REPUBLIC OF BULGARIA

Ministry of Energy

Ministry of the Environment and Water

INTEGRATED ENERGY AND CLIMATE PLAN OF THE REPUBLIC OF BULGARIA

2021–2030

TABLE OF CONTENTS

List of Abbreviations:

NPP	Nuclear power plant
AUER	Sustainable Energy Development Agency
AYaR	Nuclear Regulatory Agency
GDP	Gross domestic product
BE	Balancing energy
BIFIEK	Bulgarian Federation of Industrial Energy Consumers
BNB	Bulgarian National Bank
BNEB	Bulgarian Independent Energy Exchange
RES	Renewable energy sources
HPP	Hydropower plant
RS	Renewable sources
ViK	Water supply and sewerage
WF	Wind farm
LCP	Large combustion plants
GIS	Geographic Information System
GDC	Gas Distribution Centre
SG	State Gazette
SLR	Supplier of last resort
EBRD	European Bank for Reconstruction and Development
EE	Energy efficiency
ES	Electricity system
EIB	European Investment Bank
EC	European Commission
PL	Power line
EU	European Union
ESO	Electricity System Operator
ERDF	European Regional Development Fund
EP	Electric power plant
ZBR	Biological Diversity Act

ZG	Forestry Act
ZE	Energy Sector Act
ZEVI	Energy from Renewable Sources Act
ZEE	Energy Efficiency Act
ZID	Act amending and supplementing
ZOIK	Climate Change Mitigation Act
ZOOS	Environmental Protection Act
ZOP	Public Procurement Act
LULUCF	Land Use, Land Use Change and Forestry
ZPZP	Agricultural Producers Support Act
FTPP	Factory thermal power plant
ZChAV	Clean Ambient Air Act
ICT	Information and Communication Technologies
INECP	Integrated National Energy and Climate Plan
IPUS	Sector of industrial processes and use of solvents
STS	Smart transport systems
AAQ	Ambient Air Quality
KEVR	Energy and Water Regulatory Commission
FEC	Final energy consumption
EHC	Electricity and heat cogeneration
ER	Electricity retailer
CPCP	Construction Products Contact Point
CF	Cohesion Fund
VOC	Volatile organic compounds
MBT	Mechanic and biological treatment
ME	Ministry of Energy
IPCC	Intergovernmental Panel on Climate Change
MOSV	Ministry of Environment and Water
MRRB	Ministry of Regional Development and Public Works
SMEs	Small and medium-sized enterprises
MTSP	Ministry of Labour and Social Policy

MF	Modernisation Fund
KIDSF	Kozloduy International Decommissioning Support Fund
MFF	Multi-annual financial framework
NEK	National Electricity Company
R&D	Research and development
NMVOC	Non-methane volatile organic compounds
NFIP	National Forest Inventory
NPDEVI	National Renewable Energy Action Plan
NPDEGB	National Forest Biomass Energy Action Plan 2018—2027
NPDIK	National Climate Change Action Plan
NGO	Non-governmental organisation
NPUO	National Waste Management Plan
NSI	National Statistical Institute
EIA	Environmental impact assessment
GlO	Ground-level ozone
UN	United Nations Organisation
OPIC	Operational Programme Innovation and Competitiveness
CAP	Common Agricultural Policy
p/st	Substation
PAVETs	Pumped-Storage Hydropower Plants
GHG	Greenhouse gases
UGS	Underground gas storage [facility]
LV	Limit values
PEC	Primary energy consumption
PCIs	Projects of Common Interest
IS	Industrial system
ECA	Envelope for clean air
CAFE	Clean Air for Europe Programme
TFA	Total floor area
AQMA	Air Quality Management Area
SPRGS	Strategic Plan for the Development of the Forestry Sector

ETS	Emission trading scheme
TAP	Trans-Adriatic Pipeline
MSW	Municipal solid waste
TPP	Thermal power plant
TfETs	District heating plant
PhvP	Photovoltaic plant
PM	Particulate Matter
PO	Policy objective
CBAM	Centralised Bilateral Agreements Market
ITO	Independent Transmission Operator
LNG	Liquefied natural gas
NTC	Net transfer capacity
RBP	Regional booking platform
RDF	Refuse-derived fuels
SET plan	European strategic energy technology (SET) plan
WAM	Scenario with additional policy measures
WEM	Scenario with existing policies and measures

(CAFE Directive) Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe

PART 1

GENERAL FRAMEWORK

SECTION A: NATIONAL PLAN

1. OVERVIEW AND PROCESS FOR ESTABLISHING THE PLAN

1.1 Executive Summary

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

The European Union (EU) aims to be a global leader in the fight against climate change and is therefore striving to achieve the targets set in Paris Agreement reached by the Conference of the Parties (COP 21) to the United Nations Framework Convention on Climate Change while simultaneously ensuring clean energy across the Union. In order to fulfil this commitment, the Union has set the following binding targets for climate and energy to be achieved by 2030:

- reducing greenhouse gas emissions (GHG) by at least 40 % compared with 1990;
- increasing energy efficiency (EE) to at least 32.5 %;
- increasing the share of energy from renewable sources (RS) in gross final energy consumption in the EU to at least 32 %;
- ensuring a level of electricity interconnection between Member States equivalent to at least 15 %.

In order to ensure a co-ordinated and concerted approach across the Union and implementation of the European Union Energy Strategy, each Member State (MS) was required to submit to the European Commission its draft Integrated National Energy and Climate Plan (INECP) by 31 December 2018 and its final Integrated Plan by 31 December 2019.

In accordance with Article 34 of Regulation (EU) 2018/1999 of 18 June 2019 of the European Parliament and of the Council of 11 December 2018 on the governance of the Energy Union and climate action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament

and of the Council (Regulation (EU) 2018/1999), the Commission published its assessment of, and recommendations on, the Member States' draft plans in June 2019.

With a view to taking the Commission's recommendations on board in the final version of Bulgaria's Integrated National Climate and Energy Plan (Integrated Plan, INECP), the Ministry of Energy, together with the Ministry of the Environment and Water, have made use of grant assistance under the Structural Reform Support Programme (SRSP) for the period 2017—2020 established by Regulation (EU) 2017/825 and managed by the European Commission's Structural Reform Support Service. The process entailed the development of the final version of the Integrated Plan, taking into account the Commission's recommendations on the draft, the development of an integrated forecasting model in the area of energy and climate, and a long-term strategy in the area of climate. The consultant was selected by the Commission's Structural Reform Support Service (SRSS) and a technical assistance agreement was signed with the consultant (Deloitte and E3Modelling) on 19 August 2019.

This Integrated Plan has been developed in accordance with the requirements laid down in Regulation (EU) 2018/1999 and takes into account all recommendations received from the Commission on the draft INECP. It sets out the main objectives and measures for the implementation of Bulgaria's national energy and climate policies in the context of EU law, and the principles and priorities for energy sector development.

The objectives set out in the INECP are as follows:

- promoting low-carbon economic development;
- developing a competitive and secure energy sector;
- reducing dependence on fuel and energy imports;
- ensuring that energy is available at affordable prices to all consumers.

The national energy priorities can be summarised as follows:

- increasing energy security and diversifying the supply of energy resources;
- developing an integrated and competitive energy market;
- using and developing energy from renewable sources based on available resources, network capacity and country specifics;
- enhancing energy efficiency by developing and implementing new technologies for a modern and sustainable energy sector;
- consumer protection by ensuring fair, transparent and non-discriminatory conditions for the use of energy services.

The Integrated Plan complies with the main strategic documents at EU and national level.

The following national strategic documents (and draft documents in respect of which consultations are currently under way) were used in its preparation:

- Energy Strategy of the Republic of Bulgaria until 2020;

- National Strategy for the Development of the Mining Industry until 2030;
- Strategy for Bulgaria's participation in the Fourth Industrial Revolution;
- Long-term national strategy for support for national residential and non-residential building stock renovation with an implementation horizon until 2050;
- Innovation Strategy for Smart Specialisation;
- National Programme for Energy Efficiency of Multi-Family Residential Buildings;
- National Policy Framework for the development of a market for alternative transport fuels and deployment of the relevant infrastructure;
- National Action Plan for promotion of the production and accelerated penetration of environmentally friendly vehicles, including electromobility in Bulgaria for the period 2012—2014;
- Integrated Transport Strategy until 2030;
- National Renewable Energy Action Plan;
- National Energy Efficiency Action Plan 2014—2020;
- National Forest Biomass Energy Action Plan 2018—2027;
- National Climate Change Adaptation Strategy and Action Plan;
- National Strategy for Development of Scientific Research in Bulgaria for the period 2017—2030;
- Third National Climate Change Action Plan (2013—2020);
- Plan for the development of Bulgaria's electricity grid for the period 2019—2028;
- Ten-year plan for the development of the networks of Bulgartransgas EAD for the period 2019—2028.

For the purpose of the INECP, energy balance projections were developed on the basis of a combination of forecasts for the extraction and import of energy carriers necessary to meet demand for the consumption of fuels and energy in Bulgaria. The analysis and projections are based on predictive modelling, and more specifically on the (B)EST long-term assessment and energy planning model developed by E3-Modelling.

In accordance with the requirements laid down in Regulation (EU) 2018/1999 two scenarios — WAM (with additional policy measures) and WEM (with existing policy measures) — have been developed. In the basic scenario, WEM projections are based on existing policy measures. In the target scenario, WAM projections are based on achievement of the targets and objectives set out in this Integrated Plan. In other words, WAM projections are based on both existing and planned additional policy measures that need to be implemented in order to achieve the national targets set in the INECP. The

WEM scenario is detailed in point 4 and the WAM scenario is detailed in points 2 and 3 and Annex I.

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

- macroeconomic growth and added value of the sector, projecting the respective growth in energy supply and demand;
- appropriate energy efficiency measures to achieve a downward trend for the energy intensity of the economy;
- an integrated approach to the modelling of energy use and developments in the economy and the environment, based on historical data and forecasts, with the aim of arriving at the most realistic projection for Bulgaria's economic and social development;
- Including applicable EU policies and restrictions in the environmental area in the modelling and planning of energy production and climate.
- developing the energy, and more specifically the electricity sector, with a focus on national and regional energy security, domestic market integration and achieving a balanced energy mix that relies on a variety of domestic and imported energy sources;
- efficient use of local energy sources (coal) in compliance with environmental requirements;
- maintaining a sustainable level of dependence on imported energy resources at a level below the EU average;
- continued accelerated liberalisation of energy markets, taking into account the needs of vulnerable social groups and managing potential social risks and negative impacts;
- sustainable development of renewable energy sources on market terms, facilitation of price regulation and setting of realistic energy efficiency targets in line with European Commission's agenda and recommendations;
- adding the energy to be generated by a new nuclear power plant to the national energy mix after 2030.
- The European Commission's recommendations on the 2018 draft INECP, which were received in June 2019, have been taken into account.

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

Bulgaria's INECP sets out the following strategic goals and priorities in the area of energy and climate:

Regarding the Decarbonisation dimension, Bulgaria will make efforts to increase the share of energy from renewable sources in gross final energy consumption and reduce

GHG emissions. In line with the Commission's recommendation, Bulgaria has raised the level of ambition regarding the share of energy from renewable sources in gross final energy consumption from 25 % to 27.09 % and will thus aim to achieve the target set in Annex II to Regulation (EU) 2018/1999. To do so, Bulgaria will expand its generating capacity with an emphasis on wind and solar power. If necessary for achieving the targets set after 2025, tenders for additional renewable energy capacity may also be conducted, taking market conditions into account. Biomass use is projected to increase in all sectors — electricity, heat and cooling, and transport. The planned changes in transport will have a strong impact on the development of energy from renewable sources and GHG emissions reduction. More specifically, Bulgaria will promote the introduction and use of electric and hybrid vehicles in public and private transport and plans to create low-emission zones in large cities. These measures, among others, will contribute to the significant reduction of GHG emissions.

As regards the Energy Efficiency dimension, Bulgaria will strive to achieve energy savings in final energy consumption, focusing on improvement of the energy performance of buildings and on energy generation, transmission and distribution.

In line with the EU's priorities for increasing energy efficiency, Bulgaria considers energy efficiency to be a top priority in view of its importance for improving energy security by lowering dependence on energy imports, for reducing energy costs for businesses and households, for creating more jobs, for improving air quality, for cutting GHG emissions and for improving the quality of life of citizens.

In connection with this, national targets have been set for achieving a 27.89 % reduction in primary energy consumption and a 31.67 % reduction in final energy consumption by 2030 as compared with the PRIMES 2007 reference scenario.

The European Commission's recommendation for developing more policy measures in this area has also been taken into account and, in line with Article 7 of Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, Bulgaria places emphasis on alternative policy measures to promote energy efficiency. Such measures include financial incentives for implementing energy efficiency projects, the promotion of energy performance contracts with guaranteed savings (ESCO contracts), and the renovation of the existing building stock with a view to increasing the number of nearly zero-energy buildings.

Regarding the Energy Security dimension, Bulgaria's top priority is to diversify the sources of - and the routes for – its natural gas supply by implementing the following projects: building an interconnector between Bulgaria and Greece (IGB project), building an interconnector between Bulgaria and Serbia (IBS project), participating in the construction of a liquefied natural gas (LNG) terminal in Alexandroupoli, and gas infrastructure development in connection with the plan to build a regional gas distribution centre (Balkan Gas Hub). Bulgaria aims to increase its energy security by diversifying its energy supplies, making efficient use of domestic energy resources and further developing its energy infrastructure. In order to achieve these goals, efforts will be

focused on grid development and enhancing the flexibility of the electricity system, e.g. by further developing the 400 kV and 110 kV transmission grid. Regarding nuclear energy, and in line with the Commission's requirements and the Guidelines published by the EURATOM Supply Agency (ESA), Bulgaria is fulfilling its commitments and is currently conducting a technical and economic analysis to inform its efforts to diversify fresh nuclear fuel supplies for Units 5 and 6 of the Kozloduy NPP. The top national priority in the area of energy security is to implement a robust strategy for diversifying the sources of - and the routes for – its natural gas supply. At the same time, Bulgaria is encouraging crude oil and natural gas exploration in the Black Sea, with several projects currently under way.

Regarding the Internal Energy Market dimension, Bulgaria will develop a competitive market by fully liberalising the market and integrating it into the regional and wider EU market, as stated in relation to the Energy Security dimension. The protection of vulnerable consumers is a key element of full liberalisation. In line with the Commission's recommendation for the development of competitive wholesale and retail markets, Bulgaria will phase out regulated electricity prices by the end of 2025 while promoting competition and transitioning to fully market conditions. The coupling of the day-ahead market with Romania is expected to be completed by the end of 2020, and with other neighbouring countries by 2025. The intra-day market was coupled with Romania in November 2019. Other policy measures for the development of the internal energy market in line with the goals of the Energy Union include the development of a market-oriented capacity mechanism, consumption optimisation, incentives for creating energy communities for renewable energy generation and consumption, and encouraging consumers to play a more active role.

Regarding the Research, Innovation and Competitiveness dimension, Bulgaria is committed to promoting scientific progress in the area of innovative energy technologies, including clean power generation. Important projects promoting business innovations and digitalisation will be developed. Bulgaria plans to participate in a number of programmes in this area.

In line with the requirements laid down in Regulation (EU) 2018/1999, Bulgaria will review progress towards achieving the INECP targets in 2023.

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

Bulgaria's contribution to the achievement of the European Union targets up to 2030 is set out in the table below, following a review to ensure that the recommendations of the European Commission have been taken into account.

Table 1: *Bulgaria's targets until 2030*

Review of 2030 targets	
Renewable energy sources	
National target for the share of renewable energy in gross final energy consumption by 2030	27.09 %

RS-E[1]	30.33 %
RS-heating and cooling[2]	42.60 %
RS — transport[3]	14.20 %
Energy efficiency	
Lowering primary energy consumption as compared with the PRIMES 2007 baseline projection	27.89 %
Lowering final energy consumption as compared with the PRIMES 2007 baseline projection	31.67 %
Primary energy consumption	17 466 ktoe
Final energy consumption	10 318 ktoe
Greenhouse gas emissions	
National objective for reducing GHG emissions by 2030 as compared with 2005 for non-ETS sectors (building stock, agriculture, waste management and transport) in line with Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030.	0%
National target for the Land use, land use change and forestry (LULUCF) sector in accordance with Regulation (EU) 2018/841 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework.	Ensure that for the periods 2021—2025 and 2026—2030 GHG emissions do not exceed removals, calculated as the sum of total emissions and total removals on its territory in all land accounting categories (no-debit commitment).
Electricity interconnection level	15 %

Source: (B)EST model, E3-Modelling

1.2 Overview of current policy situation

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

Bulgaria pursues a transparent energy policy with a view to protecting national and public interest. The government's energy policy aims to ensure that the energy sector functions in accordance with market principles and further create conditions for energy independence, sustainable energy development, efficient use of energy and energy resources, meeting public demand for electric power and heat, natural gas and fuels. It is focused on:

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

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

[3]Share of renewable energy in gross final energy consumption in transport

- maintaining a secure, stable and reliable energy system;
- diversifying the sources and routes of natural gas supply;
- modernising and expanding the gas transmission network;
- eliminating dependence on imported energy resources through the use of indigenous resources (incl. coal);
- modernising and extending energy infrastructure;
- nuclear power development in line with modern requirements for reliability, safety and cost-effectiveness;
- improving energy efficiency and increasing the share of energy from renewable sources in gross final energy consumption;
- active participation in establishing a single and robust European energy market;
- developing a competitive energy market and pursuing a policy aiming to meet energy demand and protect the interests of consumers;
- ensuring fair access to the network for all consumers under clear and non-discriminatory rules;
- achieving a balance between energy quantity, quality and price for final consumers.

In pursuing national energy policy, Bulgaria has adopted the core energy policy objectives of the European Union of security of supply, competitiveness and sustainability. National policy is further consistent with the five interrelated dimensions of the European Energy Union: energy security, solidarity and trust; a fully integrated European energy market; energy efficiency contributing to demand moderation; decarbonisation of the economy; and research, innovation and competitiveness.

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

1) Decarbonisation

Decarbonisation policy measures are summarised in the National Climate Change Action Plan (NPDIK) 2013—2020. The sectorial policy measures set out in the NPDIK are consistent with and contribute to the achievement of the main objective of the plan — reducing GHG emissions in Bulgaria and ensuring compliance with the applicable EU law in the area of climate change. Priority axes for the development of each sector have been identified and relevant measures for each priority axis have been determined.

The measures are divided into two groups — measures with a measurable impact on GHG emissions reduction and measures with an indirect impact, which also contribute to emissions reduction but their impact is more difficult to measure. The plan proposes instruments necessary for the implementation of each measure. Such instruments can

be, *inter alia*, legislative changes, application of laws and by-laws, implementation of programmes, plans, schemes, etc. as well as the implementation of incentive mechanisms, conducting information campaigns and training, among others. Target groups, the institutions responsible for reporting on implementation, the start date of implementation and relevant implementation periods, the financial resources necessary and sources of financing are indicated for each measure. A performance indicator which is directly or indirectly related to the calculation of the estimated effect is established and yearly target values are set. Additional information regarding the measure has been provided. It specifies the legal act or strategic document in which the measure is set out, the projections used to calculate emission reduction, the link between the measure, the instruments, the responsible institutions, etc.

As the energy sector has the highest share in total GHG emissions, it is of primary importance for the achievement of the national emission reduction targets. Coal-fired generation of electricity and heat contributes to over 90 % of the GHGs in the sector; the main potential for emission reduction is concentrated here. The policies and measures in the energy sector as laid down in the NPDIK are based on the policy measures set out in Bulgaria's 2020 Energy Strategy and in the National Renewable Energy Action Plan.

The implementation of the additional measures envisaged for the sector will result in GHG emissions reduction by 13.8 % by 2020 compared to the baseline scenario[4].

There has been an increase in GHG emissions from the households and services sector due to higher energy consumption by households. The measures in this sector are based on Bulgaria's 2020 Energy Strategy and National Indicative Target referred to in Directive 2006/32/EC and aim to promote energy efficiency and the use of renewable energy sources in gross final energy consumption. The projected emissions reduction in the sector in 2020 to be achieved through the implementation of the measures set out in the NPDIK is 22 % compared to emission levels in the baseline scenario.

The waste sector is critically important and has an extremely high potential for emissions reduction. Reductions expected after implementing the NPDIK measures account for 36.4 % compared to the emissions in the baseline scenario. This sector appears to be one of the main sources of GHG emissions along three major lines: emissions from waste disposal, wastewater treatment and waste incineration. The measures focus mainly on the waste disposal subsector, which has the highest share in emission levels. Most of the measures planned in this sector can be achieved by applying the existing legal framework without investing substantial financial resources. This makes them highly efficient. The importance of taking measures in the transport sector is underpinned by the fact that the sector is one of the largest GHG emitters and has been continually growing, although until recently its impact on climate change has been largely overlooked. To this end, the main measures in the sector aim to achieve an optimum

[4] baseline scenario (policy measures before the reference year 2009): reducing emissions by 3.1 Mt CO_2 eq. or by 11.5 % as compared to 2005, National Climate Change Action Plan 2013—2020.

balance in the utilisation of the potential of different modes of transport and are grouped in four priority axes:

- reducing transport emissions;
- reducing fuel consumption;
- transport diversification;
- consumer awareness and training.

The implementation of the additional measures planned for the sector will result in GHG emissions reduction by 11.3 % compared to the baseline scenario levels set out in the NPDIK. The overall impact of the proposed measures by sector, expressed as projected reduction in GHG emissions by 2020, is 44.832 Mt CO_2eq.

Bulgaria is currently pursuing a targeted renewable energy development policy. Various support schemes have been introduced over the years to ensure that renewable energy production and consumption will develop to levels at which it can contribute substantially to the security and diversity of energy supply, competitiveness, environmental and climate protection, regional development and the deployment of new technologies.

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

The Energy from Renewable Sources Act (ZEVI) is the main legal instrument governing public relations in the area of renewable energy. The ZEVI and the implementing regulations thereto transpose the requirements of Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of renewable energy (Directive 2009/28/EC) into national law.

The purchase of electricity generated under long-term contracts at preferential prices was one of the most attractive incentives for the generation of renewable electricity envisaged in the ZEVI.

According to Article 18(2) of the ZEVI the achievement of the binding national target for 2020 constitutes grounds for discontinuation of certain previously available incentives, such the incentive for power plants for renewable energy, which apply for connection [to the grid] after the date of the report of the Minister for Economy and Energy (27 December 2013) confirming the achievement of the overall national target for a share of renewable energy in the gross final energy consumption (16 %).

For this reason and in view of the need to optimise support schemes in line with the current state of play and development of the sector, the ZEVI was amended in 2015 in accordance with the Guidelines on State aid for environmental protection and energy 2014—2020 and Commission Regulation (EU) No 651/2014 of 17 June 2014 declaring certain categories of aid compatible with the internal market.

As a result of the amendments in question, after 1 January 2016 the incentives relating to the purchase of renewable electricity at preferential prices under long-term contracts are now granted only to small power units (with an installed capacity of up to 30 kW),

provided that they are installed in existing buildings in urban areas, including on the roofs and facades of such buildings, and in the land plots in which they are situated.

The amendments to the ZEVI aimed to align the overall support mechanism with electricity market liberalisation and address some negative impacts of this process.

The amendments to the Energy Sector Act (ZE) adopted in 2018 and 2019 changed the rules for the promotion of electricity generation from renewable sources. The enacted amendments restrict support for renewable electricity generation by means of preferential prices. In the future, support will be provided only for electricity generated by plants with a total installed capacity of less than 1 MW.

In addition, the ZEVI also sets out specific incentives for the generation of energy for heating and cooling and gas from renewable sources, including through support for and implementation of projects for the construction of heat transmission networks in agglomerations that meet the requirements for a designated area when the viability of renewable heat has been demonstrated; projects for the construction of small decentralised heating and/or cooling systems; the connection of renewable heat generation systems to the heat transmission network and purchase by the heat transmission company of heat generated by other producers.

To achieve the binding target of 10 % share of renewable energy in transport, the ZEVI has introduced an obligation for the persons placing petroleum-derived liquid fuels to offer said fuels on the market at the time of their release for consumption blended with a bio-component in a specific ratio.

In accordance of the requirements of Directive (EU) 2015/1513 amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC, in April 2017 a national target for new generation biofuels was set and submitted to the European Commission, notably 0.05 percentage points of energy content of the share of renewable energy in all forms of transport is to be met through the use of new generation biofuels. The target is to be achieved by 2020.

In order to achieve this target, the Law amending and supplementing the ZEVI (published in the State Gazette (SG) No 91 of 2 November 2018) sets out specific measures, which will become effective on 1 April 2019. The amendment introduced an obligation on the persons that place on the market petroleum-derived liquid transport fuels to market fuels for diesel engines with a minimum biodiesel content of 6 volume fractions, with new generation biofuel being at least 1 volume fraction of the biodiesel. Such an obligation was also introduced for final distributors and for the distributors of petroleum-derived liquid fuels.

2) Energy efficiency

Energy efficiency (EE) policy is an essential component of national and EU policies on energy and climate change. The switchover to an energy system with low levels of harmful emissions requires higher energy efficiency, greater use of energy from renewable sources in gross final energy consumption, improved energy management,

development of the energy infrastructure and building the internal market, as well as designing various concepts and deployment of new technologies and services. In keeping with EU priorities, energy efficiency is accorded top priority within energy policy and is essential to the achievements of targets set for the period 2020—2030.

National legislation on energy efficiency has been brought in line with EU law. The primary statutory instrument for policy implementation is the Energy Efficiency Act (ZEE).

According to the requirements laid down in the ZEE and the provisions of Directives 2012/27/EU on energy efficiency and 2010/31/EU on the energy performance of buildings (Directive 2010/31/EU) the following strategic documents have been developed and are currently being implemented:

- National Energy Efficiency Action Plan 2014—2020;
- National Plan for nearly zero-energy buildings 2015—2020;
- National plan for improving the energy performance of heated and/or cooled State-owned buildings occupied by the public administration;
- National long-term programme to promote investments in the implementation of measures improving the energy performance of buildings of the public and private national residential and commercial building stock.

Bulgaria's primary energy efficiency priorities and policy objectives are as follows:

- achieving energy savings of 8 325 GWh by 2020;
- achieving annual energy savings of 1.5 % of the volume of energy sales;
- taking action to improve the energy performance of at least 5 % of the total gross floor area of all heated and/or cooled public buildings used by the civil service;
- increasing the number of nearly zero-energy buildings;
- ensuring that secure and affordable energy is available to all consumers;
- minimising the adverse effects of energy use on human health and the environment;
- improving living standards in Bulgaria.
- increasing the competitiveness of the Bulgarian economy.

The measures and policies envisaged for the period after 2020 ensure a link between existing and the planned policy measures within the Decarbonisation dimension, as well as a link between existing and the planned policy measures in the other dimensions of the Energy Union in the period until 2030. In view of the specificity and the interdependence of effects and expected outcomes, the policy measures in the area of renewable energy are consistently combined with those in the energy efficiency dimension. Efforts are made to co-ordinate national climate and energy policies by

making full use of the opportunities for regional co-operation with other Member States to attract the investments to enable policy implementation.

The policy measures build on the scope and substance of those already in place in order to better deploy and integrate renewable energy in achieving the main indicators for a financially affordable, safe, competitive, secure and sustainable energy system.

Progress at the level of 5 % has been achieved in the development and expansion of household gasification in Bulgaria — one of the priorities set out in the Energy Strategy. Electricity use in final consumption leads to three times higher costs for primary energy compared to the environmentally friendly alternative of direct natural gas use. Therefore, replacing electricity with natural gas for heating and other household purposes would contribute to threefold savings compared to current levels of primary energy used and should be considered as a possibility for increasing energy efficiency.

In order to create incentives for increasing the share of household gasification across Bulgaria, the Ministry of Energy is implementing project 'Energy efficiency measures at the level of final consumers of natural gas' (DESIREE) with grant assistance in the amount of EUR 10.9 million from the Kozloduy International Decommissioning Support Funds (KIDSF). The objective of the project is to encourage household gasification by supporting the initial investment to be made by approximately 10 000 households in order to be connected to the existing gas distribution network (fixed fee of 30 % of the eligible investment cost and 100 % of the connection fee, but not more than EUR 1 000 per household for systems with high-efficiency boilers and not more than EUR 1 200 per household for condensing boiler systems).

The implementation of the project will result in the reduction of atmospheric pollutants to be achieved by replacing fuels with high levels of emissions of harmful atmospheric pollutants with natural gas.

3) Energy security

- *Security in the electricity sector*

Bulgaria's security policy for the electricity sector can be summarised along two priority axes:

- efficient use of indigenous energy resources;
- increased interconnection.

Bulgaria makes maximum use of the existing potential of indigenous coal in compliance with applicable environmental regulation. The coal has the potential to provide resources for electricity generation in the next 60 years.

The use of indigenous coal reserves has the potential to act as a stabilising source of energy in the future. Power plants fired by indigenous coal account for approximately 48 % of total electricity generation and guarantee Bulgaria's energy security and the competitiveness of the Bulgarian economy. They are baseload plants and therefore essential for the Bulgarian electricity system. Being the main supplier of balancing

services, they are a key factor for Bulgaria's electricity security. This determines the role of indigenous coal as a strategic energy resource for Bulgaria's energy and national security.

