the second scientific national review of the cost-optimal minimum requirements for the energy performance of buildings prepared by the Technical University of Sofia, the Ministry of Regional Development and Public Works developed and promulgated a new Regulation No RD-02-20-3 of 9.11.2022 on technical requirements for the energy performance of buildings (published. SG No 92 of 18 November 2022). The Regulation introduces the requirements of Articles 3, 4 and 9 and Annex I of Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (OJ L 153/13 of 18 June 2010). The main contribution of the Regulation to the national legislation on energy efficiency is the national methodology for calculating the energy performance of buildings in accordance with European standards EN ISO 52000-1, EN ISO 52003-1, EN ISO 52010-1, EN ISO 52016-1 and EN ISO 52018-1, which are part of the series of standards aimed at international harmonisation of the methodology for assessing the energy performance of buildings. Regulation No RD-02-20-3 of 9.11.2022 on the technical requirements for the energy performance of buildings is a key legal act which contributes to the regulatory assurance of the implementation of energy efficiency programmes and projects supported by various European and national funding sources in accordance with the objectives set at European and national level up to 2030, including for the implementation of projects under

the National Recovery and Resilience Plan of the Republic of Bulgaria and the Long-term National Strategy for supporting the renovation of the national stock of residential and non-residential buildings by 2 050 in accordance with the objectives set, the target values of indicators for progress and for achieving the effectiveness of investments in the cost-benefit ratio.

On the basis of the technical standards for the energy performance of buildings updated in 2022, the model energy performance certificate for new and existing buildings, regulated in new Regulation No E-RD-04-2 of 16 December 2022 on energy efficiency audits, certification and assessment of energy savings of buildings, has been updated. SG No 102 of 23 December 2022).

National calculations in line with the requirements of Article 5 of Directive 2010/31/EU in the 2030 horizon will aim at harmonising technical requirements for the energy performance of buildings in line with the revised EPBD in the framework of the Fit for 55 European legislative package. Key challenges for national energy performance norms in the period up to 2030 will be:

— Phasing out fossil fuel boilers in buildings;

— Transposition of the requirement to introduce minimum European energy performance standards (MEPS) including for zero-emission buildings CO_2;

— The introduction of national requirements for solar energy recovery in new public and existing buildings (pursuant to Article 9a of the EPBD);

— Introduction of standards for mortgage portfolios.

In addressing these and other challenges to national energy performance standards for buildings, Bulgaria will follow the stated position of maintaining the possibility of exempting individual buildings (under certain conditions), reasonable timelines taking into account national socio-economic conditions, taking into account the principles of technical, economic and functional feasibility and the principle of technological neutrality.

4.4 energy security dimension

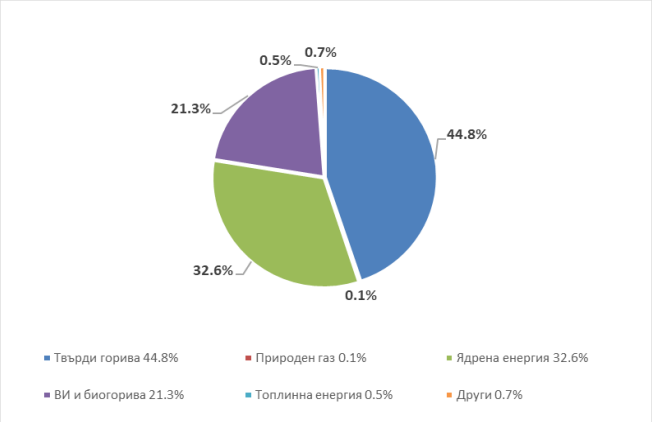
I. Current energy mix, domestic energy resources, import dependency, including relevant risks

- **Current energy mix**

According to data from the National Statistical Institute for 2022 (published in December 2023), the country's production of primary energy in 2022 amounted to 13 154.9 ktoe, covering 67 % of gross inland consumption under a relatively constant structure in recent years and with dynamics stemming from domestic energy consumption.

In the composition of primary energy production by fuel and energy type, solid fuels accounted for the largest share of 44.8 % and nuclear energy at 32.6 %. The remaining fuels and energy shall be distributed as follows: energy from renewable sources – 21.3 %, heat – 0.5 %, natural gas – 0.1 % and others (shale/sands, oil and petroleum products and non-renewable waste) – 0.7 %.

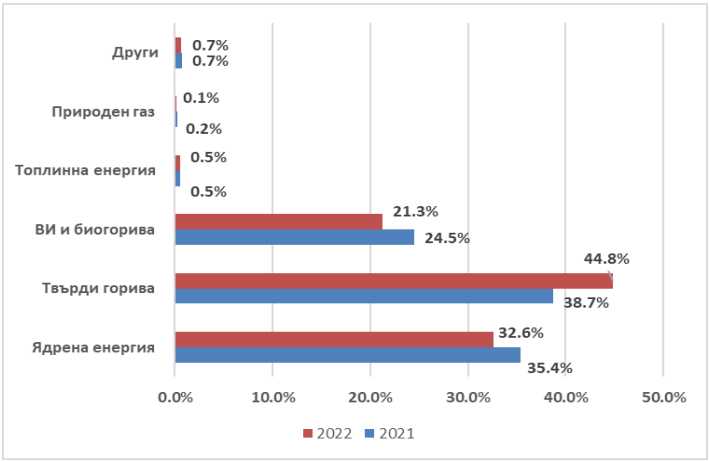
Figure 65: *Primary energy production structure,%*



Source: NSI

In 2022, primary energy production increased by 12 % compared to 2021. Solid fuels increased by 26 %, renewable energy and biofuels 15 % and others 12 %. The remaining fuels are falling, respectively: natural gas 45 %, heat 5 % and nuclear 1 %.

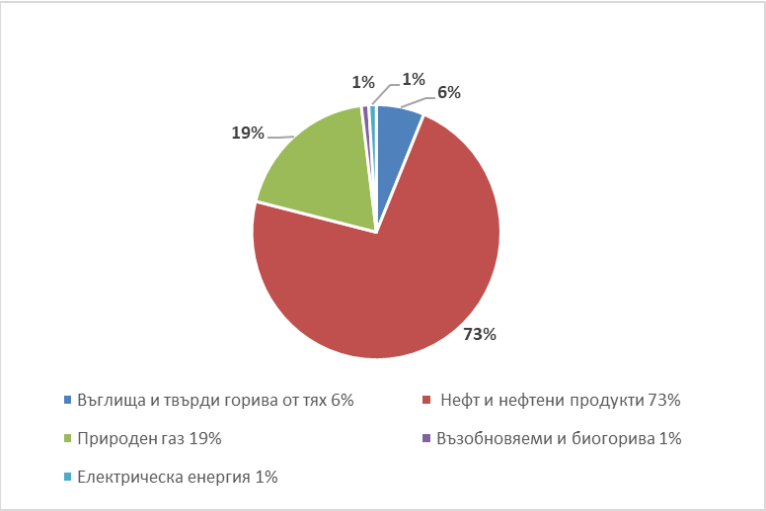
Figure 66: *Primary energy production structure in 2022 compared to 2021,%*



Source: NSI

In 2022, fuel and energy imports amounted to 12 876 ktoe. Oil and petroleum products accounted for the largest share (73 %), followed by natural gas (19 %). The remaining fuels and energy shall be distributed as follows: solid fuels 6 %, electricity 1 % and renewable energy 1 %.

Figure 67: *Fuel and energy imports,%*



Source: NSI

In 2022, imports increased by 27 % compared to the previous year 2021. Coal and solid fuels increased by 46 %, oil and petroleum products by 43 % and renewable and biofuels by 2 %. Electricity imports are reduced by 21 % and natural gas by 10 %.

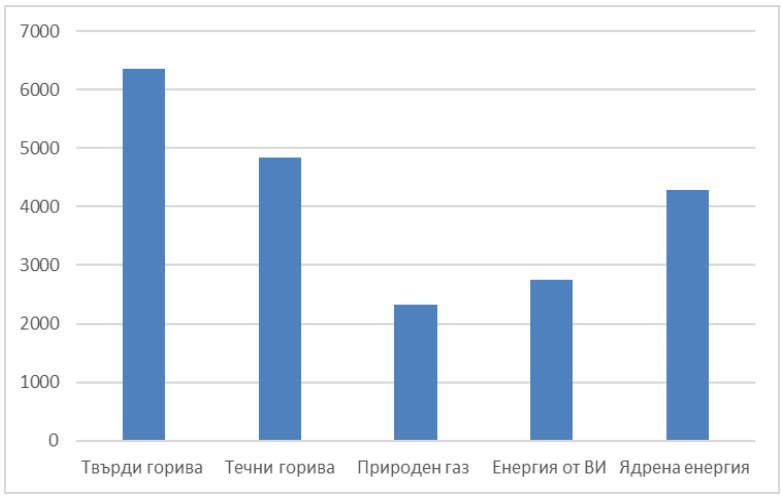
Fuel and energy exports in the country amounted to 2022 ktoe in 5 587. Liquid fuels account for 74.4 % and electricity for 21.0 %. The remaining fuels shall be distributed as follows: renewable and biofuels 3.2 % and solid fuels 1.4 %.

Figure 68: *Fuel and energy exports,%*

Source: NSI

The country's gross inland consumption of fuels and energy in 2022 amounted to 19 555 ktoe. Solid fuels accounted for 31 % of solid fuels, followed by liquid fuels at 24 %. Other fuels and energies shall be distributed as follows: nuclear energy 21 %, renewable energy 13 %, natural gas 11 %.

Figure 69: *Gross inland consumption by fuel and energy*, ktoe

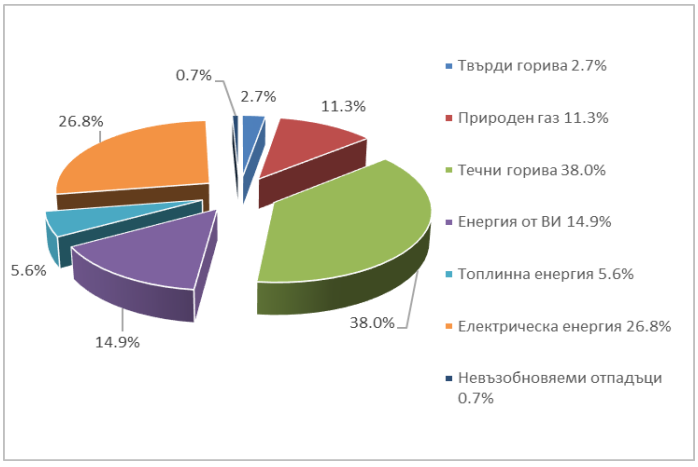


Source: NSI

In 2022, gross inland consumption increased by 1.3 % compared to 2021. Electricity consumption increased by 38.9 %, solid fuels by 18.3 %, heat energy by 6.0 %, liquid fuels by 5.7 % and non-renewable waste at 4.5 %. Reductions are recorded for natural gas by 18.1 %, renewable energy by 5.8 % and nuclear energy by 0.1 %.

Final energy consumption amounted to 2022 ktoe in 9 845. Liquid fuels account for the largest share of the structure, at 38.0 %, followed by electricity at 26.8 %. The remaining fuels and energy shall be distributed as follows: renewable energy 14.9 %, natural gas 11.3 %, heat 5.6 %, solid fuels 2.7 % and non-renewable waste 0.7 %.

Figure 70: *Structure of final energy consumption,%*

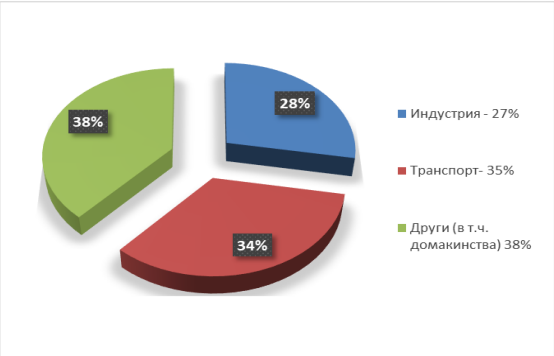


Source: NSI

The sectors of the economy show an increase in final energy consumption. In 2022, the transport sector accounted for 35 % of final energy consumption, maintaining the leading position in final energy consumption over the last ten years.

Industry accounts for 27 % and is the second most important sector. The share of final energy consumption in the rest of the household, services and agriculture sectors was 38 % respectively. The structure of final energy consumption by sector in 2022 is identical to that in recent years.

Figure 71: *Structure of final energy consumption by sector,%*

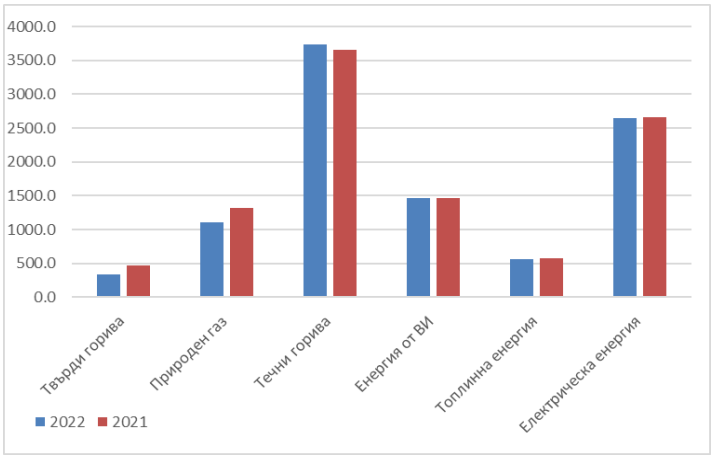


Source: NSI

With a 38.0 % share in 2022, liquid fuels mainly consumed in road transport (96 %) were the most used energy carrier in final energy consumption. In 2022, electricity consumption was 2 641 ktoe, with a share of 26.8 % of final energy consumption. In 2022, the use of energy from renewable sources was reduced by 0.2 %. The main renewable source used in the country is biomass, which is mainly used in the heating and cooling sector.

In 2022, final consumption also decreased for solid fuels by 28.3 %, natural gas by 15.8 %, electricity by 0.8 % and heat by 3.4 %. Liquid fuels increased by 2.1 %.

Figure 72: *Final energy consumption in 2022 compared to 2021*



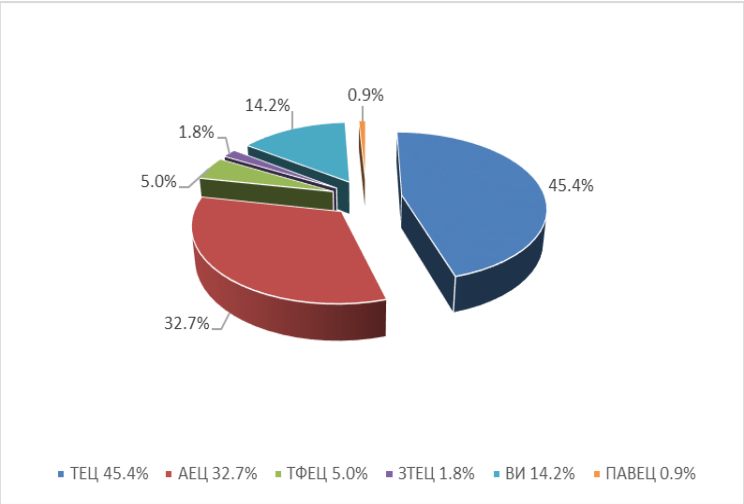
Source: NSI

Bulgaria has a diverse electricity generation mix, including nuclear, thermal and renewable energy plants (hydro, wind, solar and biomass plants).

According to the Ministry of Energy, gross electricity production was 2 022 TWh in 50,3, 5.8 % more than in 2021.

The largest shares of electricity generation in 2022 were thermal power plants (45.4 %), followed by NPP (32.7 %), RES (14.2 %), TPP (5.0 %), TPP (1.8 %) and PVPP (0.9 %).

Figure 73: *Gross electricity production**structure, per plant type,% GWh***



Source: NSI

The share of domestic energy inputs for electricity production is 96 % and the share of imported energy is 4 % (nuclear energy is recorded as a local energy carrier).

- *Own energy sources*

Bulgaria uses the existing potential of local resources while respecting environmental requirements. The main energy carriers for energy production are solid fuels and nuclear energy.

Plants using indigenous coal produce a significant part of the electricity and provide valuable services necessary for the reliable operation of the electricity system and thus contribute to Bulgaria's energy security. Nuclear energy is an important energy carrier that guarantees baseload generation of electricity at predictable and competitive prices. Kozloduy EAD provides more than 30 % of electricity production in Bulgaria and guarantees Bulgaria's energy security.

The use of energy from renewable sources is the third most important local energy resource, which has accelerated in recent years. A major contribution to this is the increased consumption of biomass, also the use of solar and wind energy for electricity generation.

- *Import dependence*

In 2022, according to NSIs, the country's energy dependency on fuels and energy was 37.1 %, compared to the average for EU Member States. This is due to the methodology adopted by Eurostat, according to which nuclear energy is recorded as a local energy source.

- *Relevant risks*

In the area of natural gas, the most significant risk relates to the volatility of the gas market on European exchanges. In this regard, Bulgaria has taken measures to diversify natural gas supply sources and routes.

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

The projections in this section have been prepared with existing national and European policies and measures.

Bulgaria will decarbonise its electricity system through the continued development and construction of renewable energy installations combined with new shunting low carbon capacities (hydropower and nuclear units).

The key indicators used in the modelling are the installed capacity of technologies for energy production, power generation, system flexibility, greenhouse gas emissions, necessary investments and costs, setting out the relevant investment and transitional framework to support the decarbonisation objective.

The forecasts for the development of Bulgarian energy are based on input data received from transmission system operators, regulatory authorities and market participants, covering electricity consumption and production, prices of key raw materials (natural gas, emission allowances, etc.) and connectivity of European electricity markets. New forms of final electricity consumption shall be taken into account with their ability to provide additional manoeuvrability in control.

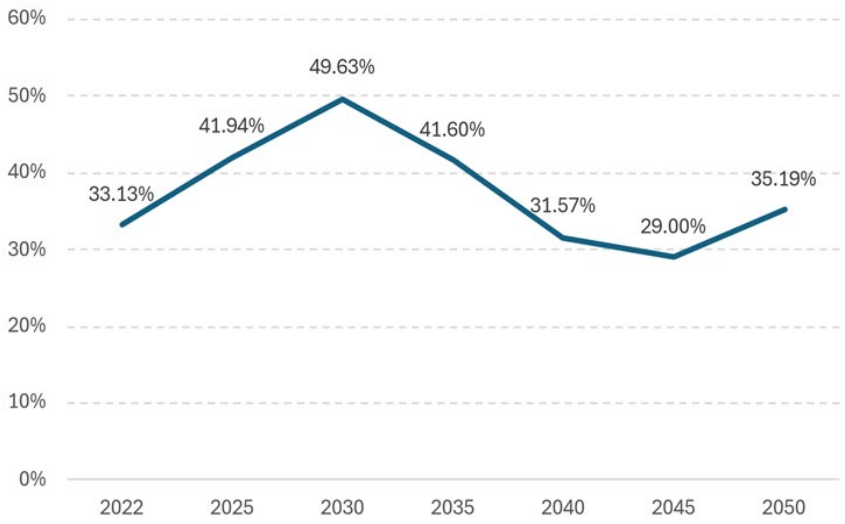
In line with the requirements of Regulation (EU) 2018/1999, two foresight scenarios were developed, WAM (with additional policies and measures) and WEM (with existing policies and measures). The projections in this point have been prepared only in the case of existing national and European policies and measures.

Under the WEM scenario, Bulgaria's energy dependency increases from 33.1 % to 49.6 % in the period 2022-2030, largely due to an increase in natural gas imports as a result of an increase in primary energy production using natural gas by 2030. A further important factor contributing to Bulgaria's import dependency is the fact that Bulgaria is a net importer of liquid fuels – by around 60 % between 2022 and 2030.

In part, the above is offset by the fact that Bulgaria remains a net exporter of electricity. However, Bulgaria's dependence on energy imports is still comparatively lower than in other Member States.

Since 2030, the import dependency ratio has started to improve due to lower gross inland consumption, reversing the upward trend and is expected to reach 36.52 % in 2040 and positively affect import dependency.

Figure 74: *Energy dependency (%), WEM Scenario*

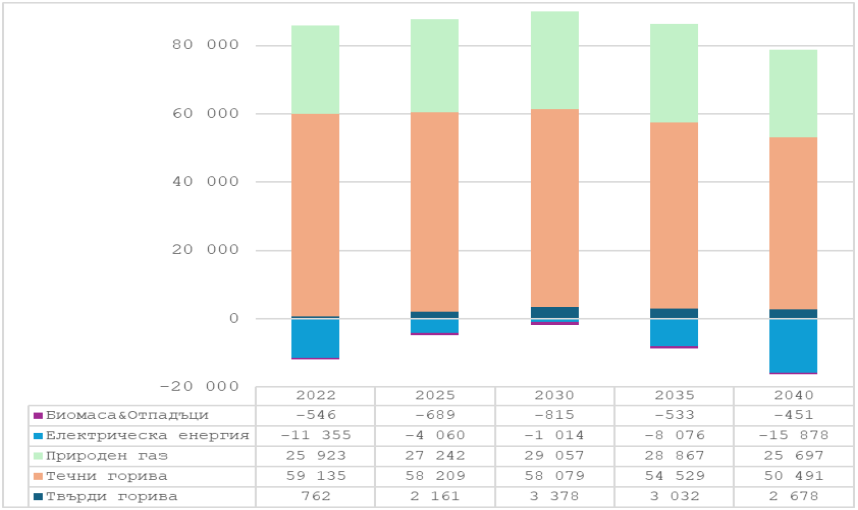


Source: (B) EST model, E3-Modelling

Bulgaria's import dependency remains above 29 % throughout the WEM scenario projection horizon, mainly due to continued dependence on imported fuels such as solids, oil and natural gas, which maintain a significant presence in all sectors. Despite slight reductions in final energy consumption, the constant use of these imported fuels does not allow a significant reduction in import dependency.

The projections in this scenario foresee a growth of low-carbon production, allowing Bulgaria to maintain its net export balance positive over the entire time horizon under consideration. No net imports of electricity are foreseen to meet consumption in Bulgaria.

Figure 75: *Net imports by fuel type in 2022-2040, GWh, WEM scenario*



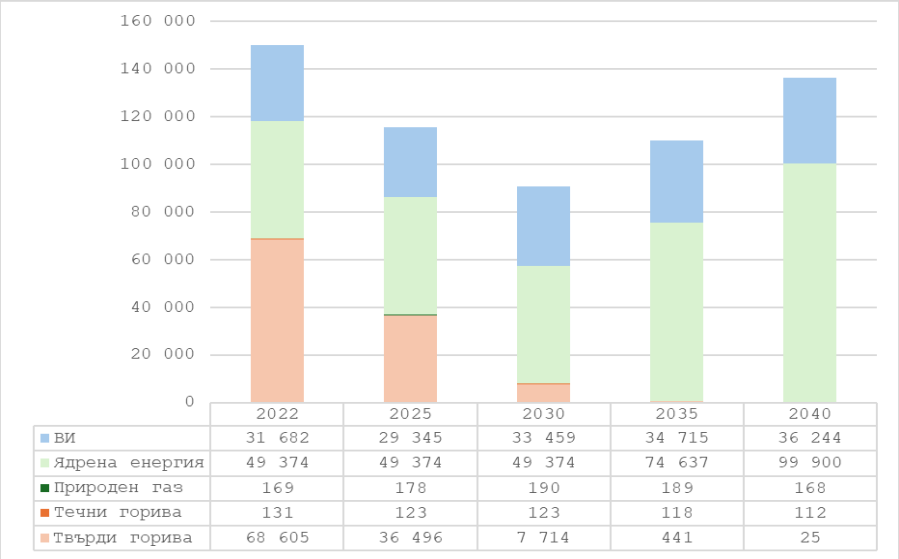
	2022	2025	2030	2035	2040
Биомаса&Отпадъци	-546	-689	-815	-533	-451
Електрическа енергия	-11 355	-4 060	-1 014	-8 076	-15 878
Природен газ	25 923	27 242	29 057	28 867	25 697
Течни горива	59 135	58 209	58 079	54 529	50 491
Твърди горива	762	2 161	3 378	3 032	2 678

Source: (B) EST model, E3-Modelling

Over the period, imports of natural gas are expected to increase by 2030, reaching 29 057 GWh, after which they will start to decline and are expected to be 2 040 GWh in 25 697, close to the 2022 level.

For liquid fuels, a decreasing trend in imports of close to 8 644 GWh (14.6 %) is projected, reaching 50 491 GWh at the end of the period.

Figure 76: *Production of primary energy by fuel type during the period 2022-2040, GWh, WEM scenario*



	2022	2025	2030	2035	2040
ВИ	31 682	29 345	33 459	34 715	36 244
Ядрена енергия	49 374	49 374	49 374	74 637	99 900
Природен газ	169	178	190	189	168
Течни горива	131	123	123	118	112
Твърди горива	68 605	36 496	7 714	441	25

Source: (B) EST model, E3-Modelling

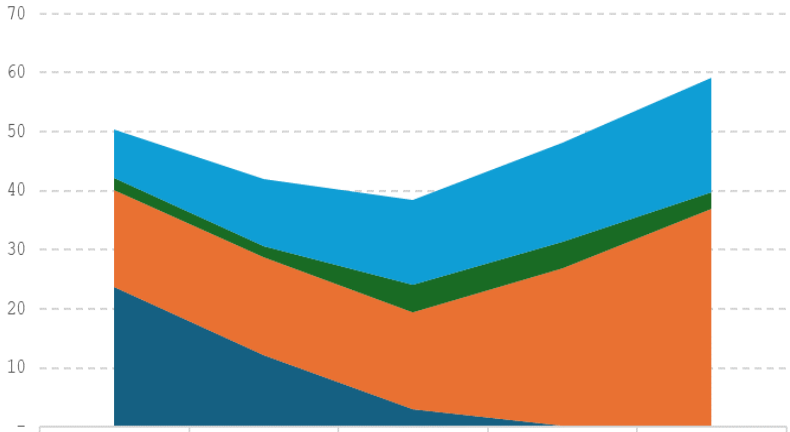
The scenario under consideration envisages a significant increase in the share of primary energy produced from renewable sources, in line with the country's climate neutrality targets. Energy production from renewable sources is expected to reach 36 244 GWh at the end of the period, which is 4 562 GWh (14.4 %) more than in 2022.

In this respect, a severe reduction of nearly 91 % of fossil energy production is expected, reaching 68 605 GWh in 2022 at the end of the period considered.

Nuclear fuel production is projected to increase significantly to 99 900 GWh in 2040, compared to 49 374 GWh in 2022.

By 2035, the production of natural gas is expected to increase by almost 12 %, reaching 189 GWh, after which it will decrease to 168 GWh at the end of the period considered.