The Kozloduy Nuclear Power Plant, being a baseload plant, plays a prominent role in maintaining the sustainability of reserves in the electricity system. It has a share of approximately 33 % of total electricity generation and is thus a guarantee for Bulgaria's energy security.

A project has been successfully implemented, which will allow the operational life of Units 5 and 6 of the Kozloduy NPP to be extended following an upgrade of the two reactors to ensure that they meet the latest global safety requirements for nuclear power plants. The implementation of the project is a strong argument for the planned long-term operation of the nuclear plant. In line with Bulgaria's Energy Strategy for the period until 2020, which was adopted by the National Assembly on 1 June 2011, in 2017 and 2019 the Bulgarian Nuclear Power Regulatory Agency extended the operating licences of Units 5 and 6 for a period of ten years in accordance with the provisions laid down in national law.

The project for the extension of the operational life of the two units was implemented in two stages due to the large scale of the project:

- During the first stage a comprehensive survey and assessment of the remaining operational life of Units 5 and 6 of NPP Kozloduy was conducted by an international consortium. The compelling justification of project feasibility relied on rigorous application of a methodology of a high standard, which is fully consistent with the requirements for an EU Member State.

The results of the comprehensive survey demonstrated that the technical condition of the structures, systems and components of Units 5 and 6 conform to all applicable requirements laid down in statutory instruments and design and construction specifications for the operation of NPP Kozloduy.

- During the second stage, programmes were implemented to prepare the facilities for long-term operation, which included specific measures determined on the basis of the results of the comprehensive survey. A total of 240 measures were implemented in order to upgrade Unit 5 and 200 measures were implemented in order to upgrade Unit 6. The process of drafting the justification of the feasibility of extending the operational life of Unit 6 entailed safety analyses, projections and qualitative assessments of the remaining operational life of the facilities and equipment that ensure the safe and reliable operation of the Unit.

In parallel to the upgrade undertaken to extend the operational life of the two units, the regular safety review of the two units was conducted. It involved a systematic review of all safety factors having an effect on the project and on the operation of the entire nuclear power plant. The safety review is a mandatory requirement for the licensing of the plant. The results of the latest periodic review confirmed that the two Units satisfy all safety parameters and are therefore fit for operation during the next period covered by

the licence. They have also demonstrated a high level of nuclear, radiation and technological safety comparable to that of the most advanced power plants.

- *Increasing interconnection*

The opportunity for electricity exchange with neighbouring countries is an important factor in increasing the security of the energy system in Bulgaria and the region. To enhance the existing capacity for electricity interconnection, plans for the construction of new interconnectors have been developed. The main projects are as follows:

- The construction of an overhead interconnecting power line between Bulgaria and Greece will have a considerable impact on the security of electricity supply in the region and will enhance the flexibility of the electricity system, the transmission of renewable electricity, and the interoperability and secure operation of the system. All projects in the group increase the net transmission capacity across the Bulgarian-Greek border, accelerate market integration and foster competition. The project is included in the list of projects of common interest and is divided into the following sub-projects:
  - Overhead electricity interconnecting power line between Maritsa Iztok substation and Nea Santa substation (Greece);
  - Domestic power line between Maritsa Iztok substation and Plovdiv substation: feasibility works;
  - Internal power line between Maritsa Iztok substation and the Open Power Distribution Device of Maritsa Iztok 3 Thermal Power Plant: feasibility works;
  - Internal power line between Maritsa Iztok substation and Burgas substation;
- Increasing the transmission capacity of the power lines between Bulgaria and Romania, including the construction a 400 kV power line between Burgas and Varna substations;
- Yadenitsa Dam Pumped Storage Plant is a project of common economic interest co-financed by the Connecting Europe Facility (CEF). The implementation of the Yadenitsa project aims to increase the volume of the lower reservoir of Chaira Pumped Storage Plant (PAVETs) through the construction of Yadenitsa reservoir and a reversible pressure tunnel connection to the Chaira reservoir. The Yadenitsa project covers construction of two basic facilities: Yadenitsa reservoir wall with a water storage facility and Yadenitsa reversible pressure tunnel. The implementation of the investment project will ensure sufficient balancing capacity in Bulgaria's electricity system, enabling the further development of electricity generation from renewable sources in line with the long-term strategies for energy sector development in Bulgaria and the European Union.

➢ *Security of natural gas supply*

The diversification of the sources and routes of natural gas supply is an essential factor for the security of supply. As an element of energy security, it is vital to Bulgaria's national security. In order to enhance its energy security, Bulgaria is currently implementing a number of key projects in the area of natural gas of national and regional importance. These include:

- The gas interconnector Greece-Bulgaria (IGB)

The interconnector has a total length of 182 km and capacity for the transportation of 3 up to 5 billion m^3 of natural gas per year. Given sufficient interest, the capacity can be increased up to 10 billion m^3 per year. The interconnector will be built between Komotini, Greece, and Stara Zagora, Bulgaria. It will connect the transmission grids of DESFA and TAP in Komotini, Greece, and the transmission system of Bulgartransgas EAD in Stara Zagora.

The project for the construction of an interconnector between Greece and Bulgaria has been included in the list of projects of common interest (PCI) of the European Union with accordance with Regulation (EU) No 347/2013 on guidelines for trans-European energy infrastructure. It is one of seven priority gas projects implemented within the framework of the Central and South East Europe Energy Connectivity (CESEC) initiative.

The project is expected to be completed by the end of 2020.

The direct effects of project implementation include real diversification of the sources of natural gas supply to Bulgaria, creating an opportunity for the supply of natural gas via the Southern Gas Corridor and from LNG sources, and connecting and transforming Bulgaria and its gas transmission system into a major part of the infrastructure for gas supply from alternative sources for the entire region of Central and Southeast Europe.

The project will ensure that Bulgaria is able to import the contracted quantity of 1 billion m^3 of natural gas per year after the Shah Deniz 2 gas field in Azerbaijan becomes operational. The interconnector will also provide a possibility for gas supply via the LNG terminal in Alexandroupoli from producers like the United States, Qatar, Algeria, Nigeria, etc., including Israel and Egypt in the future.

- Construction of a gas interconnector between Bulgaria and Serbia (IBS)

The planned reversible gas interconnector between Bulgaria and Serbia (IBS) will connect the national gas transmission networks of the two countries. With a total length of 170 km, it will run from Novi Iskar in Bulgaria to Nis in Serbia along a route that comprises a 62.2 km section in Bulgaria. The gas interconnector will be reversible, allowing two-way gas transmission of: 1 billion m^3 per annum up to 1.8 billion m^3 per annum from Bulgaria to Serbia and 0.15 billion m^3 per annum from Serbia to Bulgaria. The project is expected to be completed in mid-2022.

The Bulgaria-Serbia interconnector is a project of common interest for the European Union within the meaning of Regulation (EU) 347/2013 on guidelines for trans-European energy infrastructure and a project of common interest for the EU energy community. The project is an element of the infrastructure necessary for the construction of the Balkan gas hub. It is one of seven priority gas projects implemented within the framework of the Central and South East Europe Energy Connectivity (CESEC) initiative.

The implementation of the project will ensure the diversification of routes via an interconnector, enabling the transmission of natural gas to Serbia from the new entry points at Bulgaria's border with Turkey and Greece, as well as significant spare capacity in the Bulgarian gas transmission network. At the same time, it will allow the importation of natural gas from Serbia in crisis situations.

- Project for the construction of an LNG terminal in Alexandroupoli

The terminal has a rated annual capacity of 6.1 billion m³ and a storage capacity of 170 000 m³. It is a modern technological project involving the construction of an offshore floating unit for the reception, storage and re-gasification of LNG and a system comprising a subsea and an onshore gas transmission pipeline through which the natural gas will be shipped into the Greek national natural gas system and onwards to final consumers. The LNG terminal is strategically situated in proximity to the gas transmission network of the Greek national gas operator DESFA S.A.

The European Commission has included the project in the list of projects of common interest in accordance with Regulation (EU) No 347/2013 on guidelines for trans-European energy infrastructure, including in the third and fourth lists of the European Commission. Bulgaria has been a strong advocate for the inclusion of the LNG terminal in the PCI list.

The terminal is expected to start commercial operations in 2022.

The rated annual capacity and LNG storage capacity of the terminal will enable Greece but also Bulgaria, Romania, North Macedonia, Serbia and Hungary to balance needs on their respective domestic markets. Bulgaria considers the Alexandroupoli terminal project as complementing the gas interconnector with Greece and the Trans Adriatic Pipeline (TAP). It will give it access to producers and suppliers of liquefied gas from the United States, Qatar and Algeria as well as Israel and Egypt, among other countries, in the future.

Bulgartransgas EAD will acquire a 20 % share in the LNG terminal construction project and Bulgargas EAD will participate in the legally binding stage by booking transmission capacity. Bulgaria's participation in the project for the construction of a liquefied natural gas terminal near Alexandroupoli is of key importance for the country and the entire region of Southeast Europe. The synergy between the LNG terminal and the construction of the interconnector between Greece and Bulgaria will contribute to the security and diversification of energy supply.

- The Balkan Gas Hub

The concept developed with assistance from the European Commission envisages the construction of a gas distribution centre (gas hub) in Bulgaria, including the necessary transmission infrastructure, and a natural gas exchange. The gas hub will connect the natural gas markets of all Member States in the region — Bulgaria, Greece, Romania, Hungary, Croatia and Slovenia, linking the region to Central and Western Europe and to Serbia, North Macedonia and Bosnia and Herzegovina, which are members of the Energy Community. The concept for the construction of a gas distribution centre for South East Europe in Bulgaria is based on the idea of creating a gas trading platform by building infrastructure that will enable the supply of significant quantities of natural gas from different sources intended for further transportation via several physical entry points.

The Balkan gas hub has been included in the list of projects of common interest of the European Union in accordance with Regulation (EU) No 347/2013 as a group of projects that contribute to the development and enhancement of gas infrastructure. The projects for the interconnectors between Bulgaria and Greece and Serbia, respectively, and for the upgrade and rehabilitation of the gas transmission network of Bulgartransgas EAD have also been included in this group.

In the context of the European objectives for developing an interconnected and single European gas market, the implementation of the gas hub concept fits in with the projects for the development of the Southern Gas Corridor and in line with the plans for gas infrastructure development in Europe. The Balkan gas hub would be able to rely on natural gas supplied via the newly constructed submarine pipeline in strict compliance with the requirements for the Third Liberalisation Package of the EU and along the existing route; natural gas extracted from the Bulgarian and Romanian sections of the Black Sea shelf; natural gas from the Southern Gas Corridor (Caspian area, Middle East and Eastern Mediterranean), and LNG terminals in Greece and Turkey.

Since 9 December 2019 a gas exchange has been operating in Bulgaria on which natural gas will be traded via gas release auctions — a possibility already envisaged in the Energy Sector Act. The exchange segment will be operated by Gazov Hub Balkan EAD, a subsidiary of Bulgartransgas EAD.

During the initial stage of operation of the exchange, Gazov Hub Balkan EAD will provide the participants in the natural gas market in Bulgaria and the wider region with the possibility to use a platform with integrated software solutions for wholesale energy trading developed in accordance with the requirements laid down in Article 10 of Commission Regulation (EU) No 312/2014 establishing a Network Code on Gas Balancing of Transmission Networks.

On 2 January 2020, multilateral trade was launched via the trading platform of Balkan Gas Hub EAD, including the so-called short-term (spot) and long-term segments of the market and via gas brokers.

- Expanding the capacity of Chiren Underground Gas Storage (UGS) Facility

The project entails a staged increase of the capacity of the only gas storage facility in Bulgaria in order to expand gas storage volumes, achieve higher pressures in the gas reservoir and higher average 24-hour gas extraction and pumping capacity. The project envisages an increase in working gas volume up to 1 billion m^3 and an increase in gas extraction and pumping capacity up to 8–10 million m^3 per day. The extension of the Chiren UGS facility is a project of common interest for the European Union within the meaning of Regulation (EU) 347/2013 on guidelines for trans-European energy infrastructure and is an element of the Balkan Gas hub concept.

The expanded UGS facility is expected to become operational in 2025.

The Chiren UGS facility is a major instrument enabling the functioning of the gas market in Bulgaria, which will compensate seasonal variations in domestic natural gas consumption, providing the flexibility necessary to balance the differences in supply and demand and serving as an emergency reserve.

The project is highly important for the security of gas supplies. In the mid-term, the Chiren UGS facility will assume an important commercial role for the development of competition in the regional gas market, enhancing the flexibility of regional gas transmission systems and contributing to the management of excessive load and the seasonal optimisation of gas transmission networks.

- Rehabilitation, upgrade and expansion of the Bulgarian gas transmission network

The project is a comprehensive multi-component project for the upgrade, rehabilitation and expansion of the existing gas transmission infrastructure in Bulgaria. It will involve three stages during which the following activities will be implemented: upgrade and rehabilitation of compressor stations; repair and replacement of pipes in certain sections following inspection; expansion and upgrade of the existing network; inspections to ascertain and report on the condition of gas pipelines; implementation of systems for pipeline technical condition management optimisation.

The project for the rehabilitation and expansion of the gas transmission infrastructure in Bulgaria has been included in the list of projects of common interest for the European Union in accordance with Regulation (EU) No 347/2013 on guidelines for trans-European energy infrastructure as an element of the infrastructure necessary for the implementation of the Balkan Gas Hub. It is one of seven priority gas projects implemented within the framework of the Central and South East Europe Energy Connectivity (CESEC) initiative.

The facilities included in the second phase of the project are expected to become operational in 2022.

The Bulgarian gas infrastructure will ensure the transmission of Azeri natural gas and gas from LNG sources via the IGB to IBR and IBS to Romania and Serbia, and onwards to Hungary and Central Europe.

4) Internal energy market

Liberalisation of the electricity market

In order to achieve the objectives set out in the national Energy Strategy for the period until 2020 and in connection with Bulgaria's commitments arising from its membership of the EU, in 2012 the Energy Sector Act (ZE) was amended with a view to transposing Directive 2009/72/EC concerning the internal market in electricity into national law. The adopted legislative act and implementing regulations thereto have created conditions for energy sector development and market liberalisation in line with the requirements laid down in the Third Energy Package of the EU.

Rules have been developed and adopted for the separation and subsequent certification of the electricity grid operator ESO EAD based on the Independent Transmission Operator model. The final customers eligible to participate in the regulated market were limited to household and non-household customers connected to the low-voltage grid. The necessary legislation enabling the activities of suppliers of last resort has been adopted and licences for the respective activities have been granted. Legislation enabling the operation of the balancing energy market has similarly been adopted. On 19 January 2016, the day-ahead segment and the centralised bilateral contracts segments of the market were launched and in April 2018 the intraday segment of the Bulgarian Independent Energy Exchange EAD (BNEB) became operational. The primary task of the BNEB is to create and operate an electricity exchange. The Bulgarian electricity exchange has also been instrumental in implementing EU policy on national markets integration and the creation of well-functioning regional markets and hence a common European market. As a result of the legislative amendments adopted in early 2018, all electricity generated for the free market is traded only on the BNEB platforms.

Following the approval and introduction of Standard Load Profiles by the Energy and Water Regulatory Commission (KEVR), since 1 April 2016 household and non-household customers connected to the low-voltage grid not only have the right but also the possibility to change their electricity supplier and conclude transactions at freely negotiated prices. Despite this, the market segment for trading at regulated prices remains substantial, with a share of about 40 % of net electricity generation. For this segment, electricity prices are regulated along the entire chain from production to final consumption through the public provider NEK EAD, which performs the function of a single buyer for this market segment.

With regard to transmission capacity (interconnector cross-sections in particular), ESO EAD conforms to the requirements for the Third Energy Package and has signed agreements with neighbouring operators for auction-based capacity allocation in accordance with Regulation (EU) No 714/2009 and the relevant Network Codes (including on capacity allocation and congestion management).

Liberalisation of the natural gas market

In order to achieve the goals set out in the national Energy Strategy for the period until 2020 and in relation to the commitments arising from Bulgaria's membership of the EU, the Energy Sector Act (ZE) was amended in 2012 with a view to transposing Directive 2009/73/EC concerning the internal market in natural gas into national law.

As an important step to natural gas market liberalisation in Bulgaria and with the aim of implementing the priorities set out in Bulgaria's Energy Strategy for the period until 2020, the KEVR adopted a set of rules establishing a new balancing regime for the natural gas transmission system. The rules address the commercial balance of the natural gas market. To develop a competitive natural gas market and in the context of the EU objectives for developing a single interconnected European gas market, actions were taken to implement the Balkan Gas Hub concept in Bulgaria. The concept is in line with the projects for the development of the Southern Gas Corridor and with the plans for the development of EU-wide gas infrastructure. The aim is to improve the security and diversify of the sources and routes for natural gas supply. In order to create an appropriate market environment for the implementation of the Balkan Gas Hub, a subsidiary of Bulgartransgas EAD was established as a gas exchange operator in Bulgaria.

Bulgartransgas EAD ensures compliance with the requirements for the Third Energy Package by applying the Regional Capacity Booking Platform (RBP) as required by Regulation (EU) No 984/2013 establishing a Network Code on Capacity Allocation Mechanisms in Gas Transmission Systems.

5) Research, innovation and competitiveness

One of the priority areas in the Innovation Strategy for Smart Specialisation 2014—2020 is the development of clean technologies with a focus on transport and energy (energy storage, energy saving and efficient energy distribution, electric vehicles and eco-mobility, hydrogen-based models and technologies, waste-free technologies, technologies and methods that include by-products and materials from one production in other productions).

To date, several national scientific programmes in the area of energy and climate have been developed in Bulgaria, notably the Low-carbon energy for transport and the household sector (EPlus) and Environmental protection and lowering the risk of adverse weather events and natural disasters. The main focus of these programmes is the storage and conversion of renewable energy, effective methods for carbon dioxide capture and utilisation, hydrogen-based technologies and eco-mobility as a transition to a low-carbon economy and applied research aimed at creating a more sustainable, favourable and beneficial living environment. The programme implementation period is 3 to 5 years and the available budget is BGN 13 300 million

Energy and energy efficiency infrastructure projects are financed by Operational Programme Innovation and Competitiveness 2014—2020 (OPIC). In connection with this, a grant of BGN 76.2 million was awarded under OPIC for the construction of a gas

interconnector between Greece and Bulgaria. The implementation of this project will enable the construction of gas transmission infrastructure for the Southern Gas Corridor and will ensure the security of gas supply for Bulgaria by enhancing the transit capacity to the countries in Southeast Europe. This will contribute to the diversification of the sources of natural gas supply.

Technical assistance will be provided under OPIC 2014—2020 to support the preparatory activities necessary to commence construction works on the Bulgarian section of the Bulgaria-Serbia interconnector (IBS).

In addition, a call for proposals for enhancing energy efficiency at large enterprises has been launched under the OPIC. It is an opportunity for large enterprises to receive grants for the implementation of energy efficiency measures with the aim of achieving sustainable growth and building a competitive economy.

iii. Key issues of cross-border relevance

In line with the EU policy for creating a common energy market, Bulgaria is currently implementing a number of projects of importance for the region and the entire European Union. These are described in detail in point 2.4.2. The main projects aim to increase Bulgaria's energy interconnection with neighbouring countries in the region and achieve the coupling of energy markets. They will enhance energy security in Bulgaria and the wider region, ensure the security of supply, diversify sources and routes, and boost the development of energy and gas markets. This is a guarantee the competitiveness of local businesses and for the economic development of Bulgaria and the wider region.

iv. Administrative structure for the implementation of national energy and climate policies

According to Articles 3 and 4 of the ZE government policy in the energy sector is developed and approved by the national Parliament and the Council of Ministers and implemented by the Minister of Energy. Government policy on improving energy efficiency is implemented by the Sustainable Energy Development Agency (AUER), a body operating under the jurisdiction of the Minister for Energy. The Agency is also responsible for promoting renewable energy generation and consumption.

Government policy on the environment, including sectoral policies on climate, are implemented by the Ministry of Environment and Water.

The Ministry of Economy is responsible for the implementation of government policy on building a competitive low-carbon economy, promotion and acceleration of investment, innovations and competitiveness.

The Ministry of Transport, Information Technology and Communications implements the government policy on transport, development of road infrastructure, electronic communications and postal services.

The Ministry of Regional Development and Public Works is responsible for the reform in Bulgaria's regional development, spatial development, building core networks and

technical infrastructure and implementing the National Programme for Energy Efficiency of Multi-Family Residential Buildings.

The Ministry of Agriculture, Food and Forests implements national policy on agriculture, food and forests.

Government policy on social assistance is implemented by the Ministry of Labour and Social Policy (MTSP), which administers a heating allowance scheme.

The Ministry of Finance is responsible for the sound and transparent management of public finances in Bulgaria and supports the government in building an efficient public sector and creating conditions for economic growth. Bulgarska nezavasima energiyna borsa (*Bulgarian Independent Electricity Exchange*) EAD has been granted a ten-year operational licence to 'establish an electricity exchange' in Bulgaria. The sole shareholder of the company is the Bulgarian Stock Exchange – Sofia AD.

Bulgarian foreign policy and relations with other countries are managed, co-ordinated and supervised by the Ministry of Foreign Affairs, which maintains and develops foreign policy dialogue, security policy and bilateral, regional and multilateral co-operation. It is responsible for the overall co-ordination of Bulgaria's foreign policy and activity on the international stage.

The policy on scientific research is within the remit of competence of the Ministry of Education and Science.

The Water and Energy Regulatory Commission (KEVR) is an independent specialist government body responsible for energy sector regulation in accordance with the provisions of the ZE and the ZEVI. Its remit of competence includes the monitoring of electricity and natural gas markets.

The regulation of the safe use of nuclear energy and ionising radiation, as well as of the safe management of radioactive waste and spent fuel is within the remint of competence of the chairperson of the Nuclear Regulatory Agency.

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

i. Involvement of the national parliament

According to Article 3 of the ZE government policy in the energy sector is implemented via the National Assembly and the Council of Ministers. In this regard, in parallel to the launch of consultations with the EC on the draft INECP, consultations will be held with the National Assembly to develop the final Integrated National Plan.

On 19 December 2019, the Integrated Plan the Ministry of Energy and the Ministry of Environment and Water jointly presented the Integrated Plan before the Environment Committee and the Energy Sector Committee of the 44th National Assembly. Representatives of businesses, NGOs and the academic community took part in the discussion of the INECP with MPs from the two Parliamentary committees and had an

opportunity to share their views and opinions and ask questions. A summary of the outcome of the hearing at the national Parliament is annexed to this Plan.

The integrated plan has been consulted with all ministries and approved by a dedicated decision of the Council of Ministers prior to being notified to the European Commission.

ii. Involvement of local and regional authorities

Consultations with all stakeholder ministries actively involved in the development of the Plan have been conducted. Having received the European Commission's recommendations on the draft Plan, the Ministry of Energy notified them to all stakeholder ministries, inviting submissions. The input received has been taken into account in the final version of the INECP.

The Ministry of Environment and Water (MOSV), the competent authority responsible for environmental and climate policies, has defined the targets, the policy measures for the Decarbonisation dimension, compiled historical data on GHG emissions, and made the relevant projections. It has further provided information about waste management, the circular economy, air pollution. biodiversity and the management of Natura 2000 sites.

The Ministry of Environment and Water has provided information about energy efficiency in connection with the National Building Stock Renovation Programme, which is currently being developed and is expected to be finalised in 2020 in accordance with the Energy Efficiency Directive. In order to ensure consistency between the various strategic documents, the modelling results underlying this Plan should be taken into account in the development of the National Building Stock Renovation Programme.

The Ministry of Transport, Information Technology and Communications has provided input on the plans and policy measures for the transport sector. The principal development guidelines and the strategic goals of the national transport system for the period until 2030 are set out in a dedicated Integrated Transport Strategy with the same time horizon. The Strategy has been approved by Decision No 336 of 23 June 2017 of the Council of Ministers. The national policy framework for development of the alternative fuels market in transport and building the relevant infrastructure was approved by Decision No 87 of 26 January 2017 of the Council of Ministers and amended by Decision No 323 of 11 May 2018 of the Council of Ministers. It covers the period until 2020 with a time horizon until 2030. The Ministry of Transport has provided information about planned policy measures in the transport sector. The Minister of Transport, Information Technology and Communications has approved an annual program for the construction, maintenance, repair, development and operation of railway infrastructure for 2020 and a Programme for the development and operation of railway infrastructure for the period 2020—2024.

The Ministry of Agriculture and Forests has provided forecasts for the development of the sector, along with the strategic documents and policy measures developed. As the only strategic document in the sector for the period after 2020 is the National Action Plan for

energy from biomass for the period 2018—2027, modelling for the purposes of the projections set out in the INECP has relied on historical data from the National Plan.

The input received from the Ministry of Finance includes data on microeconomic indicators and trends and information about the sources of financing for the policy measures set out in the Plan.

At the same time, a consultation was launched with the European Commission on the draft INECP. In the context of the public consultations launched, the INECP was published on the webpage of the Ministry of Energy:

https://www.me.government.bg/files/useruploads/files/_.pdf.

Prior to notifying the Plan to the European Commission, it was also published on the webpage of the Ministry of Energy in the context of the public consultation and sent to all ministries for the purpose of interinstitutional co-ordination.

No feedback and comments were received from local and provincial authorities during the stage of finalising the Integrated National Plan.

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

The competent Bulgarian authorities responsible for drawing up the INECP participated in a number of conferences, round tables and forums with the relevant stakeholders and had the opportunity to discuss a wide variety of topics relating to the INECP.

The draft INECP has been published and all stakeholders have been given the opportunity to submit their comments and recommendations. Following the presentation of the Plan the ministries continued to receive opinions and recommendations from stakeholders.

Written opinions on the draft have been received from various stakeholders, including NGOs, private and government energy companies, industrial associations, economic institutes, etc.

These include: WWF Bulgaria, the Hydro Energy Association, the Wind Energy Association, the Bulgarian Industrial Association, the Balkanika Fishing Club, the Technical University, EVN Bulgaria EAD, the Centre for Study of Democracy, the EnEffect Energy Efficiency Centre, Environmental Association Za Zemyata, the Institute for Market Economy, the European Bank for Reconstruction and Development, the National Energy Chamber, the Bulgarian Natural Gas Association, the Energy Management Institute, the mining company Maritsa Iztok AD, the Bulgarian Federation of Industrial Energy Consumers.

An annex to the Plan sets out a summary of the opinions received from stakeholders in tabular form.

The comments received vary in terms of content and approach. Some of the opinions contain general comments and recommendations relating to the draft INECP.

Areas have been identified in which similar and consistent comments were received. These include recommendations to:

- set more ambitious targets in the Plan;
- ensure that the final Plan contains clearly worded and carefully considered policy measures;
- ensure that the Plan provides clarity on the future of coal-fired power plants and the way forward to achieve the targets for decarbonisation of the economy;
- set more ambitious targets for the use of energy from renewable resources, mostly solar and wind power; set out measures for lowering administrative barriers.
- It has also been recommended that the INECP sets more specific legislative and regulatory measures that ensure achievement of the targets set, along with a schedule and financial estimates for their implementation.
- The Plan should prioritise the policy measures and projects to be implemented, set deadlines and contain a schedule for their implementation.
- The links and interdependencies between the measures and targets in the various dimensions and subsections of the INECP should be clearly articulated and any inconsistency between them addressed.
- State aid grants and measures should be clearly identified and a roadmap for phasing them out should be provided.
- The incentives for energy efficiency and renewable energy sources must be consistent with market economy principles and a clear demarcation line should be drawn between incentives for the industrial sector and households.
- It has been recommended that the INECP sets out specific legislative and regulatory steps to enable the construction of new powers plants relying on renewable sources and their integration into the market.
- Areas have been identified that require restructuring mechanisms to ensure that the energy transmission system operates with greater efficiency and is geared up for the future.
- There is a clear need to address the absence of a legal framework and strategic documents for the development of nearly all sectors of the economy after 2020. The existing documents with a time horizon after 2020 are not entirely consistent with the goals and tasks set out in the INECP.
- The sections of the draft INECP marked as 'Not applicable' should be developed or a justification should be provided as to why they are considered inapplicable.
- The proposed policy measures and policies should be properly costed.

The comments received from stakeholders concern all sections of the draft INECP. The overview set out below contains a summary of the key comments and recommendations received.

Decarbonisation — emissions and removals

Most comments concern the role of coal in Bulgaria's energy mix forecast in relation to the Decarbonisation dimension. Interested parties have questioned Bulgaria's ability to maintain the operation of its coal-fired power plants during the entire period indicated in the draft INECP, i.e. until proven lignite deposits are depleted while at the same time achieving the EU decarbonisation and renewable energy targets. The cost of achieving the targets has also been questioned.

Most opinions expressed by stakeholders, including NGOs, economic institutes and associations of renewable energy producers, recommend that the Plan be improved in terms of the calculations made to cost the effort needed to achieve the GHG emissions reduction target. The recommendations include the development of a clear road map setting out the steps to be taken to decommission or upgrade coal-fired power plants, phasing out coal as the principle resource on which the energy system relies and transforming coal mining areas while placing special attention on the prevention and management of potential direct and indirect negative social and economic impacts on employment in the coal mining industry.

It is also recommended that specific steps be taken to ensure transition to a low-carbon economy. This may involve Bulgaria joining the EU programmes for the restructuring of coal regions (Coal regions in transition), embracing an approach for alternative industrialisation and construction of power plants relying in renewable resources in the affected areas.

On the other hand, in its comments Mini Maritsa Iztok EAD points out the need to clarify the issue with a view to enabling the company to plan its future operations in light of the concession agreement signed for the period until 2043, which grants the company an option to have it extended.

Another opinion calls for greater clarity in terms of the transition of certain coal-fired power plants to waste or biomass — a step some energy producers in Bulgaria have already taken. Stakeholders are mainly concerned that this may lead to a potential increase of air pollution. Other recommendations insist on introducing more robust measures and focusing more efforts on sectors such as agriculture and waste.

Comments have been received suggesting that data, expressed as a percentage, should be provided about GHG emissions reduction in ETS and non-ETS sectors as compared to 2005 levels and overall GHG reduction compared to 1990 levels.

All opinions comment on the links between decarbonisation and the diversification of natural gas supply and the need to develop policies on access to natural gas as transition fuel in the future.

Renewable energy sources

Most opinions also contain extensive comments on renewable energy sources. More specifically, the comments concern the integration of renewable sources into the liberalised energy market and the need for additional mechanisms to develop RES in an urban environment, active consumers and energy communities. Most opinions received also comment on the need to eliminate administrative barriers to the market entry of renewable sources and create incentives for the RES development in industrial zones and urban areas, mainly for auto-production. This has been linked to recommendations to upgrade the existing grid and develop smart grids. A proposal was received to increase the share of energy from renewable sources to at least 27 %, with some proposals containing even higher targets.

Stakeholders with various interests and goals have also made contradictory proposals and statements. Although electricity generation by hydropower plants is clearly defined as the renewable resource with the highest development potential, some comments allege that the operation of hydropower plants has a significant negative impact on the environment, biodiversity and the Natura 2000 network.

A special emphasis has been placed on the measure envisaging an increase in the use of biomass for energy generation set out in the draft INECP because an increase in the use of biomass will significantly increase the threats for air quality and biodiversity.

There have been several requests for a breakdown of the share of energy renewable sources in the sector of energy for heating and cooling and further clarity regarding energy from renewable sources in transport and the plans and policies for conversion and electrification of public transport, particularly as regards any incentives that may encourage sector-wide transformation.

Energy efficiency

Energy efficiency remains hotly debated, with many comments and proposals received. These include calls for clear articulation of energy efficiency targets for all sectors and planned energy savings in primary and final consumption, including in the sector of energy for heating and cooling.

A special emphasis has been placed on the incentives for achieving energy efficiency targets by households and in the industrial sector. Questions were received about the measures that will continue to be implemented after 2020, planned changes to the ESCO mechanism and the financial mechanisms that will be available under the Modernisation Fund. Several opinions contain requests for more detailed information about plans for building stock renovation in the private and public sector, the implementation of the Energy Efficiency Directive and the requirements for buildings that conform to the definition of nearly zero-energy buildings, including the necessary investment and target final energy savings.

As regards the requirements for energy efficiency, some proposals have suggested that there is a need to alter the current obligatory scheme applied in Bulgaria. Some stakeholders, including obligated parties, have made specific recommendations for the introduction of new requirements and incentives to raise the efficiency of EE projects.

Domestic market

Regarding the domestic market, comments were received questioning the need for small renewable energy producers to be integrated into domestic market development. Some of the opinions call for promoting investment in energy storage facilities, smart grids, enhancing demand response, electricity interconnectivity, and the integration of markets within the European electricity system.

Most comments received concern market liberalisation and the need for regulatory changes to achieve it. Stakeholders believe that the development of the day-ahead and intraday market segments are crucial for the development of renewable energy sources. As regards market integration, stakeholders believe that the INECP should place a special emphasis on aspects of auto-production and the market integration of small producers who can mobilise the significant potential inherent in decentralised energy generation. It has been recommended that existing legal barriers, the absence of clear definitions in current regulatory framework and the complex formalities of administrative licensing regimes be addressed.

Energy security

Most comments concern the planned nuclear power capacity planned. Some proposals suggest that natural gas be considered a 'transition fuel' and that some coal-fired plants switch from coal to natural gas. The energy sector security policy needs to be further developed as regards the efficient use of indigenous energy resources and the integration of additional RES and nuclear capacity into the system. In connection with the Decarbonisation dimension, the decommissioning and/or conversion of coal-fired plants, the need for a plan to enable the transition of mining areas, and the need to give priority to projects ensuring diversification in terms of both routes and sources of natural gas have been raised.

Research and innovation

The comments relating to this dimension primarily concern the fact that it has not been developed in sufficient detail in the INECP — a deficiency that needs to be addressed in order to set targets and introduce specific financial incentives for the promotion of research and development in line with the goals of the INECP.

Some comments concern the potential for the development of hydrogen technologies.

Recommendations and comments included in the final version of the INECP:

The bulk of the comments have been taken into account in this Plan.

Most comments, which concerned various inconsistencies and the lack of coherence between targets and policy measures set out in the draft and the lack of specific estimates for RES, EE, GHG emissions and the investments required, have been addressed by the inclusion of the energy and environment sector projections developed specifically for the Plan. The final INECP contains a description of the policy measures planned and a list of the direct and indirect subsidies available, including for fossil fuels.

The air pollutant emissions have been modelled. The resulting projections included in the INECP take into account thermal power plants, which have applied for derogations from environmental requirements. An increase in the share of renewable energy in gross final energy consumption up to 27 % by 2030 has been projected. In the same period the share of primary energy production from fossil fuels will decrease. Regarding energy generation from renewable sources, the government does not have plans to introduce new subsidies on the assumption that RES technology costs will reach parity with the cost of their implementation. On the other hand, electricity market liberalisation will act as an incentive for free electricity price formation, creating in turn an environment that is conducive to the implementation of projects for the utilisation of the potential of renewable energy.

In order to promote energy generation from renewable sources, measures are set out in the Plan that will support its integration into the electricity market. These include easing the administrative burden, setting up one or several contact points, etc.

The development of wind farms has been taken into account in the projections and this Plan as it presents an opportunity to increase wind power generation. Specific legislative and regulatory measures have been outlined that will enable the entry and market integration of electricity from renewable sources, increase installed capacity by constructing new power plants for renewable electricity, and promote investment in electricity storage facilities and smart grids.

Regarding interconnectivity in the electricity sector within the broader framework of the European electricity system, the targets were described as realistic and achievable. The plan further contains a section on market coupling initiatives.

Regarding energy efficiency, the table setting out the cumulative energy savings referred to in Article 7(1) of the Energy Efficiency Directive has been included in the Plan. The measures and projections relating to energy savings have been taken into account in GHG emission projections. The Plan confirms that the residential building stock renovation programme will be extended beyond 2020.

In addition, the Plan contains detailed sections on the Energy Security and Internal Energy Market dimensions, which have been linked to other dimensions of the Energy Union.

The targets for investment in research and development activity and specific projects in which Bulgaria plans to participate in order to additionally enhance the sustainability of its energy system and encourage transformation to a low-carbon economy have also been included.

iv. Consultations with other Member States

Bulgaria has developed the Plan following consultations with neighbouring countries (Romania and Greece), which involved discussing matters relating to each country's capacity to engage in regional co-operation in each of the five dimensions of the Energy Unions. To facilitate the process Bulgaria provided a summary of its draft INECP.

The following potential areas for future co-operation have been identified on the basis of the consultations:

- Cross-border projects in the area of renewable energy sources;
- Projects for energy storage in the electricity and natural gas sectors;
- Coupling of energy exchanges in Southeast Europe;
- Increasing the level of interconnection with other countries;
- Co-operation with a view to lowering energy poverty;
- Diversification of energy sources and routes;
- Digitalisation of electrical power grids and enhancing the rule of consumers in electrical power management.

In addition, the following potential barriers to future co-operation have been identified:

- Placing national interests above shared regional interest;
- Currently existing differences in national legislation resulting from different approaches taken to transposing EU legislation into national law;
- No pipeline of projects of common interests, except those in the area of interconnections or the internal market (i.e. renewable energy sources and energy efficiency).

More specifically, the Energy Efficiency dimension was discussed at a meeting in the framework of bilateral co-operation between the Sustainable Energy Development Agency (AUER) and the Austrian Energy Agency. At the meeting, the national targets to be achieved by Bulgaria and Austria were discussed, along with the possibilities to exchange good practices in the implementation and development of policy measures to improve energy efficiency in both countries.

v. Iterative process with the Commission

The Regulation on the governance of the European Union provides for ongoing consultations with the EC, comprising an evaluation of the INECP by the Commission and updates of the plans and 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

Regional cooperation in the energy sector in Southeast Europe currently takes place in the framework of the Central and South Eastern Europe Connectivity initiative (CESEC). The CESEC was established primarily to help address the historical vulnerability of Southeast Europe in terms of security of energy supply, and more specifically natural gas supply.

It contributes to enhancing the region's security in terms of supplies by allocating support, as a matter of priority, to new interconnection infrastructure projects. The CESEC Action Plan identifies a number of infrastructure projects of major importance for Bulgaria, such as the Trans Adriatic Pipeline (TAP), the interconnectors to neighbouring countries, including Greece, Romania and Serbia, and the upgrade and enhancement of Bulgaria's gas transmission network. Issues such as reverse flows, cross-border tariffs and capacity allocation are also discussed within the framework of the CESEC.

CESEC activity is primarily focused on operational infrastructure aspect of regional co-operation in the area of natural gas.

A number of market coupling projects are currently being implemented as part of the CESEC action plan following an extension of its scope. Bulgaria participates in the efforts to couple the day-ahead segment of its energy exchange with the day-ahead segments of the Greek and Italian energy exchanges, develop a methodology for calculation of the total capacity of Southeast Europe together with Romania and Greece, and complete the coupling the day-ahead market with the day-ahead segments of the energy exchanges of North Macedonia, Croatia and Serbia.

A number of studies of the potential for development of energy from renewable sources in Southeast Europe show that available capacity is currently underutilised. The topic is an element of the CESEC plan to evaluate the potential of energy from renewable sources (until 2030 and 2050) and promote the development of instruments for financing renewable energy.

The CESEC views energy efficiency, including its role in addressing energy poverty, as a priority. The current role of the CESEC is related to the exchange of information and best practices in areas such as:

- raising private financing and the use of financial instruments;
- providing assistance for improvement of project quality at the stage of implementation;
- analysing the role of energy efficiency as an effective means for alleviating energy poverty;

Opportunities for regional cooperation

Regarding the opportunities for regional cooperation, Bulgaria will start exploring the following opportunities for bilateral co-operation, including via existing platforms such as the CESEC:

Electricity market

- Coupling on the day-ahead energy exchange with 4M MC, in addition to the coupling initiatives specified in the CESEC document;
- Exploring the possibilities for regional co-operation in the area of energy poverty, for example by establishing a thematic working group on energy poverty at the level of the CESEC.

- Natural gas market
- Improving the natural gas storage capacity;
- Regional co-operation on liquefied natural gas;
- Integration of energy from renewable sources;
- Regional co-operation with a view to increasing the capacity of pumped storage hydropower plants (PAVETs);
- Regional co-operation on matters relating to the social and economic transition of mining areas, more specifically aiming to ensure that the transition is adequately funded;
- Regional co-operation on cross-border projects related to the use of energy from renewable sources with CEF financing (more than EUR 1 billion in available financing);
- Regional co-operation on energy storage capacity co-ordination.

Research and Development and Innovation (R&D&I)

Taking into account the policy measures set out in the INECPs of Romania and Greece, Bulgaria has identified possibilities for co-operation in the following areas:

- Development of innovative technologies for energy storage, such as capacity of back-up systems for the integration of electricity from renewable sources through battery storage systems;
- Digitalisation of energy networks through the development of smart grids and smart metering, smart medium-voltage and low-voltage electricity distribution systems and efficient use of local energy sources.
- Consumer protection and addressing energy poverty.

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

In accordance with Article 12 (1) of Regulation (EU) 2018/1999 'Member States shall cooperate with each other, taking account of all existing and potential forms of regional cooperation, to meet the objectives, targets and contributions set out in their integrated national energy and climate plan effectively'.

In connection with this and in line with the EU policy for creating a common European energy market, Bulgaria is implementing a number of projects of European and regional importance. The main projects aim to increase Bulgaria's energy interconnection with neighbouring countries in the region and achieve the coupling of energy markets. The aim is to enhance the energy security in Bulgaria and the wider region, ensure the security of supply, diversify the sources and routes of supply, and develop the energy and gas markets. This is a guarantee the competitiveness of local businesses and for the economic development of Bulgaria and the wider region.

2. NATIONAL OBJECTIVES AND TARGETS

2.1 Decarbonisation Dimension

2.1.1 GHG emissions and removals

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

According to the climate and energy policy framework for the period until 2030 the Union has committed to a binding target to reduce greenhouse gas emissions by at least 40 % by 2030 as compared to 1990. All sectors must contribute to achieving a reduction in emissions. The target will be achieved collectively by the EU, with a 43 % and 30 % reduction to be achieved by, respectively, the ETS and non-ETS sectors by 2030 as compared to 2005 levels.

The EU Emissions Trading System (ETS) is at the heart of the EU strategy for reducing GHG emissions from the industry and energy sectors.

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 and amending Regulation (EU) No 525/2013 sets out the national targets for non-ETS sectors (building stock, agriculture, waste management and transport). The national target for GHG emission reduction in these sectors by 2030 compared to 2005 is 0 %.

Regulation (EU) 2018/841 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU is part of the Union's efforts to reduce GHG emissions by 40 % by 2030 compared to 1990. The Regulation requires that Member States balance emissions and removals in the land use sector for two five-year periods between 2021 and 2030 (2021 to 2025 and 2026 to 2030) by applying certain accounting rules and allowing for certain flexibility.

In order to counter climate change and mitigate its impact on the economy, Bulgaria has drawn up a National Strategy on Adaptation to Climate Change and an Action Plan thereto, which was adopted by a Decision of the Council of Ministers in 2019.

The document defines the strategic framework and priorities for climate change adaptation until 2030. The aim is to lower Bulgaria's vulnerability to climate change and enhance its capacity to adapt its environmental, social and economic systems to climate change impacts.

The National strategy on adaptation to climate change covers the following nine sectors: Agriculture, Forests, Biodiversity and Ecosystems, Water, Energy, Transport, Urban Environment, Human Health and Tourism. It includes an analysis of the macroeconomic effects of climate change and an assessment of the sector tasked with the management of disaster risks.

The Strategy has filled a void in Bulgaria's policy on climate change and outlines the approach to be taken to adapting key sectors of the economy to climate change.

An Action Plan to the Strategy has also been developed, which sets out the goals and priorities for improving adaptation capacity. The plan contains a detailed description of the financial resources, expected results and competent institutions for the implementation of policy measures implementation for each sector.

The scope and scenarios for sector adaptation reflect the scope and complexity of the effects of climate change. The measures primarily aim to strengthen policy response and ensure that climate change adaptation is included in the legal framework; build adaptation capacity and develop financial, social and political guidelines on risk management; and improve knowledge management, research, education and communication with stakeholders.

Projected emissions of GHG gases from the Energy sector with additional measures (WAM)

The GHG projections are based on an analysis of Bulgaria's energy balance. The analysis is based on modelling, using the (B)EST model for long-term power generation assessment and planning. The projections take into account both existing measures to reduce GHG emissions and a number of additional measures set out in detail in sections Energy from renewable sources, Energy efficiency, Energy security and Internal energy market, which contribute to a significant change of Bulgaria's energy system and reduce greenhouse gas emissions. As at 2015, more than 74 % of GHG emissions were generated by the energy sector. Its transformation is therefore key to reducing GHG emissions overall. The measures leading to higher energy efficiency in power generation, the industry and the households sector, increase the share of energy from renewable sources in power generation and transport, and the planned changes to be undertaken on the internal energy market have a significant contribution to lowering GHG emissions.

The implementation of additional measures will result in several trends that apply to the entire energy sector. These are set out in the table below:

Table 2: *Projected GHG emissions from the energy sector with additional measures, in Gg CO_2 eq. – ktoe – WAM scenario*

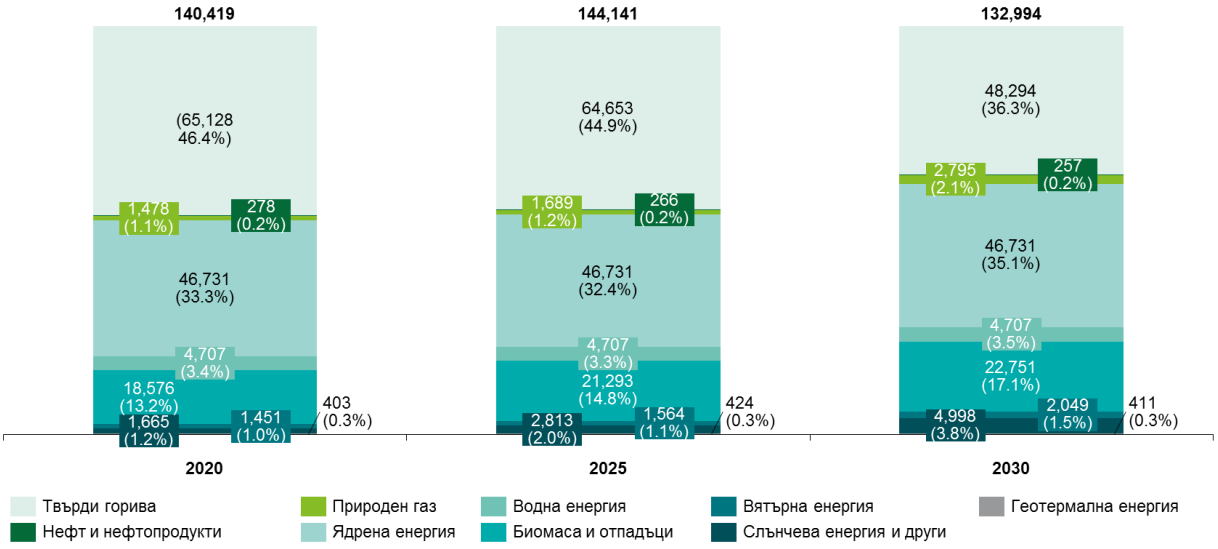
Emissions	2015	2020	2025	2030
CO_2 emissions, ktoe CO_2	45 428.60	43 579.24	42 088.03	35 702.85
CH_4 and N_2O emissions, ktoe CO_2 eq.	1 822.85	2 084.99	2 036.75	1 889.17
Total GHG emissions, ktoe CO^2eq.	47 251.45	45 664.23	44 124.78	37 592.02

Source: (B)EST model, E3-Modelling

Projections take into account all existing measures for GHG emissions reduction. Bulgaria has taken substantial measures to restructure its energy system — existing measures are reinforced by additional measures aiming to promote the use of energy from renewable sources in order to achieve an overall target of approximately 27 % of energy from renewable sources in final energy consumption. In addition, the implementation of the policy measures on energy efficiency is expected to lower energy consumption in all sectors thereby contributing to a further reduction in GHG emissions.

The results of the modelling show that GHG emission levels in the energy sector will decrease by approximately 19 % until 2030 as compared to 2015 (baseline). This is attributable to the significant drop in primary energy generation from nuclear fuel, the use of natural gas and an increase in the use of energy from renewable sources (such as solar energy, wind power and biomass) in combination with the improved energy efficiency of residential building stock and in the industrial and energy sectors.

Figure 1: *Primary energy producers (GWh)*

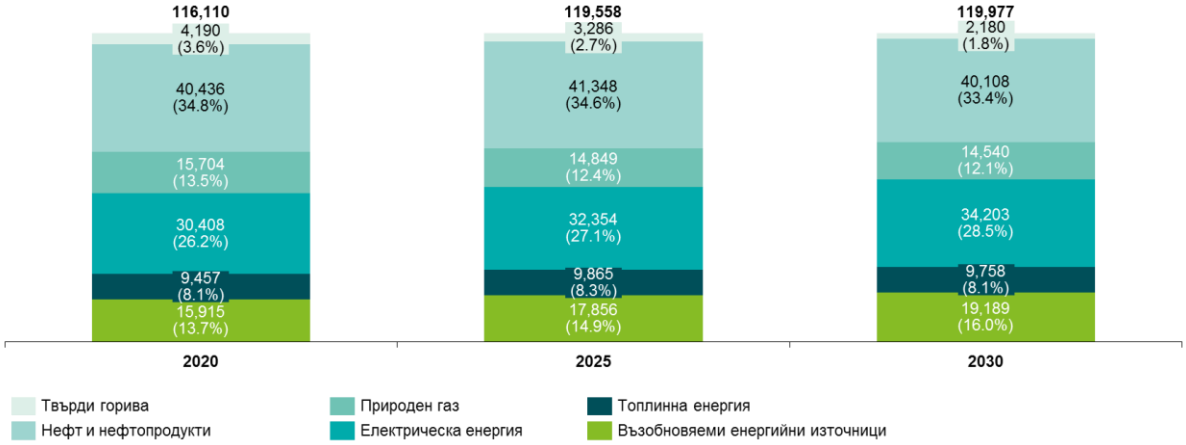


Solid fuels	Natural gas	Hydropower	Wind power	Geothermal power
Oil and petroleum products	Nuclear energy	Biomass and waste	Solar and other types of energy	

Source: (B)EST model, E3-Modelling

In the WAM scenario, the final consumption of energy from solid fuels is projected to decrease by 2030. An increase in the consumption of energy from renewable sources has been projected. During the period, the final consumption of heat from gaseous fuels, steam and renewable sources will remain at the same level. No major peaks and slumps in trends are expected. The changes expected in the consumption of various types of fuels will be higher than WEM scenario projections, which are based on continued implementation of existing measures, due to the additional measures envisaged for EE and RES.

Figure 2: *Final energy consumption by type of fuel and energy (GWh)*

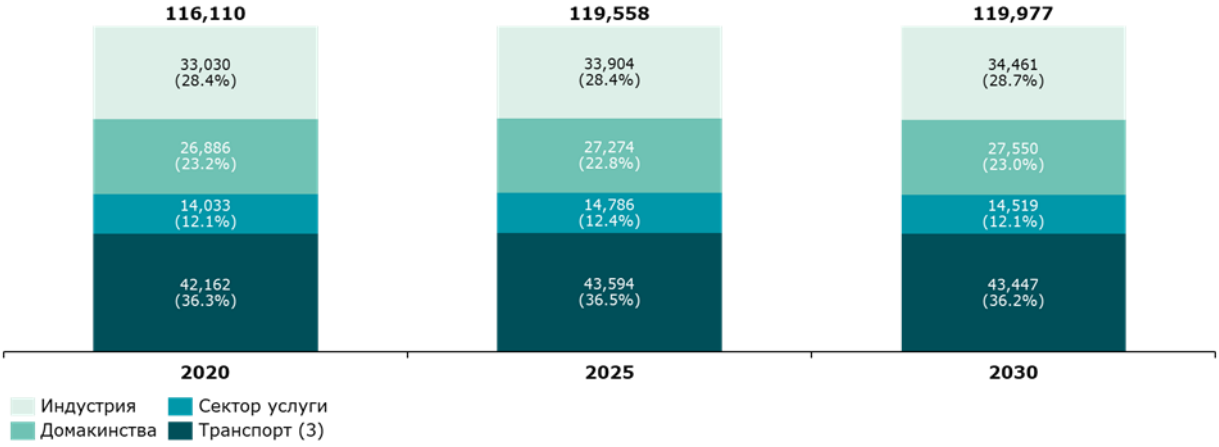


Solid fuels	Natural gas	Heat
Oil and petroleum products	Electricity	Renewable energy sources

Source: (B)EST model, E3-Modelling

As regards energy consumption in the different sectors, no significant changes in terms of the share of each sector in final demand for electricity is expected as shown below:

Figure 3: *Final energy consumption by sector (GWh)*



Industry	Services
Households	Transport (3)

Source: (B)EST model, E3-Modelling

Energy industries

The projections under this scenario also indicate that the energy industries will continue to generate the bulk of emissions. The projected trends for emissions in the Energy industries subsector are set out in the table below.

Table 3: *Emission projections for the Energy subsector with additional measures, in CO_2 eq. — ktoe*

Emissions	2015	2020	2025	2030
CO_2 emissions, ktoe CO_2 eq.	29 376.24	27 572.58	26 386.36	20 978.51
N_2O emissions, ktoe CO_2 eq.	117.30	96.93	94.37	71.88
Total GHG emissions, ktoe CO^2eq.	29 493.54	27 669.51	26 480.73	21 050.39

Source: (B)EST model, E3-Modelling

The final energy consumption of different industry sectors In the period until 2030 will remain at relatively stable levels, with an expected significant decrease in the use of solid fuels, including diesel, for power generation in the processing industry and the construction sector, along with a parallel increase in auto-production from renewable sources.

Under this scenario the total quantity of GHG emissions generated by the energy industries by 2030 are expected to decrease by approximately 26 % as compared to GHG emissions in 2015 (baseline). This is equal to approximately 102 % of the projected emissions reduction under the WEM scenario.

Manufacturing industry and construction

The projections for this sector are based on the expectations and forecasts for economic development, the shares of individual subsectors, the projected use of fuels, as well as on general projections for the use of some primary energy sources.

Table 4: *Projected emissions in subsector Processing industry and construction, WAM scenario, CO_2 eq. — ktoe*

Emissions	2015	2020	2025	2030
CO_2 emissions, ktoe CO_2 eq.	2 817.40	4 910.22	4 746.75	4 411.50
N_2O emissions, ktoe CO_2 eq.	26.69	28.66	37.65	45.74
Total GHG emissions, ktoe CO_2 eq.	2 844.09	4 938.87	4 784.40	4 457.24

Source: (B)EST model, E3-Modelling

Registered GHG emissions are projected to decrease by almost 12 % by 2030 — a reduction that is 6 times higher than that to be achieved under the WEM scenario. This would be the outcome of the continued implementation of existing policy measures along with the introduction of a number of additional measures set out in detail in section Energy Efficiency as shown by the overall decrease in the energy intensity of industrial sectors and the efforts to promote the use of renewable energy in industry. The implementation of these measures will contribute to the achievement of the national greenhouse gas emissions reduction target.

Energy consumption by the different sectors in the period until 2030 will remain relatively stable, with no major peaks or slumps expected in individual branches of the manufacturing industry. The scenario at hand once again projects a significant drop in the use of solid and liquid fuels in power generation in the industry subsector — approximately 1.1 times higher than the drop expected under the WEM scenario.

Figure 4: *Final consumption of energy by sector (GWh)*

Iron and steel	Construction materials	Machine building
Ferrous metals	Paper and pulp	Textile
Chemistry	Food, beverages and tobacco	Other industries

Source: (B)EST model, E3-Modelling

Figure 5: *Final energy consumption by type of fuel and energy in the Processing industry and Construction sectors (GWh)*

Solid fuels	Gas	Solar	Hydrogen	Electricity
Liquid fuels	Biomass	Geothermal	Heat	

Source: (B)EST model, E3-Modelling

Transport

The projection for the development of the Transport subsector is based on the projected use of fuels in the sector. The transport sector is divided into four subsectors: road traffic, air traffic, rail traffic and navigation.

Table 5: *Emission projections in the Transport subsector with additional measures, CO_2 eq. — ktoe*

Emissions	2015	2020	2025	2030

CO_2 emissions, ktoe CO_2 eq.	8 903.71	8 982.78	9 168.53	8 882.54
CH_4 and N_2O emissions, ktoe CO_2 eq.	110.32	113.56	113.90	107.23
Total GHG emissions, ktoe CO_2 eq.	9 014.03	9 096.34	9 282.43	8 989.77

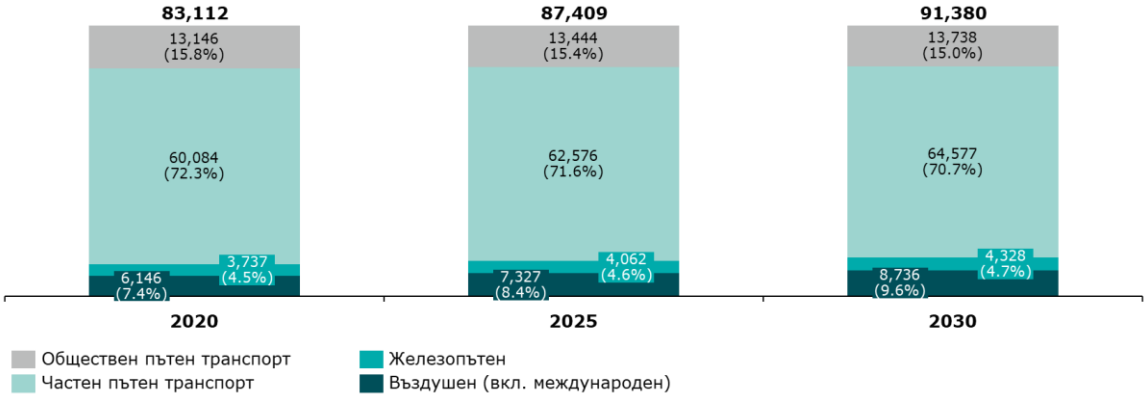
Source: (B)EST model, E3-Modelling

With regard to GHG emissions from the Transport subsector, projections under the WAM scenario indicate that a small and more gradual reduction in emissions may be expected by 2030 as compared to 2015 (baseline used for modelling purposes).