Figure 77: *Gross production of electricity by fuel during the period 2022-2040, GWh, WEM scenario*



	2022	2025	2030	2035	2040
ВЕИ	8.3	11.4	14.5	16.9	19.4
Природен газ	2.1	1.9	4.7	4.5	2.9
Ядрена енергия	16.5	16.5	16.5	26.6	36.7
Твърди горива	23.7	12.2	2.9	0.3	0.1

Source: Source: (B) EST model, E3-Modelling

Over the period considered, total electricity production is expected to increase by close to 17.4 %, reaching 2 040 GWh in 59,2, compared to 50.4 GWh in 2022.

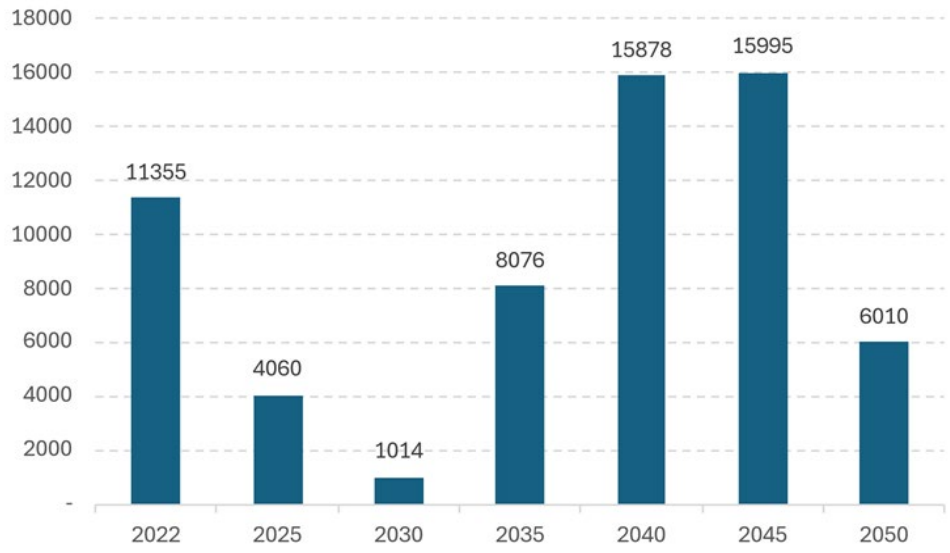
The largest increase of 11.1 GWh is projected for the production of electricity from renewable sources, from 8.3 GWh in 2022 to 19.4 GWh at the end of the period considered.

Nuclear power generation is also set to grow and is expected to reach 2 040 GWh in 36,7, compared to 16.5 GWh in 2022. Also, although significantly lower, natural gas production is also expected to grow at 2.9 GWh at the end of the period, which is around 11 % higher than in 2022.

A significant reduction in electricity production from solid fuels is projected, from 23.7 GWh in 2022 to 0.1 GWh at the end of the period considered.

Throughout the forecast horizon, Bulgaria maintains its position as a net exporter of electricity, albeit with some fluctuations. By 2030, the reduced production of solid fuel power plants, the short timeframe for the modernisation of plants and the implementation of renewable energy projects resulted in reduced exports. However, with the commissioning of two new nuclear units in 2035 and 2040, exports increased significantly. Until 2050, with the decommissioning of 5 units of the Kozloduy nuclear power plant, the country continued to maintain its exports, but to a lesser extent.

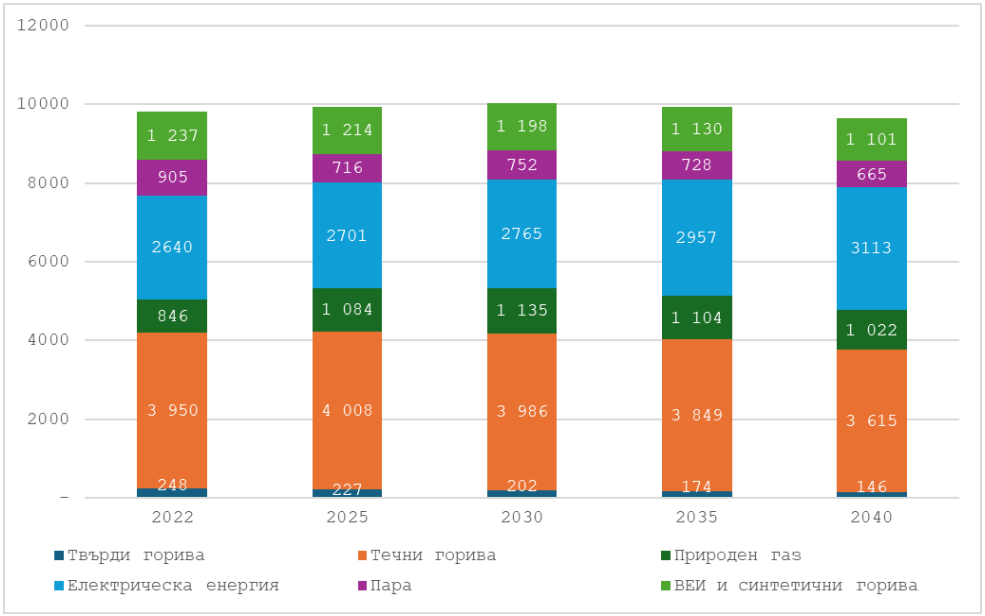
Figure 78: *Electricity**exports, (B) EST WEM forecasts (GWh)***



Source: (B) EST model, E3-Modelling

The WEM scenario projects a significant drop of more than 90 % in electricity exports by 2030, when it will reach 1 014 GWh. Over the next 10 year period, electricity exports are expected to grow to 2 040 GWh in 15 878, with an increase of 4 523 GWh (close to 40 %) compared to 2022.

Figure 79: *Final energy consumption by fuel type during the period 2022-2040, ktoe, WEM scenario*



Source: (B) EST model, E3-Modelling

A reduction in final consumption of energy produced from fossil fuels, liquid fuels and natural gas is expected in 2022-2040. The most pronounced projected reduction in fossil energy consumption is from 248 ktoe in 2022 to 146 ktoe in 2040 or 12.9 %.

Final energy consumption from liquid fuels amounted to 2022 ktoe in 3 950 and is expected to reach 3 615 ktoe at the end of the period, resulting in a reduction of nearly 8.5 %. For natural gas, an increase of 17 % is projected at the end of the period, with values of 846 ktoe in 2022 projected to reach 1 022 ktoe in 2040.

Final energy consumption from renewable sources is expected to increase throughout the period considered, with an estimated consumption of 2040 ktoe in 3 131, which is nearly 18 % higher than in 2022.

Table 37*: Share of fuels in final energy consumption during the period 2022-2040,%*

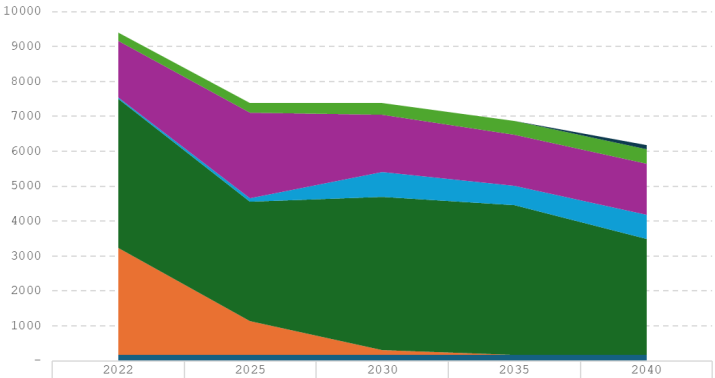
	2022	2025	2030	2035	2040
Solid fuels	2.5 %	2.3 %	2.0 %	1.7 %	1.5 %
Liquid fuels	40.2 %	40.3 %	39.7 %	38.7 %	37.4 %
Natural gas	8.6 %	10.9 %	11.3 %	11.1 %	10.6 %
Electricity	26.9 %	27.1 %	27.5 %	29.7 %	32.2 %
Steam	9.2 %	7.2 %	7.5 %	7.3 %	6.9 %
RES and synthetic fuels	12.6 %	12.2 %	11.9 %	11.4 %	11.4 %

Source: (B) EST model, E3-Modelling

The largest share of fuels in the country's energy mix in 2040 is expected to continue with liquid fuels, despite some decrease from 40.2 % in 2022 to 37.4 % at the end of the period considered. The share of energy from renewable sources and synthetic fuels is also expected to decrease from 12.6 % to 11.4 % in 2040, as well as in energy from solid fuels and steam.

The projected share of energy from natural gas is expected to increase by almost 23 % in 2040 compared to the beginning of the period, to 10.6 %.

Figure 80: *Production of heat by fuel type during the period 2022-2040, GWh, WEM scenario*



	2022	2025	2030	2035	2040
ОЦ на електрическа енергия	-	-	-	-	115
ОЦ, на ВЕИ	241	287	345	387	427
ОЦ, на нефт и газ	1616	2454	1625	1473	1448
КПЕТЕ биомаса	45	91	713	547	696
КПЕТЕ от газ	4255	3416	4386	4294	3324
КПЕТЕ от твърди горива	3069	972	147	-	-
КПЕТЕ от ядрена енергия	169	169	169	169	169

Source: (B) EST model, E3-Modelling

The production of heat in the period 2022-2040 is characterised by the projected shutdown of energy production from cogeneration installations (CHP) of solid fuels after 2030. A reduction in heat production from oil and gas heating plants (HPP) as well as from natural gas CHP is expected to decrease by 168 GWh (around 10 %) and 931 GWh (close to 22 %) respectively compared to 2022.

There is a projected increase in the heat produced in PCs using renewable sources, reaching 2 040 GWh in 427, compared to 241 GWh in 2022, representing an increase of around 70 %.

Priorities in this short period are:

1. Enabling the conclusion of long-term contracts for the supply of electricity and heat from low-emission sources, with the possibility of aggregating electricity from different low-emission fuels into a single contract, including stored energy of this origin.

2. Commissioning of new electricity generation capacity from renewable sources.

3. Develop and adopt the necessary regulations for clear and efficient procedures for the production, storage, transport and use of hydrogen and hydrogen products in transport, industry and household.

4. Development of efficient district heating and cooling and local heating systems using high-efficiency cogeneration, low carbon sources and/or renewable energy and with the possibility of short-term energy storage.

The implementation and activities under the priorities set will contribute to the successful implementation of the planned policies by 2030, which are by nature a major demand for a significant change in the energy sector towards low-emission technologies, renewable energy and innovation.

The main focus is on:

1. Implementing investment measures to promote energy independence of households, with a focus on energy communities and implementing different forms of support for energy poor households.

2. Implementation of new nuclear capacity projects, including the preparation of projects for the construction of small modular reactors (SMRs) for cogeneration on the one hand, and hydrogen, heat for district heating, chemical products and high potential heat for industry on the other.

3. Installation of renewable energy production capacity, including offshore power plants, implementation of projects for new power plants.

4. Implementation of energy efficiency measures and decentralised production of electricity and heat, as well as implementation of energy efficiency measures and production of energy for industry self-consumption.

5. Implementation of measures for the remediation of damaged coal mines and the development of functioning industrial zones in the coal regions.

In the longer term, the promotion of new RES and energy storage capacities and systems will continue to be promoted until 2035. Efforts will be to continue implementing mine remediation measures and electrification measures for industry, transport and households. Other equally important policies and activities planned relate to:

1. Developing elements of the hydrogen economy on a market-based basis and discontinuing support for investments in natural gas, where investments already made and natural gas facilities put into operation can be operated and maintained until their design lifecycle is exhausted.

2. Implementation of projects to increase cross-border connectivity.

3. Implementation of district heating projects near the resources of low-potential geothermal energy and municipal waste.

As a follow-up to the energy transformation and transition process by 2040, a number of energy efficiency and decentralised electricity generation measures are foreseen, supporting renewable energy communities and energy independence of households and small and medium-sized enterprises.

4.5 dimension "Internal Energy Market"

4.5.1. Electricity interconnectivity

i. Current interconnection level and main interconnectors

The Bulgarian electricity system (EEC) works in parallel with the EU of the countries of continental Europe. Our EEC is connected to the united European EEU through the following interconnectors:

- EP 400 kV Kozloduy (BG) – p/st Tuncareni (RO);

- EP 400 kV Kozloduy (BG) – p/st Tunceareni (RO);
- EP 400 kV/st Varna (BG) – p/st Mezzidia (RO);
- EP 400 kV p/st Dobrudzha (BG) – p/st Mezzidia (RO);
- EP 400 kV/st Sofia West (BG) – p/st N (RS);
- EP 400 kV p/st Red Mogila (BG) – p/st Styp (MK);
- EP 400 kV p/st Blagoevgrad (BG) – p/st Thessaloniki (GR);
- EP 400 kV/st Maritsa East (BG) – na Santa (GR);
- EP 400 kV TPP MI3 (BG) – p/st Hamitabat (TR);
- EP 400 kV TPP MI3 (BG) – p/st Hamitabat (TR).

The current level of electricity interconnection is:

— 21.7 % of capacity, taking into account import security criteria;

— 22.6 % of capacity, taking into account the criteria of export reliability;

— 144 % of nominal capacity, relative to peak load;

— 265 % of the total rated capacity, compared to the installed RES production capacity.

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

Prospects for the development of electricity connectivity by 2030:

Planning the development of transmission networks and interconnections in the countries of the south-east of mainland Europe is set out in the regional investment plan and is confirmed every two years in the ENTSO-E's Europe-wide ten-year plan, the long-term horizon of which is currently 2040.

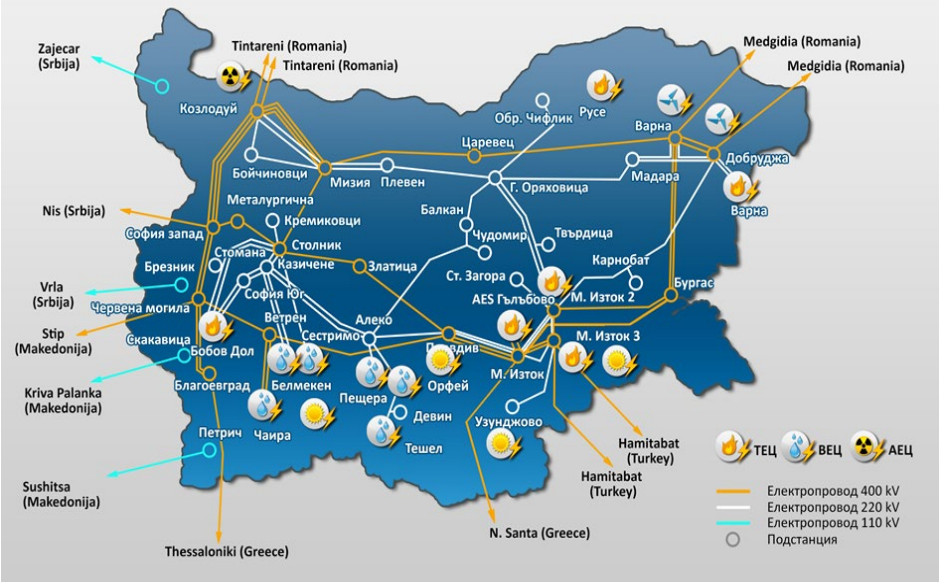
There is a trilateral Bulgaria-Greece-Türkiye project to assess the possibilities of building a third interconnection between Bulgaria and Türkiye, the work of which has not yet been completed.

4.5.2 electricity and gas transmission infrastructure

i. Main features of existing electricity and gas transmission infrastructure

The electricity transmission infrastructure of Bulgaria is owned by ESO EAD, which is an independent transmission operator certified by the European Commission. The Bulgarian electricity system works in parallel with the EU of the countries of continental Europe. Our EES is connected to the united European EEU through four electricity interconnections with Romania, two with Türkiye and Greece, and one with the Republic of Serbia and the Republic of North Macedonia.

Figure 81*: Transmission infrastructure map PD*



Source: ESO EAD

The existing electricity transmission infrastructure covers: 2 571 km of 400 kV power lines, 2 837 km of 220 kV power lines, 9 960 km of 110 kV power lines, 34 system substations and 263 lowering substations.

Overhead power lines of the national transmission system:

- 400 kV with a total length of 2 519 km;
- 220 kV with a total length of 2 812 km;
- 110 kV with a total length of 9 990 km.

Transformer substations:

- 32 system substations with a total transformer capacity of 15 888 MVA;
- 259 reducing substations with a total transformer capacity of 15 383 MVA.

Hub stations:

- One 400 kV hub station;
- One 110 kV hub station.

Fibre optic network:

- With a total length of 3 118 km.

Article 16 (8) of Regulation (EU) 2019/943 of 5 June 2 019 on the internal market for electricity provides that transmission system operators shall not limit the volume of interconnection capacity to be available to market participants as a means to address congestion in their own bidding zone or as a means of managing flows resulting from transactions that are internal to bidding zones. This requirement is met when a minimum threshold of 70 % of transmission capacity between trading areas is reached, respecting

safety standards for secure network operation, including compliance with the emergency security standard (N-1).

ESO EAD has implemented the necessary development of its transmission network and the limitations of cross-border capacities with Romania and Greece are due to lower productivity in their internal networks and third countries.

ESO EAD submitted to the KEVR a reasoned request for a derogation from the requirements of Article 16 (8) for a period of one year, with the possibility of extending the period for a further period, up to the maximum period of two years, in accordance with Article 16 (9) of Regulation (EU) 2019/943.

Structure of natural gas transmission and storage infrastructure:

Two independent transmission operators, Bulgartransgaz EAD and Ai Si Zi Bi AD, are certified and operate on the territory of the Republic of Bulgaria.

Bulgartransgaz EAD's gas transmission network infrastructure consists of 3 443 km, an underground gas storage facility in Chiren (UGS), gas highways and high-pressure gas pipelines, eleven compressor stations, an electrochemical protection system, purification facilities, a communication system, an information system and other associated facilities. The gas transmission network transports natural gas to exit points in the country and transports to cross-border points with neighbouring countries – Greece, Romania, Serbia and North Macedonia.

Bulgartransgaz EAD's gas transmission infrastructure has 11 compressor stations – KS Kardam-1, Vuschi Dol, Polski Senovets, Kardam-2, Provadia, Nova Provadia, Lozenets, Strandzha, Ihtiman, Petrich and Rasovo, with a total installed capacity of around 374 MW. The main entry and exit points of the transmission network of the operator are:

- Interconnection point (IP) Negru Water/Cardam – connection between Bulgartransgaz EAD's gas transmission network and the gas transmission system operated by Transgaz S.A. (Romania) at the Bulgarian-Romanian border in the area of the village of Kardam, municipality of General Toshevo;

- Interconnection point (IP) Kulata/Sidirokastro – connection between Bulgartransgaz EAD's gas transmission network and the gas transmission system operated by DESFA S.A. (Greece), located on the Bulgarian-Greek border in the area of the village of Kulata, municipality of Petrich;

- Interconnection point (IP) Strandzha/Malkchler (IP) – connection between Bulgartransgaz EAD's gas transmission network and the gas transmission system operated by botas (Türkiye), located on the Bulgarian-Turkish border in the area of the village of Strandzha, municipality of Bolyarovo;

- Interconnection point (IP) Strandzha 2/Малкочлар – interconnection between Bulgartransgaz EAD's gas transmission network and the gas transmission system operated by TAGTAS (Türkiye), located at the Bulgarian-Turkish border, in the region of Strandzha, municipality of Bolyarovo;

- Interconnection point (IP) Kyustendil/Zidilovo – exit point, connection between Bulgartransgaz EAD's gas transmission network and the gas transmission system operated by Nomagas (Republic of North Macedonia), located on the Bulgarian-Macedonian border in the area of the village of Gueshevo, Kyustendil municipality;

- Interconnection point (IP) Ruse/Giurgiu – connection between Bulgartransgaz EAD's gas transmission network and the gas transmission system operated by Transgaz S.A. (Romania), located on the Bulgarian-Romanian border in the area of the village of Martin, Ruse Municipality;

- Interconnection point (IP) Kyreevo/Zaychar – connection between Bulgartransgaz EAD's gas transmission network and the gas transmission system operated by Gaztrans (Serbia), located on the Bulgarian-Serbian border in the area of the village of Kyreevo, the municipality of Mareș;

- Interconnection point (IP) Kalotina/Dimitrovgrad – connection between Bulgartransgaz EAD's gas transmission network and the gas transmission system operated by Transportgaz Srbija (Serbia), located on the Bulgarian-Serbian border in Kalotina, Dragoman municipality;

- Interconnection point (IP) Stara Zagora – connection between the gas transmission network of Bulgartransgaz EAD and the gas pipeline (IGB) operated by Ai Si Zi Bi AD (Bulgaria) located in the area of the village of Zagore, Stara Zagora Municipality;

- GIS Galata – entry point from local natural gas extraction;

- GIS Dolni Dabnik – entry point from local natural gas production;

- Entry/exit point GIS Chiren – connection between the gas transmission network and UGS Chiren.

The Chiren underground gas storage facility was built in the village of Chiren on the basis of an already depleted gas-condensed deposit. The storage is equipped with the necessary underground and ground equipment for the injection and withdrawal of natural gas and preservation of the quality of gas in storage. UGS Chiren has 24 operational wells and a compressor station with a total installed capacity of 9 MW. The current storage capacity can provide storage of 550 m m^3 natural gas. The capacity for withdrawal and injection is directly dependent on the pressure exerted by injected layers of gas and the total amount of gas in storage. The minimum production capacity is 0.5 million m^3per day and a maximum of 4.7 million m^3 perday under an enhanced (emergency) production regime. However, this emergency mode can only take place with a full gas storage and a period of time of up to 30 days. UGS Chiren is used to cover the seasonal uneven consumption of natural gas in the Republic of Bulgaria and the provision of emergency reserves in the event of unforeseen and force majeure situations. Also, UGS Chiren plays an increasingly important role as a commercial storage facility for developing competition and enhancing benefits for natural gas consumers in an interconnected and single pan-European gas market. A gas storage extension project is underway, which aims to increase active gas to 1 billion m^3 and to increase daily extraction and injection capacities to 8-10 million м3/ден.

The increased capacities will ensure security of supply of natural gas and contribute to improving competition and access to natural gas from alternative sources, thus helping to increase the liquidity of the gas markets in Bulgaria and the region.

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

Electricity transmission infrastructure:

The following development of the transmission network 400 kV and 110 kV is envisaged:

- Construction of a new EP 400 kV from p/st Tsarevets to p/st Zlatitsa;
- Construction of a new EP 400 kV from TPP Maritsa Iztok 2 to p/st Tsarevets;
- Construction of a new 400 kV ring in the south-east of the country (p/st Uzundzovo – p/st Lyubimets 2 – p/st Tenevo 2);
- Construction of a new 400 kV ring in the north-east of the country (p/st Varna – p/st Dobrich 2 – p/st General Toshevo 2 – p/st Svoboda);
- Doubling of the 400 kV ring in the Varna direction – Temtzov Chiflik – Tsarevets – Mizia;
- Construction of a new EP 400 kV from Vetrenne to Blagoevgrad;
- The reconstruction of a large number of 110 kV lines, in all areas of the country with RES requested, above grid capacity;
- Staged replacement of 400/110 kV vehicle transformers in system substations with higher power;
- Reconstruction and extension of a number of 110 kV/pH substations and replacement of existing 110 kV/pH transformers with higher power;
- Construction of new substations 110 kV/SRN;
- ESO has ready technical solutions to develop the electricity grid when new nuclear capacity is connected. The envisaged development of the 400 kV network will ensure the fulfilment of the "n-2" security criterion for nuclear units, ensuring the necessary resilience of synchronous generators and allowing the export of the generated electricity to the interior and neighbouring countries, under normal and repair circuits of the grid. The requirements for back-up power for the new nuclear units will also be met.

<u>Planned and ongoing projects:</u>

- Investment C4.I4. Digital transformation of the electricity grid, National Recovery and Resilience Plan

The implementation of the Investment will achieve: (1) increase grid connection capacity by at least 4 500 MW to integrate new renewables into the electricity system and (2) cross-border capacity increase of at least 1 200 MW to optimise the use of existing assets. The

implementation of the investment is essential to ensure national energy security, as the integrated implementation of the SASP is an integral part of the overall modernisation of Bulgaria's electricity network planning, management and maintenance activities, by introducing state-of-the-art digital means and methods to provide the necessary manoeuvrability, security and speed in managing the electricity system in a low-carbon generation environment.

- Project "Sustainable adaptation of the national electricity grid to fully integrate the renewable energy production potential – GREENABLER". The proposed investment will provide the technical possibility to connect around 4 500 MW of new RES to the national network after 2 026 year. The project is divided into two main groups of investments:
  - First group – investments in the reconstruction of about 720 km of existing power lines to increase their nominal voltage from 220 kV to 400 kV and synchronised refurbishment of their adjacent substations from 220/110 kV to 400/110 kV, this investment group was approved for funding from the Modernisation Fund by the Council of Ministers Decision 110/15.02.2024;
  - Second group, investments in the reconstruction of the Hemus-Stara Mountain Pipeline from 220 kV to 400 kV, reconstructing 888 kilometres of 110 kV power lines and doubling 92 km of 110 kV power lines to increase the capacity of existing overhead lines. This investment group is to be included for funding from the National Recovery and Resilience Plan, chapter REPower EU.
- Project of Common Interest (PCI) 12.2 Carmen/Carmen (Bulgaria, Romania)

The project is for deeper cross-border cooperation between transmission system operators (TSOs) and data sharing, for deeper cooperation between TSOs and distribution system operators (DSOs), for investing in grid expansion and increasing capacity to integrate new renewable energy sources, and for improving grid stability, security and flexibility. PCI 12.2 Carmen is included in the list of projects of common and common interest of the Union for the construction of trans-European energy infrastructure in the priority thematic area Smart Grid Deployment by EC Delegated Regulation of 28.11.2023 amending Regulation 2022/869.

Gas transmission infrastructure:

Bulgartransgaz EAD's planned activities are aimed at expanding the gas transmission network and capacity of UGS Chiren, as well as increasing the technical transmission capacity at interconnection points, in order to meet the growing demand for natural gas from south to north and to enable increased gas flows from reliable and alternative sources for Bulgaria and the region.

The main projects for the extension of Bulgartransgaz EAD's infrastructure include:

- Extension of UGS Chiren;

- Construction of the LNG floating terminal at Alexandroupolis, in which Bulgartransgaz EAD participates with 20 %;
- Participation in a second LNG terminal in Greece;
- Increase of transmission capacity from Greece to Bulgaria in IP Kulata/Sidirokastro;
- Increase of transmission capacity from Bulgaria to Romania in IP Negru Voda/Kardam;
- Construction of high-pressure gas transmission infrastructure with sufficient capacity to coal regions in Bulgaria;
- Development of hydrogen transmission infrastructure.

iii. Indicative projections of developments under existing policies for 2030 (forecast up to 2040)

According to European legislation, the transmission capacity must be at least 10 % from 2020 and at least 15 % from 2030, relative to the generation installed, taking into account security, criterion (N-1) and reliability margin.