The overall increase in energy consumption in transport is attributable to the aviation segment, which is expected to grow by approximately 35 % as compared to 2020. In the period between 2020 and 2030 private road transport is also expected to grow by 7 %, with a small increase also expected in the rail transport segment.

As regards renewable energy used in transport, diversification of sources has been projected on account of the introduction of new generation biofuels (1 095 GWh in 2030) and hydrogen 32 GWh by 2030). These changes in the energy resources used in transport, including the projected increase in the share of electric public transport and hybrid electrical vehicles, coupled with the development of charging stations infrastructure in urban areas, are projected to result in a reduction in registered GHG emissions.

Figure 6: *Structure of road transport (Mpkm, %)*



Public road transport	Rail transport
Private road transport	Air transport (incl. international)

Source: (B)EST model, E3-Modelling

Figure 7: *Structure of road haulage (Mpkm, %)*

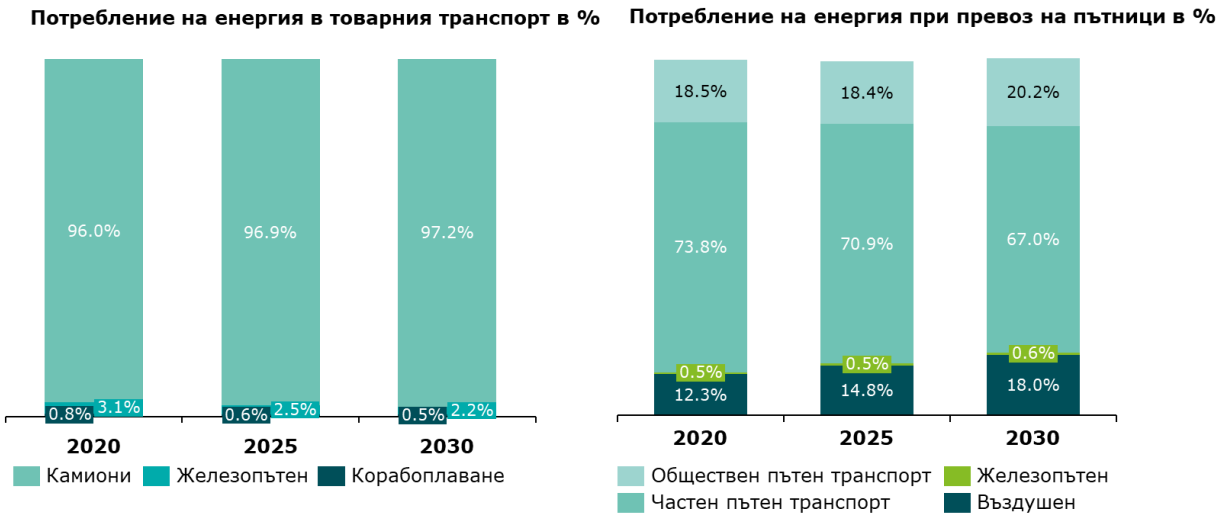
Road transport	Rail transport	Inland navigation

Source: (B)EST model, E3-Modelling

The data contained in the charts below warrants the conclusion that by 2030 no significant variations are expected in transport by transport mode under the two scenarios. Here, as in public transport, GHG emissions from the road transport segment are expected to remain stable throughout the period, with an increase of the share of aviation and rail transport. In addition, a small decrease in private road transport has been projected, with the implementation of additional measures contributing to GHG emission levels remaining lower as compared to the WEM scenario. A gradual increase in the volume of road haulage services as compared to that in the rail transport and inland waterway transport is expected.

The additional measures envisaged for the transport sector concern primarily the higher share of biofuels in conventional fuel blends and the higher number of electric vehicles (particularly light-duty vehicles).

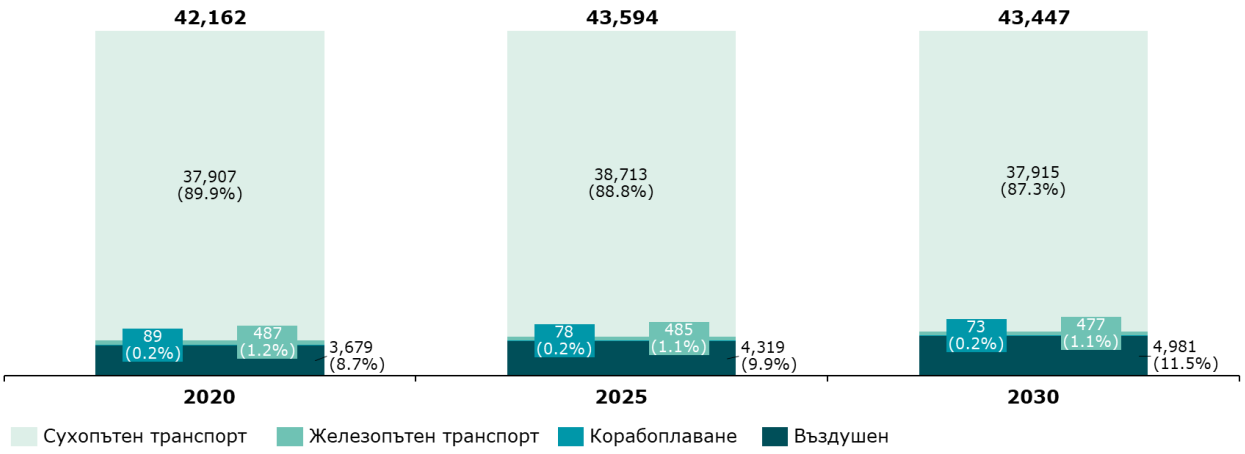
Figure 8: *Energy consumption in freight and passenger transport (%)*



Lorries	Rail transport	Maritime transport	Public road transport	Rail transport
			Private road transport	Air transport

Source: (B)EST model, E3-Modelling

Figure 9: *Distribution of energy consumption by mode of transport (GWh)*



Source: (B)EST model, E3-Modelling

Projected GHG emissions in the Industrial Processes and Use of Solvents sector

The projection of GHG emissions to be generated by the Industrial processes sector is based on an expected growth of the Bulgarian economy without any major peaks and slumps.

Table 6: *Projected GHG emissions in the Industrial Processes and Use of Solvents sector in CO_2 eq. — ktoe*

Emissions	2015	2020	2025	2030
CO_2 emissions, ktoe CO_2 eq.	4 383.57	4 631.74	4 834.26	4 988.98
N_2O and HFC_5 emissions, in ktoe CO_2 eq.	1 322.31	1 495.91	1 990.08	2 431.41
Total GHG emissions, ktoe CO^2eq.	5 705.88	6 127.65	6 824.34	7 420.40

Source: (B)EST model, E3-Modelling

In this scenario, which takes into account projected economic growth, an increase in GHG emissions from the Industrial processes sector as compared to 2015 (baseline) has been projected. GHG emissions are projected to increase by approximately 30 %, which is consistent with the increase projected under the WEM scenario. No additional measures have been planned.

Projected GHG emissions in the Agriculture sector

The GHG emission projections for the Agriculture sector are set out in the table below.

Table 7: *Emission projections for the Agriculture sector with additional measures, ktoe CO_2 eq.*

Emissions	2015	2020	2025	2030
CH_4 emissions, ktoe CO_2 eq.	1 633.94	1 889.72	1 950.00	2 036.54
N_2O emissions, ktoe CO_2 eq.	4 409.58	4 465.18	4 872.92	5 280.78
Total GHG emissions, ktoe CO_2 eq.	6 043.52	6 354.90	6 822.92	7 317.32

Source: (B)EST model, E3-Modelling

The data set out in the table above shows that no additional measures to reduce the emissions generated by the Agriculture sector have been planned. An increase in registered GHG emissions by approximately 20 %, as in the WEM scenario, has been projected as a result of the expected growth of the sector — an estimation based on projections provided by the Ministry of Agriculture, Food and Forests. The measures taken into account in the modelling exercise underlying the Third National Climate Change Action Plan and the National Air Pollution Control Programme for the period 2020—2030 have been validated for the WAM scenario.

Projected GHG emissions and removals in the LULUCF sector

The main category contributing to GHG emissions removals is the forestry sector. All other categories (Cropland, Settlements, Wetland) are sources of CO_2 emissions. The main reason for the flat overall results for removals is the decrease in removals by the forestry sector and a small increase in GHG emissions from cropland, settlements and wetland.

The main reason for the decrease in GHG emission removals by forests is the lower growth rate of forests attributable to their average age.

The increase in the use of biomass is not expected to have a negative impact on land use and the LULUCF sector overall on account of the significant potential for the use of forestry products and forestry residues. The additional requirements for land stem from the use of biofuels: the transition from conventional fuel production to the production of new generation biofuels will have a positive effect on land use because the latter category of biofuels require less land for crop cultivation as compared to the land needed for the cultivation of crops for conventional fuels.

In order to ensure that sufficient biomass is available, Bulgaria will rely on forest biomass in accordance with the National Action Plan for Energy from Forest Biomass for the period 2018-2027 but also on the unutilised potential of the biodegradable fraction of products, waste and residues from biological origin from agriculture, including vegetal and animal matter from forestry and related industries, including fisheries and aquaculture, and the biodegradable fraction of waste, including industrial and municipal waste of biological origin, that satisfy the sustainability criteria stipulated 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).

In the period between 2020 and 2030, the land necessary for the cultivation of crops to sustain the production of conventional fuels will decrease. The additional land necessary for the cultivation of new generation fuels, on account of the introduction of new measures to promote the use of new generation biofuels from 2020 onward, will be compensated by the overall reduction in the areas necessary for the cultivation of crops for conventional fuels.

Overall, no significant changes in land use are projected to occur in the next 10 years.

The model also takes into account the requirements laid down in Commission Delegated Regulation (EU) 2019/807 of 13 March 2019 as regards LULUCF in relation to the sustainability criteria for biofuels and biomass. As solid biomass is expected to be mostly derived from residues in line with applicable requirements, no additional land for bioenergy generation from biomass will be

necessary on account of the projected transition from conventional fuels to new generation biofuels.

WAM scenario projections, similarly to those under the WEM scenario, indicate that Bulgaria will be able to fulfill its obligation not to lower removals below the reference level in the period by 2030. No significant changes in land use and in the removals potential of LULUCF are expected.

Table 8: *Projected emissions and removals by LULUCF under the WAM scenario — CO_2 eq., ktoe*

LULUCF categories	2015	2020	2025	2030
Total for LULUCF, ktoe CO_2 eq.	**-8 489**	**-8 641**	**-8 594**	**-8 593**
Forests, ktoe CO_2 eq.	-7 305	-7 109	-6 924	-6 744
Cropland, ktoe CO_2 eq.	936	681	678	671
Grassland, ktoe CO_2 eq.	-1 730	-1 825	-1 939	-2 079
Wetland, ktoe CO_2 eq.	277	277	277	277
Settlements, ktoe CO_2 eq.	781	805	827	847
Other land, ktoe CO_2 eq.	-590	-575	-576	-594
Harvested wood products, ktoe CO_2 eq.	-857	-896	-937	-970

Source: (B)EST model, E3-Modelling

Forest systems have a major contribution to GHG removals compared to all other ecosystems. Despite this, model projects and data from the National Greenhouse Gas Emissions Inventory shows that a drop in the removals capacity of Bulgarian forests may be expected due to the decrease of the relative share of artificial afforestation and the higher average age of the forests described in point 4.2.1 of the WEM scenario.

Projected GHG emissions in the Waste sector

The projected GHG emissions in the Waste sector under the WEM scenario are set out in the table below. The policy measures for the sector set out in the Third National Climate Change Action Plan 2013—2020 will continue to be implemented and will be further developed. GHG emissions in the sector are projected to decrease by a little over 26 % by 2030 and their levels under the WAM scenario, which takes into account only existing measures, will remain the same. The additional measures planned will accelerate GHG emissions reduction until 2025 but will not have a significant impact on [overall] GHG emissions reduction. This is partly due to the implementation of the National Waste Management Plan, which sets out specific measures for the reduction of waste going to landfill and for intensive waste separation, recycling and recovery according to the waste hierarchy. Better waste management and the collection and recovery of biodegradable waste is essential for both scenarios, and more specifically for the WAM scenario.

Table 9: *Emission projections in the Waste sector as a result of the implementation of additional measures (WAM scenario), CO_2 eq., ktoe*

Emissions	2015	2020	2025	2030
Total emissions, ktoe CO_2 eq.	4 157.64	3 759.01	3 410.54	3 062.84

Source: (B)EST model, E3-Modelling

Conclusion

The table below sets out the projections for GHG emissions reduction in Bulgaria as at 2030 **with additional measures**.

Table 10: *Projected reduction in GHG emissions, CO_2 eq. ktoe*

Emissions	**2015**	**2020**	**2025**	**2030**
GHG emissions (CO_2 eq.), incl. LULUCF	54 656	53 495	53 117	47 553
LULUCF	-8 489	-8 641	-8 594	-8 593
GHG emissions (CO_2 eq.), excl. LULUCF	63 145	62 137	61 711	56 146
Total CO_2 emissions from the Energy sector (ktoe CO_2)	44 574	44 014	42 707	36 500
Total CO_2 emissions, excl. the Energy sector (ktoe CO_2)	4 912	5 133	5 313	5 459

Source: (B)EST model, E3-Modelling

In conclusion, the implementation of the policy measures set out in Section 3, along with the policies in the Energy sector, in combination with the implementation of additional measures will enable Bulgaria to reduce GHG emissions by 49 % by 2030 as compared to 1990.

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

Not applicable

2.1.2 Renewable energy

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

Bulgaria will strive to achieve a share of at least 27.09 % of energy from renewable sources in gross final energy consumption by 2030. Thus, the national target set should be achieved through an increase in the consumption of energy from renewable sources in all three sectors: electric power, energy for heating and cooling, and transport.

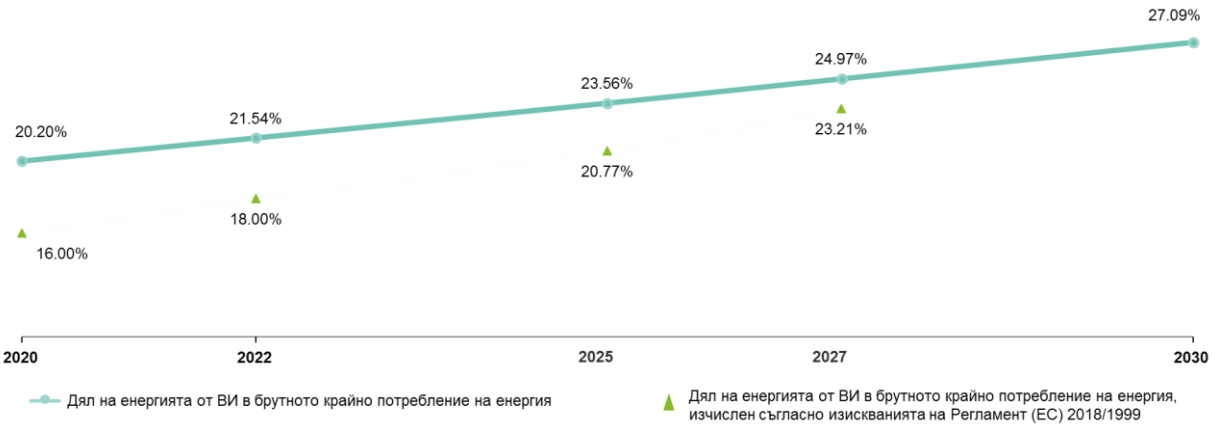
The INECP projection for the development of Bulgaria's energy balance for the period between 2020 and 2050 reflects the priority attached to energy efficiency in the transition of the national economy to a low-carbon economy and the share of energy from renewable sources for the reduction of GHG emissions.

According to the projection for Bulgaria's energy balance, in 2030 the share of energy from renewable sources in gross final energy consumption will be 11.09 percentage points higher than the national target for 2020 set in Annex I to Directive 2009/28/EC5. The projected increase takes into account Bulgaria's early efforts (target overachievement in 2020), which has translated into overachievement of the binding national target of 16 % of energy from renewable sources in gross final energy consumption and exceeds the reference values for increase of the shares of energy from renewable sources to be achieved by 2022, 2025 and 2027 set out in Article 4(1)(a)(2) of Regulation (EU) 2018/1999.

Bulgaria determined its national target for 2030, taking into account the European Commission's recommendation to raise the level of ambition for 2030 by setting the target for the share of energy from renewable sources to at least 27 %.

It will thus contribute to the highest extent possible to the accelerated increase in the consumption of energy from renewable sources and the achievement of a share of at least 32 % of energy from renewable sources in gross final energy consumption in the European Union by 2030.

Figure 10: *Indicative trajectory for the share of renewable energy in gross final energy consumption in Bulgaria for the period 2020—2030*



Share of renewable energy in gross final energy consumption	Share of energy from renewable sources in gross final energy consumption determined in accordance with the requirements laid down in Regulation (EU) 2018/1999

Source: (B)EST model, E3-Modelling, Deloitte analysis

[5]Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on promotion of the use of energy from renewable sources

Although Bulgaria has suitable weather conditions for the development of renewable energy, there are some objective restrictions in specific areas where no renewable energy facilities may be constructed.

The areas along the boundaries of protected sites within the Natura 2000 network (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora and Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds) are a case in point. According to the NPDEVI 2011—2020 the construction of wind farms in these areas is prohibited.

With a view to fulfilling its commitments, Bulgaria has designated 234 Sites of Community Importance for the conservation of the natural habitats of wild flora and fauna and 120 Special Protection Areas (SPAs) for the conservation of wild birds. Protected areas cover 41 053.2 km^2 of Bulgaria's territory, including onshore sites with an area of 38 231.84 m^2 and sites with an area of 2 821.35 km^2 in Bulgaria's marine territory. More than 90 habitat types and 121 bird species, including 28 priority habitats and 8 priority species, along with 120 birds and 70 migratory birds, are subject to conservation within the boundaries of the Natura 2000 network. The country holds one of the first places in Europe in terms of this indicator.

The development of energy from renewable sources during the period covered by the INECP will comply with all applicable requirements laid down in environmental legislation, including those applicable to protected areas and the Natura 2000 network.

All projects for the construction of power plants generating energy from renewable sources will be implemented in full compliance with the requirements laid down in the Environmental Protection Act, the Biodiversity Act and other legislative acts in the area of environmental protection.

ii. Estimated trajectories for the sectoral share of renewable energy in gross final energy consumption in the period 2021—2030 in the sectors of electricity, energy for heating and cooling, and transport

Bulgaria will achieve the national target for the share of renewable energy in gross final energy consumption by 2030 (27.09 %) by achieving the following sectoral targets:

- 30.33 % share of energy from renewable sources in electricity;
- 42.60 % share of energy from renewable sources in the sector of energy for heating and cooling;
- 14.2 % share of energy from renewable sources in transport.

During the period 2020—2030 the consumption of energy in the electricity sector is projected to increase owing to an increase in the power generated by solar plants, wind farms and biomass. According to the projections the share of electric power from renewable sources in the electricity sector will increase by 0.55 to 1.24 percentage points per year.

Table 11: *Indicative trajectory of the share of electric power from renewable sources in gross final electricity consumption for the period 2020—2030 in the electricity sector*

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Share of electric power from renewable sources in gross final consumption of electricity, %	**21.40**	**21.99**	**22.56**	**23.13**	**23.69**	**24.24**	**25.48**	**26.70**	**27.92**	**29.13**	**30.33**

Source: (B)EST model, E3-Modelling, Deloitte

The targets in sector Energy for heating and cooling have been set by taking into account the requirements laid down in Article 23(1) 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) No 2018/2001). The cited provision envisages an increase in the share of renewable energy for heating and cooling by an indicative 1.3 percentage points [as an annual average]. That increase may be limited to an indicative 1.1 percentage points for Member States where waste heat and cold is not used. Taking the above requirements into account, an indicative increase by 1.15 percentage points (calculated as the difference between the share of energy from renewable sources between 2020 and 2030 divided by the number of years) has been projected for the period 2020—2030.

Table 12: *Indicative trajectory for the share of renewable energy for heating and cooling in gross final consumption of electricity for heating and cooling for the period 2020-2030 — sector energy for heating and cooling*

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Share of renewable energy for heating and cooling in gross final heat consumption, %	**31.07**	**32.48**	**33.89**	**35.30**	**36.71**	**38.11**	**38.99**	**39.88**	**40.78**	**41.68**	**42.60**

Source: (B)EST model, E3-Modelling, Deloitte

Article 23(1) of Directive (EU) 2018/2001 introduces a requirement for fuel suppliers to ensure that the share of renewable energy in final consumption of energy in the transport sector is at least 14 % by 2030. In order to achieve the target in the transport sector, the following requirements of Directive (EU) 2018/2001 should be taken into account:

- limiting the use of conventional fuels in the road and rail transport to 7 % of final consumption of energy in the sector by 2030;
- increasing the share of new generation biofuels in final energy consumption in transport to at least 0.2 % in 2022, at least 1 % in 2025 and at least 3.5 % in 2030;

- limiting the use of biofuels and biogas produced from the feedstock listed in Part B of Annex IX of Directive (EU) 2018/2001 (waste edible oils and animal fat) to a maximum of 1.7 % of the energy content of transport fuels supplied for consumption or use on the market;
- the share of renewable electricity is considered to be four times its energy content when supplied to road vehicles and may be considered to be 1.5 times its energy content when supplied to rail transport;
- with the exception of fuels produced from food and feed crops, the share of fuels supplied in the aviation and maritime sectors is considered to be 1.2 times their energy content.

The projected increase in the use of energy from renewable sources has been calculated by taking the above requirements into account, including the requirement for the biofuels used in transport to satisfy applicable sustainability criteria.

During the period 2020-2030 the share of energy from renewable sources in transport is expected to increase to 14.20 %.

Table 13: *Indicative trajectory for the share of energy from renewable sources in gross final energy consumption during the period 2020—2030 in transport*

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Share of renewable energy in gross final energy consumption in transport, %	**9.89**	**9.91**	**9.92**	**9.94**	**9.95**	**9.97**	**10.80**	**11.62**	**12.45**	**13.27**	**14.20**

Source: (B)EST model, E3-Modelling, Deloitte

iii. Estimated trajectories by renewable energy technology that the Member State projects to use to achieve the overall and sectoral trajectories for renewable energy between 2020 and 2030, including expected total gross final energy consumption per technology and sector in Mtoe and total planned installed capacity (divided by new capacity and repowering) per technology in MW

Electricity sector

During the period 2020-2030 the net installed capacity of power plants generating electricity from renewable sources is expected to increase by 2 645 MW. This increase will be accompanied by a parallel increase of the net installed capacity of photovoltaic plants (PhVP) by 2 174 MW and wind farms (WF) by 249 MW. The projected increase of the capacity of these plants is lined to accelerated technology development and lowering investment costs for their construction.

An increase by 222 MW has also been projected for power plants generating electricity from biomass. For the purpose of accounting their contribution to the achievement of the national target and sectoral targets, it is essential for the gaseous fuels and solid fuels from biomass used by plants generating electricity and energy for heating and cooling with a nominal rated thermal input equal to or higher than 20 MW for solid fuels from biomass and total nominal rated thermal input equal to or higher than 2 MW for gaseous fuels and biomass to satisfy sustainability criteria and lead to a reduction in the GHG emissions referred to in Article 28(2) to (7) and (10) of Directive (EU) 2018/2001.

Table 14: *Protected net installed capacity of power plants generating electricity from renewable sources for the period 2020—2030, MW*

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
BEU	2 508	2 508	2 508	2 508	2 508	2 508	2 508	2 508	2 508	2 508	2 508
BTEU	699	709	719	729	739	749	788	828	868	908	948
PhvP	1042	1 191	1339	1 488	1636	1 785	2071	2357	2643	2930	3216
Power plants using biomass and waste	80	114	149	184	219	253	263	273	282	292	302
Total	**4 329**	**4 521**	**4 714**	**4 907**	**5 101**	**5 294**	**5 630**	**5 966**	**6 302**	**6 638**	**6 973**

Source: (B)EST model, E3-Modelling, Deloitte analysis

In the period 2020—2030 gross consumption of electricity from renewable sources will increase by more than 33 % and 41 %as a result of an increase in electricity generated by photovoltaic plans and wind farms, respectively. An increase by 46 % in electricity generated by power plants using biomass by 2030 has also been projected. In this segment, the use of biodegradable waste will increase from 14 GWh in 2020 up to 115 GWh in 2030.

The two scenarios considered in the INECP (WAM and WEM) take into account the vulnerability of water resources and the risk of their decrease due to climate change. In keeping with this trend, in the period 2015—2020 hydroelectricity generation registers a decrease by 17 % (from 5 660 GWh in 2015 to 4 707 GWh in 2020). The electricity output of hydropower plants is expected to remain at the same level throughout the period.

Table 15: *Projection curves by technology for renewable energy generation the period 2020—2030, GWh — electricity*[6]

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
HPP	4707	4707	4707	4707	4707	4707	4707	4707	4707	4707	4707
WF	1451	1474	1496	1519	1542	1564	1661	1758	1855	1952	2049
PhvP	1402	1623	1844	2064	2 285	2506	2 935	3364	3 793	4 223	4652
Biomass-powered plants	1 113	1 177	1 241	1 304	1 368	1 432	1 471	1 510	1 549	1 588	1 627
Gross renewable electricity generation	8 673	8 981	9 288	9 595	9902	10 209	10 775	11340	11 905	12 470	13 035

[6]RE-E — Share of electricity from renewable sources in gross final consumption of electricity in Bulgaria

Gross final consumption of electricity from renewable sources	40 521	40 842	41 162	41482	41802	42123	42 294	42 465	42 636	42 807	42 978
RS-E, %	**21.40**	**21.99**	**22.56**	**23.13**	**23.69**	**24.24**	**25.48**	**26.70**	**27.92**	**29.13**	**30.33**

Source: (B)EST model, E3-Modelling, Deloitte analysis

Heating and cooling sector

In 2030, the final consumption of energy for heating and cooling in Bulgaria is projected to decrease by 2 % as compared to 2020 owing to the additional policy measures to be implemented with a view to improving energy efficiency. These are expected to have a positive impact on losses from district heating, which are projected to decrease from 2 229 GWh in 2020 to 1 574 GWh in 2030. Regarding the renewable energy mix, there are plans to further develop solar plants, which are expected to generate 347 GWh in energy for heating in 2030.

A significant increase in biomass used for the generation of energy for heating is expected as a result of the development of cogeneration plants (from 4 GWh in 2020 to 2 497 GWh in 2030). At the same time, the share of geothermal sources and heat pumps is expected to register a small increase over the period. The planned increase in biomass consumption includes the use of biodegradable waste, which will also increase over the period 2020—2030 from 36 ktoe (414 GWh) to 75 ktoe (873 GWh).

Table 16: *Projection curves by technology used to generate energy from renewable sources for the period 2020-2030, ktoe — heating and cooling*[7]

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Biomass	1 109	1 163	1 217	1 270	1 324	1 378	1 404	1 430	1 456	1 482	1 508
Solar energy	23	23	24	25	26	26	27	28	28	29	30
Geothermal power	35	35	35	36	36	36	36	36	36	36	35
Heat pumps	98	101	104	108	111	114	116	117	119	120	122
Gross final consumption of heating and cooling from renewable sources	1 264	1 322	1 381	1 439	1 497	1 555	1 583	1 611	1 639	1 667	1 695
Gross final consumption of heating and cooling	4 069	4 072	4 074	4 076	4 078	4 080	4 060	4 039	4 019	3 999	3 978
RS-Heating and cooling, %	**31.07**	**32.48**	**33.89**	**35.30**	**36.71**	**38.11**	**38.99**	**39.88**	**40.78**	**41.68**	**42.60**

Source: (B)EST model, E3-Modelling, Deloitte analysis

Transport sector

During the period 2020—2030 the energy from renewable sources used in transport is expected to diversify through the introduction of new generation biofuels and hydrogen

[7] RS -heating and cooling — Share of heating and cooling in gross final consumption of heating and cooling in Bulgaria

(in 2030). The consumption of electricity from renewable sources is also expected to double.