In order to achieve this objective and to diversify natural gas supply sources and routes, Bulgaria has implemented the projects detailed in point 2.4.4.

4.5.3 gas and electricity markets, energy prices

i. Current situation of electricity and gas markets, including energy prices

Electricity

In connection with the restructuring of activities related to generation, transmission and management of the energy system in accordance with Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2 009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC (Directive 2009/72/EC), the Republic of Bulgaria has chosen the 'independent transmission operator' model, whereby the transmission operator and network assets are separated into a separate legal entity within a vertically integrated undertaking carrying out functions of generation and supply.

In compliance with the requirements of Directive 2009/72/EC, following the completion of the procedure for unbundling ESO EAD from NEK EAD in 2014, ESO EAD is the owner and operator of the entire electricity transmission network in Bulgaria.

ESO EAD was certified as an independent transmission operator by a decision of the KEVR of 2015, fulfilling the requirements of Articles 10 and 11 of Directive 2009/72/EC and Article 3 of Regulation (EC) No 714/2009.

The distribution of electricity is carried out by electricity distribution system operators in separate areas: Zapad EAD, Elektrorazpredelenie Sever AD, Elektrorazpredelenie Yug EAD and Elektrorazpredelenie Zlatni Sands AD.

In accordance with Directive 2009/72/EC and under the Energy Act, the electricity market in Bulgaria has been liberalised since 1.7.2007, with the liberalisation process being phased out and electricity trading in Bulgaria taking place in two market segments, at freely negotiated prices and at regulated prices.

The electricity market in the Republic of Bulgaria is characterised as national. Its structure and organisation are governed by the Electricity Trading Rules. The electricity market consists of an electricity market through bilateral contracts concluded on the exchange operator's platform, an exchange market, a balancing energy market, a reserve market and ancillary services, a market for the provision of interconnection capacity.

Commercial actors are electricity producers, electricity traders, balancing group coordinators, final customers, the public electricity supplier, final electricity suppliers, the independent transmission operator, the exchange market operator, distribution system operators, suppliers of last resort and the distribution undertaking of traction electricity.

The electricity exchange market is organised by BEB EAD, which holds a licence for this activity. The BEB carries out the administration of all transactions in the 'Day ahead', 'Intraday' and 'Intraday' segments and a centralised market for the purchase and sale of electricity by means of bilateral contracts.

With a change to the Energy Act, which entered into force in 2018, transactions in electricity at freely negotiated prices also included transactions to compensate for the technological costs of transmission and distribution of transmission and distribution system operators. Article 100 (4) of the Energy Act provides that these transactions are to be carried out on an organised electricity exchange market.

With the amendments to the Energy Act, all RES and RES producers with an installed capacity greater than or equal to 500 kW must offer their electricity on an organised exchange market. These changes, as well as the obligation for all business users to be part of the free market from 1.7.2021, have substantially altered the market model.

Four electricity distribution system operators are active on the retail market, which are licensed to distribute electricity to customers connected to the low and medium voltage distribution system on the respective distinct territories.

From a supply-side perspective, the retail market consists of three groups of suppliers:

- A supplier of last resort ('WHT'), a supplier that guarantees the provision of a universal service as a last resort, in accordance with a licence from the KEVR, is under an obligation to supply electricity customers who are connected to the distribution system and who have not selected a trader of electricity or where the trader of their choice does not supply for reasons beyond the customer's control. The final selling prices of the WHT are determined in accordance with the KEVR Methodology for determining the electricity prices of a supplier of last resort;

- Final supplier of electricity – supplies electricity at regulated prices set by the KEVR to household and non-household final customers connected to the electricity distribution network at low voltage level;
- Free market supplier, a trader supplying electricity to household and non-household customers at prices determined on the basis of supply and demand.

Until 2025, electricity supply costs within the WEM forecast include a significant share of emissions and energy charges. With the introduction of increasing renewable capacity and the phasing out of carbon-intensive power plants, the cost structure of electricity supply has shifted towards an increased contribution of capital costs. On the contrary, fuel costs are reducing their share, reflecting the transition to less fuel-dependent renewable energy technologies, which are, however, more capital intensive.

Natural gas

The operation of Bulgaria's national gas system is directly linked to the activities of the two gas transmission companies in Bulgaria, Bulgartransgaz EAD (which also owns the underground gas storage facility UGS Chiren) and Ai Si Zi Bi AD, as well as of the national public natural gas supplier Bulgargaz EAD.

Bulgartransgaz EAD is certified as an independent transmission operator (ITO) carrying out licensing activities for the transmission and storage of natural gas in Bulgaria. Domestic consumption of natural gas is mainly covered by imports through Bulgartransgaz EAD's gas transmission system and the IGB pipeline.

Data from the NSI's overall energy balance for 2022 show that the share of natural gas in primary energy consumption is 11.88 % and 11.25 % of final fuel and energy consumption.

In 2022, the country's consumption of natural gas amounted to 28 203 GWh. The quantities transported through Bulgartransgaz's gas transmission network to cross-border points with neighbouring countries amount to 135.4 TWh, with a significant increase of around 33 % year-on-year compared to 2021. The demand for natural gas from alternative sources and LNG terminals have continued to grow. With the implementation of the major new infrastructure and regasification terminals projects in the region, additional quantities of natural gas will be provided for the regional gas market.

In order to ensure security of supply of natural gas at prices acceptable to consumers in Bulgaria, a natural gas exchange has been operational in Bulgaria since 2 January 2020, which provides the conditions for a competitive environment for traders and consumers of natural gas. As of 2 January 2020, the BALKAN EAD gas hub trading platform launched multilateral trading on the organised exchange market, including a short term segment (spot), a long-term segment and a brokerage service. The state monopoly in the sector has thus largely been abolished.

The main players in the gas market are the following:

- Bulgartransgaz EAD – a combined gas operator licensed to carry out the activities of transmission and storage of natural gas;

- Balkan Gas Hub EAD and Bulgarian Energy Trading Platform AD- operators of trading platforms providing a trading environment for an organised exchange market for trading in natural gas on a bilateral basis;

- Gas distributors – they supply both natural gas from the final gas supplier and activities of distribution of natural gas, supply of natural gas to customers connected to their networks. It is their duty to build and develop the gas distribution networks in accordance with the long-term business plans and conditions of the KEVR;

- Bulgargaz EAD, a public natural gas supplier in Bulgaria, responsible for ensuring the supply of natural gas at prices and conditions approved by the KEVR;

- Traders in natural gas – carry out a natural gas supply transaction with the public supplier, final suppliers, customers, other natural gas traders, production companies, natural gas storage companies and the combined operator;

- Non-household natural gas customers connected to the gas transmission networks;

- Non-household and household natural gas customers connected to the gas distribution networks.

The total length of distribution networks is 5 587 km and covers 173 municipalities. The total number of gas distribution companies' customers as at 31.12.2022 was 152 383, of which 8 253 non-household customers and 144 130 household customers. There is considerable potential for increasing the number of consumers, both on existing gas distribution infrastructure and in expanding it, leading to an increase in gas consumption.

Ai Si Zi Bi AD is the operator of the gas interconnector Greece-Bulgaria IGB. It was put into commercial operation on 1 October 2022. IGB connects a gas transmission network of Greece near the town of Komotini to the Bulgarian gas transmission network in the city of Stara Zagora. IGB is also connected to the Transatlantic Pipeline (TAP). The company carries on the activity 'Transmission of natural gas' on the basis of licence No L-576-06 of 4.11.2021 issued by the Energy and Water Regulatory Commission.

Bulgargaz EAD is a single-member joint stock company within the structure of Bulgarian Energy Holding EAD. The company carries out the activities 'Public supply of natural gas' for the territory of the Republic of Bulgaria and 'Trade in natural gas' on the basis of licence No 14/29.11.2006 for the activity 'Public supply', which has a duration of 214 years and licence No 15/16.06.2021 of the KEVR for the activity 'Trade' for a period of 35 years. Bulgargaz EAD has registration on the organised exchange market on the platform of Gazov Heb Balkan EAD, Balgarska Energy Trade Platform AD, the Gas Exchange in Greece (ENEX) and registration for trading in Slovakia and Serbia. A registration procedure for Bulgargaz EAD on Hungarian and Romanian gas exchanges is ongoing.

Bulgargaz EAD carries out the following activities:

- Enter into transactions with natural gas undertakings and traders in order to purchase natural gas in the quantities necessary to cover the consumption of customers directly connected to the gas transmission network and the quantities agreed for the operation of public suppliers;
- Enters into transactions for the sale of natural gas with customers;
- Enters into natural gas storage transactions with storage operators;
- Carries out other necessary activities related to the public supply of natural gas;
- Ensures a continuous and quality supply of natural gas;
- Shall not refuse to conclude a contract for the sale of natural gas to a customer who is directly connected to the gas transmission network or to a public supplier, in accordance with the legislation in force.

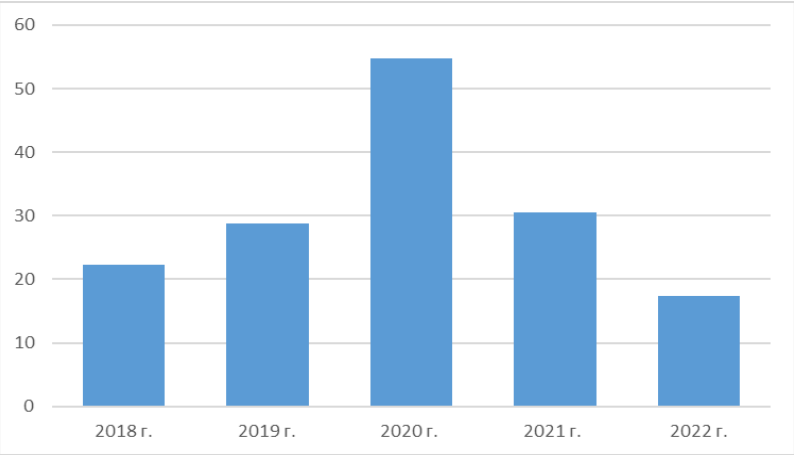
The complex gas market situation in Europe following Russia's military invasion of Ukraine and subsequent actions by OO Gazprom Export caused a shortage of natural gas in 2022. In order to safeguard the needs of all European consumers, the European Parliament and the Council adopted (in force since 1.7.2022) Regulation EU 2022/1032 amending Regulation 2017/1038 on safeguarding the security of natural gas supply (the Regulation). It establishes Member States' minimum filling obligations for underground gas storage facilities (at least 80 % of their operational capacity) for the autumn and winter period of 2022/2023. The Regulation obliges Member States to take the necessary measures, giving priority to market-based measures, including enabling the introduction of financial incentives or compensations for filling existing gas storages. The targets set out in the Regulation for the period 2023/2024 are even more ambitious than those for 2022 and provide for the capacity of all gas storage facilities in Europe to be filled to 90 % of their operating capacity by the end of October 2023.

Military action in Ukraine in early 2022 and increased demand for natural gas on the European gas market during the 2022 preparatory season led to record high prices of stored natural gas. Subsequently, the stabilisation of the gas market in Europe, as well as the decline in demand for natural gas in early 2023, due to the unusually high average temperatures on the continent, led to a situation where:

- European gas storage facilities, including Bulgaria, store quantities of natural gas at a higher price than their market value at the time of extraction during the winter period 2022-2023;
- It has become impossible to obtain these quantities in the timetable initially foreseen during the winter period of 2022-2023.

Natural gas production takes place on the territory of the country, but the quantities are very limited, which is also apparent from the graph.

Figure 82: *Extraction of natural gas in the country, mcm*



Source: ME

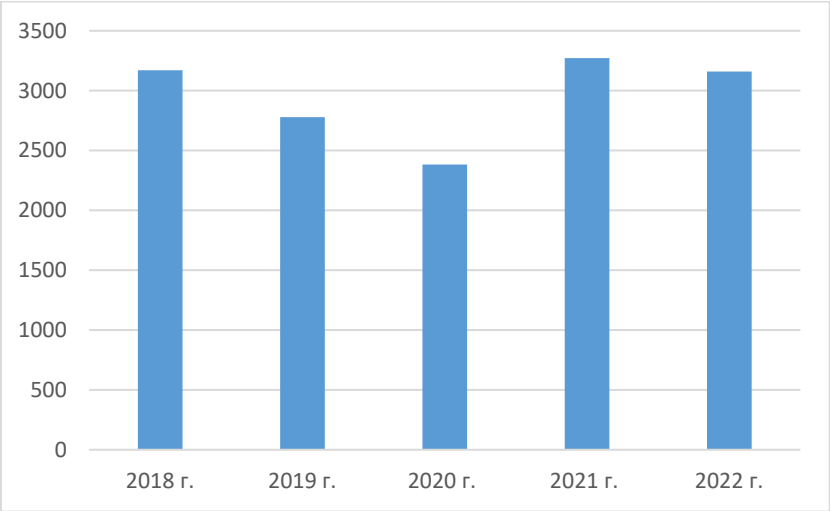
The Chiren underground gas storage facility has a total volume of 1300 mcm and the storage capacity (active gas) is 550 mcm active gas. The remaining capacity of 750 mcm is reserved for buffer gas storage. The values of the quantities of natural gas extracted and injected from 2018 to 2022 are presented in the following table.

Table 38: *Quantities of natural gas extracted and injected*

Natural gas at UGS Chiren	**2018**	**2019**	**2020**	**2021**	**2022**
	billid.m^3	billid.m^3	billid.m^3	billid.m^3	billid.m^3
Quantity injected	0.319	0.410	0,362	0,37279	0,42656
Quantity harvested	0.324	0.358	0,41295	0,47021	0,24055
Average daily yield for 1 month	0.00191	0.00212	0,00208	0,00243	0,00174
Minimum average daily yield for 1 month	0.00154	0.00107	0,00126	0,00178	0,00084
Maximum average daily yield for 1 month	0.00242	0.00281	0,00261	0,00284	0,00255

The quantities of natural gas delivered to the country between 2018 and 2022 are shown in the following graph:

Figure 83: *Imports of natural gas, mcm*



Source: ME

The chart shows the significant drop in imported volumes of natural gas in 2020. There was also a record low consumption in the same year.

Natural gas consumption in Bulgaria

Bulgaria's consumption of natural gas in recent years has been in the range of 30-35 000 GWh/y (3-3.5 billion $m^{3\ per}$ year). A significant proportion of district heating plants use natural gas as a fuel, their consumption being seasonal and increasing significantly during the winter season. Given the trends to promote decarbonisation and the use of low-carbon fuels, natural gas has the potential for significant and sustainable growth in industry, energy and household consumption. It also recognises its role as a transitional fuel in the decarbonisation process and the pursuit of a low-carbon economy.

Achieving higher levels of consumption and thus enabling it to be met is an essential process in creating a sustainable environment conducive to the development of industry and the economy.

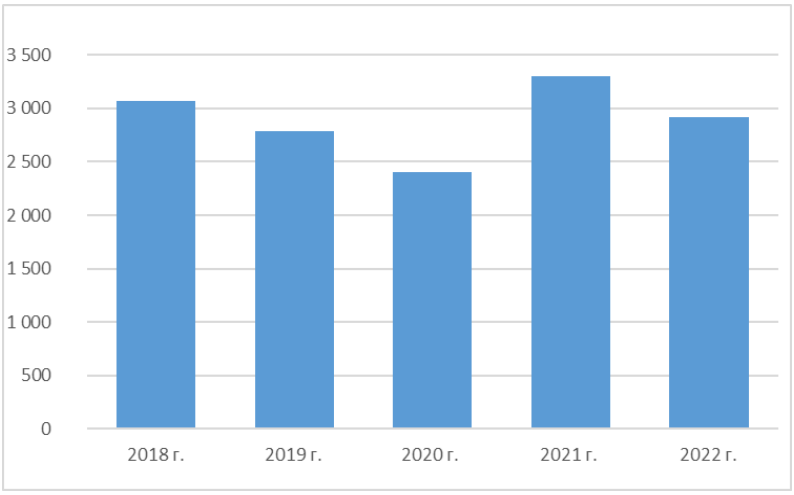
In addition to supporting the economy, increased consumption in line with the expansion of the gas network in new regions is directly linked to the development of the regions concerned – in business and social terms. Providing access to a sustainable and environmentally friendly energy source such as natural gas enables the gasification of new settlements, increasing the competitiveness of economic operators and subsequently reducing emissions of greenhouse gases and harmful substances by replacing traditionally used solid and liquid fuels.

Non-household natural gas customers and gas distribution networks were connected to the gas transmission network of Bulgartransgaz EAD. The non-household customers connected to the gas transmission network at the end of 2022 were 228. A large part of the gas distribution networks in the country were also connected to the gas transmission network. Three gas distribution networks are connected to natural gas extraction facilities in the country and receive natural gas from local production, while two of these networks also receive alternative supplies. The main supplier of non-household customers connected to

the gas transmission network is Bulgargaz EAD (191 customers at the end of 2022). Supplies to relevant customers are also made by natural gas traders.

The country's annual consumption of natural gas for the period from 2018 to 2022 by year is presented in the following figure:

Figure 84: *Natural gas consumption in the country, mcm*



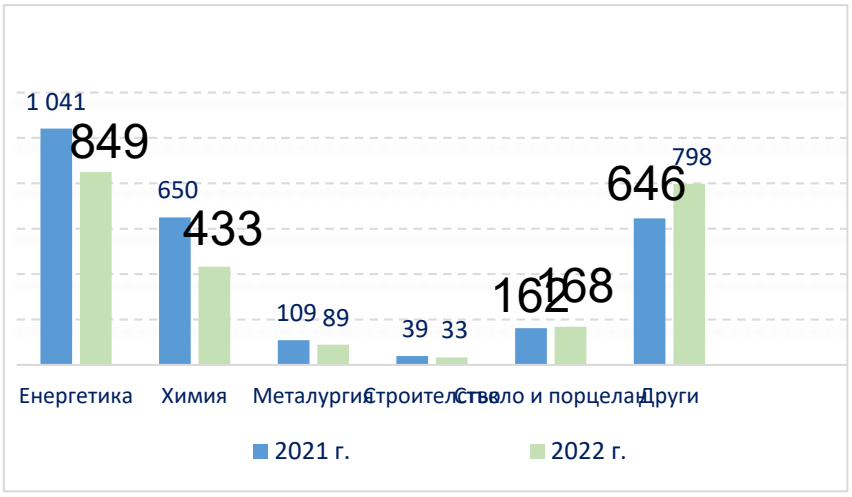
Source: ME

The main consumers of natural gas in the country are commercial companies in the energy and heima sectors.

State of play of the gas sector 2021 г./2022

The consumption of natural gas by the country's economy in 2022, compared to the consumption in 2021, is shown in the graph below, including the quantities of natural gas for the Hemia sector (1 517 km² 3)[purchased]by the LPG.

Figure 85: *Consumption of natural gas by the country's economy, million cubic metres.*

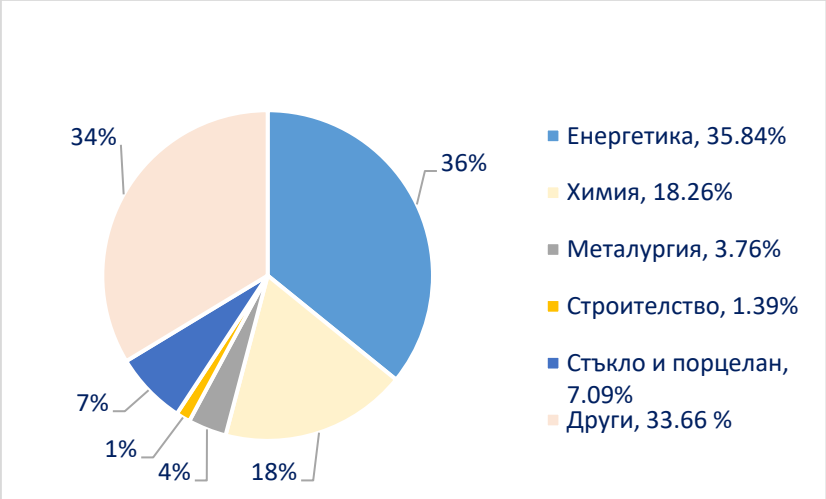


Source: ME

The chart shows that the consumption of natural gas in 2022 by the sectors of the country's economy was generally reduced, excluding glass and porcelain.

The structure of consumption by industry is presented in the following figure:

Figure 86: *Structure of natural gas consumption by the country's economy in 2022, million cubic metres.*

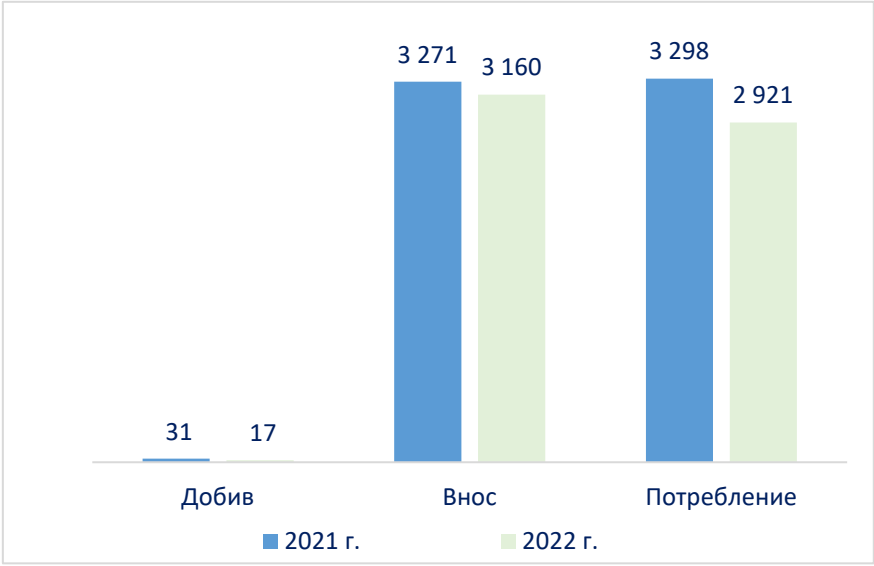


Source: ME

Energy remains the largest consumer of natural gas in the country, followed directly by the chemical industry. The two sectors consume 54.10 % of the total natural gas consumed in the country's economy.

Imported, consumed and extracted quantities of natural gas in Bulgaria are shown in graphic form, comparing them between 2022 and 2021.

Figure 87: *Production, import and consumption of natural gas in the country in 2022 compared to 2021, million cubic metres.*



Source: ME

In 2022, imports and consumption of natural gas in the country were marginally reduced. It should be noted that in 2022, for the first time, there was a real diversification of both sources and suppliers of natural gas to consumers in the country.

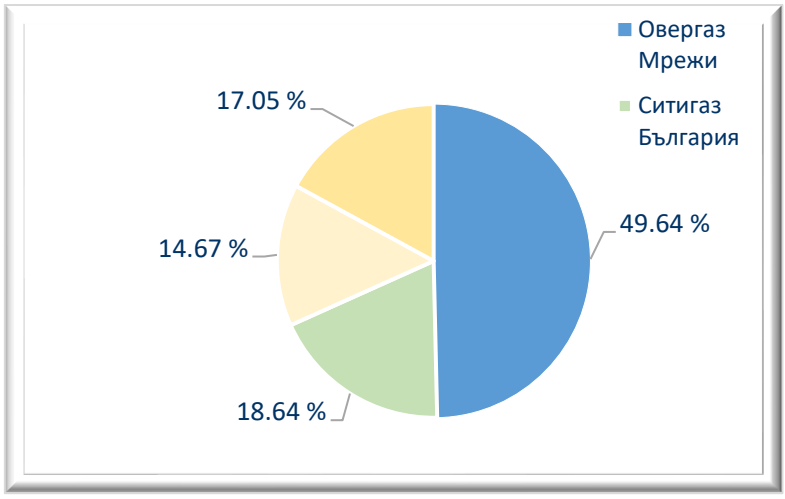
At the same time, the production of natural gas in Bulgaria is almost exhausted. As already mentioned, for the last 10 years it has been reduced by more than 22 times, or from 389 454 thousand m^3 in 2012, for the 2022 accounting year the yield in the country was only 17 379 thousand 3.

In 2022, the gas distribution companies purchased: (1) 347 437 thousand^3 natural gas from Bulgargaz EAD, which is 4.6 % less than in 2021, (2) 1 767 thousand 3^{of} the CNG, a decrease of 36 % compared to 2021 and (3) 120 392 thousand^3 from other sources of supply.

The total quantity of natural gas distributed in Bulgaria in 2022 was 469 596 thousand^3. This is 19 % lower than the implementation in 2021.

Gas distribution companies with the largest market share in the country and in 2022 were Overgas Networks AD, Sitigaz Bulgaria EAD and Aresgaz AD. Their market share in percentages for 2022 is shown in the graph below:

Figure 88: *Market share of gas distributors in 2022, mcm*



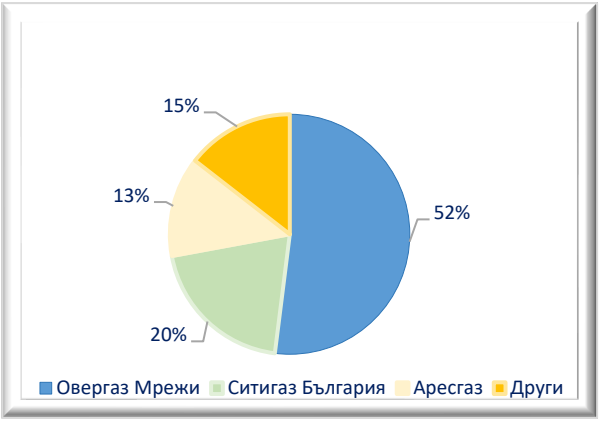
Source: ME

In 2022, with the largest market share of 49.6 % or 233$^{113\ thousand\ 3}$, the majority owned companies were Overgas Networks AD. This quantity is 23 % lower than that allocated by Overgas Networks AD in 2021. Furthermore, the amount of natural gas distributed in the country is Sitiga-Bulgaria EAD. The company has a market share of 18.6 %, which, in terms of quantity of natural gas distributed to final customers, represents 87 527 km²^3. Compared to the quantities delivered in 2021, Sitiga-Bulgaria EAD has a reduction of 25 % for the accounting year.

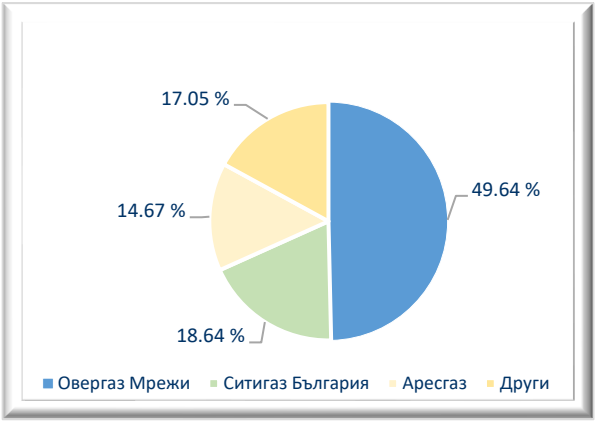
Aresgas AD has a market share of 14.67 %. The company distributed 68 885 km[23] natural gas, which is 12 % less than in 2021. The remaining licensees have a total share of 17.05 %. In structural terms, sales by customer type in 2021 and 2022 are presented in graphical form:

Figures 89 and 90: *Market share of gas distributors in 2021 and 2022,%*

2021



2022



Source: ME

At the end of 2022, in Bulgaria, 24 gas distribution companies (GRD) licensed for the activities 'Distribution of natural gas' and 'Supply of natural gas by end supplier' were active in 35 licensing territories, covering 173 municipalities, representing 65 % of all municipalities in Bulgaria. Non-household and household natural gas customers were connected to the gas distribution networks of those companies. Nine of the companies supply natural gas by supplying compressed natural gas to customers on the territory of municipalities which have no connection with the gas transmission network.

In Bulgaria, natural gas is predominantly used for electricity production by combined heat and electricity (cogeneration) plants. The largest cogeneration plants are:

Toplofikatsia Sofia EAD – TPP Sofia and TPP Sofia Iztok – a total of 277.349 MWe (3 337.4 MWt);

EVN Bulgaria Toplofikatsia EAD – a total of 80 MWe (392 MWt);

Weolia Energy Varna EAD – a total of 11.18 MWe (47.169 MWt);

Toplofikatsia Burgas EAD – a total of 17.82 MWe (74.45 MWt);

Toplofikatsia Pleven EAD – a total of 95.19 MWe (349.85 MWt);

Toplofikatsia Vratsa EAD – a total of 8.24 MWe (85.15 MWt);

Toplofikatsia Veliko Tarnovo AD – 2.81 MWe (111.75 MWt).

The above cogeneration plants produce heat and electricity using exclusively natural gas.

The amount of natural gas for electricity and heat production in the country for the period 2019-2022, in billion m 3/year is shown in the following table:

Table 39: *Quantities of natural gas for electricity and heat production in the country in 2019-2022*

Type of production	2019	2020	2021	2022
	billion$^{m\ 3}$/year	billion$^{m\ 3}$/year	billion$^{m\ 3}$/year	billion$^{m\ 3}$/year
Natural gas for electricity generation	0.362	0.402	0.615	0.344
Natural gas for heat generation	0.721	0.727	0.793	0.655
Total:	1.083	1.129	1.408	0.999

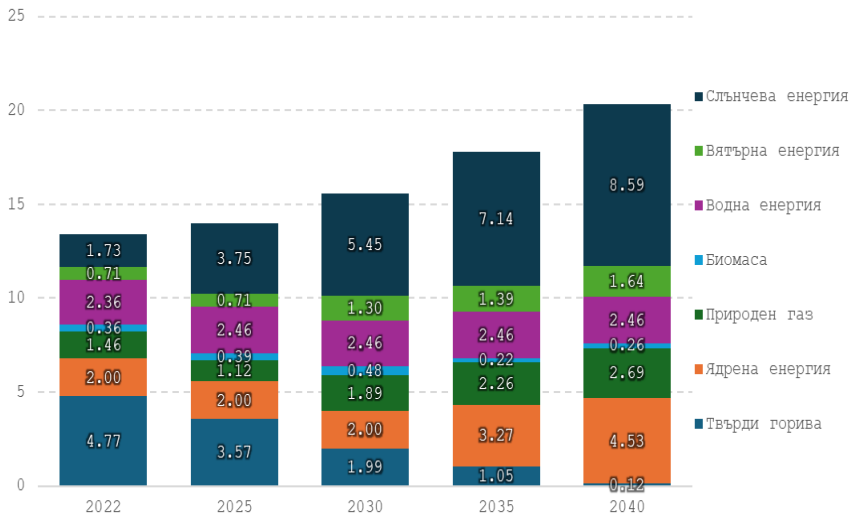
Source: ME

The production capacity of installations using natural gas for the production of electricity in Bulgaria compared to the total generation capacity in the electricity sector in Bulgaria is low, but it is essential to ensure the country's energy balance. The likely effects of a disruption of natural gas supply in the electricity sector will not have a significant impact on the internal electricity market, given the low rate of production capacity using natural gas.

ii. Projections of developments in existing policies and measures until at least 2040 (including 2030)

In the WEM modelling process, lignite power plants are gradually replaced by RES in the WEM scenario and, in the longer term, by PAVPs and new nuclear capacity. In order to balance the system, the increase in renewable energy production has been accompanied by an increase in nuclear capacity between 2030 and 2040.

Figure 91: *Installed capacity per plant type during the period 2022-2040, GW, WEM Scenario*



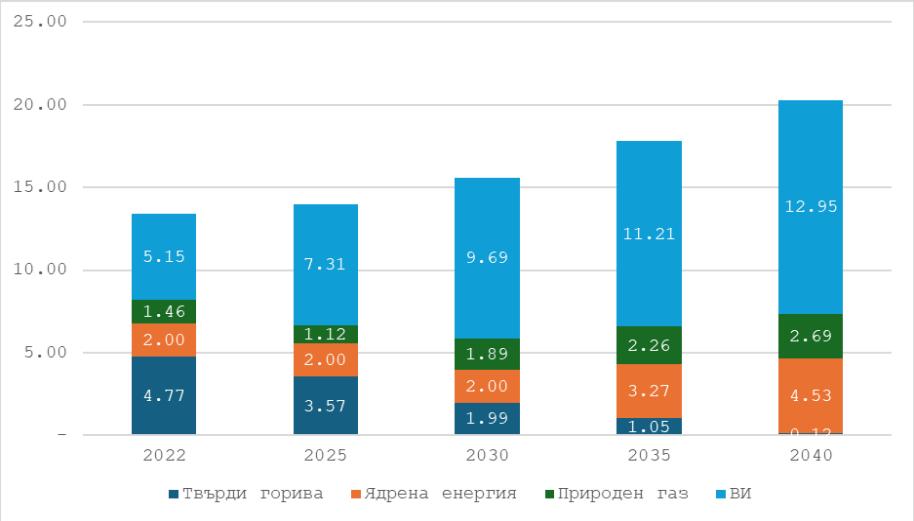
Source: (B) EST model, E3-Modelling

In line with the country's policy towards decarbonising energy, there is an increase in installed renewable energy capacity, with the largest increase of nearly 7 GW expected for photovoltaic plants, reaching 8.59 GW in 2040. Wind farms are also projected to increase their installed capacity and from 0.71 GW in 2022 is expected to reach 1.64 GW at the end of 2040, with an increase of 0.93 GW.

The country's nuclear capacity is projected to increase by 2.53 GW over the period considered and is expected to reach 2 040 GW by 4,53.

In pursuit of energy policy, the projected severe reduction in energy capacity using solid fuels, from 4.77 GW in 2022 to 0.12 GW in 2040, is projected.

Figure 92: *Installed capacity by energy carrier type during the period 2022-2040, GW, WEM scenario*

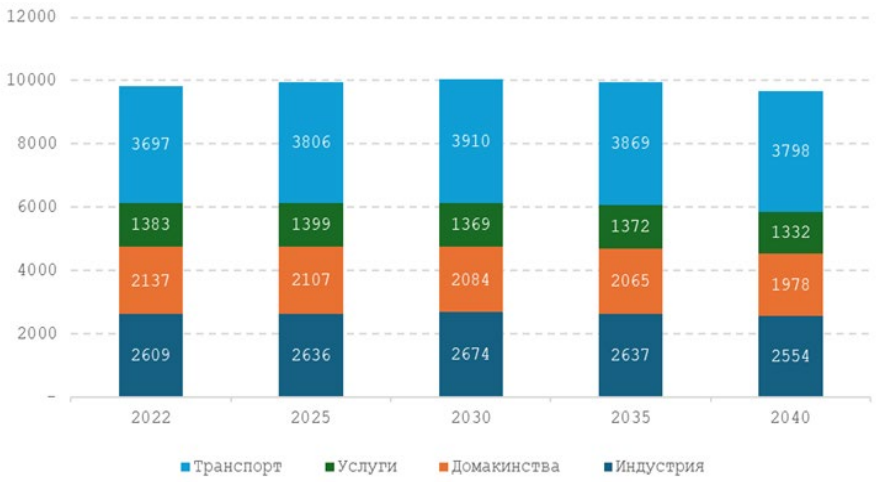


Source: (B) EST model, E3-Modelling

By pursuing the targets set for the use of nature-friendly resources, Bulgaria is setting an increase of nearly 7.8 GW of its renewable energy capacity, reaching 12.95 GW in 2040.

Energy capacity using natural gas is expected to increase by almost 84 % over the period considered, reaching 2 040 GW in 2,69.

Figure 93: *Final energy consumption by sector during the period 2022-2040, ktoe, WEM scenario*



Source: (B) EST model, E3-Modelling

In the period 2022-2040, a reduction in final energy consumption (FEC) is expected in all sectors except *Transport,* where final energy consumption is projected to reach 3 798 ktoe or 2.7 % more than in 2022 at the end of the period.

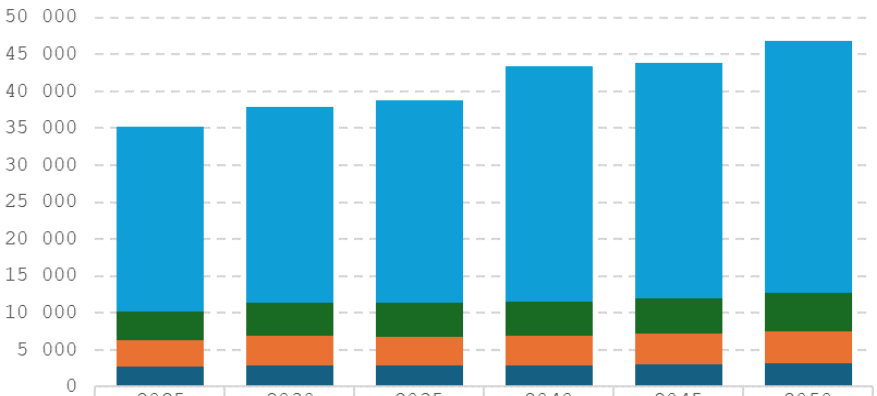
In the *household* sector, the most notable reduction in FEC by around 4.4 % is expected, from 2 137 ktoe in 2022 to 1 978 ktoe at the end of the period.

In 2025, final energy consumption in the *services* sector is projected to increase by around 3.6 % to 1 399 ktoe, after which the trend will reverse and consumption is expected to be 2040 ktoe in 1 332, with a decrease of close to 1 % compared to 2022.

In the *transport* sector, a reduction in final energy consumption is also projected, with 2 554 ktoe or 55 ktoe lower than FEC in 2022 at the end of the period.

Total system costs in the WEM scenario show an upward trend throughout the forecasting period across all sectors, increasing at an average annual rate of 1.6 % from 2022 to 2050. A similar trend is observed in various industrial sectors, with costs for energy efficiency investments ranging from EUR 320 million to EUR 798 million’ 15 over a five-year period.

Figure 94: *Total system costs by sector, forecasts (B) EST WEM (million EUR '15)*



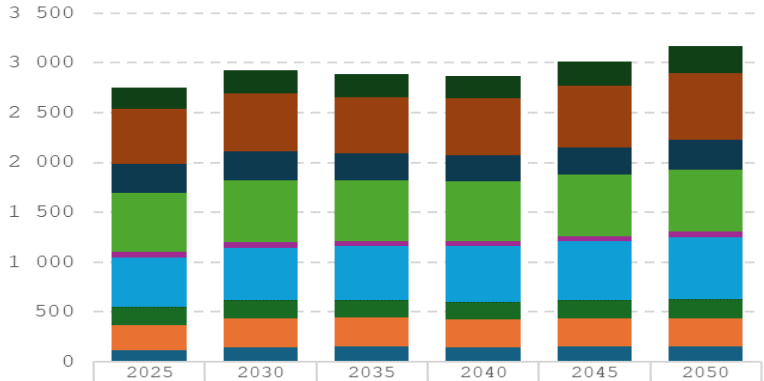
	2025	2030	2035	2040	2045	2050
Транспорт	24 886	26 394	27 431	31 859	31 801	34 226
Услуги	3 946	4 562	4 514	4 673	4 826	5 115
Домакинства	3 560	3 957	3 946	3 967	4 143	4 364
Индустрия	2 751	2 926	2 885	2 871	3 018	3 171
Общо – WEM	35 143	37 839	38 776	43 370	43 788	46 875

Source: (B) EST model, E3-Modelling

An overall increase in energy costs is expected for all sectors over the period 2022-2040, with EUR 30 308 million in 2022 reaching EUR 43 370 million.

The highest growth of almost 28 % is projected in the transport sector, *from* EUR 24 886 in 2022 to EUR 31 859 in 2040. For the rest of the sectors, a more gradual increase in energy costs is expected, respectively by 18 % in the services *sector*, by 11 % in the household *sector* and by 4.4 % in the industrial sector.

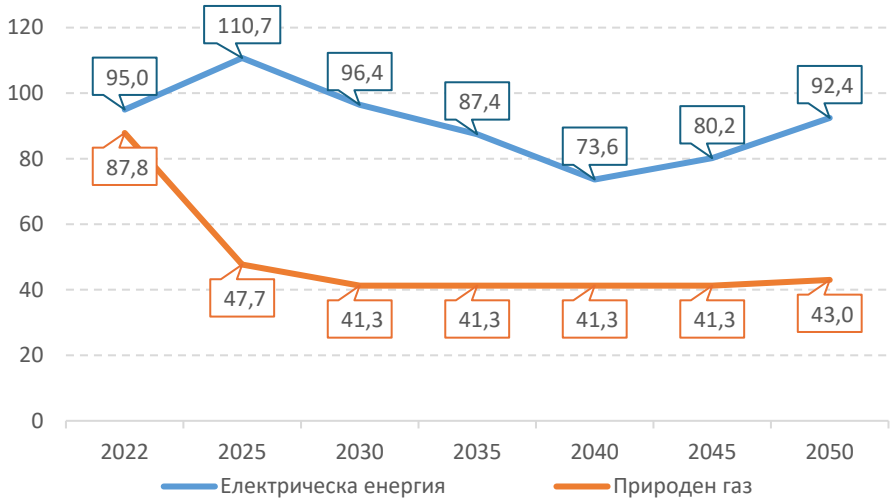
Figure 95: *System costs in industry by sector (direct use, incl. heat recovery), (B) EST WEM estimates (million EUR '15)*



	2025	2030	2035	2040	2045	2050
Инженеринг	213	232	230	229	250	276
Други индустриални	555	581	566	568	613	669
Храна, напитки, тютюн	283	289	269	262	278	293
Химикали	591	628	611	603	618	627
Текстил	61	55	49	47	50	51
Неметални материали	497	523	543	559	586	619
Целулоза, хартия печат	182	181	174	177	188	196
Цветни метали	251	289	288	277	282	284
Желязо и стомана	118	149	155	149	153	156
Общо – WEM	2 751	2 926	2 885	2 871	3 018	3 171

Source: (B) EST model, E3-Modelling

Figure 96: *Consumer prices of electricity and natural gas in 2022-2050, EUR '15/MWh, WEM scenario*



Source: Eurostat, (B) EST model, E3-Modelling

In the WEM scenario scenario, consumer electricity prices show a transitional increase in 2025, rising by 16.6 % compared to 2022 prices. This is mainly due to the continued involvement of solid fuel plants, which contribute 29.1 % to gross electricity production. Electricity prices are expected to gradually decrease as of 2035. By contrast, consumer gas prices are in line with projected international price trends.

Electricityprices for domestic consumers are expected to move in the range of EUR 73.6-110.7/MWh over the period considered, with a peak of EUR 2025/MWh in 110.7 and EUR 2050/MWh at the end of the period in 92,4.

With regard to the domestic gas price, the WEM scenario projections are at a relatively constant level in the range of 41.3 to EUR 47.7/MWh.

4.6 dimension "Research, innovation and competitiveness"

i. Current situation of the low-carbon-technologies sector and, to the extent possible, its position on the global market (that analysis is to be carried out at Union or global level)

As a result of the efforts of the academic and technical communities in Bulgaria, energy-saving technologies, which lead to significant reductions in energy costs, more comfort and better quality of life, are developing rapidly. The Innovation Strategy for Smart Specialisation of the Republic of Bulgaria 2014-2020 identifies the development of clean technologies with a focus on transport and energy (energy storage, saving and efficient distribution, electric vehicles and eco-mobility, hydrogen-based models and technologies free of waste, technologies and methods that include by-products and materials from one production in other industries) as a priority area. Innovation in the energy sector contributes both to achieving an overall reduction in energy costs and to imposing new

energy efficiency standards and moving towards lower and more sustainable energy consumption.

The development of industry is a strategic priority for the country, which requires a stand-alone strategy for its development. In this context, on 26 March 2024, the European Commission formally approved the Ministry of Economy and Industry's project for the development of a National Industrial Strategy. The strategy will be developed through the financial support of the Technical Assistance Instrument of DG Reforms of the EC, under Regulation (EU) 2021/240 of the European Parliament and of the Council, in the framework of the 2 024 cycle. The selection of an EC Implementation Adviser for the development of the Strategy is under way. The actual work on the document is expected to start as of September 2024. The deadline for its development shall be no more than 18 months.

The strategy will include several important industrial policy themes – reducing the carbon footprint of industry, increasing the digitalisation of production, improving resource and energy efficiency, introducing circular production models and promoting investor interest in industrial parks in the country. The strategy will involve two sectors of our economy – manufacturing and extractive industries. For the purpose of developing the strategy, several important analyses of the manufacturing and extractive industries will be carried out, under: industrial analysis, Net-Zero Industry analysis, analysis of critical raw materials in Bulgaria, analysis of industrial parks including an up-to-date assessment of investor interest and information on the conditions available for the use of low-carbon energy sources and existing digital infrastructure. In addition, the preparation of the Technical Terms of Reference for the establishment of a National Investment Portal is planned.

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

Under the Competitiveness and Innovation in Enterprises Programme 2021-2027, approximately BGN 370 million has been earmarked for the development and implementation of innovation by enterprises in the Clean Technologies, Circular and Low-Carbon Economy area of the Innovation Strategy for Smart Specialisation 2021-2027, but by mid-2024 there are still no ongoing contracts.

One of the tools for implementing the objectives of the National Strategy for Research Development 2017-2030 to provide Bulgarian scientists with access to state-of-the-art scientific facilities in order to conduct competitive research at high international level is the National Roadmap for Scientific Infrastructure (NCRI). The NCRP includes the main scientific complexes in the country, including the Centres of Competence and Centres of Excellence and their respective prioritisation at European and national level, in line with the impact areas of the European Strategic Forum for Scientific Infrastructure (Energy, Environment, Health and Food, Natural and Engineering, Social and Cultural Innovation and e-Infrastructure) and the Innovation Strategy for Smart Specialisation (ICT and

Informatics, Healthy Lifestyle and Biotechnology Industries, Mechatronics and Clean Technologies and New Technologies in Creative and Recreative Industries).

Another research funding instrument was adopted in 2018. National Research Programmes (NSAs) in priority areas. In the field of environment, three programmes are implemented: NDP 'Low carbon energy for transport and household' (EPLUS), NAP 'Environmental protection and risk reduction of adverse events and natural disasters' and NPI for polar research 'From Pole to Pole'. They carry out research on climate, water resources, disasters, biotechnology, low-carbon energy sources, etc. They deliver quality scientific results for the benefit of the economy and society, create a critical mass of scientists to work on societal challenges, as well as attract young scientists to careers in science to create a new generation of highly skilled professionals. This contributes to overcoming fragmentation in the research system, consolidating research potential and sharing the use of built infrastructure. The programmes are implemented by scientific consortia formed by higher education institutions, the BAS, the SAA with identified capacity in the field concerned. They carry out research on climate, water resources, disasters, biotechnology research, low-carbon energy sources, etc.

The main objective of the programme was to support the transition to a competitive low-carbon economy through coordinated and targeted research and innovation in the field. An important specific objective was to pool expertise and promote cooperation between scholars from higher education institutions and the Bulgarian Academy of Sciences. A specific feature of the NPP ESLUS is that it provides for both research and application activities carried out through demonstration projects. The programme ended on 31.12.2023, with all indicators fulfilled and some of them significantly overachieved.

The link between science and practice is demonstrated by the 5 demonstrator models implemented (for 5). It should be noted that another project (for hybrid trolleybus) has been prepared but will be demonstrated later due to the need to align the demonstration with multiple institutions.

The most widespread public interest of the demonstration models led to the demonstration of the HydRUforce ecological vessel in the Danube aquatory in Silistra and the 'Green House' demonstration project showing the possibilities for sustainable generation, storage and consumption of renewable energy. Detailed information on the programme and the results achieved can be found on the Programme website - https://eplus.bas.bg/bg.

The objective of the Programme 'Protection of the environment and reducing the risk of adverse events and natural disasters' is to conduct fundamental and applied research aimed at ensuring a sustainable, favourable and safer living environment for the population of the Republic of Bulgaria. Surveys are being carried out on groundwater, the chemical and ecological status of rivers in river basin directorates, flood and erosion risk assessments at regional level, field studies to identify the characteristic dependencies of destructive rock-rock or debrite streams, both in the past and in their contemporary manifestations, as well as other studies related to the hazards and consequences of

catastrophic earthquakes, adverse/catastrophic atmospheric and hydrospheric phenomena, water balance and water resources of Bulgaria, climate characteristics, etc.

The programme is due to be implemented by the end of 2024, with BGN 6 000 000 approved, of which about BGN 1 500 000 has been spent on research into climate change and its impact on water balances, ecosystems, on the public economy and on quality of life. Detailed information on the programme and the results achieved can be found on the website of the programme – https://nnpos.wordpress.com.

Infrastructure complexes

Infrastructure for Sustainable Marine Research and Participation in European Infrastructure (EURO-ARGO) – Masri - http://masri.io-bas.bg/bg/home-bg/

Research and applied research to support the sustainable development of the key sectors of the maritime economy linked to the Blue Growth Initiative, by: coastal tourism, maritime transport, fisheries and aquaculture, shipbuilding and ship repair, port activity, oil and gas extraction and renewable electricity production.

National research infrastructure for monitoring atmospheric aerosols, clouds and gas pollutants within the ACTRIS pan-European infrastructure - https://actris-bg.eu/

ACTRIS aims to contribute to solving emerging challenges by providing a platform for researchers to combine their efforts more effectively and by providing monitoring data on aerosols, clouds and gas pollution to anyone who wishes to use them. ACTRIS plays an essential role in supporting the acquisition of new knowledge and the development of an EU-wide policy on climate change, air quality and long-range (including transboundary) pollution transport.

Energy storage and hydrogen energy (Sevé) - https://niseve.iees.bas.bg/bg

The North scientific infrastructure is a modern, unique to Bulgaria and the region, thematically oriented infrastructure planned and structured with a clearly defined mission: promote the development and accelerate the introduction of innovative high zero-emission technologies for transport, industry and household with a focus on hydrogen-based technologies, almost unknown in Bulgaria in the period of its design, but intensively and preferentially developed in Europe. For the period from its launch to the present, the North is fulfilling its main objective and, following the dynamism of the single European decarbonisation process, has created a modern technology infrastructure base for research and innovation in the current topic of renewable energy storage and its efficient use through domestic conversion, transport and industry. Since its inception, the North has followed the European effort to accelerate and sustainably develop the green transition, in line with the objectives of the European Green Deal to achieve a climate-neutral European economy by 2050.

Digital Technology Systems for a Clean and Secure Environment – 5D ALLIANCE - https://5dalliance.eu/

5D Alliance is a distributed digital science infrastructure with potential impact in the Danube Macroregion (EDMR) to deliver cutting-edge interdisciplinary research for the smart, secure, environmentally sound management of interconnected systems and their business applications to achieve a clean and secure environment. The project envisages the construction of physical infrastructure to enable the virtual operation of the infrastructure in the context of sharing research objectives, resources, computing power and expertise, both between its partners and with external stakeholders to carry out joint research projects contributing to the achievement of macro-regional sustainable development.

Competence Centre "Clean Technologies for Sustainable Environment – Water, Waste, Energy for Circular Economy" (CLEAN -CIRCLE) - https://www.clean-circle.eu/

The Clean Circle Centre aims to invest in scientific infrastructure, professional capacity, innovative, technological and business models that enable a clean tech and circular economy ecosystem with a focus on water, energy and waste management. Three vertical and four horizontal modules are at the heart of the Competence Centre concept. Vertical modules are 'Water', 'Solid waste' and 'Transfers'. The 'Water' and 'Waste' modules work on the strands 'Monitoring, assessing and identifying problems' and 'Creating clean technologies'.

Bulgarian Antarctic Base "Sv. Kliment Ohridski - https://bab-bg.weebly.com/

https://bai-bg.weebly.com/1041107210791072109010 72.html

Carrying out multidisciplinary research to address scientific tasks in a global context in the polar regions and the World Ocean.

NAP "Environmental protection and risk reduction of adverse events and natural disasters" - https://nnpos.wordpress.com

The objective of the Programme is to conduct fundamental and applied research aimed at ensuring a sustainable, favourable and safer living environment for the population of the Republic of Bulgaria. Groundwater surveys shall be carried out; the chemical status and ecological potential of rivers in river basin directorates; flood risk and erosion assessments at regional level; field studies to identify the characteristic dependencies of destructive rock-rock or flow streams, both past and contemporary, as well as other studies related to the hazards and consequences of catastrophic earthquakes, adverse/catastrophic atmospheric and hydrospheric phenomena, water balance and water resources of Bulgaria, the characteristics of the climate, etc.

NDP Low Carbon Energy for Transport and Housing - https://eplus.bas.bg/bg

The main objective of the Programme is to support the transition to a competitive low-carbon economy through coordinated and targeted research and innovation in the field. For the first time, a cogeneration system based on a high temperature fuel cell was

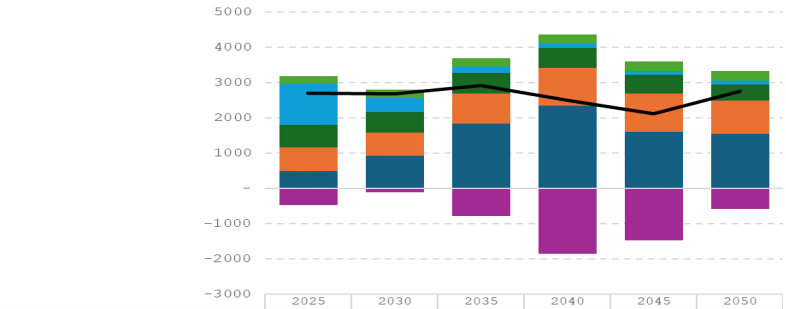
introduced in south-eastern Europe. In implementation of Bulgaria's first Green House demonstration project, a hybrid energy system was built for autonomous electricity and heat supply. A complex green hydrogen energy cycle on a real scale has been built and a cogeneration system based on solid oxidised fuel cells has been put into operation. The first demonstration project in Bulgaria for the introduction of hydrogen electromobility in heavy-duty transport has been developed through the original niche economically justifiable retrophite approach (STG 4 – 5/6). A small river vessel (20 kW) with hybrid solar power, battery and hydrogen fuel cell is built.