Table 17: *Projection curve by renewable energy technology for the period 2020—2030 , ktoe — transport*[8]

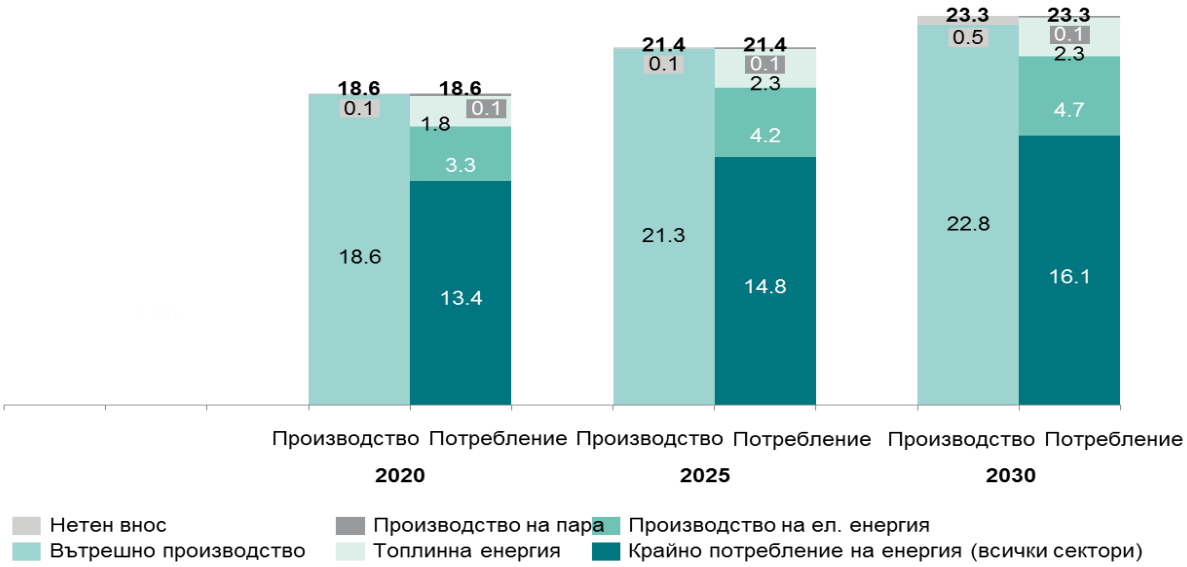
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Biofuels (content of up to 7%)	187.6	189.0	190.3	191.7	193.0	194.4	181.5	168.2	155.0	141.7	128.4
New generation biofuels	27.7	28.0	28.2	28.5	28.7	29.0	42.0	55.0	68.1	81.1	94.1
New generation biofuels, multiplied by 2 or 2*1.2	55.4	55.9	56.5	57.0	57.5	58.0	84.1	110.1	136.2	162.3	188.4
Biogas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Biogas, multiplied by 2 or 2*1.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
E-RS in road transport	1.3	1.7	2.1.	2.4	2.8	3.2.	5.3	7.5	9.7	11.9	14(1)
E-RS in transport (for 2020, multiplied by 5 in accordance with Directive 2009/28/EC, for the period 2021—2030, multiplied by 4 in accordance with Directive (EU) 2018/2001)	6.6	7.8	9.0	10.2	11.4	12.6	21.4	30.1	38.9	47.6	56.4
E-RS in rail transport	6.0	6.3	6.6	6.9	7.2	7.4	7.9	8.5	9.0	9.5	10.0
E-RS in rail transport (for 2020, multiplied by 2.5 in accordance with Directive 2009/28/EC, for the period 2021—2030, multiplied by 1.5 in accordance with Directive (EU) 2018/2001)	15.0	14.2	13.5	12.7	11.9	11.2	11.9	12.7	13.4	14.2	15.0
E-RS in other transport sectors	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.7	0.7	0.8
Hydrogen	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7
Gross final consumption of energy from renewable sources in transport	223.1	225.4	227.7	229.9	232.2	234.5	237.4	239.9	242.4	244.9	250.2
Final consumption of energy from renewable sources in transport calculated for the purpose of defining the sectoral target	265.2	267.5	269.8	272.1	274.4	276.7	299.5	321.9	344.3	366.6	391.7
Final energy consumption in transport	2 680.6	2 699.8	2 719.0	2 738.2	2 757.3	2 776.5	2 773.0	2 769.4	2 765.8	2 762.2	2 758.6
RS-T, %	**9.89**	**9.91**	**9.92**	**9.94**	**9.95**	**9.97**	**10.80**	**11.62**	**12.45**	**13.27**	**14.20**

Source: (B)EST model, E3-Modelling, Deloitte analysis

iv. Estimated trajectories for bioenergy demand, disaggregated between heat, electricity and transport, and for biomass supply by feedstock and origin (distinguishing between domestic production and imports). For forest biomass, an assessment of source and impact on LULUCF removals

[8]RS-T, % — share of renewable energy in gross final energy consumption in transport.

Figure 11: *Projection curve of consumption of energy from biomass until 2030 by consumption and origin (TWh)*

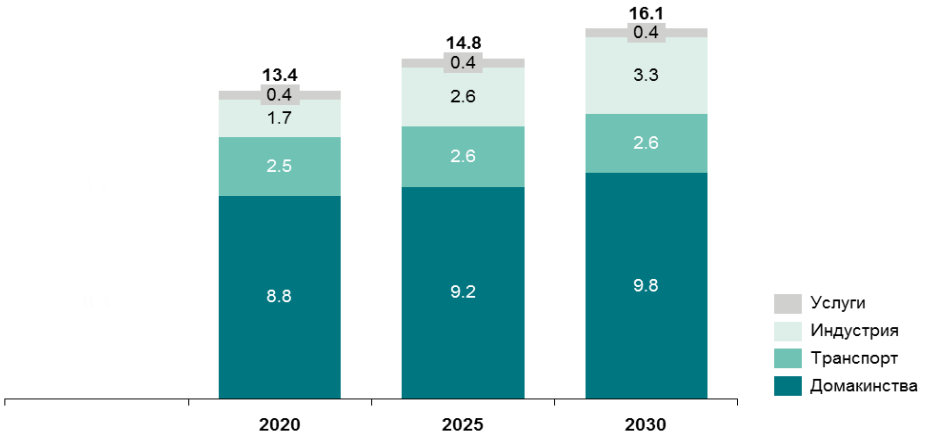


Generation	Consumption	Generation	Consumption	Generation	Consumption
Net import		Steam generation		Electricity generation	
Domestic generation		Heat		Final energy consumption (all sectors)	

Source: (B)EST model, E3-Modelling, Deloitte analysis

The consumption of energy from biomass is expected to increase both in final energy consumption and electricity generation The additional consumption of energy from biomass will require an increase in (sustainably produced) biomass quantities in Bulgaria, where to increase by 37 % in the period 2020—2030 is projected.

Figure 12: *Final consumption of energy from biomass by sector (TWh)*



Services	Industry	Transport	Households

Source: (B)EST model, E3-Modelling, Deloitte

The industry sector is projected to see the greatest increase in the use of energy from biomass by nearly 100 % in 2030 as compared to 2020. For the households sector, where the greatest share of biomass is currently used (66 % of final energy consumption in 2020), a moderate increase by 11 % is projected. A lower increase by 2.3 % and 2.6 % in 2030 as compared to 2020 is projected for the sectors of transport and services, respectively.

Regarding biomass and in order to assess the impact of the source of biomass on LULUCF removals, the National Forest Inventory in which the reference level for forests for the period 2021—2025 is determined, along with the National Action Plan for Energy from Forest Biomass (NPDEGB) 2018-2027, have been taken into account. More detailed information about this assessment is set out in Chapter 5.2.

v. Where applicable, other national trajectories and objectives, including long-term or sectoral (e.g. share of renewable energy in district heating, renewable energy generated by cities, energy communities and independent consumers, energy recovered from the sludge derived from wastewater treatment)

Not applicable

2.2 Energy efficiency dimension

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

Indicative national energy efficiency contribution

In 2030, Bulgaria plans to achieve a decrease in the consumption of primary energy by 27.89 % and a decrease by 31.67 % in final energy consumption as compared to the PRIMES 2007 reference scenario.

As regards [the target for] energy consumption in 2030 expressed in absolute terms, Bulgaria has set a target of 17 466 ktoe for primary energy consumption and a target of 10 318 ktoe for final energy consumption.

Figure 13: *Primary and final energy consumption trajectory, ktoe*

Primary energy consumption, ktoe
Final energy consumption, ktoe

Total cumulative target for energy savings over the period 2021—2030 under Article 7(1)(b) on the energy saving obligations pursuant to Directive 2012/27/EU, ktoe

In accordance with Article 7(1) of Directive (EU) 2018/2002 of the European Parliament and of the Council of 11 December 2018 amending Directive 2012/27/EU on energy efficiency (Directive (EU) 2018/2002) the energy savings targets to be achieved by each Member State in the period from 1 January 2021 to 31 December 2030 must be equivalent to at least 0.8 % of annual final energy consumption, averaged over the period 2016–2018.

The table below sets out final energy consumption averaged over the period 2016–2018 and used to calculate annual energy savings and the cumulative target for the period until 2030.

Table 18: *Final energy consumption for the period 2016–2018 and average annual final energy consumption for the period*[9]

	2016	2017	2018
Final energy consumption, ktoe	9 731.2	9 976.0	10 003.0
Annual average final energy consumption (FEC) for the period 2016—2018	**9 903.4**		

The energy savings to be achieved during the period 2021-2030, respectively the cumulative target for energy savings to be achieved by 31 December 2030, have been

[9] The fuels necessary for the operation of international flights have been included in final energy consumption.

calculated on the basis of the average annual final energy consumption for the period 2016-2018. The respective values are set out in the table below.

Table 19: *Annual energy savings in final energy consumption, ktoe*

2021	69.2										**69.2**
2022	69.2	69.2									**138.4**
2023	69.2	69.2	74.05								**212.45**
2024	69.2	69.2	74.05	74.05							**286.5**
2025	69.2	69.2	74.05	74.05	92.0						**378.5**
2026	69.2	69.2	74.05	74.05	92.0	92.0					**470.5**
2027	69.2	69.2	74.05	74.05	92.0	92.0	92.0				**562.5**
2028	69.2	69.2	74.05	74.05	92.0	92.0	92.0	92.0			**654.5**
2029	69.2	69.2	74.05	74.05	92.0	92.0	92.0	92.0	92.0		**746.5**
2030	69.2	69.2	74.05	74.05	92.0	92.0	92.0	92.0	92.0	92.0	**838.5**
TOTAL cumulative savings for the period 2021—2030 period											**4 357.55**

Bulgaria will use the possibility available under Directive (EU) 2018/2002 to gradually increase its national target (from 0.7 % up to 0.92 %) until the cumulative target of 4 357.55 ktoe is reached in 2030.

ii. Indicative milestones for 2030, 2040 and 2050, domestically established progress indicators and their contributions to the Union's energy efficiency targets as included in the roadmaps set out in the long-term renovation strategies for the national stock of residential and non-residential buildings, both private and public, in accordance with Article 2a of Directive 2010/31/EU

In accordance with Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 amending Directive 2010/31/EU each Member State is to establish a long-term renovation strategy to support the renovation of the national stock of residential and non-residential buildings, both public and private, into a highly energy efficient and decarbonised building stock by 2050, facilitating the cost-effective transformation of existing buildings into nearly zero-energy buildings. The provisions of the Directive are to be transposed into national law by 10 March 2020. To this end, a long-term strategy to support the renovation of the national stock of residential and non-residential buildings with a time horizon until 2050 must be developed. The strategy must include:

- indicative interim targets for 2030, 2040 and 2050;
- indicative description of financial resources to support strategy implementation;
- effective mechanisms for promoting investments in building renovation.

The table below sets out information about the indicative interim targets for the ten-year periods from 2021 to 2050.

Table 20: *Indicative interim targets for renovation of 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 area as a share of currently existing building stock for renovation	%	7.9 %	17.5 %	19.8 %
CO_2 emission savings	**tonne**	**1 306 435**	**2 891 610**	**3 274 453**
Residential buildings	tonne	1 065 184	2 448 461	2 706 441
Non-residential buildings	tonne	241 251	443 149	568 012

The targets set for building stock renovation are expected to contribute to the achievement of Bulgaria's obligations under Article 7 of Directive (EU) 2018/2002 of the European Parliament and of the Council of 11 December 2018 repealing Directive 2012/27/EU.

The analysis of available data about certified buildings shows that in order to achieve the quantitative target indicators, renovation policy should focus primarily on building stock in the energy classes E, F and G.

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 higher energy efficiency targets has a strategic link to building stock renovation and priority will be given to energy efficiency in combination with the use of renewable energy sources in buildings.

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

In addition, the use of efficient district heating and cooling will be promoted. There are plans to upgrade public buildings and buildings used in the services sector that do not have district heating supply by building new district heating networks — either local or extensions of existing ones.

The potential for energy efficiency of the central heating and cooling infrastructure can be achieved through the rehabilitation of heat transmission networks and replacing obsolete direct subscriber district heating stations with modern highly efficient automated indirect

stations, which would reduce heat transmission and distribution losses and lower CO_2 emissions.

The best practices associated with the use of pre-insulated pipes in district heating systems help reduce losses to 3 %. A similar loss level can be achieved for high-power density systems. Taking into account the specific national conditions, it is assumed that the average power density of district heating systems will allow heat losses to be reduced to 10 % in a scenario where the best available technology is used. The development of high efficiency electricity cogeneration contributes to fuel use reduction, greater efficiency of electricity generation and better environmental protection.

2.3 Energy security dimension

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

Energy diversification solutions in Europe and ensuring energy security through solidarity and co-operation between Member States, enhanced diversification of EU energy supply and development and use of indigenous energy resources are key EU priorities for the energy sector. The main goal is to ensure the security of energy supply or, in other words, to guarantee uninterrupted and adequate energy supply from all sources for all consumers.

In view of the above, Bulgaria has set energy security objectives for:

- diversification of the supply of energy resources;
- increasing the flexibility of the national energy system;
- addressing constrained or disrupted supply of energy sources for the purpose of enhancing the resilience of regional and national energy systems; and
- improving interconnectivity and information security (cybersecurity).

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

Increasing diversification of the sources of natural gas supply through interconnectors with neighbouring countries and supply:

- from the Caspian Region via the Southern Gas Corridor;
- of liquefied natural gas from the Mediterranean region and other countries via an LNG terminal.

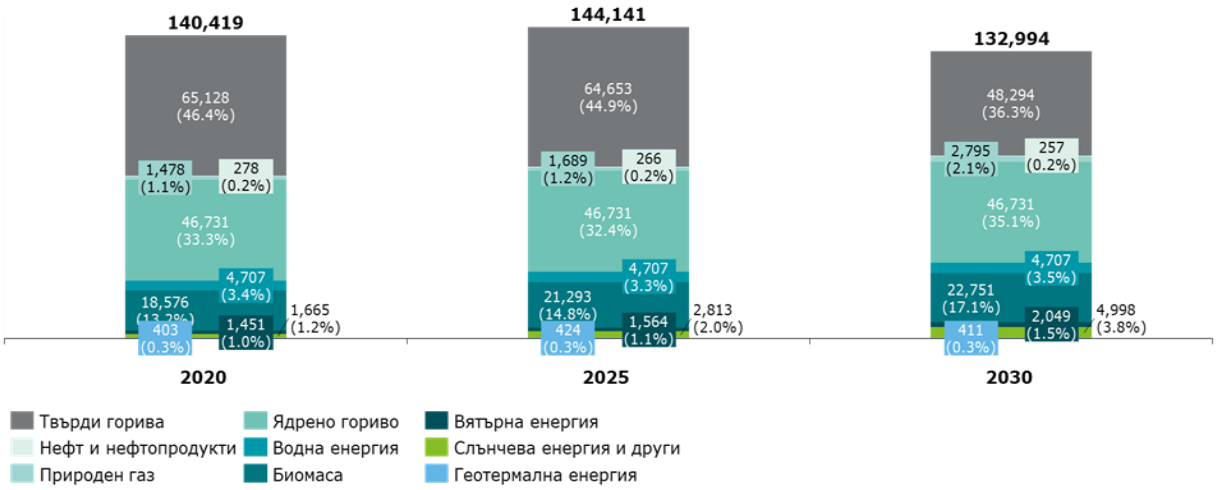
The development of local extraction of natural gas through the exploration of new oil and natural gas deposits, including in the deep-water section of the Black Sea will also contribute to diversification.

The aim of diversifying the supply of fresh nuclear fuel is to guarantee the uninterrupted operation of the nuclear plant and the safety and reliability of electricity generation.

utilising the potential of renewable energy sources as an indigenous resource that helps reduce dependence on imports, improves the security of energy supply and alleviates environmental protection obligations.

In 2030, solid fossil fuels are projected to have a share of 36.3 % in primary energy production. Nuclear power, which is considered a local energy source, will play an even more important role, with a share of 35.1 % in primary energy production in 2030. Bulgaria also aims to diversify its energy sources in order to increase the use of renewables, with biomass, solar power and wind power projected to increase up to, respectively, 17.1 %, 3.8 % and up to 1.5 % by 2030.

Figure 14: *Primary energy production, WAM scenario (GWh)*



Solid fuels	Nuclear fuel	Wind power
Oil and petroleum products	Hydropower	Solar and other types of energy
Natural gas	Biomass	Geothermal power

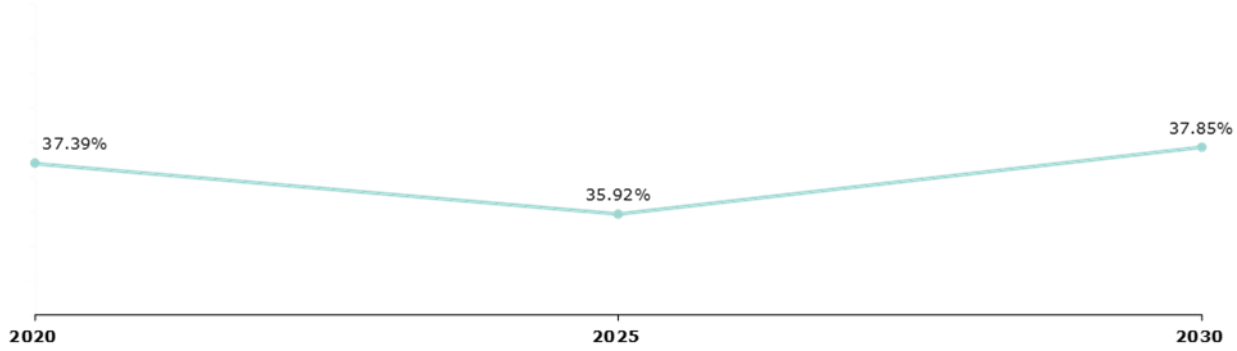
Source: (B)EST model, E3-Modelling

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

The diversification of the sources and routes for supply of natural gas will enhance the resilience of the national energy system. In connection with this, Bulgaria will implement a number of projects of common interest for the European Union.

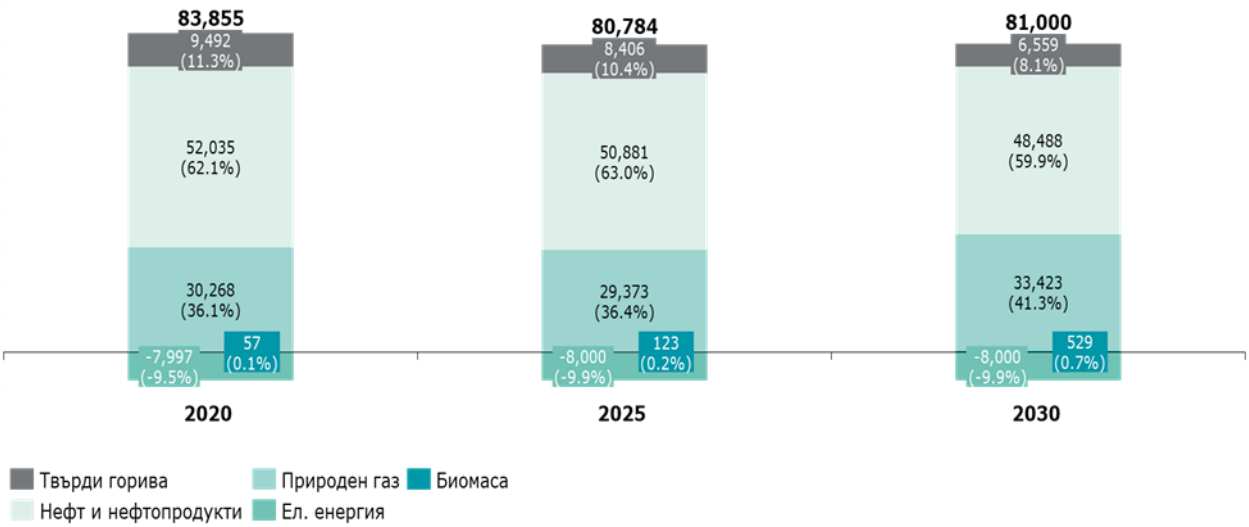
It strives to maintain a low level of dependence on the import of energy resources. Current projections indicate that dependence on imported energy resources in 2030 will be at a level similar to that in 2020.

Figure 15: *Dependence on imports, WAM scenario*



Source: (B)EST model, E3-Modelling

Figure 16: *Net import, WAM scenario (GWh)*



Solid fuels	Natural gas	Biomass
Oil and petroleum products	Electricity	

Source: (B)EST model, E3-Modelling

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:

- preserve the key role of indigenous energy resources (coal) and their use in existing production facilities in line with the requirements of the environmental legislation;
- preserve the role of nuclear energy which is considered a local energy source;

- maintain and develop the transmission capacity of the electricity and gas transmission networks;
- optimise consumption in the energy system through the development of energy markets;
- increase the electricity and natural gas storage capacity by developing the existing storage facilities and by building new storage facilities.

Measures supporting the development of energy infrastructure, the integration of electricity from renewable sources in the electricity grid and the wider uptake of smart energy storage systems will be introduced in the period 2021—2030. The implementation of such measures will enable the full potential of electricity generated from renewable sources to be exploited as they will facilitate its integration in the electricity system.

2.4 Internal energy market dimension

2.4.1 Electricity interconnectivity

i. The level of electricity interconnectivity that the Member State aims for in 2030 in consideration of the electricity interconnection target for 2030 of at least 15 %, with a strategy with the level from 2021 onwards defined in close cooperation with affected Member States, taking into account the 2020 interconnection target of 10 % and the following indicators of the urgency of action:

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

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

In accordance with EU law each Member State must achieve an interconnectivity target of least 10 % and 15 % of domestic installed capacity by 2020 and 2030, respectively. The maximum transmission capacity of power lines and network elements must be ensured in line with applicable safety standards for network operation, including the safety standard for emergency situations. In line with applicable EU requirements, Bulgaria has set an electricity system interconnection target of at least 15 %. The target will be achieved through the implementation of projects of common interest and additional initiatives, which are described in detail below. The projections for the period after 2030, i.e. after the power lines referred to in point 2.4.2 have been constructed, are as follows:

- 14 600 MW — total installed generation capacity of the Bulgarian electricity system;

- 6 880 MW — transmission capacity upon export (electricity interconnection of 47.1 % upon export);
- 6 880 MW — transmission capacity upon import (electricity interconnection of 47.1 % upon import).

The transmission capacity upon import/export indicated above will be achieved on the condition that bottlenecks in the internal electricity grids of Romania and Greece are addressed, an agreement is reached on the application of Article 16(8) of REGULATION (EU) 2019/943 and the capacities available at Bulgaria's borders with third countries (Turkey, North Macedonia and Serbia) are calculated in co-ordinated manner.

In accordance with the requirements laid down in Regulation (EU) 1999/2018, the interconnectivity strategy, in addition to being in line with the EU interconnectivity target, must also take into account three emergency indicators. On the basis of currently available data two of the emergency indicators are as follows:

Table 21: *Transmission capacity emergency indicators*

Indicator	Comment
Price differential in the wholesale market exceeding an indicative threshold of EUR 2/MWh between Member States, regions or bidding zones	
Nominal transmission capacity of electricity interconnectors compared to peak load	Projected maximum system load for 2030 — 8 100 MW Projected total nominal transmission capacity of interconnected transmission lines in 2030 — 12 320 MW or 152 % of peak load
Nominal transmission capacity of interconnected transmission lines compared to installed renewable energy power plants.	The projected installed capacity for electricity generation from renewable sources in 2030 is 7 126 MW. Total nominal transmission capacity of interconnected transmission lines — 12 320 MW or 173 % of the installed capacity of renewable energy power plants.

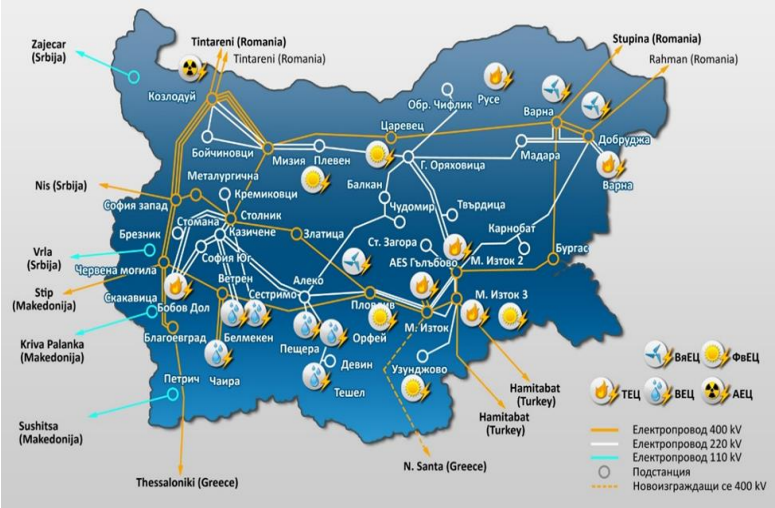
Source: ESO EAD

The nominal transmission capacity of interconnected transmission lines must be at least 30 % of peak load.

The projected capacities for 2030 are as follows:

- 8 100 MW — maximum system load;
- 12 320 MW — total transmission capacity of interconnecting lines equal to 152 % of peak load.

Figure 17: *Interconnectivity*



Wind farms	*Solar plants*	
TPP	HPP	NPP
		Power line 400 KV
		Power line 220 KV
		Power line 110 KV
		Substation
		New 400 KV power lines under construction

Source: ESO EAD

Nominal transmission capacity of interconnector transmission lines below 30 % of the installed capacity of renewable energy power plants.

According to Electricity System Operator data the figures are as follows:

- 7 126 MW — projected installed capacity for renewable energy generation for 2030;
- 12 320 MW — total nominal transmission capacity of interconnected transmission lines or 173 % of the installed capacity of power plants generating energy from renewable sources.

It should be noted that the nominal transmission capacity of a 400 kV power line with 2xACO500 and 3xACO400 conductors is 1 200 MW and 1 280 MW, respectively (taking into account the capacity of all conductor elements of the power line and an average power factor of 0.93).

The Bulgarian electricity system operates in parallel with the electricity systems of the countries in continental Europe. The Bulgarian ES is interconnected with the common EU EES via four interconnectors with Romania; two interconnectors with Turkey; and one interconnector with Serbia, Macedonia and Greece, respectively. They are as follows:

- 400 kV interconnecting power line from the Kozloduy Nuclear Power Plant (BG) to Cancarene substation (RO);

- 400 kV interconnecting power line from the Kozloduy Nuclear Power Plant (BG) to Cancarene substation (RO);
- 400 kV interconnecting power line from Varna substation (BG) to Stupina substation (RO);
- 400 kV interconnecting power line from Dobrudzha substation (BG) to Rahman substation (RO);
- 400 kV interconnecting power line from TETs Maritsa Iztok 3 (BG) to Hamitabat substation (TR);
- 400 kV interconnecting power like from TETs Maritsa Iztok 3 (BG) to Hamitabat substation (TR);
- 400 kV interconnecting power line from Sofia zapad substation (BG) to Nish substation (RS);
- 400 kV interconnecting power line from Chervena Mogila substation (BG) to Štip substation (MK);
- 400 kV interconnecting power line from Blagoevgrad substation (BG) to Thessaloniki substation (GR).

2.4.2 Electricity and gas transmission infrastructure

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

The key electricity and gas transmission infrastructure and modernisation projects are:

1. In the area of electricity transmission infrastructure

In order to achieve the priorities relating to European energy infrastructure, the European Commission has included several cross-border infrastructure development projects in the list of projects of common interest (PCI) approved in October 2019. They are as follows:

Priority corridor North-South electricity interconnections in Central Eastern and South Eastern Europe ('NSI East Electricity').

- Bulgaria—Greece cluster and construction of the necessary infrastructure in Bulgaria, including:
  - 400 kV interconnecting power line between Maritsa Iztok substation (Bulgaria) and Nea Santa substation (Greece);
  - 400 kV internal power line between Maritsa Iztok substation and Plovdiv substation;

- 400 kV internal power line between Maritsa Iztok substation and the open distribution switchyard of TPP Maritsa Iztok 3.
- 400 kV internal power line between Maritsa Iztok substation and Burgas substation;

All power lines to be constructed will have a capacity approximately 1 280 MW.

- The Bulgaria—Romania cluster ('Black Sea corridor') aims to increase existing capacity and will comprise an internal 400 kV power line between Varna substation and Burgas substation.
- Bulgaria-Yadenitsa hydro-pumped storage project

Yadenitsa hydro power plant is essential for electricity system balance. The project has been included in the PCI list.

2. Key gas transmission infrastructure projects

In 2019, the Bulgarian regulatory body published the Ten-year plan for development of the network of Bulgartransgas EAD for the period 2019—2028. The plan will serve as the basis for the development of Grid Regional Investment Plans (GRIPs). [It is aligned with] the Community Grid Development Plan developed by the European Network of Transmission System Operators for Gas (ENTSO-G).

The projects aim to ensure the security of natural gas supply to Bulgaria through the construction of gas interconnectors and expanding the storage capacity of the Chiren UGS facility both in terms of extraction and compression facilities and capacity expansion to ensure that greater volumes of natural gas can be stored. Another main goal is to provide access to natural gas to a greater number of municipalities and final customers thereby contributing to environmental protection, improving quality of life and enhancing energy security. In connection with this, there are plans to expand the existing gas transmission network to new areas in Bulgaria and build new metering and (decompression) regulating stations (DRS).

In order to create a regional market in natural gas, it is essential that projects for the construction and operation of new infrastructure facilities be implemented, including projects of common interest. The Greece—Bulgaria interconnector is of key importance in this respect. It is one of the seven priority projects for the EU to be implemented in parallel to the Trans-Adriatic pipeline (TAP). The Bulgarian and Greek regulatory bodies have adopted a joint decision to apply for a temporary exemption of the interconnector from the requirements for access of third countries, regulated tariffs and unbundling in accordance with Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas.

- The gas interconnector Greece-Bulgaria (IGB)

The interconnector has a total length of 182 km and capacity for the transportation of 3 up to 5 billion m^3 of natural gas per year. Given sufficient interest, the capacity can be increased up to 10 billion m^3 per year. The interconnector will be built between Komotini,

Greece, and Stara Zagora, Bulgaria. It will connect the transmission grids of DESFA and TAP in Komotini, Greece, and the transmission system of Bulgartransgas EAD in Stara Zagora.

The project for the construction of an interconnector between Greece and Bulgaria has been included in the PCI list of the European Union with accordance with Regulation (EU) No 347/2013 on guidelines for trans-European energy infrastructure. It is one of seven priority gas projects implemented within the framework of the Central and South East Europe Energy Connectivity (CESEC) initiative.

The project is expected to be completed by the end of 2020.

The direct effects of project implementation include real diversification of the sources of natural gas supply to Bulgaria, creating an opportunity for the supply of natural gas via the Southern Gas Corridor and from LNG sources, and connecting and transforming Bulgaria and its gas transmission system into a major part of the infrastructure for gas supply from alternative sources for the entire region of Central and Southeast Europe.

The project will ensure that Bulgaria is able to import the contracted quantity of 1 billion m^3 of natural gas per year after the launch of the Shah Deniz 2 gas field in Azerbaijan. The interconnector will also provide a possibility for gas supply via the LNG terminal in Alexandroupoli from producers like the United States, Qatar, Algeria, Nigeria, etc., including Israel and Egypt in the future.

- Construction of a gas interconnector between Bulgaria and Serbia (IBS)

The planned reversible gas interconnector between Bulgaria and Serbia (IBS) will connect the national gas transmission networks of the two countries. With a total length of 170 km, it will run from Novi Iskar in Bulgaria to Nis in Serbia along a route that comprises a 62.2 km section in Bulgaria. The gas interconnector will be reversible, allowing two-way gas transmission of: 1 billion m^3 per annum up to 1.8 billion m^3 per annum from Bulgaria to Serbia and 0.15 billion m^3 per annum from Serbia to Bulgaria. The project is expected to be completed in mid-2022.

The Bulgaria-Serbia interconnector is a project of common interest for the European Union within the meaning of Regulation (EU) 347/2013 on guidelines for trans-European energy infrastructure and a project of common interest for the EU energy community. The project is an element of the infrastructure necessary for the implementation of the Balkan gas hub. It is one of seven priority gas projects implemented within the framework of the Central and South East Europe Energy Connectivity (CESEC) initiative.

The implementation of the project will ensure the diversification of routes via an interconnector, enabling the transmission of natural gas to Serbia from the new entry points at Bulgaria's border with Turkey and Greece, as well as significant spare capacity in the Bulgarian gas transmission network. At the same time, it will allow the importation of natural gas from Serbia in crisis situations.

- Project for the construction of an LNG terminal in Alexandroupoli

The terminal has a rated annual capacity of 6.1 billion m³ and a storage capacity of 170 000 m³. It is a modern technological project involving the construction of an offshore floating unit for the reception, storage and re-gasification of LNG and a system comprising a subsea and an onshore gas transmission pipeline through which the natural gas will be shipped into the Greek national natural gas system and onwards to final consumers. The LNG terminal is strategically situated in proximity to the gas transmission network of the Greek national gas operator DESFA S.A.

The European Commission has included the project in the PCI list in accordance with Regulation (EU) No 347/2013 on guidelines for trans-European energy infrastructure, including in the third and fourth lists of the European Commission. Bulgaria has been a strong advocate for the inclusion of the LNG terminal in the PCI list.

The terminal is expected to start commercial operations in 2022.

The rated annual capacity and LNG storage capacity of the terminal will enable Greece but also Bulgaria, Romania, North Macedonia, Serbia and Hungary to balance needs on their respective domestic markets. Bulgaria considers the Alexandroupoli terminal project as complementing the gas interconnector with Greece and the Trans Adriatic Pipeline (TAP). It will give it access to producers and suppliers of liquefied gas from the United States, Qatar and Algeria as well as Israel and Egypt, among other countries, in the future.

Bulgartransgas EAD will acquire a 20 % share in the LNG terminal construction project and Bulgargas EAD will participate in the legally binding stage by booking transmission capacity. Bulgaria's participation in the project for the construction of a liquefied natural gas terminal near Alexandroupoli is of key importance for the country and the entire region of Southeast Europe. The synergy between the LNG terminal and the construction of the interconnector between Greece and Bulgaria will contribute to the security and diversification of energy supply.

- The Balkan Gas Hub

The concept developed with assistance from the European Commission envisages the construction of a gas distribution centre (gas hub) in Bulgaria, including the necessary transmission infrastructure, and a natural gas exchange. The gas hub will connect the natural gas markets of all Member States in the region — Bulgaria, Greece, Romania, Hungary, Croatia and Slovenia, linking the region to Central and Western Europe, and to Serbia, North Macedonia and Bosnia and Herzegovina, which are members of the Energy Community. The concept for the construction of a gas distribution centre for South East Europe in Bulgaria is based on the idea of creating a gas trading platform by building infrastructure that will enable the supply of significant quantities of natural gas from different sources intended for further transportation via several physical entry points.

The Balkan gas hub has been included in the PCI list of the European Union in accordance with Regulation (EU) 347/2013 as a group of projects that contribute to the development and enhancement of gas infrastructure. The projects for the

interconnectors between Bulgaria and Greece and Serbia, respectively, and for the upgrade and rehabilitation of the gas transmission network of Bulgartransgas EAD have also been included in this group.

In the context of the European objectives for developing an interconnected and single European gas market, the implementation of the gas hub concept fits in with the projects for the development of the Southern Gas Corridor and in line with the plans for gas infrastructure development in Europe. The Balkan gas hub would be able to rely on natural gas supplied via the newly constructed submarine pipeline in strict compliance with the requirements for the Third Liberalisation Package of the EU and along the existing route; natural gas extracted from the Bulgarian and Romanian sections of the Black Sea shelf; natural gas from the Southern Gas Corridor (Caspian area, Middle East and Eastern Mediterranean), and LNG terminals in Greece and Turkey.

Since 9 December 2019 a gas exchange has been operating in Bulgaria on which natural gas will be traded via gas release auctions — a possibility already envisaged in the Energy Sector Act. The exchange segment will be operated by Gazov Hub Balkan EAD, a subsidiary of Bulgartransgas EAD.

During the initial stage of operation of the exchange, Gazov Hub Balkan EAD will provide the participants in the natural gas market in Bulgaria and the wider region with the possibility to use a platform with integrated software solutions for wholesale energy trading developed in accordance with the requirements laid down in Article 10 of Commission Regulation (EU) No 312/2014 establishing a Network Code on Gas Balancing of Transmission Networks.

On 2 January 2020, multilateral trade was launched via the trading platform of Balkan Gas Hub EAD, including the so-called short-term (spot) and long-term segments of the market and via gas brokers.

- Expanding the capacity of the Chiren Underground Gas Storage (UGS) facility

The project for expansion of the capacity of Chiren Underground Gas Storage (UGS) facility involves the staged increase of the capacity of the only gas storage facility in Bulgaria in order to increase gas storage volumes and pressures in the gas reservoir and achieve higher average gas extraction and pumping capacity over 24 hours. The project envisages an increase in working gas volume up to 1 billion m^3 and an increase in gas extraction and pumping capacity up to 8–10 million m^3 per day. The extension of the Chiren UGS facility is a project of common interest for the European Union within the meaning of Regulation (EU) 347/2013 on guidelines for trans-European energy infrastructure and is an element of the Balkan Gas hub concept.

The expanded UGS facility is expected to become operational in 2025.

The Chiren UGS facility is a major instrument enabling the functioning of the gas market in Bulgaria, which will compensate seasonal variations in domestic natural gas

consumption, providing the flexibility necessary to balance the differences in supply and demand and serving as an emergency reserve.

The project is highly important for the security of gas supplies. In the mid-term, the Chiren UGS facility will assume an important commercial role for the development of competition in the regional gas market, enhancing the flexibility of regional gas transmission systems and contributing to the management of excessive load and the seasonal optimisation of gas transmission networks.

- Rehabilitation, upgrade and expansion of the Bulgarian gas transmission network

The project is a comprehensive multi-component project for the upgrade, rehabilitation and expansion of the existing gas transmission infrastructure in Bulgaria. It will involve three stages during which the following activities will be implemented: upgrade and rehabilitation of compressor stations; repair and replacement of pipes in certain sections following inspection; expansion and upgrade of the existing network; inspections to ascertain and report on the condition of gas pipelines; implementation of systems for pipeline technical condition management optimisation.

The project for the rehabilitation and expansion of the gas transmission infrastructure in Bulgaria has been included in the list of projects of common interest for the European Union in accordance with Regulation (EU) No 347/2013 on guidelines for trans-European energy infrastructure as an element of the infrastructure necessary for the implementation of the Balkan Gas Hub. It is one of seven priority gas projects implemented within the framework of the Central and South East Europe Energy Connectivity (CESEC) initiative.

The facilities included in the second phase of the project are expected to become operational in 2022.

The Bulgarian gas infrastructure will ensure the transmission of Azeri natural gas and gas from LNG sources via the IGB to IBR and IBS, i.e. to Romania and Serbia, and onwards to Hungary and Central Europe.

ii. Where applicable, major infrastructure projects other than projects of common interest (PCIs)

- Construction of a new dual 400 kV interconnecting power line between Bulgaria and Serbia

The project has been included as a new investment in the last ENTSO-E ten-year network development plan 2018. An assessment of the need to build a second interconnector between Bulgaria and Serbia has been conducted in the framework of the market surveys undertaken 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 Bulgaria and Romania and the Western Balkan region.

- Construction of a new 400 kV power line between Bulgaria and Turkey;

- Construction of new 400 kV internal power lines between the Vetren switchyard and Blagoevgrad substation and between Tsarevets substation and Plovdiv substation.
- Upgrade and expansion of elements of the internal electricity distribution network and management systems with a view to increasing the efficiency, flexibility and security of supply;
- Connecting new low-voltage and zero-emission sources of energy to the grid.

2.4.3 Market integration

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

Electricity market liberalisation

In line with Third Liberalisation Package of the EU, Bulgaria took steps toward full liberalisation of its electricity market. As a result of the legislative amendments adopted in early 2018, the electricity generated for the free market is now traded exclusively via BNEB platforms.

Developing an intraday market

The producers of electricity from renewable sources are expected to make use of the opportunities offered by the intraday market in order to lower their balancing costs. In 2018, the intraday market segment was launched. It acts as a link between long-term contracting, short-term trading on the day-ahead market and the real-time (balancing) market. The launch of the intraday segment completes the overall structure on the Bulgarian market, which is now similar to that of markets in most other Member States and allows participants to modify their contractual positions in order to respond to production or consumption forecasts at significantly shorter intervals before auction bidding sessions.

Participation in integration

ESO EAD, together with all transmission grid operators in Europe, operates in accordance with the requirements laid down in Regulation (EU) 2015/1222. In May 2018, it signed the Agreement on the single coupling of day-ahead markets in a coordinated manner between TSOs and NEMOs (Intraday Operational Agreement, IDOA) and the TSOs Cooperation Agreement for Intraday Coupling (TCID) thereby joining, together with the

BNEB, the process of integration of the Bulgarian border into the common EU market within the framework of the of the Cross-Border Intraday Project (XBID).

Bulgaria is part of the LIP 15 local project and has established a common intra-day cross-border market with Romania, which has been fully operational since November 2019. With this step, the Bulgarian-Romanian border will become the first border at which transmission capacity will be implicitly allocated within the intraday time frame in coupled region in Europe.

Preparatory work is currently under way to launch a project for capacity allocation in the intraday time frame at the Bulgarian—Greek border. The ESO and BNEB and the Greek operators (IPTO and HEnEx) have sent letters to the regulatory bodies in the two countries, requesting the Bulgarian—Greek border coupling project to be approved and integrated into the IBWT-Italian Border Working Table) project.

Balancing model and balancing of renewable sources

Bulgaria's balancing model is transparent and offers uniform energy balancing conditions, regardless of the generation technology used, plant size and whether plants supply electricity at regulated or freely negotiated prices.

In Bulgaria, the total installed capacity of power plants generating renewable electricity is relatively high compared to total available capacity and the two units of NPP Kozloduy EAD, each with a capacity of 1 000 MW, that operate in a relatively small electricity system, are the reason why capacity is maintained in cold reserve mode. They also account for the availability enabling the provision of additional services (primary and secondary regulation). The integration of consumers into slow tertiary reserve provision by lowering consumption in the case capacity shortages within the electricity system has been ensured through the development of dedicated rules and conducting the first auction in October 2018. This has expanded the sources of balancing power and the potential of dispatchable generation capacity available to the operator, thereby reducing balancing costs.

Grid balancing energy aggregators

The ESO has launched a project implemented under the Structural Reform Support Programme (SRSP), which is focused on the development of requirements for aggregator registration, technical connectivity of the operators of electricity distribution networks to the systems of ESO EAD, communication between network operators, determination of regulating power provided and settlement of payments.

After the Energy and Water Regulatory Commission (KEVR) adopted and introduced Standard Load Profiles in 2016, low-voltage household and non-household customers have the right to change their electricity supplier and bid in auctions in which electricity is traded at freely negotiated prices. Despite this, the market segment for trading at regulated prices is substantial, with a share of approximately 40 % of net electricity generation. In connection with this, in 2020 a process of phasing out regulated prices for household and small industrial consumers will be launched. Full liberalisation is expected

to be achieved over a period of three to five years. The derogation under Article 5(6) of Directive (EU) 2019/944 on common rules for the internal market for electricity is a temporary measure with a time horizon until the full liberalisation of the retail market for electricity.

The staged elimination of regulated prices for all end consumers and of the prices for producers will boost competition among electricity suppliers. The full liberalisation of the electricity market will create conditions for enhanced system flexibility by securing conditions for achieving competitive prices while increasing liquidity on the electricity exchange.

It is a precondition for achieving the objective for full electricity market liberalisation in the common European energy market.

Integration and coupling of electricity markets

In order to achieve interconnectivity targets, Bulgaria has taken specific measures to achieve electricity market integration at regional level and plans to enhance interconnectivity with Romania, Greece and North Macedonia. The respective projects are at different stages of implementation. In some cases, project implementation depends on the development of the electricity markets in the respective countries.

Table 22: *Coupling of the electricity market*

Draft	Stage of implementation:
Bulgaria – Romania **Day-ahead market**	Bulgaria participates in the Multi-Regional Coupling (MRC) and is technically prepared to launch a day-ahead market integration project. Bulgaria and Romania are implementing market coupling activities under a bilateral project, which is expected to be completed by the end of 2020.
Bulgaria – Romania **Intraday market**	Bulgaria is part of the LIP 15 local project and has established a common intraday cross-border market with Romania, which has been fully operational since November 2019.
Bulgaria–Greece **Day-ahead market**	The market coupling between Bulgaria and Greece will be possible after Greece introduces a day-ahead market, which is expected to take place in 2021.
Bulgaria–North Macedonia **Day-ahead market**	The coupling of the electricity markets of Bulgaria and North Macedonia depends on the establishment of an electricity exchange and a day-ahead market in the neighbouring country, which is expected to take place in 2022.
XBID project	The participants in the Single Intra-day Coupling (SIDC) project [formerly known as XBID] are the electricity exchange operators and electricity system operators of all EU Member States. Implementation of the LIP 15 local project: since 19 November 2019 the Bulgarian—Romanian border became part of the so-called second wave [of countries] that jointed XBID. The Bulgarian—Greek border is

Draft	Stage of implementation:
	expected to join by the end of 2020.
Trilateral market coupling Bulgaria – Serbia – Croatia	Launch and participation in a project for trilateral market coupling of day-ahead markets of the bidding zones of Bulgaria, Serbia and Croatia.

Regulation (EU) 2019/943 on the internal market for electricity sets a minimum cross-border transmission capacity margin of 70 % electricity transmission capacity, which respects operational security limits and takes into account contingencies. The criterion will be applied from [the beginning of] 2026. In addition, Article 15 of the Regulation requires the adoption of an action plan to adjust to the 70 % margin.

In this context, the Bulgarian electricity system operator has applied for a derogation under Article 16(9) of Regulation (EU) 2019/943. The derogation is subject to approval following consultations with the regulatory bodies of neighbouring countries. The maximum period of the derogation is one year.

Liberalisation of the market in natural gas

The liberalisation of the market in natural gas occupies an important place in the European energy policy and is associated with the strategic goals for improved security of supply, diversification of natural gas supply sources and routes, and with the development of an interconnected and single European gas market. By expanding gas interconnections, diversifying natural gas supply sources and establishing a gas hub, conditions for the operation of a liquid exchange for trading in natural gas will be created.

With a view to implementing the Balkan gas hub concept, Bulgaria has already established a natural gas exchange, which will create a competitive environment for both consumers and traders in natural gas. The exchange has been operational since 1 December 2019. On 2 January 2020, multilateral trade commenced via the trading platform of Balkan Gas Hub EAD, including in the so-called short-term (spot) and long-term segments. An option for trading via gas brokers is also available.

In line with the description set out in Section 2.4.2 the development plan for the period 2019—2028 published by Bulgartransgas EAD aims to expand and upgrade gas transmission infrastructure, further develop interconnection points and increase gas storage capacity.

The achievement of these goals will create the necessary conditions for the operation of the Balkan regional gas distribution centre. This will create a competitive market in natural gas, providing more opportunities to market participants, along with price incentives promoting liquidity in the market in natural gas.

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

In accordance with the requirements laid down in Regulation (EU) No 2019/943 and Directive (EU) 2019/944 on the internal market for electricity and in order to fully liberalise its electricity market, Bulgaria will strive to promote the participation of retail clients in consumption optimisation through aggregation. It will also adopt rules granting final customers, including those offering consumption optimisation through aggregation, [access to] all electricity markets on the same terms as those available to producers.

iii. Where applicable, national objectives with regard to ensuring that consumers participate in the energy system and benefit from auto-production and new technologies, including smart meters

Bulgaria further aims to progressively eliminate the regulatory and trade barriers, which currently prevent consumers from using, storing and selling electricity they have produced and thereby participating in the market with a view to enhancing the flexibility of the system through energy storage and consumption optimisation.

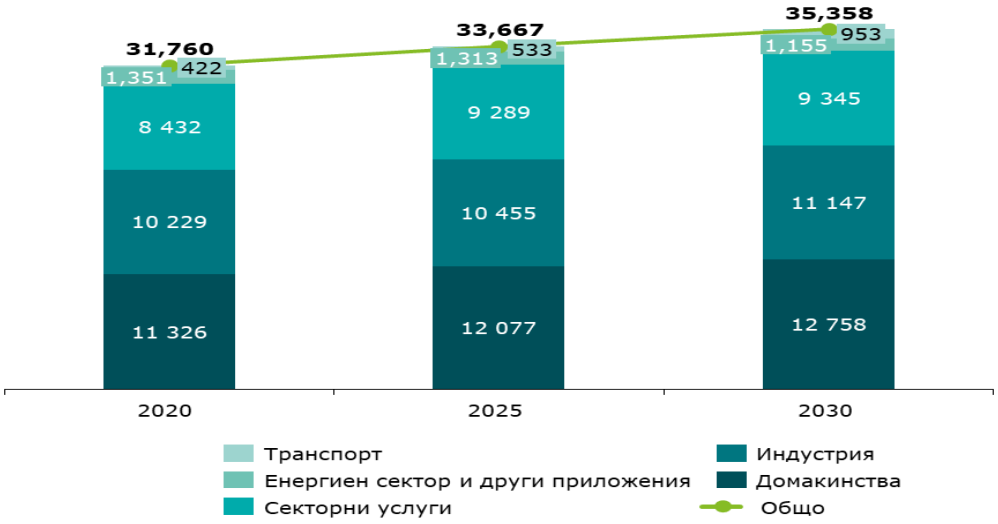
With a view to encouraging a more active and effective participation of energy consumers in the market, additional measures will be taken (further details are set out in section 3.4). These measures include:

- Promotion of local energy communities within the meaning of Directive (EU) 2019/944 and adopting rules on their establishment and functioning;
- Creating options, such as dynamic electricity pricing and aggregation contracts, developing platforms that enhance the transparency of information, particularly for the benefit of consumers and micro enterprises.
- Developing a regulatory framework that creates incentives for consumers.

The measures are intended to complement the process of liberalisation described in detail in section 2.4.3.i.

The achievement of these goals is particularly important in lights of projections, which indicate that in the period 2020—2030 domestic electricity consumption will increase by 11 %, reaching 35 358 GWh. The highest increase is expected in the household and industrial sectors which, will retain their combined share of two-thirds of total consumption. Consumption in transport will double to approximately 953 GWh in 2030.

Figure 18: *Increase in domestic electricity consumption (GWh)*



Transport	Industry
Energy sector and other applications	Households
Sectoral services	Total

Source: (B)EST model, E3-Modelling

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

The full liberalisation of the electricity market will create conditions for enhanced system flexibility by securing conditions for achieving competitive prices while increasing liquidity on the electricity exchange.

The flexibility of the system will be enhanced by developing balancing facilities, increasing energy storage capacity and improving energy management skills.

In order to alleviate internal overloads and increase interconnection capacity, network capacity will be upgraded.

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

In line with Third Liberalisation Package of the EU, Bulgaria took steps toward full liberalisation of its electricity market. The phasing out of regulated prices for all end consumers will boost competition among electricity suppliers while exposing consumers to greater price volatility. In this regard, Bulgaria will strive to provide adequate protection to vulnerable household consumers of electricity.

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

A definition of vulnerable users, criteria for identifying them and measures for their protection are currently being developed.

Bulgaria is currently implementing a support scheme for persons who meet certain income-tested and property-based criteria for poverty, granting heating allowances to eligible recipients via the social assistance system throughout the heating period.

The electricity market in Bulgaria is partly liberalised, with a regulated share of 40 %. The retail electricity market in Bulgaria is partly liberalised. In line with Third Liberalisation Package of the EU, Bulgaria took steps toward full liberalisation of its electricity market. Since 2007, all final consumers, including households, have been able to purchase electricity at agreed prices and freely choose their electricity supplier. Despite this, for a certain category of final customers, including households, an option is available to purchase electricity from a retailer supplier operating in the respective area at prices regulated by the Energy and Water Regulatory Commission (KEVR).

The phasing out of regulated prices for all final consumers will boost competition among electricity suppliers but it will also expose consumers to greater price volatility. In order to ensure the protection of vulnerable clients, the government will introduce support measures to ensure a smooth transition to full liberalisation (see also section 3.4.4).

In connection with this Bulgaria will seek to achieve:

- adequate protection of people at risk of energy poverty by providing target heating allowances via
- a mechanism for the protection of vulnerable consumers following full liberalisation of electricity prices for final consumers, including households.
- Building stock renovation The renovation of multi-family residential buildings with a view to upgrading them to energy class C will lower the average monthly cost of heating homes and may result in low-income households being able to improve their living conditions sufficiently to be dropped from the category of households at risk of energy poverty;
- improving energy efficiency by complementing the national target under Article 7 of Directive 2012/27/EU through a requirement for the implementation of measures, as a matter of priority, to improve energy efficiency for the benefit of vulnerable clients, including households affected by energy poverty and, when appropriate, in buildings used for social housing.

2.5 Research, innovation and competitiveness dimension

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

There is a clear need for the implementation of the latest energy technologies. Bulgaria aims to accelerate this process in order to speed up transition to clean and highly efficient energy technologies. This is one of the mechanisms for achieving a secure, sustainable, environmentally friendly and highly efficient energy sector. The implementation of new technologies will contribute to lowering technological losses in existing networks, expand the energy market, contribute to finding solutions to the challenges of decarbonisation, lower energy costs for consumers and reduce harmful emissions, thereby improving quality of life for citizens.

In connection with this, the goals of the Bulgarian government in the area of research, innovation and competitiveness are as follows:

- achievement of the targets set in the 2030 Climate and Energy Package and development of a low-carbon economy in the long run;
- achievement of the Energy Union targets for increased security of energy supply and improved energy and resource efficiency in transport;
- promotion of the development of innovations, their subsequent commercialisation and the technological renewal of enterprises;
- support for local industries for the introduction of low-carbon technologies and for the public administration and household sectors for the use of new highly efficient energy-saving technologies;
- improvement of ambient air quality;
- introduction of new energy-saving technologies that improve the quality of life and working conditions of Bulgarians;
- introduction of new insulating materials for glass surfaces;
- building smart grids for automated electricity system control to be used by both energy suppliers and consumers with a view to ensuring the highest possible standard of electricity supply to consumers and utilising to the maximum extent possible energy from renewable sources. The ultimate goal is to upgrade and automate existing electricity systems.
- construction of storage facilities;
- support for research and innovation in the area of nuclear energy and sustainable and safe management of nuclear waste;

- enhancing the competitiveness and market positions of Bulgarian industry and promoting the development and manufacturing of innovative products with high added value;
- preserving the competitiveness of basic energy-intensive industries and limiting the risks of 'carbon leakage';
- developing electric cars and hydrogen technologies;

ii. Where available, national 2050 objectives related to the promotion of clean energy technologies and, where appropriate, national objectives, including long-term targets (2050) for deployment of low-carbon technologies, including for decarbonising energy and carbon-intensive industrial sectors and, where applicable, for related CO_2 transport and storage infrastructure.

There are no national targets in this area

iii. Where applicable, national objectives with regard to competitiveness

Not applicable

3. POLICY MEASURES

3.1 Decarbonisation Dimension

3.1.1 GHG emissions and removals

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

The INECP scenario envisages a limited number of decarbonisation specific measures. The existing and planned measures in the energy sector, which generates most GHG emissions, will have a major contribution to decarbonisation. Existing measures for decarbonisation will be extended until 2030 and will complement the measures supporting RES sector transformation and other dimensions of the Energy Union, notably energy efficiency, the internal market and energy security, which are described in detail in the sections below. Furthermore, Bulgaria's strategic documents for the period after 2021 will include measures which ,coupled with the main target, could have a positive impact on GHG emissions reduction targets. The strategic documents concerned include

the National Integrated Transport Programme with a time horizon until 2030 and the National Air Pollution Control Programme 2020—2030. Additional information about planned policy measures in the transport sector is also expected to become available. The relevant sector specific policy measures are listed below.

Transport sector

The main objectives of GHG emissions reduction policy in the transport sector are to:

- boost the production of electric and other environmentally friendly vehicles;
- boost the use of/demand for new environmentally friendly vehicles;
- accelerated deployment of the infrastructure for charging electric and hybrid cars;
- promote research and development in the area of environmentally friendly vehicles and toll systems;
- organise awareness campaigns and build stakeholder capacity for development of resilient mobility.

Integrated Transport Strategy by 2030

The Strategy outlines the main areas for development of the national transport system in the period until 2030.

It defines three strategic objectives that cover 9 strategic priorities, each comprising a framework of targets (tasks). Based on this, it identifies the most appropriate measures to achieve the objectives concerned.

The strategic objectives of the transport policy by 2030 are as follows:

- increase the efficiency and competitiveness of the transport sector;
- improve transport connectivity and accessibility (both internal and external);
- reduce the adverse effects of transport sector development.

The strategic priorities in transport development are as follows:

- effective maintenance, modernisation and development of transport infrastructure;
- improved management of the transport system;
- development of intermodal transport;
- improved conditions for application of the principles of transport market liberalisation;
- reduced fuel consumption and increased energy efficiency in transport;
- improved connectivity of the Bulgarian transport system with the single European transport area;
- ensuring quality and accessible transport in all regions of the country;

- limiting the negative impact of transport on environment and human health;
- strengthening the security and safety of the transport system.

A National Transport Model developed for passenger and freight transport and applicable to individual modes of transport in the country, international transport and transit transport was prepared as part of the strategy.

Promoting sustainable urban mobility

The measures in the transport sector with immediate effect are as follows:

- rehabilitation and modernisation of the existing road infrastructure to ensure optimum speed and optimum mode of operation of car engines;
- implementing smart transport systems in the national and urban road networks;
- increasing the share of public electric transport: rail, trolleybus, tram, and underground;
- boost the development and construction of intermodal terminals for combined transport;
- increase the share of biofuels.