NPI for polar studies "OT Pole DO Pole"

The programme sets out the vision and objectives for the development of Bulgarian polar research in the period 2022-2 025 in the Antarctic and the Arctic. The programme builds on the predecessor Antarctic Research Development Programme, outlining a new strategic framework for conducting, including logistic provision of a wide range of research in the two polar regions and the long-term development of Bulgarian research potential, building on the main scientific priorities for the next twenty years formulated by the Scientific Committee for Antarctic Research (SCAR) and the Horizon 2020 programme of the European Union countries. The essence of the Programme is based on its international scope, interdisciplinarity, its competitive funding model for scientific projects and the introduction of globally accepted criteria for high scientific quality in the field of polar research.

iii. Breakdown into current price elements that make up the three main price components (energy, network, taxes/charges)

Figure 97: *Electricity supply costs by category and total, (B) EST WEM forecasts (million EUR '15)*



	2025	2030	2035	2040	2045	2050
Мрежи	221	226	241	254	263	270
Други разходи/приходи [2]	-481	-109	-775	-1860	-1478	-576
Емисии/енергийни такси	1171	405	176	120	115	118
Горива	632	584	583	563	534	459
Негоривни	663	650	857	1070	1091	938
Основни разходи [1]	497	930	1842	2349	1595	1549
Общо	2703	2687	2925	2497	2120	2759

Note: [1] annual equivalent;

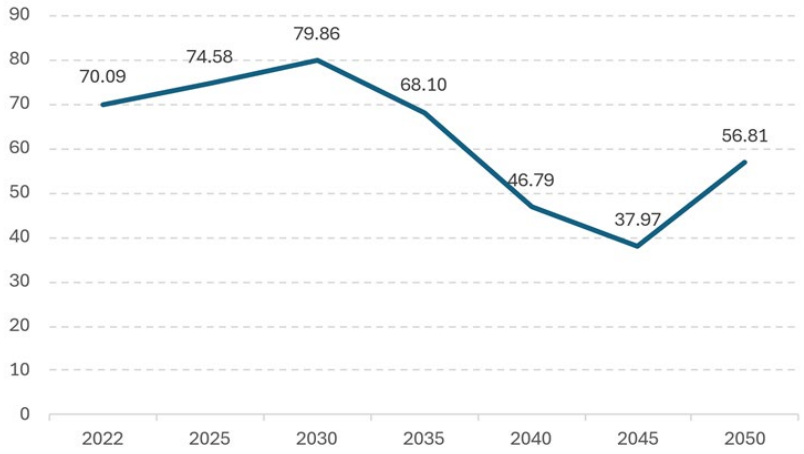
[2] costs related to carbon storage and import/export related costs/revenues

Source: (B) EST model, E3-Modelling

The average electricity production costs in the WEM forecast show an upward trend over the medium term until 2030. This is mainly due to increased capital expenditure for renewable projects, resulting in an average annual growth rate of 1.2 % between 2022

and 2025 and 15.1 % between 2026 and 2030. However, for the years after 2035, average costs started to decrease due to lower fuel and emission costs.

Figure 98: *Average electricity production costs, (B) EST WEM estimates (EUR '15/MWh)*

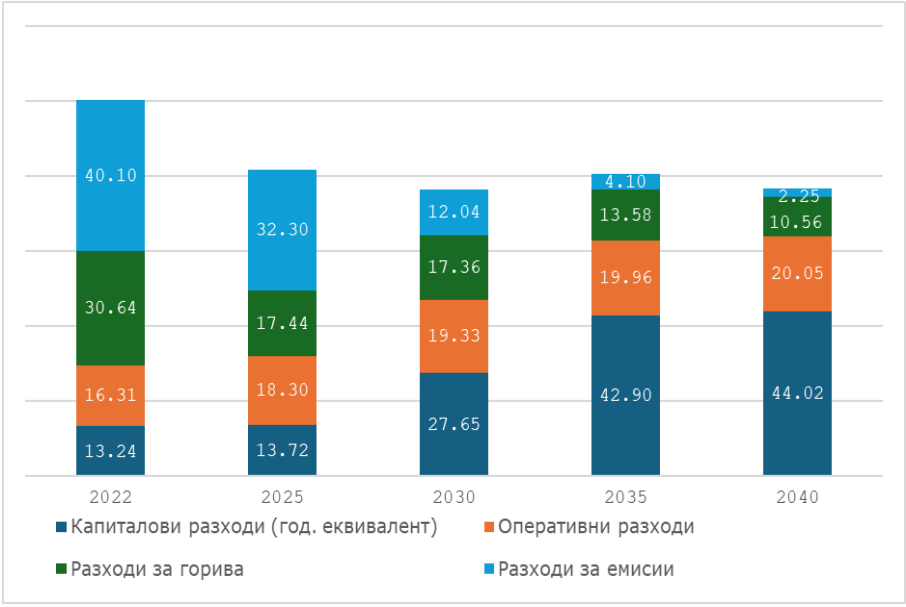


Source: (B) EST model, E3-Modelling

Over the period 2022-2050, the WEM scenario projects an increase of EUR 980 million in the main annual electricity supply costs, reaching EUR 2 050 in 1 549. At the same time, a reduction of more than 65 % in network costs and more than 90 % in emission costs is expected to be EUR 2050 and EUR 459 in 118.

A reduction of around 65 % in fuel expenditure is expected, from EUR 1 315 in 2022 to EUR 459 in 2050.

Figure 99: *Electricity production**costs, (B) EST WEM forecasts (EUR '15/MWh)***



Source: (B) EST model, E3-Modelling

Over the period considered, an increase in the operating and capital costs of electricity production is projected, by close to 23 % and by more than 230 % respectively. Operating

costs are expected to reach EUR 2050/MWh in 20,05 and capital costs up to EUR 44,02/MWh.

For the remaining electricity generation costs, a decreasing trend is expected, the most pronounced in terms of emission costs, from EUR 40,10/MWh in 2022 to EUR 2,25/MWh at the end of the period, resulting in a reduction of more than 94 %. Fuel costs are expected to absorb up to EUR 10,56/MWh in 2025, which is close to 65 % less than at the beginning of the period.

iv. Description of energy subsidies, including for fossil fuels

Bulgaria does not provide subsidies, including for fossil fuels.

In order to achieve the targets for the share of energy from renewable sources in gross final consumption of energy in accordance with Directive 2009/28/EC on the promotion of the use of energy from renewable sources and Directive 2012/27/EU on energy efficiency with Bulgarian legislation and in line with the Guidelines on State aid for environmental protection and energy 2014-2020, support is granted under the following schemes:

RES scheme

SA.44840 – Support scheme for the production of energy from renewable energy sources under the Energy from Renewable Sources Act

The scheme is linked to operating aid granted to producers of electricity from renewable sources in the form of preferential purchase prices for the electricity they produce under the ZEVI.

In Decision C (2016) 5205 final of 4.8.2016 on support for the production of energy from renewable sources in Bulgaria – SA.44840 (2016/NN), the Commission concluded that the measure constituted State aid within the meaning of the Treaty on the Functioning of the European Union.

The Commission concludes that the aid is compatible with the internal market under Article 107 (3) (c) TFEU under certain conditions. In order to fulfil the conditions laid down in Commission Decision No C (2016) 5205 final of 4.8.2016 on State aid, amendments were made to the ZEVI (State Aid Act No 91 of 2 November 2018).

Provision of support under Article 10c of Directive 2003/87/EC

In accordance with Article 10c of Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a system for greenhouse gas emission allowance trading within the Union and amending Council Directive 96/61/EC, the Republic of Bulgaria made use of the possibility of granting free emission allowances to installations for the production of electricity for the period 2013-2020. By Decisions C (2012) 4560 of 6.7.2012 and C (2013) 8455 final of 4.12.2013, the European Commission authorised Bulgaria to derogate under Article 10 (5) of Directive 2003/87/EC. The National Investment Plan (NIP) includes all operators eligible to participate in the derogation under Article 10c of Directive 2003/87/EC. The objective of implementing the investment projects included

in the NIPs is to ensure a sustainable transition to a low-carbon economy based on the modernisation of generation capacities, clean technologies, infrastructure reconstruction and modernisation, diversification of the energy mix and diversification of energy supply sources. For the entire implementation period (2013-2020) of the NIPs, a total of 54 168 005 GHG allowances have been allocated.

Planned direct and indirect subsidies

In accordance with the provisions of Directive 2018/410 of 14.3.2019, Bulgaria notified the Commission of its intention to derogate under Article 30.09.2019c of Directive 2018/410 by allocating free allowances to installations for the production of electricity in order to enhance cost-effective reductions in GHG emissions and low-carbon investments during the fourth phase of the EU ETS for the transitional period 10-2021.

The right to benefit from a derogation under Article 10c of the ETCE Directive to enhance cost-effective emission reductions and low-carbon investments by supporting investments with free allocation of greenhouse gas emission allowances for the period 2021-2030 constitutes a State aid measure. According to Article 3 of Council Regulation (EU) 2015/1589 of 13.7.2015 laying down detailed rules for the application of Article 108 TFEU, State aid notified under Article 2 (1) will not be put into effect before the Commission (DG Competition) has taken a decision authorising such aid. As there is no positive decision from the Commission (DG Competition) to implement the State aid measure, the possibility of allocating greenhouse gas emission allowances to operators of installations that have to implement investment projects in the period 2021-2030 is not applicable.

On the other hand, by letter of 31.10.2023 from DG CLIMA, the Commission informed that the Member States concerned may grant transitional free allocation in accordance with Article 10c of the revised Directive establishing a system for greenhouse gas emission allowance trading (ETS) within the Union (Directive 2023/959/EC of the European Parliament and of the Council of 10.5.2023 amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading and Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union's greenhouse gas emission trading system) only for investments completed until 31.12.2024. All allowances available to the countries concerned in accordance with Article 10c for the period 2021-2030 and which are not used for such investments in accordance with Article 10 may be used in accordance with Article 10 of the Directive. In the letter, the Commission recalled the need for formal notification by Member States of their decisions on the use of quotas under Article 10c of the Directive by the Member States by 15.5.2024 via the Permanent Representations to the European Union.

Implementation of a market-based capacity mechanism for a period of 10 years

Regulation (EU) 2019/943 on the internal electricity market allows Member States to apply a capacity mechanism in case of national resource adequacy concerns. This mechanism operates on a market-based basis and complies with the requirements for CO_2 limit values of 550 g $CO_{2/kWh}$for electricity and compliance with the limit of 350 kg CO_2 on average per

year for the production of electricity from fossil fuels per installed capacity in kW from 1 July 2025.

Bulgaria's efforts will focus on the approval and implementation of a capacity mechanism to ensure the security and adequacy of the system and enable electricity producers to obtain additional financial revenues for their participation in the market.

5. ASSESSMENT OF THE IMPACT OF PLANNED POLICIES AND MEASURES

5.1 impact of the planned policies and measures described in section 3 on the energy system and greenhouse gas emissions and removals, including comparison with projections based on existing policies and measures (referred to in section 4)

i. Projections of the development of the energy system and GHG emissions and removals as well as, where relevant of emissions of air pollutants in accordance with Directive (EU) 2016/2284 under the planned policies and measures at least until ten years after the period covered by the plan (including for the last year of the period covered by the plan), including relevant Union policies and measures.

Share of energy from renewable sources

The national target of 34.96 % share of energy from renewable sources in gross final consumption of energy by 2030 set under the WAM is in line with Annex I to Directive (EU) 2018/2001. The national target thus defined is 1.96 percentage points higher than in COM/2023/796final and more than 7 percentage points compared to the 2030 target in the current INECP. According to the WEM, the possible share of renewable energy in gross final energy consumption by 2030 is 26.01 %, significantly lower than expected under the WAM.

The electricity sector has a 49.34 % share of energy from renewable sources in gross final consumption of electricity, which has been increased by 19 percentage points compared to the share set in the current INECPs. This share is projected to be achieved by increasing electricity consumption from newly built capacities using renewable energy (mainly wind and solar power) after 2022. The WAM Scenario projects a significant increase in installed wind energy capacity in 2030, with the first second plant located in the Black Sea expected to be operational in 2030.

Higher growth in renewable energy in 2030 than in 2020 was observed in the WAM Scenario in all three sectors: electricity, heating and cooling and transport in 2030.

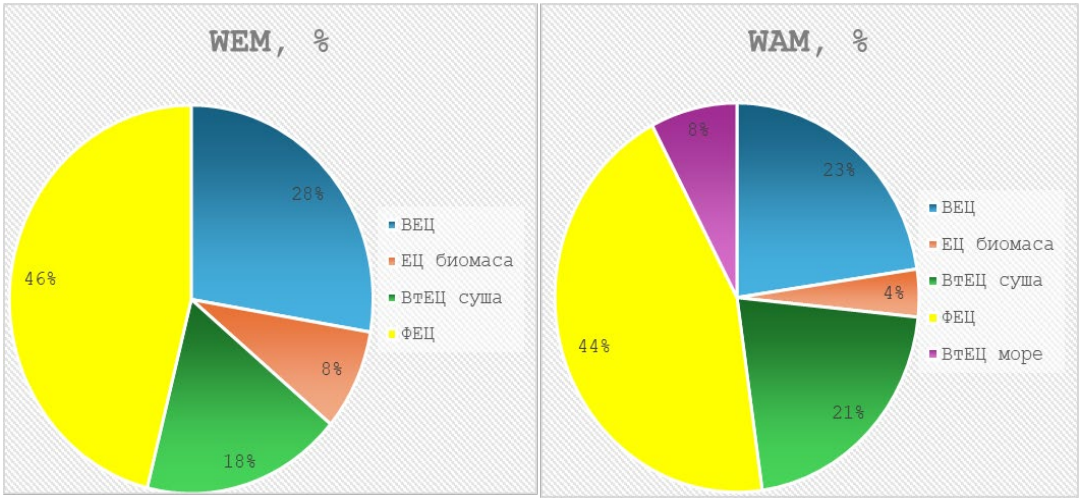
Comparison of the shares of renewable energy under the two scenarios is presented in the following table.

Table 40: *Comparison between Scenaries*

	2030	
	WEM	**WAM**
Share of energy from renewable sources%	**26.08**	**34.96**
VI-TE and EC%	33.47	44.01
CI-E%	42.35	49.34
VI-T%	12.94	29.93

The share of electricity from renewable sources in the gross final consumption of electricity under the WAM Scenario is about 7 percentage points higher than that of the WEM scenario. Net electricity production from renewable sources in WAM will be more than 28 % higher than in the WEM Scenario. This is due to the expected significant increase in production from all types of plants, with the largest increase in production from Second Power Plant and FPP.

Figure 100: *Structure of net electricity generation from renewable sources by type of plants according to WEM and WAM scenarios in 2030 (GWh)*



Source: (B) EST model, E3-Modelling

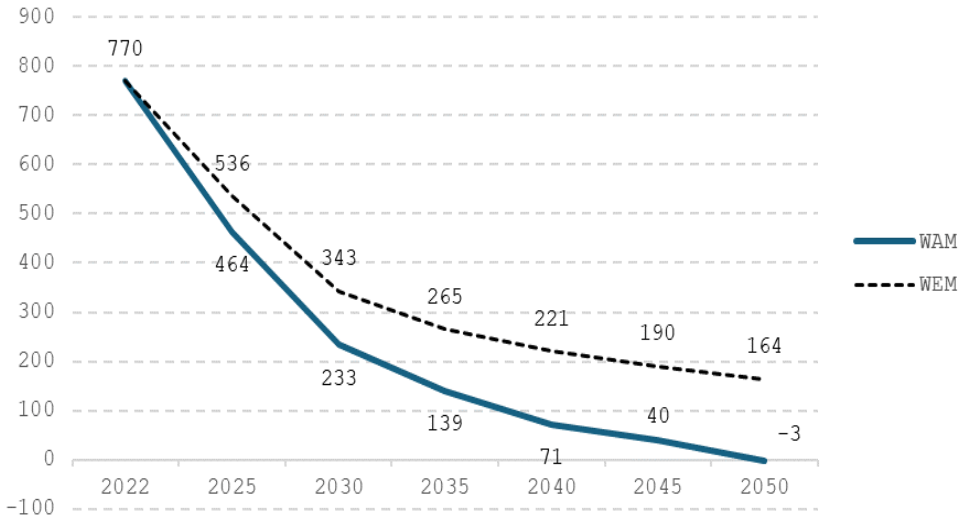
ii. Assessment of the interaction between policies (between existing policies and measures and planned policies and measures in a given policy dimension and between existing and planned policies and measures of different dimensions) until at least the last year of the period covered by the plan, in particular to build a reliable picture of the impact of energy efficiency/energy savings policies on the scale of the energy system and to reduce the risk of stranded investments in energy supply

The planned (additional) policies and measures envisaged in this Plan are largely complementary to existing policies and measures, aimed at raising Bulgaria's ambition across all five dimensions of the Energy Union, contributing to the achievement of the EU's objectives. In this sense, existing and planned (complementary) policies and measures interact as the latter in most cases broaden the scope of the former or further develop them, enhancing their impact.

Carbon intensity of GDP

At country level, Bulgaria's carbon intensity of GDP is steadily decreasing in the WAM projection over the horizon at an annual equivalent rate of 11 % to 16 %, significantly higher than the annual reduction of 311 % noted in the WEM scenario forecast, as the country deviates from fossil fuels towards renewable energy sources. In 2030, it reached EUR 237 tnCO2/млн' 15, almost one third of the 2022 GDP carbon intensity.

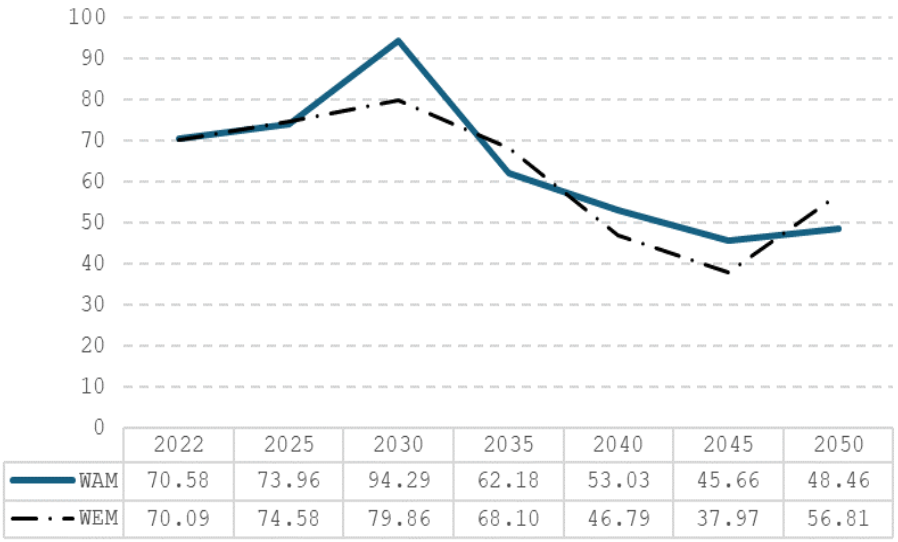
Figure 101: *Carbon intensity of GDP in Bulgaria, historical data (2022) and projections (B) EST WAM (2025-2050), (tnCO2/млн. EUR '15)*



Source: (B) EST model, E3-Modelling

Costs

Figure 102: *Average electricity generation costs, historical data (2022) and forecasts (B) EST WAM (2025-2050), EUR '15/MWh*



	2022	2025	2030	2035	2040	2045	2050
WAM	70.58	73.96	94.29	62.18	53.03	45.66	48.46
WEM	70.09	74.58	79.86	68.10	46.79	37.97	56.81

Source: (B) EST model, E3-Modelling

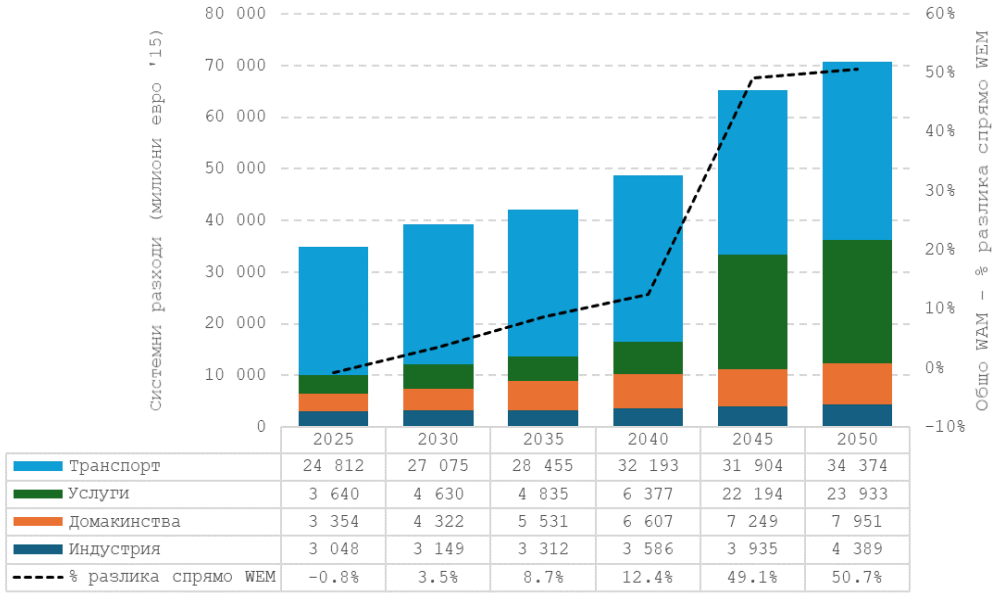
The average electricity generation costs in the WAM forecast show an upward trend over the medium term until 2030, which is steeper than the WEM forecast.

In 2030, the average cost of electricity generation in WAM's forecast was EUR 14,43/MWhe higher than the WEM forecast. This increase is due to higher capital expenditure related to the switch to wind and solar photovoltaic, which are capital-intensive technologies.

For the years up to 2050, despite higher capital costs, the electricity system benefits from already realised investments in renewable technologies, thus avoiding fuel and emission costs and leading to lower average electricity generation costs in 2045-2050 compared to the WEM forecast, with investments gradually being depreciated.

As Bulgaria's energy system is expected to become carbon neutral by 2050, the total system costs in the WAM scenario show an increase both over the entire projection horizon and compared to the WEM scenario.

Figure 103: *Total system costs by sector in Bulgaria, (B) EST WAM estimates (EUR million '15)*

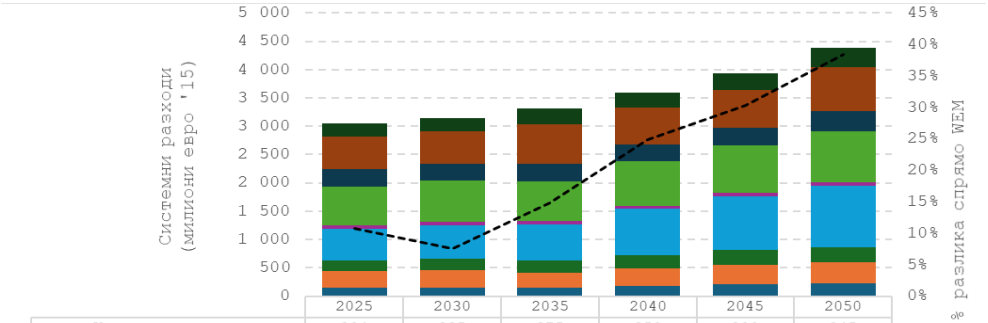


	2025	2030	2035	2040	2045	2050
Транспорт	24 812	27 075	28 455	32 193	31 904	34 374
Услуги	3 640	4 630	4 835	6 377	22 194	23 933
Домакинства	3 354	4 322	5 531	6 607	7 249	7 951
Индустрия	3 048	3 149	3 312	3 586	3 935	4 389
% разлика спрямо WEM	-0.8%	3.5%	8.7%	12.4%	49.1%	50.7%

Source: (B) EST model, E3-Modelling

The transition to carbon neutrality in industrial sectors requires mobilising capital to invest in advanced technologies and heat recovery. Compared to the WEM forecast, the WAM scenario shows the need to invest an additional 1038 % to enable the industry to decarbonise effectively.

Figure 104: *System costs in industry by sector, (B) EST WAM estimates (million EUR '15)*



	2025	2030	2035	2040	2045	2050
Инженеринг	234	235	275	258	290	345
Други индустриални	577	579	702	648	665	780
Храна, напитки, тютюн	305	295	307	298	318	357
Химикали	681	735	698	785	842	898
Текстил	65	57	62	55	56	62
Неметални материали	553	591	645	819	954	1 080
Целулоза, хартия печат	195	199	206	230	261	276
Цветни метали	294	303	274	315	343	364
Желязо и стомана	145	156	142	179	206	228
Общо - WAM	3 048	3 149	3 312	3 586	3 935	4 389
% разлика спрямо WEM	10.8%	7.6%	14.8%	24.9%	30.4%	38.4%

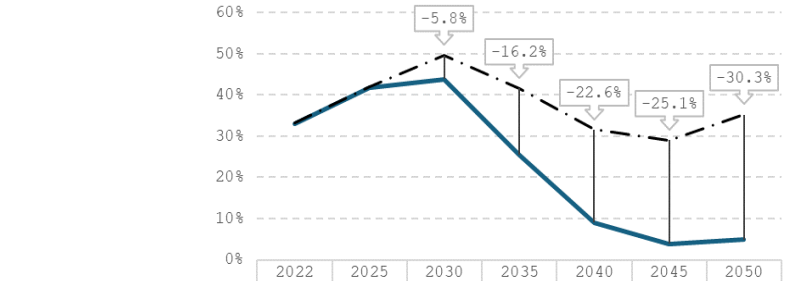
Source: (B) EST model, E3-Modelling

Import dependence

During the period considered 2022-2050, the WEM scenario foresees a decrease in total import dependency from 33 % to 35 % in 2050.

By 2030, Bulgaria's import dependency in the WAM scenario is expected to decrease by 6 % compared to the WEM scenario. As Bulgaria continues its efforts to reduce final energy consumption and switch to domestic resources such as wind and solar energy, reducing the use of mostly imported fuels, i.e. solid fuels, oil and natural gas, the coming years show an even greater reduction in import dependency ranging from 18 % to 40 %.

Figure 105: *Evolution of import dependency, WEM and WAM scenarios,%*



	2022	2025	2030	2035	2040	2045	2050
Зависимост от внос - WAM	33.1%	41.8%	43.8%	25.4%	9.0%	3.9%	4.9%
Зависимост от внос - WEM	33.1%	41.9%	49.6%	41.6%	31.6%	29.0%	35.2%

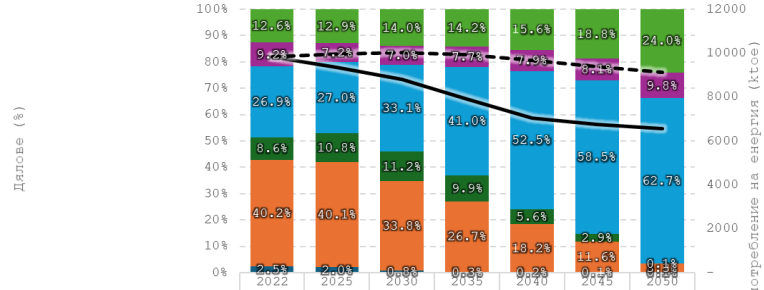
Source: (B) EST model, E3-Modelling

Final energy consumption

Final energy consumption in the country between 2022 and 2050 shows a decreasing trend in both scenarios under consideration.

By fuel

Figure 106: *Final energy consumption by fuel (ktoe) and shares (%) by WAM scenario and comparison WEM and WAM*



	2022	2025	2030	2035	2040	2045	2050
ВЕИ и синтетични горива	1237	1212	1237	1125	1098	1270	1572
Пара	905	677	618	611	559	543	642
Електрическа енергия	2640	2524	2916	3241	3700	3942	4102
Природен газ	846	1011	990	784	397	192	6
Течни горива	3950	3751	2984	2111	1284	783	215
Твърди горива	248	189	73	28	12	9	7
Общо - WAM	9827	9365	8819	7900	7048	6740	6544
Общо - WEM	9827	9949	10037	9942	9661	9388	9120

Source: (B) EST model, E3-Modelling

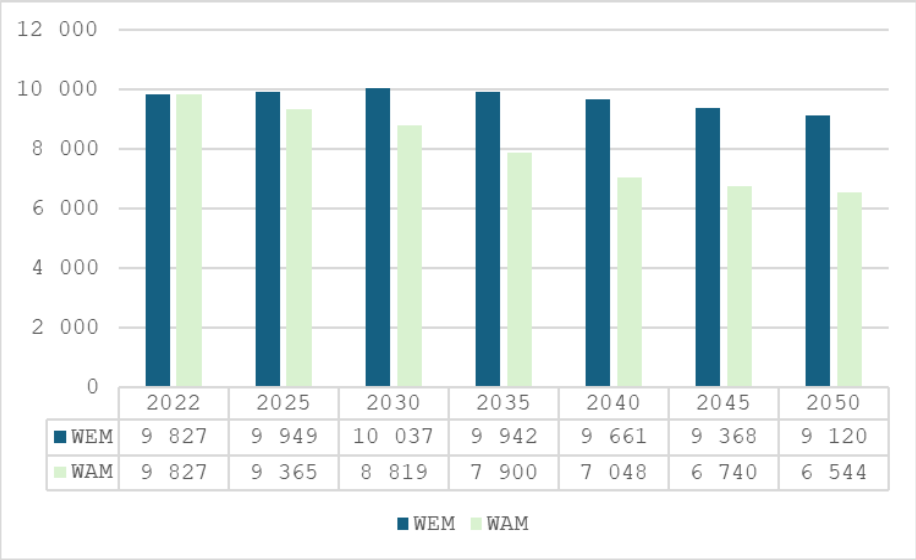
The fuel mix in Bulgaria's final energy consumption is undergoing a significant change in the WAM scenario. Projections show a consistent decline in the contribution of conventional energy carriers, replaced by increased use of electricity, renewables and synthetic fuels. In particular, solids and natural gas have been almost completely eliminated by 2050, each accounting for only 0.1 % of final energy consumption. Meanwhile, the use of liquid fuels

is expected to decrease to less than one tenth of its volume for 2022. In the medium term, the use of natural gas continues, but starts to decrease significantly after 2035.

Sectors

All sectors in the country contribute to the overall reduction of final energy consumption, while the sectors continue to improve their energy efficiency in the long term.

Figure 107: *Comparison of final energy consumption scenarios WEM and WAM, (ktoe)*



Source: (B) EST model, E3-Modelling

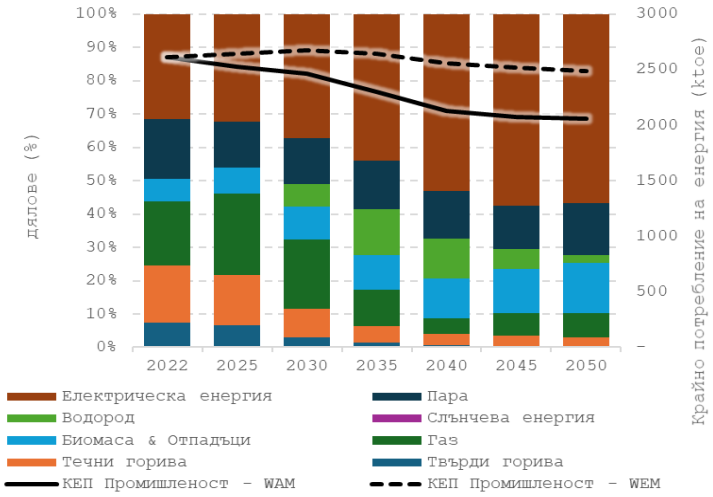
All sectors in the country contribute to the overall reduction of final energy consumption, while the sectors continue to improve their energy efficiency in the long term.

With existing measures and policies (WEM scenario), the reduction in final energy consumption is expected to be smoother and will reach 2050 ktoe in 9 120.

As a consequence of the additional measures, in a WAM scenario, the final energy consumption in 2050 is projected to be 6 544 ktoe or 2 576 ktoe lower than the WEM scenario for the same period.

Industry sector

Figure 108: *Final energy consumption in industry (ktoe) and shares (%) under WAM and comparison WEM and WAM*

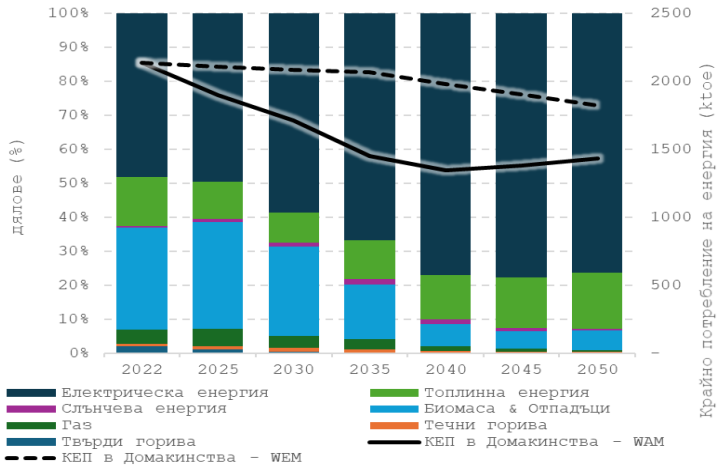


Source: (B) EST model, E3-Modelling

The industrial sector has seen a significant change in the fuel mix. The increased use of electricity has increased its share from 31.6 % in 2022 to 37 % in 2030, and is also expected to rise to 57 % in 2050. Boomass and waste also play a crucial role in the transition of industrial sectors towards carbon neutrality, with their share increasing from 7 % in 2022 to 10 % in 2030 and 15 % in 2050. Biomass and waste volumes increase from 175 ktoe in 2022 to 244 ktoe in 2030 and 309 ktoe in 2050, as total final energy consumption in industrial sectors decreases due to improved energy efficiency.

Households sector

Figure 109: *Final energy consumption in the household sector (ktoe) and shares (%) under WAM and comparison WEM and WAM*



Source: (B) EST model, E3-Modelling

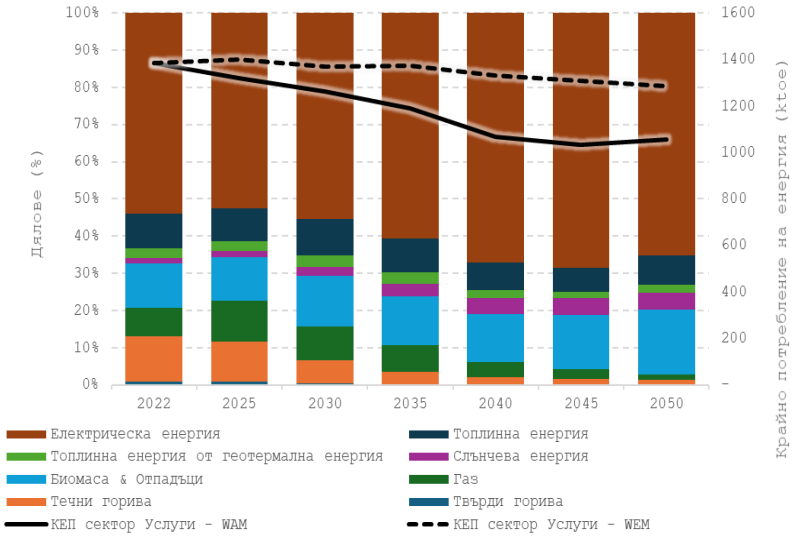
Under a WAM scenario, households that currently rely on biomass and waste for almost a third of their energy needs are projected to switch to the use of electricity, especially for conversion to heat. This transition is supported by measures to promote energy efficiency through reforms that reduce the administrative burden and support households in the implementation of energy efficiency projects. By 2030, the share of biomass and waste in

final energy consumption in households is expected to decrease by close to 4 % compared to 2022, and by 2050 by an additional 20 %, reaching 6 %.

In contrast, electricity is expected to gradually dominate the energy mix in this sector, reaching 59 % in 2030 and 76 % in 2050, although its overall volume is projected to remain comparable to the 2022 level.

Services and Agriculture sectors

Figure 110: *Final energy consumption in the services and agriculture sectors (ktoe) and shares (%) under WAM and comparison WEM and WAM*



Source: (B) EST model, E3-Modelling

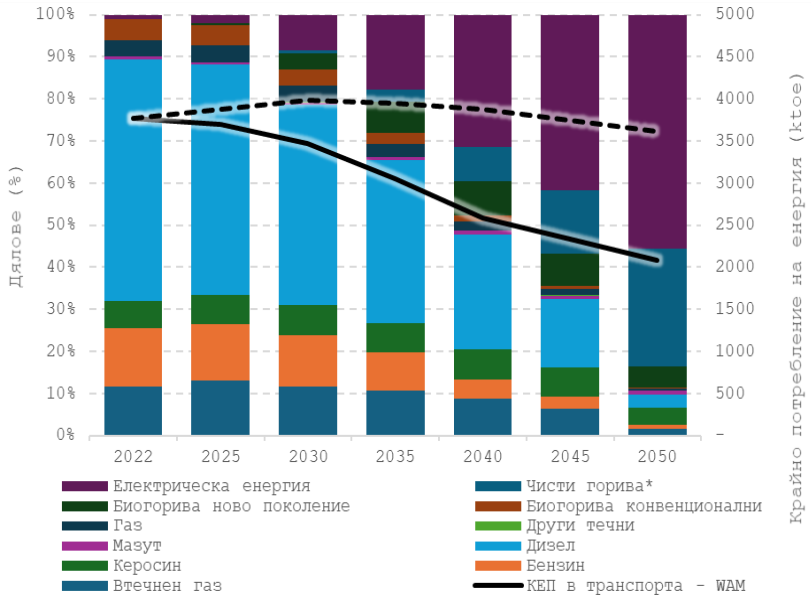
In the WAM scenario, the services and agriculture sectors are gradually abandoning the use of liquid and gaseous fuels and eliminating the use of solids by 2050.

Biomass and waste increase their share of the fuel mix, reaching 17 %. Electricity is also increasing its share from 54 % in 2022 to 56 % in 2030 and 65 % in 2050. The reason is increasing electrification combined with energy efficiency improvements supported by reforms aimed at reducing the administrative burden of energy efficiency projects.

Solar energy also shows a gradual increase, both in terms of share and absolute volume.

Transport Sector

Figure 111: *Final energy consumption in the transport sector (ktoe) and shares (%) under WAM and comparison WEM and WAM*



Source: (B) EST model, E3-Modelling

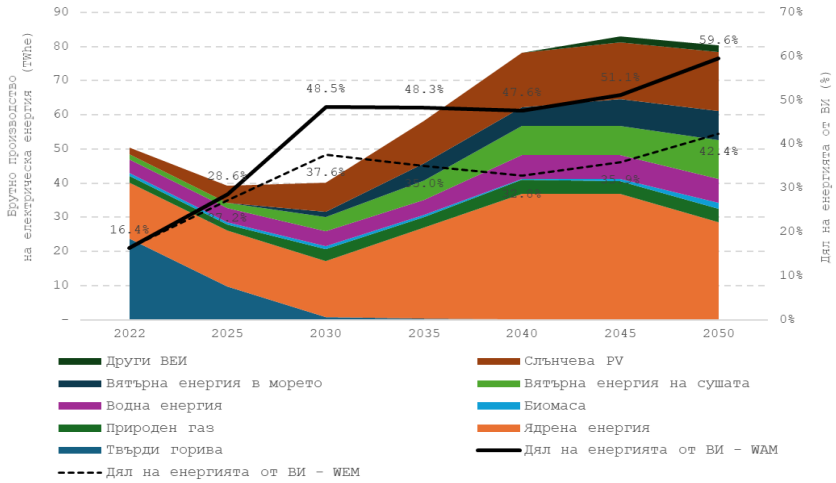
The transport sector's transition to carbon neutrality in the WAM scenario is achieved through increased use of electricity, advanced biofuels and clean fuels such as hydrogen and ammonia. Sustainable aviation fuels are also mandatory throughout the forecast period for the aviation sector.

Supported by the development of electric charging infrastructure, tax incentives and subsidies for electric and plug-in hybrid vehicles, as well as facilitating measures such as the introduction of lockdowns in urban centres and free parking for electric vehicles, electricity represented 9 % of final energy consumption in transport by 2030, increasing to 56 % in 2050.

In the medium term, blending biofuels supports the transition of road transport (both passenger and freight) until more sophisticated options such as clean fuels emerge. With the development of hydrogen transport infrastructure, these fuels, representing 1 % of final energy consumption in transport in 2030, are expected to reach a share of 28 % in 2050.

Gross electricity production

Figure 112: *Gross electricity production by plant type (TWh) and share of renewable energy (%), historical data (2022) and (B) EST WAM projections (2025-2050)*

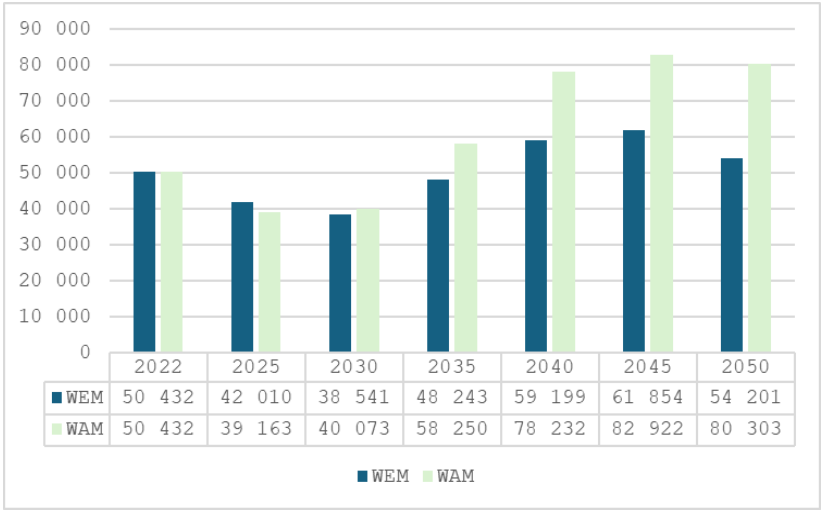


Source: (B) EST model, E3-Modelling

In the energy sector, coal is planned to be shut down by 2038. The production of electricity from renewable sources is expected to increase over the period considered, with solar power most noticeable, ranging from 2 TWh in 2022 to 17 TWh in 2050. The WAM predicted an increase in electricity production from wind to 20 TWh (on land and offshore) in 2050, as well as from nuclear power, reaching 29 TWh at the end of the period considered.

In 2030, the share of renewable energy in gross electricity generation almost tripled, reaching 49 %, while in 2050 it is expected to be 60 %.

Figure 113: *Comparison of gross electricity production WEM and WAM scenarios (GWh)*



Source: (B) EST model, E3-Modelling

The WEM scenario projections predict some reduction in electricity production by 2030, with 50 432 GWh expected to reach 38 541 GWh. After this period, electricity production will increase to 54 201 GWh.

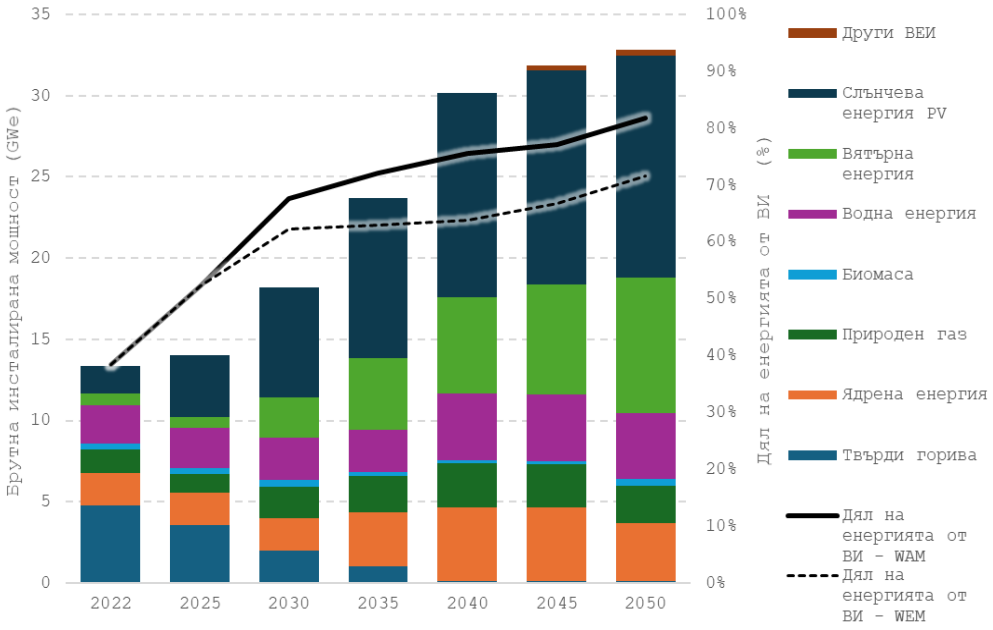
Additional policies and measures, under the WAM scenario, are also expected to reduce electricity production by 2030, but at the end of the period a higher electricity production

of 80 303 GWh is projected, which is close to 50 % more than projected in the WEM scenario.

Gross installed capacity for electricity production

In the period 2022-2050, both scenarios foresee an increase in installed electricity generation capacity in Bulgaria.

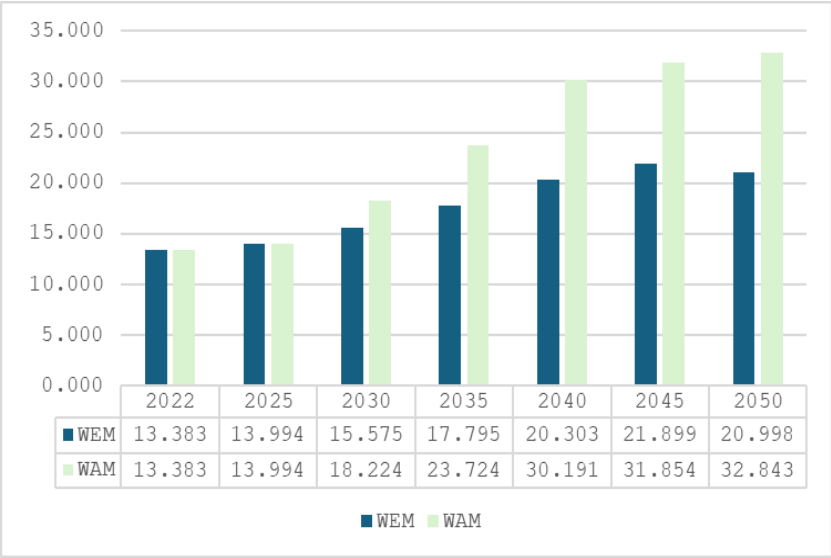
Figure 114: *Gross installed capacity for electricity production by type of plant (GW) and share of RES in gross installed capacity, WAM scenario*



Source: (B) EST model, E3-Modelling

The WAM scenario projects the largest increase in installed capacity in solar power plants, with 1.7 GW in 2022 expected to reach 13.7 GW at the end of the period considered. An increase in installed wind power capacity is foreseen, from 0.7 GW to 8.3 GW in 2050, as well as an increase after 2 035 in nuclear capacity, which will reach 4.1 GW.

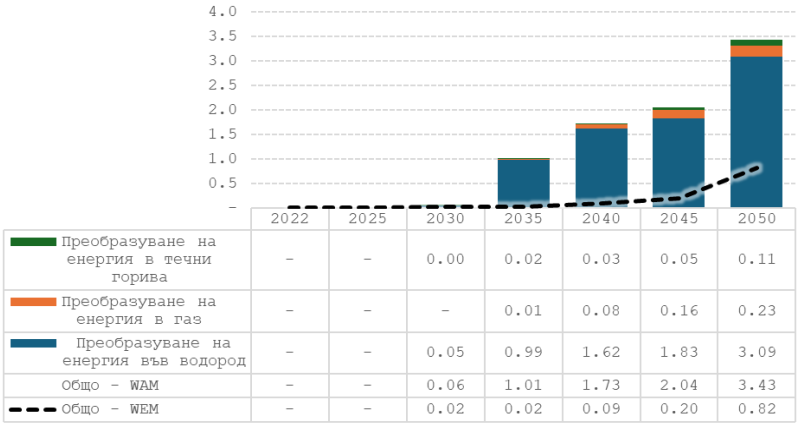
Figure 115: *Comparison of push-installed power generation capacity according to WEM and WAM scenarios, GW*



Source: (B) EST model, E3-Modelling

According to the WEM scenario, with existing policies and measures in place, the total installed power generation capacity is expected to reach 20.998 GW at the end of the period, while the WAM scenario projects 32.843 GW of electricity generation installed in 2050. This is 56.4 per cent more than projected under the WEM scenario and is due to additional measures and policies taken in the area.

Figure 116: *Power-to-X (GW) installed capacity, historical data (2022) and (B) EST WAM forecasts (2025-2050) and total installed capacity of power-to-X installations in (B) EST WEM (2025-2050)*

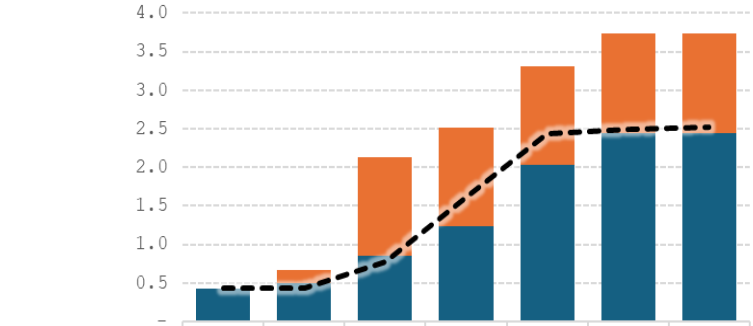


	2022	2025	2030	2035	2040	2045	2050
Преобразуване на енергия в течни горива	-	-	0.00	0.02	0.03	0.05	0.11
Преобразуване на енергия в газ	-	-	-	0.01	0.08	0.16	0.23
Преобразуване на енергия във водород	-	-	0.05	0.99	1.62	1.83	3.09
Общо - WAM	-	-	0.06	1.01	1.73	2.04	3.43
Общо - WEM	-	-	0.02	0.02	0.09	0.20	0.82

Source: (B) EST model, E3-Modelling

The increasing demand for direct use of hydrogen and synthetic liquids was already covered in 2030 by power-to-X installations producing the products concerned, with installed capacity starting at 0.05 GW in 2030 and reaching 3.09 GW in 2050. Power-to-X installations also include an indirect form of storage, as their electricity needs can be flexibly regulated within one day or several consecutive days depending on the availability of periodic renewable energy sources.

Figure 117: *Installed electricity storage capacity (GW) in Bulgaria, historical data (2022) and (B) EST WAM projections (2025-2050)*



	2022	2025	2030	2035	2040	2045	2050
Батерии	-	0.18	1.28	1.28	1.28	1.28	1.28
ПАВЕЦ	0.43	0.50	0.85	1.23	2.03	2.45	2.45
Общо - WAM	0.43	0.67	2.13	2.51	3.31	3.73	3.73
Общо - WEM	0.43	0.43	0.77	1.62	2.44	2.49	2.52

Source: (B) EST model, E3-Modelling

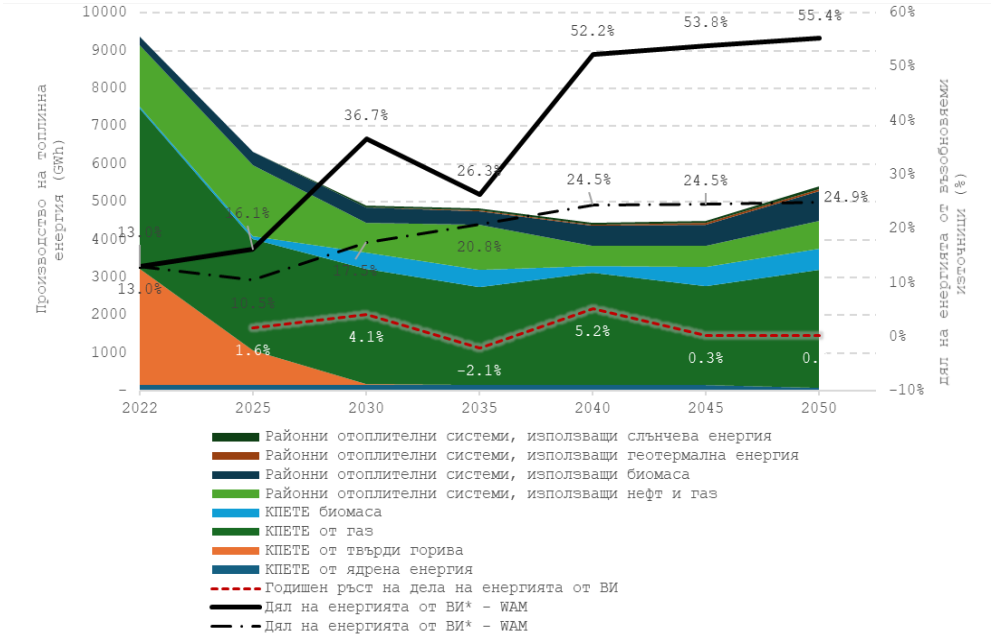
Direct forms of storage, such as batteries and pumping storage, are also important in the WAM scenario, as they allow for the smooth integration of periodic RES into the electricity grid. Two new pumped storage plants (Batak and Dospat), 0.8 GW each, are planned to be installed in 2035 and 2040, while battery capacity increased from 0.18 GW in 2025 to 1.28 GW at the end of the period considered.