Intelligent transport systems (ITS) cover a wide range of technical solutions intended to improve transport by improving mobility and increasing traffic safety. Telematics (a combination of telecommunications and informatics) uses state-of-the-art technologies to meet transport needs. Intelligent transport systems and telematic solutions help improve road safety, boost the efficiency of the existing infrastructure and contribute to reducing pollution by means of traffic control and traffic flow management.

Intelligent transport systems in urban conditions can include integrated management of public transport charges, advanced management of customer relations, traffic forecasts, improved traffic management, information on passengers and collection of road tolls. These systems apply modern technologies for gathering more and better data, for analysing said data and for connection through more efficient networks. The outcome is more efficient and effective traffic with a stronger focus on customers. The measures will be financed by EU funds, complemented by public co-financing from the budgets of central and local government, and in some cases the green investment scheme and private investments. The following schemes are implemented within the framework of the Climate Investment Programme:

- Scheme for the improvement of energy efficiency of buildings and other sites (Energy Efficiency Scheme, EES);

- Scheme promoting the use of electric vehicles (Electric Vehicles Scheme, EVS).

Road toll system

The Road Infrastructure Agency will introduce an electronic toll system for motor vehicles in 2019.

From 1 January 2019 motor vehicles up to 3.5 tonnes will have to buy an e-vignette to use road infrastructure and will be charged on a time basis.

The new policy measures to be introduced and existing policy measures in the transport sector are as follows:

- Upgrading the car fleet in Bulgaria by adopting legislation that allows solely the import of vehicles that comply with EURO 4 and higher emission standards in line with the National Air Pollution Control Programme 2020-2030.
- Establishing Low-emission zones (LEZ) in large urban agglomerations to limit the demand for drivers of passenger vehicles that conform to the EURO and EURO 1 emissions standard (diesel vehicles) and enable access to city centres in accordance with the National Air Pollution Control Programme 2020-2030.
- Promotion of the use of hybrid electric vehicles in line with the Third National Climate Change Action Plan (the measure should be promoted beyond 2030) and the strategic plans submitted by the Ministry of Transport;
- Fiscal policy incentives for the economy aiming to limit the consumption of conventional fuels in n line with the Third National Climate Change Action Plan 2013-2020 (the measure should be promoted beyond 2030).
- Decreasing the volume of freight transported by road at a distance of more than 300 km by diverting it to more environmentally-friendly modes of transport, such as rail transport, in line with the Third National Climate Change Action Plan 2013-2020 (the measure should be extended beyond 2030) and the strategic plans submitted by the Ministry of Transport;
- Facilitating the informed choice of motor vehicles to increase the number of vehicles that conform to higher emission standards (corresponding to EURO 4, 5 or 6).

Industry sector

The measures in the industry sector aim to achieve:

- higher energy efficiency and lower heat losses in the industry sector;
- increased use of natural gas in industry through new gas infrastructure
- use of alternative fuels;
- creating a technological park by introducing incentives to encourage the private sector to invest in research and development and in innovation in widely used production methods aimed at optimum resource efficiency;
- promoting the exchange of good practices between enterprises in reference to efficient use of inputs in production.

- Systems for monitoring of energy use in industry
- Energy efficiency audits and implementation of the measures prescribed

In addition to the EU Emissions Trading Scheme, EU law on industrial emissions (integrated prevention and control of pollution), the reduction of fluorinated greenhouse gases and the control of substances that deplete the ozone layer also contribute to lowering GHG emissions and air pollutants.

Agriculture sector

The Agricultural Producers Support Act (ZPZP) governs State support for agricultural producers with regard to the measures included in the National Plan for Development of Agriculture and Rural Areas. Support is provided to agricultural producers operating and registered in disadvantaged areas or areas covered by the Natura 2000 network.

The ZPZP specifies some of the activities through which the measures intended for the agricultural sector and those related to the production of biofuels can be implemented. It also establishes the main financial mechanism for the management of agricultural activities. Most of the proposals for restoration of damaged farm areas or for introduction of water-saving irrigation technologies, regardless of whether in relation to the introduction of best practices for rice production or the promotion of crop rotation, particularly with nitrogen-fixing crops, can be implemented through the financial mechanisms established by the ZPZP.

According to the Agricultural Land Protection Act the intended use of farmland may be altered only in certain special cases.

The burning of stubble and other crop residues in agricultural land is prohibited. The tenants of farmland are responsible for the burning of stubble and other crop residues in agricultural land and must participate in putting out the fires.

The owners and tenants of farmland are entitled to tax and credit reliefs when they fulfil mandatory restriction of farmland use and implement projects for restoration and improvement of farmland fertility.

The legal framework established by the Act covers some of the activities intended for the agriculture sector, such as tackling the burning of stubble and crop residues and promotion of agricultural practices aimed at reducing greenhouse gas emissions.

The measures set out in the Third National Climate Change Action Plan 2013-2020 aim to lower emissions from all main sources of emissions in the sector. The measures are in line with the situation in the sector and the top CAP priorities for the period from 2014 to 2020. One of the major challenges facing the CAP is to find a solution to the increasingly deteriorating production conditions in agriculture due to climate change and the need for the farmers to reduce their share of greenhouse gases and play an active role in climate change mitigation, and to supply energy from renewable sources.

Based on the analysis of the main sources of emissions in agriculture, the following two main objectives are set:

- to reduce and/or optimise the emissions in the agriculture sector;
- to raise the awareness of both farmers and administration regarding actions and their impact on climate change.

The following priorities relate to these main objectives:

- Reducing farmland emissions.
- Reducing methane emissions from biological fermentation in livestock breeding.
- Improving manure management.
- Optimising the use of plant residues in agriculture.
- Improving the management of rice fields and rice production technologies.
- Improving the knowledge of farmers and the administration of the methods for emissions reduction in the agriculture sector.

The measures set out in the Third National Climate Change Action Plan with an implementation horizon beyond 2030 and the National Air Quality Control Programme 2020-2030 include:

- Incentives for the use of crop rotation with a focus on nitrogen-fixing crops;
- Management of degraded agricultural land through:
  - biological re-cultivation using grasses that are indigenous to the area; and
  - anti-corrosion measures and soil erosion methods;
- introducing irrigation and water and energy saving technologies, promoting extensive farming;
- implementing measures to reduce methane emissions from biological fermentation in livestock breeding;
- Improving manure use and management;
- introducing low-emission livestock manure processing practices, i.e. composting and anaerobic conversion of livestock manure into biogas;
- raising awareness and improving the knowledge of agricultural producers of the possible use of vegetable residues and the risks of after-crop burning;
- implementing Good Agricultural Practice (GAP) rules to control the ammonia emissions released into the air from agricultural sources in accordance with the ECE Framework Advisory Code of Good Agricultural Practice for Reducing Ammonia Emissions:
  - good practices for manure application / use of low-emissions livestock manure and more rigorous application of the Nitrates Directive)
  - good practices for the management of livestock manure.

Waste management sector

The following measures set out in the Third National Climate Change Action Plan 2013-2020 will continue to be implemented and will be further developed until 2030:

- extending and expanding the scope of the separate collection of 'green' waste in municipalities;
- biogas capture and burning in all new and existing regional landfills;
- biogas capture in old municipal landfills scheduled for closure;
- assessing the energy potential of biogas from the landfills scheduled for closure;
- introducing anaerobic sludge stabilisation through biogas capture and incineration in new installations and installations undergoing reconstruction in agglomerations of more than 20 000 population equivalent;
- constructing municipal biodegradable waste recovery facilities with capacity for energy generation and the production of compost;
- introducing differentiated charges for generated waste.

The main targets for the Waste sector are set out in detail in the National Waste Management Plan 2014-2020 and in the detailed programmes and measures put in place to ensure its implementation. The plan and the respective programmes will be updated and in the period 2021—2030 efforts will continue with greater intensity to ensure achieve the targets set. The main targets envisage a significant increase of the share of waste for recovery and recycling over the years and utilising Bulgaria's significant potential for waste management improvement and prevention of waste generation.

The implementation of the following programmes of measures is expected to continue as part of the implementation of the national plan:

- National Programme for the prevention of waste generation;
- Programme for achievement of the targets for preparation for re-use and recycling of paper, metal, plastic and glass municipal waste;
- Programme for achievement of the targets for biodegradable waste;
- Programme for achievement of the targets for recycling and recovery of ordinary waste;
- Programme for improvement of the hierarchy for the management of other waste flows and reducing the environmental effects of landfills.

More efforts will be focused on the implementation of the programme for achieving the targets and requirements for biodegradable waste. Achievement of the quantitative targets for waste separation, recycling and recovery of municipal waste. The goal is to reduce the share of biodegradable waste and limit the quantity of biodegradable waste going to landfill and to expand and upgrade existing landfills.

Energy sector

Most of the measures with an impact on decarbonisation intended for the energy sector are included in the sections on renewable sources, energy efficiency, the internal

market and energy security below because the changes in these dimensions lead to overall GHG emissions reduction. In addition to the measures set out in the sections below, there are a number of additional measures with an indirect positive impact on reducing GHG emissions. All of the following measures from the Third National Climate Change Action Plan 2013-2020 are assumed to have been extended until 2030:

- Reconstruction of district heating cogeneration systems and boilers with natural gas turbines;
- Reducing losses in distribution and transmission networks;
- Reducing losses in heat transmission networks;
- Transition from coal to natural gas;
- Increasing high efficiency cogeneration;
- Increasing the share of heating and cooling from renewable sources;
- Improving the generation efficiency of the existing coal power plants.

Summary of the policies and measures in the household sector and the public sector

- Household gasification;
- Installation of solar collectors;
- Implementation of the measures of the Accelerated Gasification Programme (PAG) in Bulgaria;
- Renovation up to the annual percentage set for public and State-owned buildings (with a total floor area exceeding 250 square metres) after the entry into force of the energy efficiency directive;
- Introducing a binding energy efficiency scheme (reducing fuel and energy consumption in final energy consumption);
- Earlier entry into force of the Eco-design Regulation (2015/1185) and introducing mandatory accelerated discontinuation of the use traditional polluting heating devices (stoves) in line with the National Air Pollution Control Programme 2020-2030;
- Introducing a national standard for the quality of fuels used in heating systems, surrogate measures to lower humidity in firewood used in municipalities that do not meet air quality criteria (PM_{10}) and, tentatively, of a standard for the maximum humidity in firewood in line with the National Air Pollution Control Programme 2020—2030;
- [Providing support to] the households affected by the mandatory discontinuation of the use of traditional burning stoves in the transition to heating systems fired by natural gas (reconnection and building new network extensions), district heating (reconnection and building new network extensions) or heating devices that conform to eco-design requirements in line with the National Air Pollution Control Programme 2020—2030;

The use of fuels other than conventional fuels for primary energy production requires parallel implementation of the following measures:

- Development and adoption of a national analysis of the potential for the sustainable biomass from all sectors (incl. but not limited to forests and agriculture) and relevant sustainability criteria, taking into account the sustainability criteria set out in Directive (EU) 2018/2001;
- Alignment between strategic documents relating to the management and use of forests. When reviewing, updating and developing strategic documents, ensure that the documents concerned are consistent with each other and with the INECP. The strategic documents subject to review, updating or alignment with the INECP may include: the Forestry Sector Report, the Annex to the Action Plan to Bulgaria's National Climate Change Adaptation Strategy, the National Strategy for Development of the Forestry Sector, the National Action Plan for Energy from Forest Biomass, and the National Action Plan for Renewable Energy;
- Alignment between strategic documents relating to the agricultural sector. When reviewing, updating and developing strategic documents, ensure that the relevant documents are consistent with each other and with the INECP. The strategic documents to be reviewed, updated and aligned with the INECP may also include plans for the implementation of the Common Agricultural Policy in the period after 2020;
- Alignment between strategic documents relating to the waste sector. When reviewing, updating and developing strategic documents, ensure that the relevant documents are consistent with each other and with the INECP. The strategic documents to come up for review, update and alignment with the INECP may include: The Waste Management Plan and the respective implementing programmes thereto, such as the Programme for achievement of biodegradable waste targets, including biological waste targets and the Programme for improvement of the hierarchy for the management of other waste flows and reducing the environmental effects of landfill for the period after 2020.

The implementation of the additional measures set out above is expected to have a positive impact on primary energy production and on LULUCF sectors.

<u>Land use, land use change and forestry sector</u>

Forestry Act

Forest activities are subject to planning. Forest planning is implemented at three levels and includes a National Strategy for Development of the Forestry Sector, a strategic plan for the development of the forestry sector and regional plans for forest development and forest plans and programmes.

The forest management plans and programmes define a maximum permitted level of use of forest resources to achieve the forest management objectives over a period of 10 years. The ZG prohibits any reduction in the total percentage of forest land in the country. Land use change in forest areas is possible only in a limited number of specific cases.

National Strategy for Development of the Forestry Sector in the Republic of Bulgaria 2013—2020

The strategic document is based on EU and national policies and strategic documents relating to forests and forestry in Bulgaria, the main principles and analyses relating to the Bulgarian forestry sector conducted between 2006 and 2011, the vision, mission and objectives, the priorities and measures, and the sources of financing to achieve the objectives of the strategy and the monitoring of its implementation.

Strategic Plan for the Development of the Forestry Sector 2014—2023 (SPRGS)

The plan was developed with grant assistance from the European Social Fund for project 'Strategic planning in the Bulgarian forests — a guarantee for effective management and sustainable development' implemented under Operational programme Administrative Capacity.

The implementation of the operational objectives within the relevant budget, the timetable, the expected results, the performance indicators, the responsible institutions and the stakeholders are laid down in the following specific sub-activities of the SPRGS:

Operational objective 1: 'Increasing forest areas, timber stocks and carbon stocks in forest areas';

Operational objective 2: 'Improving forest management and use';

Operational objective 3: 'Enhancing the efficiency 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'.

These operational objectives and activities are expected to have a direct and sometimes indirect positive effect on the adaption of forest ecosystems to climate change and on reducing the adverse impact of climate change, including by increasing the absorption of greenhouse gases from the atmosphere.

The existing provisions of the Agricultural Land Ownership and Use Act provide that every year municipal councils adopt a decision on the rules for the use of meadows and grasslands. These provisions cover:

- a prospective pasture action plan;
- parts of grasslands and pastures mainly intended for mowing;
- measures to preserve, maintain and improve grasslands, including clearing bushes and other undesired plant species, anti-erosion activities, spreading of

fertilisers, temporary fencing;

- parts of grasslands and pastures intended for artificial lawns for sowing appropriate grass mixtures;
- manner of use, prohibitions and restrictions depending on the landscape, soil, climate and other environmental conditions.

Regarding arable land, Article 7 of the Agricultural Land Ownership and Use Act stipulates that agricultural land which is eroded, polluted, salinated, with high acid content or with excess moisture in the surface layer shall be recovered and improved through a set of activities or technologies, acting in line with pre-designed, coordinated and approved technologies and projects approved by an Expert Council.

Planes, quarries and other areas with disturbed soil profile, tailing ponds, landfills and other waste disposal sites, old riverbeds, routes of abandoned canals, roads, railways and construction sites after removal of engineering equipment, claddings and superstructures are subject to revegetation. Revegetation is to be done on the basis of an agreed and approved project which is an integral part of the design for the development of the site. The procedure for use of humus after its removal, the procedures for revegetation, land improvement and acceptance of restored areas are laid down in Regulation No 26 on land revegetation, improvement of low productivity land, humus layer removal and recovery.
One of the key strategic documents, which sets out measures for land use, land use change and forestry is the Third National Climate Change Action Plan 2013-2020 (NPDIK). The following measures set out in the Plan will continue to be implemented after 2030:

- Use of 'non-afforested areas intended for afforestation' in forest territories;
- Afforestation of abandoned agricultural lands, barren and deforested areas, areas affected by erosion and areas at risk of erosion outside forest territories;
- Increasing the area for urban and suburban parks and green spaces;
- Recovery and sustainable management of wetlands Protection and conservation of wetlands in forest territories, peat bogs, swamps;
- Recovery and maintenance of protective woodland belts and new anti-erosion afforestation.
- Increasing the density of the natural and artificial plantations listed above.

ii. Where relevant, regional cooperation in this area

Regional cooperation in this area is considered unfeasible.

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 Renewable energy

To achieve the national target of a 27.09 % share of renewable energy in gross final energy consumption by 2030, both the existing and additional policy measures will be implemented.

The policies and measures take account of the priorities and guidelines in the new European energy and climate policy and are in line with the experience gained and results achieved from hitherto pursued policies and measures in the area of generation and consumption of energy from renewable sources. The aim is to achieve a cost-effective development of renewable energy as an important part of the EU decarbonisation policy by 2030.

In the period 2021—2030, the development of the electricity sector will take into account of the capacity for maximum integration of the renewable energy generated in the energy market, decentralised electricity generation and the provision of renewable electricity to consumers at the lowest possible price. An enabling framework was developed to promote and facilitate the development of renewables self-consumption and establish renewable communities.

To ensure wider and annually increasing penetration of renewables in the heating and cooling sector, priority will be given to the commissioning of highly efficient heating and cooling installations, the deployment of innovative technologies using geothermal, hydrothermal and solar energy and the use of waste heat and cold. The use of biomass for centralised and local heat generation will increase in compliance with the requirements laid down in Article 28(2) to (7) and (10) of Directive (EU) 2018/2001.

In order to achieve a share of 14.20 % of energy from renewable sources, the transport sector will encourage the penetration of new generation biofuels, renewable liquid and gaseous fuels of non-biological origin for transport, recycled carbon fuels and renewable energy supplied to the road and rail transport. Consumption of these fuels and energy should contribute to achieving the targets of the policy of energy diversification and decarbonisation of the transport sector. To ensure the use of electricity from renewable sources in transport, the government will focus its efforts on the deployment of electric mobility, developing and promoting the use of public electric transport and accelerating the integration of modern technologies into the railway sector.

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

(1) Support schemes

In the period 2021—2030, support will continue to be provided in the form of preferential prices under contracts already concluded for the purchase of renewable electricity generated by power plants with a total installed capacity of less than 1 MW. During this

period granting preferential prices and purchasing electricity under long-term contracts is only envisaged in the case of commissioning new facilities with a total installed capacity of up to and including 30 kW intended to be installed in existing buildings in urban areas, including on the roofs and facades of such buildings and in the land plots in which they are situated.

Renewable electricity generation by power plants with a total installed capacity of 1 MW and above 1 MW for which long-term contracts for purchase at preferential prices have been concluded will be promoted through a premium for the quantity of electricity sold on the exchange. Support will be provided until the expiration of the time limit set in the contracts for the purchase of electricity.

The remaining budget for supporting electricity generation from renewable sources for the period 1 January 2019 until the expiry of the periods agreed in the contracts for the purchase of electricity from renewable sources at preferential prices during which premiums will continue to be paid is EUR 4 970 746 000[10].

In the future, wind farms and solar and biomass plants will be constructed in line with market principles, without any investment or operational financial aid being granted to investors.

The option for holding auctions to provide capacity for renewable electricity generation and the provision of a premium to the market price of electricity sold on the electricity market are considered to be appropriate forms of support.

The above support schemes will be in line with the requirements of the applicable European state aid rules and guidelines.

The annual progress towards achieving the target for a share of energy from renewable sources in gross final energy consumption will be subject to analyses in the biennial reports of the INECP; if it is found that the target is not met and a need of new energy facilities exists, a procedure for starting a support scheme through auctions may be launched.

(2) Development of electricity transmission and distribution infrastructure, of smart networks, of storage facilities and interconnectors

The need to support the integration of renewable electricity into the transmission and distribution networks, the need for a more extensive use of smart networks and use of energy storage systems was identified and will be among the primary and important measures in the period 2021—2030. In this period, the pace of building new power plants generating renewable energy is expected to slow down compared to 2010—2018. In turn, this entails better and timely planning and building of the infrastructure required to ensure smooth connection and transmission of the renewable electricity generated. The Electricity System Operator and the operators of distribution networks envisage

[10]State aid SA.44840 (2016/NN) — Bulgaria Support for the Production of Energy from Renewable Sources, which has been approved by the European Commission

measures and investments necessary to ensure a secure and reliable operation of the electricity system in Bulgaria while taking account of the increased number of power plants generating renewable energy, including wind and solar power. The measures concerned are included in their respective development plans.

In order to ensure that the necessary electricity storage facilities are available, efforts will be focused on developing existing and adding new storage capacity. The implementation of the Yadenitsata project will enable the further development of electricity generation from renewable sources in line with the long-term strategies for energy sector development in Bulgaria and the European Union.

Detailed information is set out in section 3.3 'Energy security dimension'.

4) Requirements for the use of renewable energy in buildings

The promotion of the use of renewable energy in buildings will continue over the entire time horizon of the Plan. The ZEVI contains the requirement for use of renewable energy, where this is technically feasible and economically viable, when new buildings are built or existing buildings are reconstructed, undergo major renovation, overhaul or refurbishing. It requires that at least 15 per cent of the total heating and cooling energy needed for the building be produced from renewable sources by installing:

- district heating fuelled by biomass or geothermal energy;
- individual facilities for burning 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 near-surface geothermal systems.

The Energy from Renewable Sources Act requires analyses of the possibilities of using renewable energy to be carried out when part 'Energy Efficiency' of investment designs for new buildings or for reconstruction, major renovation, overhaul or refurbishing of existing buildings is prepared and when the energy efficiency of existing buildings is audited. The analysis of the possibilities for using renewable energy is part of the evaluation indicators of annual energy consumption in the building.

The requirement for the use of renewable energy in buildings has been further developed with the adoption of the new Energy Efficiency Act in 2015, which introduced a definition of nearly zero-energy buildings into national law. According to the definition a nearly zero-energy building is a building that simultaneously satisfies the following requirements:

(a) the energy consumption of the building, defined as primary energy, complies with the requirements for Class A energy performance on the scale of energy efficiency classes for buildings of the relevant type;

(b) not less than 55 per cent of the energy consumed (supplied) for heating, cooling, ventilation, domestic water heating and lighting is energy from renewable sources produced on-site or near the building.

Directive 2010/31/EU stipulates a requirement according to which after 31 December 2018 all new buildings occupied and owned by public authorities must be nearly zero-energy buildings and after 21 December 2020 all new buildings must be nearly zero-energy buildings.

The precision of current legislative requirements for the use of renewable energy in buildings will be improved in order to achieve the goal for EU building stock decarbonisation.

According to the Renewable Sources of Energy Act where projects for the upgrade of production processes in small and medium-sized enterprises are implemented, the energy efficiency measures need to be combined with the commissioning of plants for production of heat and cooling from renewable sources that is sufficient to meet the technological needs of the enterprise.

4) Strengthening the role of central and local authorities to enable a higher penetration of renewable energy

The contribution of the local authorities to a higher penetration of renewable energy and to the creation of conditions for renewables self-consumption and consumption of renewable energy by separate 'renewable energy communities' at local level is essential for the cost-effective development of renewable energy in the country. Directive 2009/28/EC and the new Directive*EU) 2018/2001 require that opportunities for the use of renewable energy be considered when planning, designing, building and renovating urban infrastructure, including industrial, commercial and residential areas, and energy infrastructure, with a special focus on the use of heating and cooling from renewable energy sources.

In this regard, the ZEVI creates an obligation for central and local government authorities to take measures to ensure that, effective from 1 January 2012, the new buildings occupied by the public service, as well as the existing public service buildings undergoing reconstruction, major renovation, overhaul or refurbishment play the role of models for achieving the objectives of the Act. This obligation can be implemented by meeting the standards for housing buildings with zero consumption of energy or by ensuring the use of the roofs of such buildings or multi-purpose buildings, including public service buildings, by third parties for installing units for generation of energy from renewable sources.

Local authorities will remain actively engaged in the implementation of government policy in the area of renewable energy throughout the implementation period of the INECP, ensuring that they fulfill their obligations and responsibilities under the ZEVI by developing long-term and short-term municipal programmes for promotion of the use of energy from renewable sources and biofuels within each municipality.

5) Introducing a simplified procedure for grid connections when installations of renewables self-consumers and demonstration projects that use renewable energy with an electrical capacity of 10.8 kW or less are to be connected to electricity distribution networks

Directive (EU) 2018/2001 requires that a simplified procedure be introduced when renewable energy self-consumers and demonstration projects that use renewable energy with an electrical capacity of 10.8 kW or less are to be connected to electricity distribution networks. This requirement will be considered and the existing statutory requirements will be streamlined.

At present the ZEVI provides for a simplified procedure for connection of installations with a total installed capacity of up to and including 30 kW, envisaged to be mounted on roof and facade structures of buildings connected to the electricity distribution grid and in real estate adjacent to such buildings in urbanised areas.

6) Assessment of the potential energy from renewable sources and the potential use of waste heating and cooling in the heating and cooling sector

This assessment will be part of the second comprehensive assessment in accordance with Article 14(1) of Directive 2012/27/EU to be developed by 31 December 2020.

7) Access to and operation of grids

Article 18(2) and (3) of the ZEVI provides for incentives for the development of gas generation from renewable sources and generation of renewable heating and cooling in the country. The incentives referred to above will be extended beyond 2020 and during the process of transposing Directive (EU) 2018/2001 into national law the need for amendments to legislation with a view to increasing the share of renewable energy in the heating and cooling sector will be discussed.

8) Creating conditions for renewables self-consumers and renewables communities

The interest of Bulgarian consumers in generating renewable electricity for self-consumption is low and this method of electricity consumption is still underdeveloped. The ZEVI provides an opportunity to build small units that use renewable sources for joint electricity generation, consumption and sale.

The ZEVI currently in force provides the producer with the opportunity to declare that the generated renewable electricity will be used for self-consumption when filing an application to the operator of the electricity network for exploring the conditions and manner of connection. Also, shorter time limits for connection are envisaged and no building and use permits are required for small systems with an installed capacity of up to 30 kW (Article 24(1) of the ZEVI). Construction permits are issued on the basis of an opinion issued by a structural engineer. The quantity of electricity that is not used for self-consumption shall be purchased by the respective end supplier at a price set by the KEVR according to the conditions and the procedure laid down in the respective regulation referred to in Article 36(3) of the Energy Act.

In 2019, Article 147(1)(14) of the Spatial Development Act (ZUT) was amended. The cited provision currently stipulates that 'no approval of investment projects for the issuance of building permits shall be required for the installation of units for the generation of renewable electricity and heating and/or cooling with total installed capacity of up to and including 1 kW installed in existing buildings in urban areas, including on the roofs and facades of such buildings and in the land plots in which they are situated

For the purpose of undertaking the construction works referred to in Article 147(1)(14) of the ZUT, opinions from a structural engineer, electrical engineer and/or heat engineer, together with drawings, diagrams, calculations and directions for the execution of said works and an opinion stipulating the conditions for connection to the distribution network, must be presented.

With a view to putting in place an enabling framework to promote and facilitate the development of renewables self-consumption, legislative changes are planned in order to streamline legislation and better regulate the rights of consumers. Support will be provided through the possibility to operate in the energy system, facilitating integration into the market, creating favourable conditions to raise public interest in the initiative and developing and putting in place optimal administrative procedures that take into account the specific needs of renewable energy communities, etc.

During the period 2021—2030 opportunities will be sought to fund projects and measures will be undertaken to provide access to the consumption of energy from renewable sources for low-income consumers or vulnerable households through the social assistance system.

9) Promoting the use of heating and cooling energy produced from renewable sources

The Renewable Energy Act promotes the production of renewable energy for heating and through:

- support for and implementation of projects for construction of heat transmission networks in settlements that meet the requirements for a designated area when the economic viability of consumption of heat from renewable sources is proved and a preliminary investment design has been submitted for the heat production;
- support for and implementation of projects for construction of small decentralised heating and/or cooling systems;
- connecting of units for generation of renewable heat to the heat transmission network and purchase by the heat transmission company of the heat generated by another heat producer, where this is technically feasible and economically viable.

The ZE further envisages incentives for high-efficiency cogeneration in the form of preferential prices for the purchase of electricity generated or the payment of premiums for the sale of electricity. An obligation has been introduced for the public supplier of electricity and retailers to purchase electricity from plants with total installed capacity of

less than 1 MW connected to the respective grid. The obligation extends to the entire quantity of electricity from high-efficiency cogeneration. A certificate of origin for the electricity generated issued by the KEVR is required.

The quantities of electricity from high-efficiency combined generation of heat and electricity are purchased up to the amount of the quantities specified by the decision of the KEVR setting the preferential price.

The simplified procedure referred to in Article 147(1)(14) of the ZUT (measure described in point 8) also applies to the generation of renewable energy for heating and cooling by plants with total installed capacity of up to 1 MW, including systems installed in existing buildings in urbanised areas, including on the roofs and facades of such buildings and in the land plots in which they are situated.

The above measures will be extended beyond 2020 and new possibilities will be sought for the development of high efficiency cogeneration, efficient district heating plants and installing local systems in buildings in order to achieve the annual target for the use of renewable energy for heating and cooling set in Directive (EU) 2018/2001. Possibilities will be also sought to replace conventional fuels with energy from renewable sources, if this would lead to efficient and economically feasible production and consumption of heating and cooling.

10) Promotion of the use of geothermal energy

In order to make full use of the potential of this renewable energy source, the implementation of small-scale projects for heat generation by centralised and local systems will be promoted.