Heat

Planned energy efficiency measures in residential and non-residential buildings, including buildings owned and used by central government, and modernisation of district heating networks using best available technologies contribute to lower heat production due to lower final consumption and lower heat losses (currently 23 % to be reduced to 10 % by 2030). Thus, compared to the WEM scenario, the generation of heat in the WAM scenario is around 65 % lower by 2035.

Heat production in the country over the period considered, according to the WEM scenario, will decrease by almost 43 %, from 9.396 GWh in 2022 to 5.315 GWh in 2050.

Figure 118: *Heat generation by fuel (GWh) and shares (%) of renewable energy in heat generation under the WAM scenario and comparison of WEM and WAM scenarios*

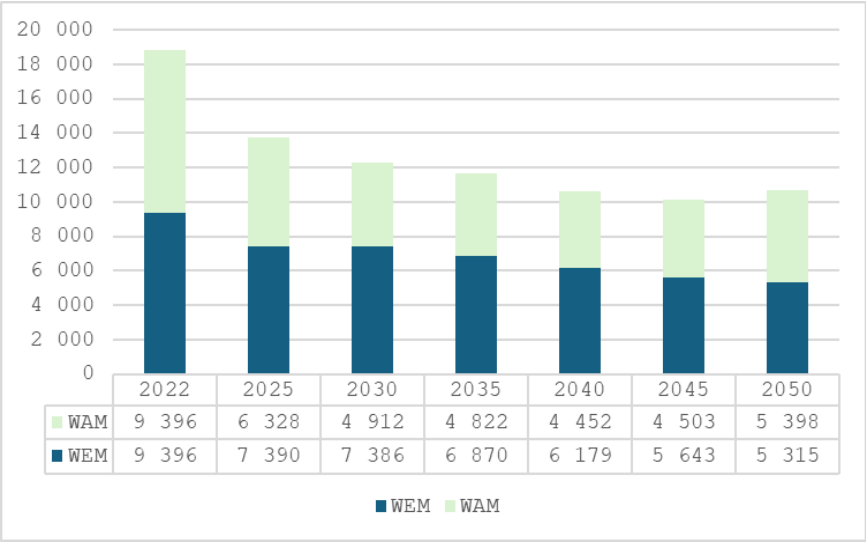


Source: (B) EST model, E3-Modelling

In parallel, the development of renewable technologies in heat production, such as biogas, natural gas blended with biogas and green hydrogen, and biomass meeting sustainability criteria, displaces the use of natural gas. The development and use of modern technologies in the sector is reflected in an increase in the share of renewables in heat generation, which ranged between 16.1 % and 55.4 % between 2025 and 2050 and was higher by 5.6 % to 30.5 % compared to the corresponding share in the WEM scenario.

As a result, the annual increase in the share of renewables in district heating and cooling was 1.6 % in 2021-2025, 3.7 % in 2026-2030 and 2.6 % in 2021-2030, which is at least 1.1 % higher than the corresponding increases in the WEM scenario. These increases are in line with the Renewable Energy Act, as amended in 2023, as well as with the indicative annual increases of Directive 2023/2413, Article 24(4).

Figure 119: *Comparison of heat generation according to WEM and WAM scenarios (GWh)*



Source: (B) EST model, E3-Modelling

When taking additional policies and measures for the development of the WAM sector, the scenario envisages a lower reduction in heat production, with an estimated end of the period of 5 398 GWh, which is 83 GWh higher than expected under the WEM scenario for 2050.

iii. Assessment of interactions between existing policies and measures and planned policies and measures, and between those policies and measures and Union climate and energy policy measures

Both existing and planned policies and measures interact with Union energy and climate policy measures. In addition, all existing and planned policies and measures implemented across all five dimensions of the Energy Union are in line with EU legislation and/or contribute to the EU's overall energy and climate objectives.

5.2 impacts of planned policies and measures described in section 3 at the level of the macro-economy and, to the extent possible, health, environment, employment and education, skills and social impacts, including just transition aspects (in terms of costs and benefits and cost-effectiveness), at least until the last year of the period covered by the plan, including comparison with projections based on existing policies and measures

Preserving and achieving synergies with policies and objectives for biodiversity conservation and critical ecosystem functions and services relevant for both mitigation and

adaptation will be essential in the implementation of the policies and measures outlined in Section 3 of the Plan.

An important aspect will be to improve the digital knowledge and skills of human resources in the country, helping to make widespread use of information and communication technologies and services based on them and to achieve digital growth.

Environmental impact

The environmental and biodiversity impact of this Plan will be assessed under environmental legislation. In accordance with Article 86 (3) of the ZOOS, Article 86 (3) ZOOS will be assessed, likely significant impacts on the environment, including biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, etc., including secondary, cumulative, simultaneous, short-, medium- and long-term, permanent and temporary, positive and negative effects.

Impacts of RES development on Natura 2000 areas, biodiversity and natural resources, including waste.

The Republic of Bulgaria will aim to achieve a 34.96 % share of energy from renewable sources (RES) in gross final energy consumption by 2030. The national target thus set should be achieved by increasing energy consumption from renewable sources in all three sectors: electricity, heating and cooling, and transport. Achieving this objective implies the construction and extension of renewable energy facilities due to an increase in electricity produced from solar, wind and biomass with possible direct and indirect negative impacts on protected areas for the conservation of natural habitats and wild fauna and flora and for the conservation of wild birds, as follows:

— damage, destruction and loss of natural habitats and habitats of species, including birds subject to conservation in protected areas, resulting from the construction and operation of energy facilities;

— fragmentation of natural habitats and habitats of species, including birds subject to conservation in protected areas, both from the realisation of energy parks and from the construction and operation of the infrastructure accompanying them;

— transformation of natural habitats and habitats of species, including birds, due to the entry of rudimentary/synanthropic and invasive species;

— permanent and irreversible landscape change, determining the existence of key features of protected areas;

— change in the conservation status of forest natural habitats due to the loss of areas and their deterioration as habitats of species;

— different duration and intensity of concern of the animals protected due to the construction and operation of extraction, storage and transport facilities causing them to escape from their habitats;

— changes in the species composition, size, structure and density of the populations of the protected species (plants and animals), both due to direct destruction of specimens and indirectly due to changes in the qualities of their habitats;

— barrier effect in different types of migration movements (food, breeding, seasonal, vertical and horizontal), discontinuation of biocoloria, and leading to difficult or impossible reproduction.

The occurrence of the above negative impacts is a prerequisite for the possible disruption of the integrity of protected areas and the disruption of functional links between them, delays/impediments to the achievement of the specific and detailed conservation objectives of the protected areas.

Cumulative impacts on protected areas and their conservation object are possible as a result of the combined impact of the plan's projections and projects implemented so far for hydropower, thermal power plants, HPP, TPP, NPP, geothermal energy, for the use of biofuels, bioliquids and biomass fuels, gas systems, electricity transmission systems, etc. and the implementation of the measures set out in the plan.

The areas with proven wind potential along the Northern Black Sea System overlap with the Via Pontica migration route. The same is the case for the Via Aristotelis migration route and others. These circumstances shall be taken into account in the analysis of RES potential in terms of environmental constraints and in the development of a Plan for the identification of priority areas for the development of wind power plants, which is conducive to the achievement of the renewable energy target.

In terms of hydroenergy, it can be expected that:

- Modification of the morphological conditions and water flow of the water body, which may lead to deterioration of the status of the water body, loss of reservoirs or loss of natural habitats, habitats of water-dependent species and species;
- Habitat degradation;
- Loss or deterioration of protected natural habitats in or along the river bed;
- Alteration and destruction of river habitats, aquatic and coastal fauna, destruction and fragmentation of habitats, barrier effects of river species, effects on fauna due to intermittent river runoff, concern during the operation of a hydroelectric power plant, including the hydropeaking effect of the difference in temperatures;
- A change in hydromorphology is a factor in changing the ecological status of surface water bodies and associated ecosystems due to the effects of abstraction, flow regulation and disruption of river continuity from river barriers without constructed or well-functioning fish passes, which may result in failure to achieve the good status objectives of Directive 2000/60/EU for surface water bodies. The construction of multiple HPPs on the tributaries in the catchment of the same river or river length also has a cumulative effect;

VCCs are vulnerable both to the availability of water resources due to climate change and its manifestations of drought and to the integrated use of water for other purposes – water

supply, irrigation, etc. in accordance with the priorities set out in Article 50 of the Water Act.

The use of hydrogeothermal energy as part of geothermal energy can also have a significant effect on groundwater bodies and lead to failure to meet the objectives of good quantitative and qualitative status under Directive 2000/60/EU. The construction of heat pump installations in urbanised areas leads to a cumulative effect combining influence with private use, drinking and household abstraction, industrial users and irrigation. Water is a strategically valuable resource for the drinking and household supply of urban areas, which is becoming increasingly important in the face of climate change and which must be protected for future generations.

Planned offshore wind installations in the Black Sea may affect the achievement of the objectives of good marine environmental status under the Marine Strategy Framework Directive, which takes into account complex environmental factors such as marine mammals, noise, etc., and it is therefore necessary to plan serious studies on the expected impact before implementing the praned projects.

Effect on health

Air pollution poses a global health risk. The measures planned in the INECPs are assessed under environmental legislation and in terms of impacts on human health resulting from expected changes in ambient air quality.

Air pollution is also recognised as the fifth leading risk factor for chronic diseases. Air pollution is the greatest environmental risk to the health of Europeans. Once released, pollutants undergo various physical and chemical processes (such as transport, reactions, absorption and deposition on vegetation or with rainwater) affecting ambient air quality, which can be analysed by measuring pollutant concentrations. Air pollution affects human health in particular by particulate matter, nitrogen dioxide (NO_2) and ground-level ozone. PM emissions are the main cause of premature pollution deaths causing problems in respiratory (lung cancer), cardiovascular or brain (ischaemic attacks) systems. As regards O_3, although typically associated with damage to farming systems, it also has a significant impact on health associated with respiratory diseases.

Energy efficiency measures such as thermal insulation, heating (heating control), ventilation, humidity, fuel use, surface area and glazing orientation are key factors contributing to reducing excessive cold or heat, air pollution and associated health risks. The greatest economic and social benefits of building renovation will be realised by improvements in heating and insulation.

Adaptation to climate change

The impact of climate change in Bulgaria and adaptation options were analysed as part of the National Strategy for Adaptation to Climate Change and the Action Plan 2030.

The macroeconomic analysis was developed on the basis of two climate scenarios, a temperature change of 2 °C (optimistic) and 4 °C (pessimistic) by 2050. Each climate scenario has also been tested for assumptions of high and low vulnerability in each sector

(in terms of climate sensitivity and adaptability). Climate change can directly (or indirectly) affect the cost and availability of materials and production in the economy, affecting the level and structure of the overall economic activity. The loss of real GDP growth in 2050 compared to the baseline is estimated at around 1 % in the optimistic climate scenario and 3.5 % in the pessimistic climate scenario. This would mean that the projected annual GDP growth of around 1.7 per cent by 2050 would be fully reversed if Bulgaria faces the full impact of a 2 °C increase by 2050.

Taking into account the impact of the climate change scenarios in Bulgaria for the whole sector up to 2050, the economic analysis concludes that:

- Climate change has a direct negative effect on productivity in the agricultural sector (represented by crop production) and thus a decline in output in all scenarios. The production of wheat, cereals and other crops has suffered the greatest negative impact in the four river basin management regions in Bulgaria. The Danube basin, where agricultural productivity is highest, is the sub-region most affected by climate change;

- In all scenarios considered, there will be a decline in energy sector production. This is explained by the reduced demand from the market economy, reflected in reduced output;

- The transport sector also has a negative impact, with the overall decline in economic activity (negative changes in GDP) responsible for a decline in demand for output for these sectors;

- Energy-intensive sectors, including chemical, ferrous and non-ferrous metallurgy, cement and ceramics, have a positive output driven by the positive conditions of trade changes, helping to increase export demand, helping to mitigate falling domestic demand.

The general conclusions for other macroeconomic and social parameters are as follows:

- Following the impact of climate change in Bulgaria, jobs will move away from those sectors that are negatively affected;

- Climate change will change Bulgaria’s overall trade structure. There will thus be an increase in imports of goods whose domestic production is strongly influenced by climate change;

- In all climate impact scenarios considered, there would be an increase in the price level across the economy. In addition, rising commodity prices can lead to a significant reduction in real income and an increase in poverty, as households spend a large share of their income on commodities whose prices are rising significantly (including food);

- Overall, revenue from skilled and unskilled labour will decrease in all scenarios. Thus, combined with rising prices and falling labour revenues, more people are expected to fall below the poverty line. In these climate scenarios, there are very likely more poor people living in Bulgaria until 2050. Moreover, it is widely accepted that the impacts of climate change, including from extreme weather events, disproportionately affect lower

incomes and vulnerable groups, increasing the impact of price increases and falling revenues on these groups.

The messages emerging from the climate adaptation analysis are summarised as follows:

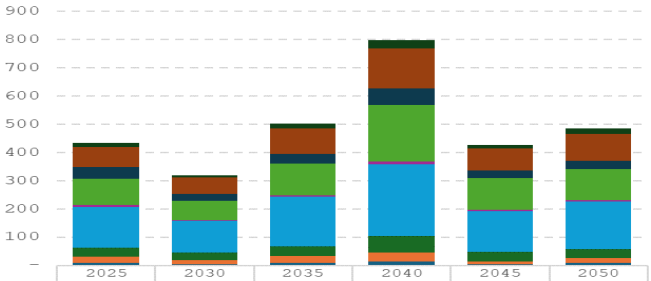
- Relevant transformation in horizontal sectors, mitigation and adaptation measures also expect benefits and positive effects related to climate change;
- External resources, such as structural funds from the European Union or their successors, or other bi- or multilateral mechanisms focused on climate finance, may also be used for adaptation, in addition to internal resources;
- With regard to the allocation of adaptation funding, the analysis concludes that orienting resources for adaptation in sectors (and not only the most vulnerable sectors) brings more benefits to the Bulgarian economy and citizens, as it increases the availability of capital in productive sectors, with expansion of production and added value, partly exceeding the negative impacts of climate change.

5.3 Overview of investment needs

i. Existing investment flows and forward investment assumptions with regards to the planned policies and measures

This section presents the WEM projections of the investment needs scenario for the national energy system as a whole and by specific sectors or areas of investment.

Figure 120: *Investment costs for heat recovery in industry by sector, (B) EST WEM estimates (million EUR '15 over 5 year)*



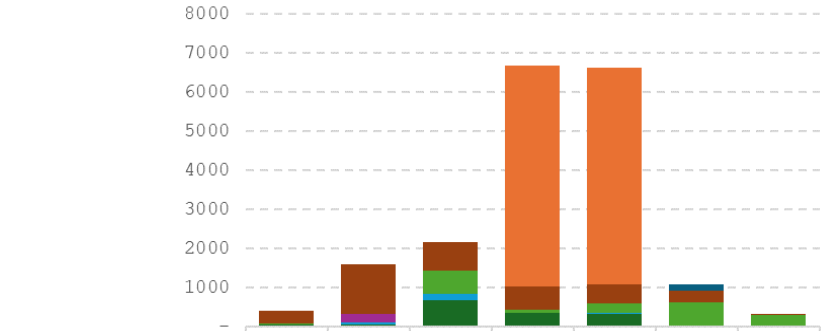
	2025	2030	2035	2040	2045	2050
Инженеринг	14	8	17	28	12	20
Други индустриални	73	57	91	142	77	96
Храна, напитки, тютюн	40	24	34	59	27	28
Химикали	93	70	112	199	114	110
Текстил	8	4	5	11	5	4
Неметални материали	145	112	176	253	143	170
Целулоза, хартия печат	32	25	35	59	34	32
Цветни метали	21	14	23	31	9	16
Желязо и стомана	8	5	10	15	5	9
Общо – WEM	435	320	503	798	427	486

Source: (B) EST model, E3-Modelling

The WEM forecast shows a significant volume of investment costs in renewable energy projects, mainly occurring until 2030. From 2035 onwards, the related costs have stabilised around EUR one million '15 over a five-year period. Moreover, the years 2035 and 2040

were characterised by the commissioning of the two new nuclear units and the associated costs.

Figure 121: *Investment costs for power plants (B) EST WEM forecasts (million EUR '15 over 5 year)*



	2022	2025	2030	2035	2040	2045	2050
Ядрена енергия	-	-	-	5640	5550	-	-
Геотермална енергия	-	-	-	-	-	156	-
Фотоволтаици	323	1264	746	611	485	309	49
Офшорен вятър	7	8	595	85	238	619	282
Хидро	-	217	-	-	-	-	-
Биомаса	3	52	150	-	16	-	-
Природен газ	58	58	679	336	333	-	-
Общо - WEM	391	1599	2170	6673	6621	1084	331

Source: (B) EST model, E3-Modelling

A characteristic of the projected annual investment costs for electricity in power plants is that by 2030, all costs are expected to increase, except for photovoltaic plants, followed by a decreasing trend until the end of the period considered. The most pronounced increase is expected for offshore wind farms, where costs will increase by EUR 588 million, to EUR 595 million in 2030 and decrease to EUR 2 050 million in 282. The increase in costs for natural gas plants is more gradual, from EUR 58 million in 2022 to EUR 679 million in 2030, followed by a decrease to EUR 333 million at the end of the period considered.

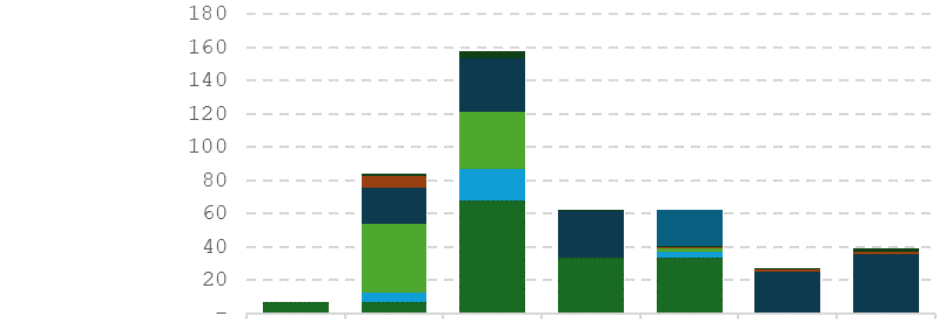
Electricity costs and biomass plants are projected to increase by 2030, from EUR 3 million in 2022 to EUR 150 million in 2030.

For the nuclear power plant, electricity investments are estimated to be needed in the range of EUR 5 550-5 640 million between 2035 and 2040.

Over the entire projected horizon of the WEM scenario, new CHP and heating plants are planned to be commissioned to cover heat needs in Bulgaria and replace existing plants at the end of their operation. RES such as biomass, solar and geothermal energy are the constantly preferred technologies. In addition, some investments in natural gas are taking

place in the medium term to ensure a stable transition and to meet intermediate energy needs.

Figure 122: *Investment costs in CHP and Heating Plants, (B) EST WEM forecasts (MEUR '15 for 5 year)*



	2022	2025	2030	2035	2040	2045	2050
ОЦ електричество	-	-	-	-	22	-	-
ОЦ слънце	-	1	4	1	1	1	2
ОЦ геотермия	-	7	-	-	1	1	2
ОЦ биомаса	-	22	32	28	-	25	36
ОЦ газ, нефт	-	41	35	-	2	-	-
ВКП биомаса	-	5	19	-	4	-	-
ВКП газ	7	7	68	34	33	-	-
Общо - WEM	7	84	158	62	62	27	39

Source: (B) EST model, E3-Modelling

An increase in annual investment costs for cogeneration plants (CI) is expected between 2022 and 2030, with an expected increase of EUR 61 million for natural gas users and an estimated increase of EUR 14 million for biomass KIs. In 2040, the estimated costs for both types of CI will decrease to EUR 33 million and EUR 4 million respectively.

For biomass heating plants, an increase of 63.4 % in annual costs is projected, from EUR 22 million in 2022 to EUR 36 million at the end of the period considered. A sharp drop in the necessary investment costs is expected for gas and oil PCs. In 2025, expenditure is estimated at EUR 41 million, while in 2040 it is expected to decrease by EUR 39 million, reaching EUR 4 million.

The investment costs of photovoltaic plants remained relatively constant over the period considered, with the exception of 2030, when they are expected to increase by EUR 3 million compared to 2025. In 2050, the costs will amount to EUR 1 million, which is at the level of 2025.

Investment costs for geothermal plants are expected to increase by EUR 2 040 million between 2050 and 1, from EUR 1 million in 2040 to EUR 2 million in 2050.

Table 41: *Investment costs for heat recovery in industry by sector, (B) EST WEM estimates (million EUR '15 over 5 year)*

	2025	2030	2035	2040	2045	2050
Iron and steel	8	5	10	15	5	9
Non-ferrous metals	21	14	23	31	9	16
Pulp, Paper and printing	32	25	35	59	34	32
Non-metallic materials	145	112	176	253	143	170
Textiles	8	4	5	11	5	4
Chemicals	93	70	112	199	114	110
Food, beverages, tobacco	40	24	34	59	27	28
Other industrial	73	57	91	142	77	96
Engineering	14	8	17	28	12	20
Total – WEM	**435**	**320**	**503**	**798**	**427**	**486**

Source: (B) EST model, E3-Modelling

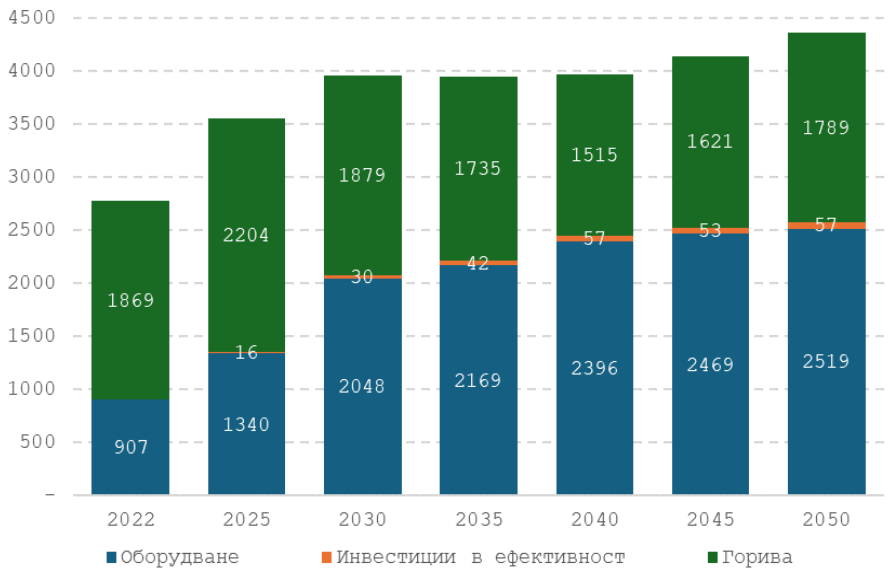
An overall increase is also estimated for the necessary annual investment costs for heat recovery in industry by sector. In the *non-metallic materials* sector, expenditure is expected to increase by close to 17 % compared to 2025, reaching EUR 170 million at the end of the period. At the same time, expenditure increases are projected in the *Chemicals* and *Other Industrial* sectors by 18.3 % and 31.5 % respectively, while in the *Engineering sector the* expected increase is close to 43 %.

The Celulosis*, Paper and Printing and Iron and Steel* sectors show a trend of remaining relatively fixed costs over the period considered, while the remaining sectors are forecasted to decrease, the most noticeable of which is in *the food, beverages and tobacco* sectors, from EUR 40 million in 2025 to EUR 28 million in 2050.

A reduction of nearly 24 % in expenditure is expected in the *Colour Metals* sector as well as in the *Textiles* sector by 50 %, reaching EUR 16 million and EUR 4 million respectively in 2050.

In the household sector, an increase in system costs is expected, mainly due to investments in equipment and fuel purchases. Indeed, fuels contribute at least 38 % to total system expenditure in households over the entire WEM scenario projection horizon.

Figure 123: *System expenditure of households by category, (B) EST WEM projections (EUR million '15)*



Source: (B) EST model, E3-Modelling

The figure above provides information on the projected evolution of the *household* expenditure on equipment, efficiency and fuels.

Over the period considered, equipment and efficiency costs are expected to increase by around 177 % and 90 % respectively, reaching in 2050:

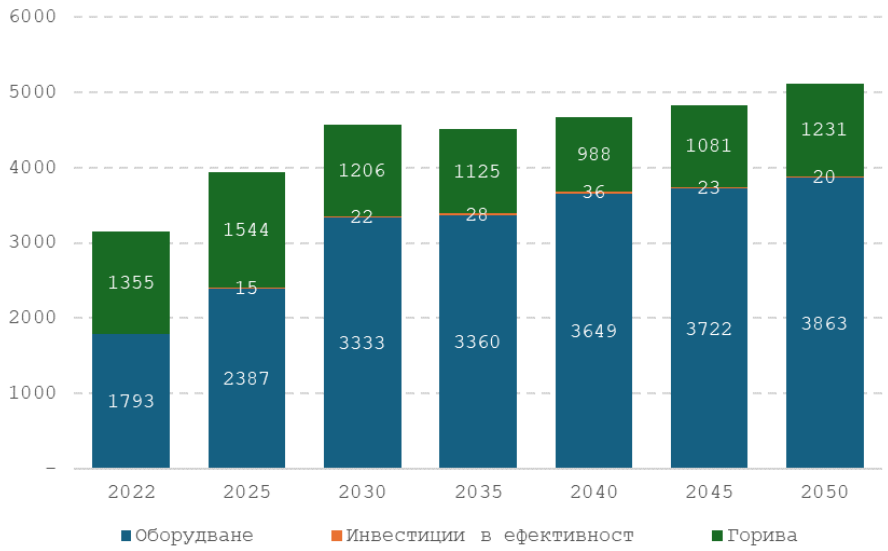
→ for equipment, EUR 2 519 million;

→ efficiency – EUR 57 million.

Fuel costs are expected to decrease by 4.3 % over the period, from EUR 1 869 million in 2022 to EUR 1 789 million in 2050.

Services and agriculture in the WEM projection show similar trends, with the cost of purchasing equipment and fuel dominating system costs in the tertiary sector.

Figure 124: *System costs for services and agriculture by category, (B) EST WEM estimates (million EUR '15)*



Source: (B) EST model, E3-Modelling

For the *services* and *agriculture* sectors, a reduction in fuel expenditure is expected to reach EUR 1 231 million in 2050, a decrease of around 9 % compared to 2022. At the same time, an increase of more than 115 % in equipment costs is foreseen, reaching EUR 3 863 million at the end of the period considered.

By 2040, expenditure on efficiency is projected to grow from EUR 15 million in 2025 to EUR 36 million in 2040, after which it is expected that this expenditure will decrease and amount to EUR 2 050 million in 29.

The WEM forecast shows a significant volume of investment costs in renewable energy projects, mainly occurring until 2030. From 2035 onwards, the related costs have stabilised around EUR one million '15 over a five-year period. Moreover, the years 2035 and 2040 were characterised by the commissioning of the two new nuclear units and the associated costs.

Investments in renewable energy in the electricity and heat generation sectors

In order to achieve the renewable energy share targets of the WAM scenario, significant funds need to be invested in the development of renewable energy capacity in the electricity and heat generation sectors. These investments amounted to almost EUR 3.6 billion for the period 2021-2030, almost EUR 1.56 billion more than in the WEM. Around EUR 1.07 billion is expected to be invested in the development of the FPP, as well as around EUR 1.28 billion in onshore wind farms. The table below provides a summary of the investment needs for RES capacity for the period 2021-2030.

Table 42: *RES**investments for electricity and heat from renewable sources in WAM scenario, EUR million***

	2022	2025	2030	2035	2040	2045	2050
Electricity							

Biomass	3	52	90	17	—	—	593
Hydropower	—	217	371	—	727	—	—
Onshore wind	7	8	1 280	720	1 294	1 048	226
Offshore wind	—	—	825	1 948	986	548	1 734
Solar power	323	1 264	1 072	1 209	1 054	263	157
Geothermal energy	—	—	—	—	—	1 013	—
Total investments in electricity from RES	**333**	**1 540**	**3 638**	**3 894**	**4 062**	**2 873**	**2 710**
Heat							
NCP biomass	—	5	11	2	—	—	75
NOP biomass	—	76	—	—	59	136	106
Nuclear geothermal energy	—	—	5	1	1	1	2
Solar power	—	—	6	1	1	1	1
PTO electric power	—	—	—	—	—	—	—
Total heat	**0**	**82**	**22**	**4**	**61**	**138**	**183**
Total investments in electricity and heat	**333**	**1 622**	**3 660**	**3 898**	**4 123**	**3 011**	**2 893**

Source: (B) EST model, E3-Modelling

Overview of funding sources

A non-exhaustive list of potential sources of funding is presented below.

For the next Multiannual Financial Framework 2021-2027, Bulgaria intends to benefit from the Structural Funds to finance investment needs to decarbonise the energy sector, ensuring climate adaptation and a just transition. According to Annex D to the Bulgaria Country Report, priority investment needs have been identified to promote energy efficiency measures, improve resource efficiency and waste management and promote the transition to a circular economy. Bulgaria intends to have access to ERDF and Cohesion Fund resources:

I. Structural Funds: European Regional Development Fund and Cohesion Fund

The new MFF 2021-2027 provides EUR 273 billion for the ERDF and CF. The new MFF will have a thematic focus, from which Policy Objective 2: "A greener Europe" and Policy Objective 3: "A more connected Europe" has the closest connection to investment needs.

For the energy sector, PO 2 is the most appropriate. This PO promotes a greener, low-carbon Europe by promoting the transition to clean and fair energy, green investment, the circular economy, climate adaptation and risk prevention and management. Under this MP, the specific objectives of the ERDF/CF are:

Promoting energy efficiency and reducing greenhouse gas emissions

In this regard, the following investment priorities have been identified:

- Support measures to improve energy efficiency for green investments and low carbon emissions from the whole economy and the entire energy chain;
- Supporting energy efficiency of public, industrial and residential buildings through renovation, including by joining the seismic risk consolidation component;
- Support for energy efficiency for SMEs, large enterprises and local authorities.

Promotion of renewable energy

In this regard, the following investment priorities have been identified: development and modernisation of energy storage and backup systems, supporting decentralised distribution, adapting transmission and distribution, increasing grid adequacy.

Developing smart energy systems, grids and storage outside TEN-E

In this regard, the following investment priorities have been identified:

- Digitalisation of the national energy system in the transport, distribution and consumption segments and the introduction of intelligent management systems and measures to support the implementation of the concept of smart city step by step.
- Development of transmission and distribution capacity of electricity networks in order to ensure the necessary technical parameters for good interconnection with trans-European energy infrastructure.

For the **environmental sector,** PO 2 is the most relevant. The ERDF/CF shall pursue the following specific objectives for this sector:

Promoting climate change adaptation, risk prevention and disaster resilience

In this regard, the following investment priorities have been identified:

- Adapting to climate change measures, preventing or managing climate risks, floods and landslides, fires, storms, etc.;
- Risk prevention and management of non-climatic natural hazards (e.g. earthquakes) and risks related to human activities (e.g. technological accidents), including awareness raising systems, infrastructure, civil protection and disaster management.

Promoting the transition to a circular economy

In relation to the strategic objectives defined in the Strategy for the Transition to a Circular Economy 2022-2027:

- A green and competitive economy;
- Less waste, more resources;
- An economy that benefits consumers.

The following investment priorities are appropriate:

- Promoting competitiveness through better use of resources;
- Promoting waste reduction and the use of recycled materials as raw materials;

- Increasing the benefits to consumers of circular use of resources.

For the **transport sector**, PO 3 is the most appropriate. This PO will support the following investments:

- Developing a sustainable TEN-T network adapted to climate change, secure and intermodal;
- Developing and strengthening sustainable, flexible and intermodal national, regional and local mobility, including improving access to the TEN-T network and cross-border mobility.

II. InvestEU

The InvestEU programme under the new MFF provides an EU budget guarantee of EUR 38 billion. The Fund will be invested through financial partners, the main being the EIB Group. Eligible investments are organised in several policy windows, of which the following are most closely linked to the INECPs:

- **Sustainable infrastructure**

This area aims at developing the energy sector, developing sustainable transport infrastructure, innovative equipment and technologies, protecting the environment and resources, developing digital connectivity of infrastructure. Eligible investments shall include in particular:

- The production, supply or use of clean, sustainable and safe energy from renewable resources and other energy sources close to zero or low emissions, including natural gas as a transitional fuel;
- Energy efficiency and energy savings;
- Development and modernisation of sustainable energy infrastructure at the level of transport and distribution of energy, storage, smart grids;
- Developing innovative low- or zero-emission heating and cogeneration systems;
- Production and supply of synthetic fuels derived from renewable or carbon-neutral energy sources;
- Infrastructure for carbon capture and storage systems;
- Alternative fuels infrastructure: electricity, hydrogen and liquefied gases and other low- and zero-emission technologies;
- Projects aimed at combating or adapting to climate change.

- **Research, innovation and digitalisation**

This area aims to stimulate the digital transformation of European companies, markets and EU Member States. It aims to deliver scientific, technological, economic and societal impact by strengthening the EU's scientific and technological base, with the ultimate aim of

delivering on the EU's strategic priorities and providing support for the modernisation of innovative companies and for bringing technologies to the market.

- **Small and medium-sized enterprises**

This area aims to promote the competitiveness of SMEs across the EU at every stage of their development.

- **Social investment**

This area aims to: reducing inequalities, increasing inclusion, social enterprises and the social economy, social inclusion, improving citizens' health, general well-being and quality of life, boosting education outcomes, supporting a just transition to a low-carbon economy.

Sources of funding outside the MFF 2021-2027:

III. Modernisation Fund

Between 2021 and 2030, 2 % of the total quantity of EU allowances will be auctioned and the funds will be allocated to the MoF in accordance with Article 10 (1) of Directive (EU) 2018/410 of the European Parliament and of the Council amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814. The budget of the Modernisation Fund (Modernisation Fund) is made up of revenues equivalent to the 2 % of total allowances to benefit 10 Member States, including Bulgaria.

On 26 January 2023, Decision No 67 of the Council of Ministers of the Republic of Bulgaria adopted the 'Programme of conditions and procedures for the selection of projects for activities to be financed from the Modernisation Fund'.

In this regard, the Ministry of Energy has prepared an analysis of the state of the electricity system in the country and the need to take urgent measures to ensure the continuity of electricity supply to final customers. The investments supported shall be consistent with the objectives of Directive 2003/87/EC of the European Parliament and of the Council in relation to the operation of the Modernisation Fund, as well as with the objectives set out in the Union's 2030 climate and energy policy framework and the long-term objectives set out in the Paris Agreement. They lead to the integration of renewable energy sources and enable consumers to become more active as 'active consumers/producers'. These are key enablers of the energy sector reforms set out in Bulgaria's Recovery and Resilience Plan.

The priority areas to which 80 % of the funding will be allocated are:

- Production and use of electricity produced from renewable sources;
- Improving energy efficiency (including in transport, buildings, agriculture and waste), excluding energy production from solid fossil fuels;
- Energy storage;
- High pressure gas transmission infrastructure;
- Hydrogen transmission infrastructure;

- Modernisation of energy networks, including pipelines in urban district heating, electricity and gas networks, increasing interconnection between Member States;
- A just transition of carbon-dependent regions to support development and recruit new human resources positions in their respective regions.

The remaining 20 % will be used to finance non-priority investments, and these investment proposals will be evaluated by the Investment Committee in the first semi-annual disbursement cycle of the calendar year.

No support will be provided to projects based on solid fossil fuels, with the exception of Romania and Bulgaria for thermal power plants.

Inaccordance with the programme adopted by the Council of Ministers, the Minister for Energy organises the management of funds from the Modernisation Fund designated for the Republic of Bulgaria, carries out ongoing and ex-post controls on the implementation of projects financed from the Modernisation Fund and assesses the compliance of the investments with the requirements of the MoF and the progress in their implementation.

Separately, the European Investment Bank, as a member of the Investment Committee, also comprising: a representative from each beneficiary Member State, a representative of the European Commission and three representatives selected by the other Member States for a period of five years will assess the eligibility of the projects, the management of assets, the provision of quota revenues.

IV. European Investment Bank loans

- Investments in energy efficiency, taking into account the EU target of 32.5 % by 2030, especially for residential buildings, with a new energy efficiency instrument expected to be introduced, a European Building Renovation Initiative, which will also target the energy efficiency of SMEs;
- Decarbonising energy supply, bearing in mind the EU-wide GHG emissions reduction target of at least 40 % compared to 1990 (in this regard, the EIB will commit to supporting the integration of renewable energy projects and better regional cooperation);
- Supporting investments in innovative technologies and new types of energy infrastructure;
- Security related to energy infrastructure (EIB continues to support non-fossil fuel projects of common interest).

From 2022 onwards, the EIB will no longer finance investments related to fossil fuels, including natural gas, with emissions of 250 gCO2/kWh or less.

The EIB will also cooperate with the EC in developing the Just Transition Fund to support regions experiencing difficulties in transitioning to a carbon-neutral economy. The EIB will finance up to 75 % of the eligible costs. Projects will benefit from EIB financial support and advisory services.

V. Private investment

It should be borne in mind that information on the sources of funding from EU funds is currently temporary and subject to change, as the MFF 2021-2027 has not yet been formally finalised at the time of the preparation of the INECPs.

ii. Sector or market risk factors or barriers in the national or regional context

The main potential sources of risk that could hamper Bulgaria in the process of achieving the targets and ambitions are limited to the timely and adequate implementation of the planned policies and measures. Bulgaria has significant investment needs in the field of energy and climate change prevention activities, which are closely linked to the achievement of the targets.

With regard to the development of electricity produced from renewable energy sources, Bulgaria plans to invest more in RES and FPP, as well as to increase the use of biomass for electricity generation, and in this respect Bulgaria will have to ensure a sustainable supply.

The transport sector will also play an important role in the period 2021-2 030 in terms of decarbonisation and the use of energy from renewable sources. The transport sector will have a transition to alternative fuels and new technologies such as hybrid and electric cars. Such technologies are currently still expensive, but their economic viability is expected to improve in the future. Accordingly, the growing demand for travel needs to be met and investment decisions in this area should therefore not slow down or hinder the development of the transport network and infrastructure. As the switch to alternatively fuelled vehicles leads to significant infrastructure changes, it is of great importance that Bulgaria develops measures for the infrastructure planning of publicly accessible charging stations for electric vehicles, natural gas refuelling stations and hydrogen refuelling infrastructure.

iii. Analysis of additional support with public finances or resources to address the shortcomings identified in point (a)

A number of EU funding mechanisms are available to support the development of sustainable mobility in Europe, including the Connecting Europe Facility. Financial measures to stimulate private investment, especially in the field of energy efficiency, will also be encouraged. The financing of projects of common interest and EIB loans are also important sources of financing.

5.4 impact of planned policies and measures described in section 3 on other Member States and regional cooperation until at least the last year of the period covered by the plan, including comparison with projections based on existing policies and measures

i. Impacts on the energy system in neighbouring and other Member States in the region to the extent possible

An analysis by the European Investment Bank from the end of 2023 shows that the countries of Central and Eastern Europe need nearly EUR 8 billion to invest in low-carbon technologies every year until 2030. The study has been prepared by a working group of the Vienna Initiative on Climate Change and the Financing of Clean Projects. It can also be concluded that all countries' efforts must address the complexity of climate change risks and promote sustainable financial practices in Central, Eastern and South-Eastern Europe.

At the same time, it should be noted that while large corporations within the EU have successfully adapted to the strict requirements of environmental, social and governance standards, companies in South-East European countries, micro and small and medium-sized ones, which dominate the region, often lack the necessary information to understand the climate and financial risks they face. In this sense, in the coming years, the financial sector will also play a critical role in driving the transition to a more sustainable economy and achieving the EU's green transition objectives. Coordinated efforts to unlock the potential of sustainable finance in the South East Europe region are crucial to boost sustainable development.

The security of the Bulgarian gas transmission network is a high priority, as it both transports natural gas to the gas distribution networks and non-household natural gas customers in the country, and transports to neighbouring countries Romania, Greece, Serbia and the Republic of North Macedonia. Bulgartransgaz EAD, an operator of the gas transmission network in Bulgaria, also participated as a 20 % shareholder in the project for the construction of a new LNG regasification terminal near the Greek city of Alexandroupolis.

Separately, Russia's invasion of Ukraine has made it necessary to redirect natural gas supplies towards gas flows from south to north through the Southern Gas Corridor, which has significantly increased:

- The demand for liquefied natural gas;
- The demand for capacity products needed to create new logistics circuits;
- The importance of UGS Chiren for the security of the gas market in the region.

ii. Impact on regional cooperation where appropriate

Electricity markets

Regulation No 2009/714 and the accompanying guidelines and network codes provide that a market-based and non-discriminatory allocation process for cross-border transmission capacities must be coordinated at regional level. The Joint Allocation Office is the service company that supports the markets for cross-border transmission capacities and has since 1 October 2018 become the Single Allocation Platform-SAP for all European Transmission System Operators (TSOs) in accordance with Article 59 of Regulation (EC) No 2016/1719. JAO is owned by twenty-five transmission system operators (TSOs) from 22 countries.

ESO EAD has been the owner of part of JAO's capital since the end of 2019, using the company's long-term capacity allocation services at the borders with Romania, Greece and Serbia. In terms of short-term capacity allocation, ESO uses JAO services for the borders with Greece and Serbia. The allocation of capacities in the day-ahead timeframe of the border with Romania is carried out by the Romanian transmission operator, which will change following the introduction of the market coupling between the two bidding zones at the end of 2020. At the border with North Macedonia, both long-term and short-term capacities are allocated by the Macedonian and Bulgarian transmission operators respectively. With regard to the border with Türkiye, the capacity allocation shall be carried out by each operator for 50 % of the contracted capacity.

Since January 2019, daily explicit auctions have been introduced at the Bulgarian-Serbian border, which are conducted by the Serbian transmission operator and at the border with Romania, after the launch of the market pool within the 19.11.2019 day interval, the daily capacities are allocated implicitly.

On 22 May 2020, the Transmission System Operators of Bulgaria (ESO EAD), Greece (IPTO), Italy (TERNA SpA) and Romania (Transelectrica) set up a Southeast Electricity Network Coordination Center ("Selene CC"), based in Thessaloniki, Greece. The four transmission operators have an equal shareholding in the share capital of the public limited company. On the basis of Article 26 (1) and (2) of the Statutes of Selene CC, the transmission system operator of Romania decided, for regulatory reasons, to terminate its shareholding in Selene CC as from 1.7.2022 and will use the Centre's services on the basis of a contract. Since 1.7.2021, Selene CC has been active in operational security analysis, coordinated disruption planning, coordinated capacity allocation, short-term and close to real time adequacy forecast, individual and common grid modelling and data provision. According to the provisions of Regulation 2019/943 on the internal market for electricity, regional security centres should be replaced by regional coordination centres as of 1.7.2022 and the coordination centre is aligned with Regulation 2019/943 at the end of 2 022.

The Bulgarian independent power exchange, administers the short term 'Day ahead' and 'Intraday' market segments. The abolition of the electricity export tariff in 2019 was an important step towards achieving the upcoming market alliances on the national market with neighbouring ones.

Natural gas markets

Bulgaria has a strategic geographical location, a well-developed gas infrastructure and, with the implementation of the new projects already implemented and planned, has the potential to develop its role as an important factor in ensuring energy security and diversification of natural gas supply sources and routes to the countries of the region. Natural gas is at the heart of the EU's policy to reduce greenhouse emissions by 2030. Gas infrastructure will play a key role in decarbonising and achieving carbon neutrality by 2050.

EU policy aims to phase out coal and gradually increase the use of alternative green energy carriers such as hydrogen. Despite a relatively low share of final energy consumption, gas is a significant natural resource with the potential to increase its share of the country's total energy consumption in the coming years. At present, the share of domestic gas supply in Bulgaria remains low compared to other EU Member States. The promotion of gasification, the expansion of distribution companies' networks and trends to reduce the consumption of solid and liquid fuels over natural gas also lead to an increase in the use of natural gas in the household sector.

With the construction of the planned projects for new gas infrastructure in the country (increasing transmission capacities, extension of UGS Chiren, implementation of the LNG terminal in Alexandroupolis and other new terminals), it is expected to significantly increase the quantities of natural gas from alternative sources, and ensure energy security, diversification and access to a variety of gas sources at competitive prices for both Bulgaria and the countries of the region.

The available well-developed gas transmission infrastructure is a prerequisite for the successful and accelerated uptake of hydrogen in the country's energy mix, and plans to build new hydrogen transmission infrastructure will ensure the large-scale development of the energy sector in the country.

Since 1.10.2022, the IGB interconnector of the second natural gas transmission operator ICGB, issued by the Energy and Water Regulatory Commission (KEVR) for a period of 576 years, entered into operation in Bulgaria. The IGB gas interconnector ensures a real diversification of both routes and sources of natural gas for Bulgaria and the whole region. As part of the development of the Southern Gas Corridor, Bulgaria and its neighbouring countries have direct access through IGB to alternative supplies from the Caspian region, as well as from existing or foreseen LNG terminals.

The distribution of gas in Bulgaria is carried out by private regional and local companies operating under licensing and price regulation for the activity of distribution. The companies with the largest market share in the country are Overgas Networks AD, Sitigaz Bulgaria EAD and Aresgas AD.

Bulgaria currently has two licensed gas exchanges in force. Licences issued shall be for a maximum period of 35 years. The two gas exchanges operate with the same trading platform, Trayport Global Vision Trading System, a product of TrayportLimited UK, which has developed the most common and globally applied software to administer transactions.

Set up in 2019, the company 'Gas Heb Balkan' EAD (BGH EAD) builds up, operates and is responsible for the functioning of the organised market for the trading of natural gas by

BGH EAD. The online platform with a segment and for bilateral trade offers modern physical and financial products, including VTP and some of the physical points of the networks provided through the pan-European PEGAS platform.

The short-term segment (spot) of the platform shall include standardised 'intraday', 'Day ahead', as well as temporal and local products for balancing the TSOs' network. Trade takes place on an anonymous basis according to the provisions of Regulation (EU) No 312/2014.

The long term segment of the trading platform offers products that are tradable on a medium and long-term basis – weekly, monthly, quarterly and annual.

The Gas Release Program supply segment at the end of 2022 was completed by the adoption of § 10 of the Transitional and Final Provisions of the Act amending the Corporate Income Tax Act (promulgated. SG No 99/2022), which repealed the provisions of Article 176a (1) (4) and (5) of the Energy Act, under which the public supplier was obliged to offer to the organised exchange market certain quantities of natural gas in 2023 and 2024. The long-term contract of Bulgargaz EAD has not been in force since 31.12.2022 and the supplies thereunder were suspended on 27.4.2022. BULargaz EAD needs to provide alternative sources for both its activities as a public supplier and its bilateral contracts and the quantities under the Programme. The emerging shortage of the programme is compensated by alternative suppliers at market conditions. More than 70 traders are licensed to freely trade natural gas on the organised exchange market. In this sense, Bulgargaz EAD competes on the market together and on an equal footing with them for the purchase of natural gas.

PART 2

List of parameters and variables to be reported in Section B of the national plans[13][14][15][16]

The following parameters, variables, energy balances and indicators are to be reported in Section B 'Analytical Basis' of the National Plans, if used:

1. GENERAL PARAMETERS AND VARIABLES

(1) Population, [million]

(2) GDP [euro million]

(3) Sectorial gross value added (including main industrial, construction, services, and agriculture sectors) [euro million]

(4) Number of households [thousands]

[13] For the plan covering the period 2021-2030: for each parameter/variable in the list, trends over the years 4-5 (2005-2040 where appropriate) including for the year 2 005 in five year intervals shall be reported both in section 2050 and 2030. Parameter based on exogenous assumptions v modelling output shall be indicated.

[14] To the extent possible, reported data and projections must be based on and consistent with Eurostat data and the methodologies used for reporting European statistics in the relevant sectoral legislation, as European statistics are the main source of statistics used for reporting and monitoring in accordance with Regulation (EC) No 223/2009 on European statistics.

[15] Note: all projections are to be performed on the basis of constant prices (2016 prices used as base year)

[16] The Commission will provide recommendations on the main parameters for projections covering at least oil, gas and coal import prices as well as carbon prices in the EU ETS

(5) Household size [inhabitants/households]

(6) Disposable income of households [euro]

(7) Number of passenger-kilometres: all modes, i.e. split between road (cars and buses separated if possible), rail, aviation and domestic navigation (when relevant) [million pkm]

(8) Freight transport in tonne-kilometres: all modes excluding international maritime, i.e. split between road, rail, aviation, domestic navigation (inland waterways and national maritime) [million tkm]

(9) International oil, gas and coal fuel import prices [euro/GJ or euro/toe] based on the Commission's recommendations

(10) EU-ETS carbon price [EUR/EUA] based on the Commission's recommendations

(11) Exchange rates to EUR and to USD (where applicable) assumptions [euro/currency and USD/currency]

(12) Number of Heating Degree Days (HDD)

(13) Number of Cooling Degree Days (CDD)

(14) Technology cost assumptions used in modelling for main relevant technologies

2. ENERGY BALANCES AND INDICATORS

2.1. Energy supply

(1) Indigenous yield by fuel type (all fuels and energy produced in significant quantities), [ktoe]

(2) Net imports by fuel type (including electricity and split into intra- and extra EU net imports) [ktoe]

(3) Import dependency from third countries [%]

(4) Main import sources (countries) for main energy carriers (including gas and electricity)

(5) Gross inland consumption of fuels by source type (including solid fuels, all fuels and energy: coal, crude oil and petroleum products, natural gas, nuclear energy, electricity, heat, renewable energy sources, waste) [ktoe]

2.2. Electricity and heat

(1) Gross electricity generation [GWh]

(2) Gross electricity production by fuel type (all fuels and energy), [GWh]

(3) Share of combined heat and power generation in total electricity and heat generation [%]

(4) Capacity electricity generation by source, including retirements and new investment [MW]

(5) Heat generation from thermal power generation

(6) Heat generation from cogeneration plants, including industrial waste heat

(7) Cross-border interconnection capacity for gas and electricity transmission [definition of electricity in line with the outcome of ongoing discussions on the basis of a 15 % interconnection target] and estimated utilisation factors for this capacity.

2.3. Energy transformation sector

(1) Fuel input to thermal power plants (including solid, liquid and gaseous fuels), [ktoe]

(2) Fuel input to other conversion processes [ktoe]

2.4. Energy consumption

(1) Primary and final energy consumption [ktoe]

(2) Final energy consumption by sector (including industry, residential, services and transport (with separate data for passenger and freight transport, where available), [ktoe]

(3) Final energy consumption by fuel (all energy products) [ktoe]

(4) Final non-energy consumption [ktoe]

(5) Primary energy intensity of the overall economy (primary energy consumption per GDP [toe/euro]

(6) Final energy intensity by sector (including industry, residential, tertiary and transport (including split between passenger and freight transport, when available))

2.5. Prices

(1) Electricity prices by type of using sector (residential, industry, tertiary)

(2) National retail fuel prices (including taxes, per source and sector) [euro/ktoe]

2.6. Investments

Investment costs in energy transformation, supply, transmission and distribution sectors

2.7. Renewable energies

(1) Gross final consumption of energy from renewable sources and share of renewable energy in gross final consumption of energy, including by sector (electricity, heating and cooling, transport) and by technology

(2) Electricity and heat production from renewable energy in buildings; this includes, where available, separate data on energy produced, consumed and injected into the grid by solar photovoltaic systems, solar thermal systems, biomass, heat pumps, geothermal systems and other decentralised renewable sources)

(3) Where applicable, other national trajectories, including long-term or sectoral (the share of food-based biofuels and advanced biofuels, the share of renewable energy in district heating, as well as renewable energy produced by cities and energy communities as defined in Article 22 of Directive (EU) 2018/2001.

3. GHG EMISSIONS AND REMOVALS RELATED INDICATORS

(1) Greenhouse gas emissions by policy sector (EU ETS, Effort Sharing Regulation and LULUCF)

(2) Greenhouse gas emissions determined in accordance with the Intergovernmental Panel on Climate Change (IPCC) methodology by sector and by gas (as appropriate, data shall be provided separately for the EU ETS and effort sharing sectors) [TCO_2eq]

(3) Carbon intensity of the economy as a whole [$_{TCO\ 2}$eq/GDP]

(4) CO2 emission$_{performance}$

а)Интензитетностнаемисиитенапарниковигазовевсобственотопроизводствонаелектрическаитоплинна енергия [tCO_2eq/MWh]

(b) Greenhouse gas intensity of final energy consumption by sector [TCO_2eq/toe]

(5) Parameters for non-CO_2 emissions

(a) Livestock: dairy cattle [1 000 heads], non-dairy cattle [1 000 heads], sheep [1 000 heads], pig [1 000 heads], poultry [1 000 heads]

(b) Nitrogen input from application of synthetic fertilisers [kt nitrogen]

(C) Nitrogen input from application of manure [kt nitrogen]

(D) Nitrogen fixed by N-fixing crops [kt nitrogen]

(e) Nitrogen in crop residues returned to soils [kt nitrogen]

(f) Area of cultivated organic soils [hectares]

(g) Municipal solid waste (MSW) generation

(h) Municipal solid waste (MSW) going to landfills

(I) Share of CH_4 caught in the total generation of CH_4 in landfills [%]