Various studies and national strategies show that Bulgaria is rich in geothermal sites, of which 840 water sources with temperature of up to 103 °C have been explored. In addition, there are 136 mineral springs with temperatures in the range between 20 °C and 101.4 °C with various water flow characteristics. At the same time, only 18 % of geothermal energy in Bulgaria is utilised and only 6 % of mineral sources have been explored.

The development of technologies for the utilisation of solutions enabling energy storage in the form of heat in ground reservoirs has been highly dynamic and requires adequate and timely solutions for their economically feasible utilisation, taking national specificities into account.

11) Providing final consumers with information about the energy performance and the share of renewable energy in heating and cooling systems

When the legislation relating to the use of renewable energy is amended, requirements for the provision of information about the energy performance of the renewable source used in the generation of heating and cooling will be introduced for cogeneration plants and district heating plants.

12) Introducing legal requirements for issuance of guarantees of origin for energy from renewable sources

The requirements laid down in Directive 2009/28/EC on the promotion of the use of energy from renewable sources have been transposed in the ZEVI and in Regulation No RD-16-1117 of 14 October 2011 laying down the terms and procedure for the issuance, transfer and cancellation of guarantees of origin for energy from renewable sources. The guarantee of origin is to be issued in order to certify the origin of the electricity and the heating and cooling energy generated from renewable sources. Directive (EU) No 2018/2001 requires Member States to ensure the issuance of guarantees of origin for gas, including hydrogen. In connection with this, the provisions transposing Directive (EU) 2018/2001 in national law will be streamlined and supplemented to bring them in line with the new requirements stipulated in said Directive.

A possibility will be envisaged in legislation for the transfer of guarantees of origin to consumers who wish to prove the origin of the electricity they use.

13) Streamlining the legal framework for application of the stricter requirements stipulated in Directive (EU) 2018/2001 as regards sustainability criteria and GHG emission reductions when using biofuels and liquid, gaseous and solid fuels from biomass.

The provisions of national law that currently transpose the requirements laid down in Directive 2009/28/EC and Directive (EU) 2015/1513 of the European Parliament and of the Council of 9 September 2015 amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources (Directive (EU) 2015/1513) as regards the sustainability criteria of biofuels and liquid fuels from biomass will be streamlined and brought into line with Directive (EU) 2018/2001 to ensure that the requirements for sustainability criteria and GHG emissions reduction have been transposed in full. The legislative acts to be developed for the purpose of transposing Directive (EU) 2018/2001 into national law will stipulate requirements for the sustainability criteria and the reduction of GHG emissions from gaseous fuels and solid fuels from biomass used in the cogeneration of electricity and energy for heating and cooling or in fuels.

The sustainable use of existing wood and agricultural resources and the development of new production systems in forestry and agriculture are encouraged in the production and use of renewable energy, provided that the criteria for sustainability and GHG reduction are met.

Biofuels, non-transport liquid fuels from biomass and gaseous and solid fuels from biomass used to achieve the national target and such biofuels benefitting support schemes must meet the criteria for sustainability and GHG emission reduction.

The introduction of requirements relating to the sustainability criteria for biofuels and for non-transport liquid fuels from biomass is essential to the achievement of the national and European energy policy objectives.

14) Introducing an obligation for fuel and electricity suppliers for achieving the target set for the transport sector

In order to achieve the new, more ambitious targets, specific obligations will be legally imposed on fuel and energy suppliers, which release on the market conventional biofuels, new generation biofuels, liquid and gaseous transport fuels of non-biological origin, renewable electricity and recycled carbon fuels.

At present, consumption of the quantities of biofuels required to achieve the national binding target for 2020 is ensured through an obligation on the persons that place on the market petroleum-derived liquid transport fuels to market petroleum-derived fuels with a bio-component the percentage of which is set forth in the ZEVI, including advanced biofuels. Such an obligation was also introduced for end distributors and for the distributors of petroleum-derived liquid fuels.

In view of the requirements laid down in Directive (EU) 2018/2001, the adopted approach towards achieving the target for the transport sector could be changed by introducing quotas for each supplier of renewable energy.

16) Promoting the use of renewable energy in public transport

In order to achieve the target in the transport sector, local authorities will perform their responsibilities relating to the implementation of the policy on energy from renewable sources and, in keeping with their long-term and short-term programmes, will develop and implement schemes for promotion of the use of energy from renewable sources, including alternative fuels from renewable sources, new generation biofuels, recycled carbon fuels and electricity from renewable sources, and will further develop and promote the use of public electric transport, taking into account the specific conditions in each municipality.

The increase in the use of energy from renewable sources in public transport will be achieved through the implementation of the integrated policy measures envisaged, which are set out in detail in points 3.1.1 Decarbonisation dimension and 3.2 Energy Efficiency dimension

17) Creating conditions for the development and use of advanced biofuels, renewable liquid and gaseous biofuels of non-biological origin and recycled carbon fuels

To ensure that the necessary quantities of advanced biofuels, renewable liquid and gaseous biofuels of non-biological origin and recycled carbon fuels for the purposes of Directive (EU) 2018/2001 are available at affordable prices, integrated measures relating to both the consumption and production of such fuels will be required.

Efforts in this less developed but advanced area will focus on applied research and larger-scale demonstration activities relating to utilisation of new energy sources and implementation of technologies for their use. It is necessary to create an integrated research and innovation chain to cover elements from applied research through generation before release to market penetration of these fuels.

Local authorities will also develop and implement schemes promoting the use of energy from renewable sources, alternative fuels from renewable sources, new generation biofuels and recycled carbon fuels, taking into account the specific conditions in each municipality within the framework of programmes for promotion of the use of energy from renewable sources and biofuels in line with the priorities set in national programmes and strategic documents promoting the use of these fuels in transport.

An important factor in promoting the use of these fuels is to make them popular and overcome the initial scepticism of consumers and households. To this end, measures for organising information campaigns among the population of the respective municipalities should be implemented to encourage the use of these fuels in transport.

18) Promotion of the development and deployment of electric mobility in transport, including by building road transport infrastructure and introducing new technologies in railways

To promote and deploy electric mobility, obligations will be imposed on local authorities to introduce as part of their short- and long-term programmes their own specific measures on their territory in order to increase the attractiveness of the use of such transport. The programmes should also include measures to promote the development and use by the population of urban public and rail transport.

The actions undertaken by individual municipalities will be promoted as good practices in order to be widely disseminated, for instance: tax reliefs, simplified access to and provision of a minimum number of parking places, etc. when electric vehicles are used.

Appropriate legislation will be adopted to ensure favourable conditions for the development of the necessary infrastructure. The ZE currently stipulates requirements for the operators of publicly accessible charging stations for electric vehicles. In order to achieve full compliance with the provisions laid down in Directive (EU) 2018/2002 and Directive (EU) 2018/844, current legislation will be amended to include a requirement for installing at least one charging station for electric vehicles within the perimeter of new non-residential buildings and non-residential buildings that have undergone complete renovation with more than ten parking spaces. At the same time, the buildings must be equipped with cabling infrastructure that enables the installation of charging stations for electrical vehicles.

19) Creating appropriate financial incentives to ensure the achievement of the target in the transport sector

In line with the requirements of the Guidelines on state aid for environmental protection and energy, possibilities will be considered, where relevant, for introducing financial incentives (through tax relief, support schemes, etc.) for the consumption of alternative renewable fuels and advanced biofuels and for electric mobility deployment.

The main source of financing of 'green' public transport projects in Bulgaria are the EU Structural Funds and the Cohesion Fund disbursed via different operational programmes.

The targets in the transport sector will be achieved through the implementation of the financial programmes mentioned below. Although, they will be discontinued after 2020, they are expected to have a long-lasting effect beyond 2021.

- During the new programming period 2021-2027 Operational programme Transport and Transport Infrastructure 2014—2020 will be renamed to Transport Connectivity.
- Priority axis 1 'Sustainable and integrated urban development' of Operational programme Regions in Growth 2014—2020 envisages activities for the development and improvement of urban transport systems, including the purchase of new rolling stock for the needs of urban public transport operators.
- Operational programme Environment 2014—2020 provides support to the transport sector on account of its contribution to air pollution in Bulgaria with a focus on fine particulate matter (PM10) emissions and nitrogen oxides (NOx); More specifically, under priority axis 5 'Improvement of ambient air quality' grant assistance is provided for the implementation of measures for the reduction of emissions from public transport.

In July 2019, a new call 'Measures targeting transport as a source of pollution of ambient air' with a budget of BGN 500 million was launched under the priority axis. The call aims to contribute to the

- improvement of ambient air quality by reducing the levels of emissions of fine particulate (PM_{10}) or nitrogen oxides (NOx);
- Environmental protection through improved operation of public transport vehicles, and more specifically replacing old rolling stock with environmentally friendly vehicles;
- Greater reliability and comfort and optimal travel times of public transport to promote a change in transport patterns and reduce personal car journeys, thereby reducing harmful gases from internal combustion engines.

The procedure has two components:

Component 1: Implementation of activities for the improvement of ambient air quality by the purchase and delivery of electric road vehicles – electric buses and trolleybuses.

Component 2: Implementation of activities for the improvement of ambient air quality by the purchase and delivery of electric vehicles for rail transport – tramway rolling stock.

The eligible applicants under the call include 11 municipalities (Burgas, Varna, Vratsa, Pernik, Pleven, Ruse, Sliven, Stara Zagora, Sofia Metropolitan Municipality and Haskovo) in partnership with the respective companies providing passenger transport services within the respective municipality under a public service agreement (municipal public transport company).

- The Connecting Europe Facility finances projects that provide opportunities to fill gaps in the energy, transport and digital structure of Europe.

19) Production of hydrogen from renewable sources

With a view to ensuring that sufficient hydrogen to meet demand is available, steps will be taken to launch hydrogen production via Power to X plant solutions. Surplus electricity generated from solar and wind power is expected to be used for hydrogen production.

ii. Where relevant, specific measures for regional cooperation, as well as, as an option, the estimated excess production of energy from renewable sources which could be transferred to other Member States in order to achieve the national contribution and trajectories referred to in point 2.1.2

The achievement of the ambitious national target for renewable energy for 2030 entails relying on the co-operation mechanisms envisaged in Directive (EU) 2018/2001. In this regard, in case of a surplus or a deficit of renewable energy Bulgaria will make use of the statistical transfer mechanism.

Bulgaria will join the European Union renewable development platform (the Platform) which will provide opportunities for trading in units of renewable energy. Annual data on the national contribution of Member States to the binding Union target, including expected surpluses and deficits of renewable energy and the cost of transfer of surpluses of renewable energy from or to another Member State, will be published in the Platform.

As an option to fulfil its national target for a share of renewable energy in gross final consumption, Bulgaria considers participating in initiatives for implementation of joint projects with other Member States and/or third countries.

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 enable wider deployment of renewable energy in the sector, Union funds will be used to promote and use heating and cooling energy from renewable sources.

Projects for enhancing energy efficiency and increasing the use of renewable energy will be funded under the Renewable Energy, Energy Efficiency and Energy Security Programme financed through the European Economic Area Financial Mechanism with a total budget of approximately EUR 33 million.

The implementation of these measures is expected to translate into projects for the production of electricity and heating and cooling from renewable sources of a total of 46 000 MWh per year and annual CO_2 emissions reductions of 54 280 tCO_2.

In the period 2021—2030, Bulgaria will benefit from investment support from the Modernisation Fund and the option for funding projects related to renewable energy production, improvement of energy efficiency, energy storage and upgrade of the energy networks will be considered. The Fund will be established pursuant to 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. In the period 2021—2030, 2 % of total EU emissions quotas will be sold by auction and the proceeds will be paid into the Modernisation Fund 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.

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

Not applicable

v. Specific measures to introduce one or more contact points, streamline administrative procedures, provide information and training, and facilitate the uptake of power purchase agreements

Summary of the policy measures under the enabling framework Member States have to put in place pursuant to Articles 21(6) and 22(5) of Directive (EU) 2018/2001 to promote and facilitate the development of self-consumption and renewable energy communities

In view of the requirement of Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources, legislative initiatives will be undertaken to establish one or more contact points to support investors (applicants) in the process of issuing permits by competent authorities. The responsibilities of the contact points and the time limits for issuing permits will be consistent with the requirements set in Directive (EU) No 2018/2001.

Municipal authorities have an obligation to issue some of the permits for building plants for renewable electricity generation. In addition, their role in planning and expanding the use of renewable energy in the territory of the municipality involves a greater commitment to the process of implementation of investment proposals. In this regard, it is appropriate to designate municipalities as contact points.

Securing the necessary information and adequate training are key to promoting the wider use of renewable energy.

Regional measures for development in the areas that promote the exchange of best practices in the production of renewable energy between local and regional development initiatives, programmes for training to strengthen the regulatory, technical and financial expertise and for better knowledge of available financing opportunities are supported.

To achieve efficient results in this area, stakeholders and potential participants in the process of dissemination of appropriate information and conducting training procedures are identified. The relevant institutions and local authorities are particularly active participants in these processes and they will carry out combined information campaign

initiatives, fora, awareness raising programmes and training programmes for citizens on the benefits of and opportunities for using renewable energy. Information campaigns are addressed to citizens and provide information on practical issues relating to the development and use of renewable energy.

Information on the opportunities for use of renewable energy is disseminated in the framework of the activities performed by relevant ministries and their executive agencies, including in connection with completed projects financed by international and European programmes.

In order to raise citizens' awareness of and interest in using renewable energy, suppliers of equipment and systems and the competent bodies provide information regarding the net profit, costs and energy efficiency of the equipment and systems for use of renewable electricity, heating and cooling energy. The information will be provided in an efficient and easily accessible manner.

Qualification schemes for installers of small-scale biomass boilers and stoves, solar photovoltaic and solar thermal systems, shallow geothermal systems and heat pumps are provided based on the actions carried out to date in accordance with Directive 2009/28/EC in relation to the acquisition of qualification for installation and maintenance of biomass installations, solar photovoltaic installations, solar thermal installations, heat pumps and shallow geothermal installations and based on the related information.

Public information regarding the persons who have acquired qualification for installation and maintenance of such facilities is made available.

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

The assessment of the potential for use of high efficiency cogeneration of heat from conventional fuels and renewable energy is based on the current annual consumption of heat. Introducing highly efficient technologies would be socially and economically viable over the next 10 years if the existing heating systems are replaced where technical and market developments allow. There are plans to upgrade public buildings and buildings used in the services sector that do not have district heating supply by building new district heating networks — either local or extensions of existing ones. This is expected to result in saving 52 000 tonnes of CO_2 per year. One possibility is to use the potential of highly efficient solutions such as gas-fuelled engines, small to large open- or closed-cycle gas turbines, biomass fuelled steam turbines, heat pumps, etc. The use of biomass with a focus on biomass from waste and industrial and household waste and the use of geothermal energy offer a potential to increase the share of renewable energy in district heating and cooling systems. The potential for energy efficiency of the central heating and cooling infrastructure can be achieved through the rehabilitation of heat transmission networks and replacing obsolete direct subscriber district heating stations with modern highly efficient automated indirect stations, which would reduce heat transmission and distribution losses and lower CO_2 emissions.

The best practices associated with the use of pre-insulated pipes in district heating systems help reduce losses to 3 %. A similar loss level can be achieved for high-power density systems. In the context of the national conditions in Bulgaria, it is assumed that the average power density of district heating systems will make it possible to reduce heat losses to 10 % by using the best available technology. The development of high efficiency electricity cogeneration contributes to fuel use reduction, greater efficiency of electricity generation and better environmental protection.

vii. Where applicable, specific measures on the promotion of the use of energy from biomass, especially for new biomass mobilisation, taking into account:

– biomass availability, including sustainable biomass: both domestic potential and imports from third countries

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

Solid biomass is the renewable energy source most widely used in Bulgaria, mainly in the heating and cooling sector. Consumption of other types of biomass, including waste, is still insignificant.

Firewood is the main type of biomass used in the country and the use of wood waste and plant waste has been growing. The positive trend towards an improvement in waste management practices continues and the national targets for household waste recycling, reuse and recycling of packaging waste and, last but not least, recycling of ordinary waste, have been achieved. Biogas production from anaerobic fermentation of biomass and from sewage sludge is still negligible. Biogas is used in electricity and heat generation, in the Agriculture sector and in the Other services activities sector.

In this regard, use of biomass for energy purposes has wide potential for development. The efforts are focused on the wider use of waste (municipal solid waste, sludges from wastewater treatment plants, etc.) and industrial by-products, without affecting the health and quality of life of the population in the regions where the biomass fuelled energy installations are located.

For biofuels generated from forest biomass, non-transport liquid fuels from biomass and gaseous and solid fuels from biomass to be taken into account for the purpose of the increase of their share in energy from renewable sources, requirements will be adopted to minimise the risk of using biomass derived from unsustainable production. Regulatory requirements will be introduced for sustainable production and consumption of gaseous and solid fuels from biomass, when said fuels are used in the generation of electricity and heat in biomass fuelled installations with a total nominal heat power equal to or higher than 20 MW for solid fuels from biomass and with a total nominal heat power equal to or higher than 2 MW for gaseous fuels from biomass.

This ensures the use of wood that meets specific quality criteria. In connection with this, Regulation No 6 of 7 October 2019 of the Minister of Agriculture, Food and Forests laying down the requirements for and the control of harvested wood used as firewood for residential heating SG No 81 of 15 October 2019, in force as from 15 October 2019) was developed and adopted.

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 avail of the option for free allocation of greenhouse gas emission allowances for power plants from 2021 to 2030 in order to modernise its 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.

The following will be developed:

- project selection criteria for projects involving a total amount of investment of up to EUR 12.5 million on the basis of which a List of the investments to be financed with free allocation of GHG emission allowances in the 2021—2030 period will be prepared;
- rules for competitive bidding for the selection of projects involving a total amount of investment exceeding EUR 12.5 million which will be financed through free of charge allocation of emission allowances between 2021 and 2030;
- Amendments to the Energy Act.

ii. Policy measures to achieve other national targets, where applicable

Not applicable

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

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 policy measures and programmes to achieve the indicative national energy efficiency target for 2030 as well as other objectives referred to in point 2.2, including planned measures and instruments (also of a financial nature) to promote the energy performance of buildings, in particular with regard to the following:

i. Energy efficiency 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 developed in accordance with Annex II))

1) Setting the overall cumulative target by 2020

In furtherance of the national target for energy efficiency and in order to comply with the requirements of Article 7 of Directive 2012/27/EU, Bulgaria has introduced:

- an energy saving obligation scheme and
- alternative measures

to ensure that the overall cumulative target for energy savings in final energy consumption will be achieved by 31 December 2020.

The overall cumulative energy savings target in 2020 is 1 942.7 ktoe. Its distribution is shown in the table below.

Table 23: *Annual breakdown of the overall cumulative energy savings target for the 2014—2020 period, ktoe*

Year	2014	2015	2016	2017	2018	2019	2020
2014	**61.7**	**61.7**	**61.7**	**61.7**	**61.7**	**61.7**	**61.7**
2015		**61.7**	**61.7**	**61.7**	**61.7**	**61.7**	**61.7**
2016			**75.2**	**75.2**	**75.2**	**75.2**	**75.2**
2017				**75.2**	**75.2**	**75.2**	**75.2**
2018					**77.1**	**77.1**	**77.1**
2019						**77.1**	**77.1**
2020							**78.3**

2) Energy efficiency obligations scheme until 2020

The individual targets for energy savings represent annual energy savings at the level of final customers to be achieved in the period 1 January 2014–31 December 2020. The individual targets are set as the difference between the calculated annual cumulative target and the assessed energy savings from alternative measures. The difference is distributed in proportion on the basis of the quantities of energy sold in the previous year by each obligated person among the following obligated persons:

1. end suppliers, suppliers of last resort and traders licensed to trade in electricity, which sell electricity in amounts exceeding 20 GWh per year to final customers;

2. heat transmission companies and heat power suppliers which sell heat energy in amounts exceeding 20 GWh p.a. to final customers;

3. end suppliers and traders of natural gas which sell natural gas in amounts exceeding 1 million m^3 per year to final customers;

4. traders of liquid fuels which sell liquid fuels (excluding transport fuels) in amounts exceeding 6.5 kt p.a. to final customers;

5. traders of solid fuels which sell solid fuels in amounts exceeding 13 kt p.a. to final customers.

The annual individual targets of obligated parties are established by the AUER based on declarations of the quantities of fuels and energy sold to customers in final energy consumption during the previous calendar year. The declarations must be submitted to the AUER by 1 March of every year. The list of obligated parties and their individual annual targets are updated annually to take into account the change in the volume of sales by the obligated party concerned vis-a-vis the total volume of sales by all obligated parties for the previous year. The list is updated by the AUER in the Annual Reports on the implementation of the National Energy Efficiency Action Plan.

In the period 2014–2019 the following alternative measure were applied:

Alternative measure 1: Individual energy savings targets for owners of industrial systems and of state and municipal buildings

According to the ZEE, in the period from 2014 to 2016, individual energy saving targets were set for the following two groups of obligated parties in addition to traders in fuels and energy:

- owners of state and municipal buildings;
- owners of industrial systems with annual energy consumption in excess of 3 000 MWh.

The period of validity of these targets was from 2010 to 2016 but only savings made in the last three-year period from 2014 to 2016 were taken into account for the purposes of the alternative approach to the implementation of the obligations scheme.

The list of obligated parties and the values of individual targets for energy savings were adopted by the Council of Ministers and their breakdown is as follows:

Table 24 *Values of energy savings targets for owners of buildings and owners of industrial systems*

Obligated parties	***Energy savings target for the 2010—2016 period***		***Energy savings target within the alternative approach for the 2014—2016 period***	
	GWh p.a.	*ktoe p.a.*	*GWh p.a.*	*ktoe p.a.*
Owners of state and municipal buildings	521	44.8	260.5	22.4
Owners of industrial systems with energy consumption exceeding 3 000 MWh per year	819	70.4	409.5	35.2
Total	*1 340*	*115.2*	*670*	*57.6*

Allocation of responsibilities: participants and actors

- Obligated parties: implement and report to the AUER on an annual basis the progress achieved in the implementation of the measure.
- Energy efficiency consultants registered in the AUER public register: carry out energy efficiency audits before and after measures are implemented or make assessments of the energy savings achieved using specialised methods laid down in Regulation No E-RF-04-3 of 4.05.2016; draft a report containing an assessment of the savings achieved.
- The Sustainable Energy Development Agency monitors the implementation of the measure by compiling summaries, analysing and assessing its overall implementation based on the reports submitted by the obligated parties; exercises control over the qualification and activities of energy efficiency consultants, the application of the specialised methods and the reports containing assessments of the savings achieved; verifies the energy savings achieved by the obligated parties and issues certificates; and keeps databases on the implementation of the measure.

Alternative measure 2: National Programme for Energy Efficiency of Multi-Family Residential Buildings

Description of the measure

In 2015, Bulgaria adopted a National Programme for Energy Efficiency of Multi-Family Residential Buildings aimed at the renovation of multi-family residential buildings by implementing energy efficiency (EE) measures.

The main goal of the Programme is to improve the living conditions for citizens living in multi-family residential buildings, improve temperature comfort and improve the quality of the living environment through the implementation of EE measures. The programme provides financial and organisational support to associations of owners in multi-family residential buildings registered in accordance with the procedure laid down in the Condominium Ownership Management Act to improve energy efficiency in the buildings in which they live.

Support and assistance are provided to associations of owners whose buildings meet a set of eligibility criteria determined in advance. The associations of owners apply for financial assistance to the respective municipalities. According to the selection criteria all eligible associations of owners receive a grant that covers 100 % of the costs and organisational arrangements necessary for renovation works to be undertaken until depletion of the funds available under the programme.

Municipalities accept applications and documents relating to the assessment, approval and monitoring of the implementation of energy efficiency measures for the buildings. The mayor of each municipality is responsible for the implementation of the overall process of renovation of residential buildings and for the selection of contractors for the

implementation of the activities on the buildings in accordance with the procedure laid down in the Public Procurement Act (ZOP).

All 265 municipalities in Bulgaria are eligible to participate in the Programme. To date, actions have been implemented in 143 municipalities.

The Programme was implemented with national funds and had a budget of BGN 2 billion, partially in the form of State-guaranteed loans from the Bulgarian Development Bank (BBR). Its extension is contingent on additional funds becoming available.

Alternative measure 3: Operational Programme Innovation and Competitiveness — Call BGI6RFOP002 – 3.002 Improving energy efficiency in large enterprises

Description of the measure:

The time horizon of the alternative measure is the period 2019-2020. Operational programme Innovation and competitiveness 2014—2020 (OPIC) provides grant assistance for the introduction of energy-saving technologies and renewable energy utilisation by enterprises. The programme is financed by the European Union under the European Regional Development Fund (ERDF). Grant assistance for the implementation of EE measures is provided Investment priority 3.1 Energy technologies and energy efficiency of Priority axis 3 Energy and resource efficiency of Operational Programme Innovation and Competitiveness. The beneficiaries are existing enterprises outside the sector of trade and the services sector. Call BGI6RFOP002-3.002 was launched in 2019 and 68 grant agreements have been concluded in the total amount of BGN 253 791 859.90, including BGN 122 614 711.56 in grant assistance (48.3 % grant aid intensity). The energy savings to be achieved by the enterprises under the grant agreements stand at 553 505.51 MWh per year and the expected annual GHG emissions reduction is 330 006.61 tonnes of CO_2. For the purposes of Article 15(2) and in order to set the national cumulative target for energy efficiency referred to in Article 14(1) of the ZEE as an alternative measure under Article 14(7)(2), only energy savings the correspond to the amount of the grant assistance received under Call BGI6RFOP002-3.002, equal to 267 737.7 MWh (22.99 ktoe) will be used.

The energy savings achieved will be determined in line with the 'bottom-up' method on the basis of actually implemented projects for the improvement of energy efficiency at enterprises.

Alternative measure 4: European Economic Area Financial Mechanism 2014–2021 — Programme area 'Renewable energy, energy efficiency, energy security'

Description of the measure:

The time horizon of the alternative measure is the period 2019—2020. The Renewable energy, Energy Efficiency and Energy Security Programme is financed by the European Economic Area (EEA) Financial Mechanism 2014–2021. The main goal of the programme is lowering carbon intensity and enhancing the security of supplies. It will be achieved by increasing energy generation from renewable sources, improving energy efficiency in

buildings, the industry and municipalities and enhancing expert capacity in the area of renewable energy and energy efficiency.

In the renewable energy, energy efficiency and energy security programme area grant assistance of approximately EUR 33 million (EUR 28 million in grant assistance under the EEA Financial Mechanism and EUR 4.9 million in national co-financing) is available. For the purpose of the national cumulative energy savings target set in accordance with Article 7 of Directive 2012/27/EU, Bulgaria has used the energy savings estimated to result from the implementation of measure 'Improvement of energy efficiency in buildings, the industry and municipalities' of 117 000 MWh (10.06 ktoe) and measure 'Increasing the capacity for the generation of energy from renewable sources — geothermal and hydropower' of 46 000 MWh (3.96 ktoe). The implementation of the measures commenced in 2019 and grant aid intensity is 100 %.

The energy savings achieved will be determined in line with the 'bottom-up' method on the basis of actually implemented projects for the improvement of energy efficiency.

3) Setting the overall cumulative target for the period 2021—2030

The total cumulative target for the period 2021-2030 has been set to 4 357.55 ktoe in accordance with the requirements set in Directive (EU) 2018/2002 of the European Parliament and of the Council of 11 December 2018 amending Directive 2012/27/EU. The data on the average sales of energy to final consumers for the period 2016-2018 are set out in the tables below

Table 25: *Average annual energy consumption for the period 2016-2018, ktoe*

	2016	**2017**	**2018**
Final energy consumption	**9 731.2**	**9 976.0**	**10 003.0**
Average consumption for the period 2016-2018		**9 903.4**	

The annual allocation of the total cumulative target to be achieved in the period 2021-2030 is based on an approach of gradual increase of annual energy savings from lower levels at the beginning of the period to higher levels of increase to be reached halfway through the period.

Table 26: *Annual breakdown of the overall cumulative energy savings target for the 2021—2030 period, ktoe*

2021	69.2							**69.2**
2022	69.2	69.2						**138.4**
2023	69.2	69.2	74.05					**212.45**
2024	69.2	69.2	74.05	74.05				**286.5**
2025	69.2	69.2	74.05	74.05	92.0			**378.5**
2026	69.2	69.2	74.05	74.05	92.0	92.0		**470.5**

2027	69.2	69.2	74.05	74.05	92.0	92.0	92.0				**562.5**
2028	69.2	69.2	74.05	74.05	92.0	92.0	92.0	92.0			**654.5**
2029	69.2	69.2	74.05	74.05	92.0	92.0	92.0	92.0	92.0		**746.5**
2030	69.2	69.2	74.05	74.05	92.0	92.0	92.0	92.0	92.0	92.0	**838.5**
TOTAL cumulative savings for the period 2021—2030 period											**4 357.55**

4) Energy efficiency obligation scheme until 2030

To help achieve the national energy efficiency (EE) target by 31 December 2030, an energy savings obligation scheme and alternative measures will be established to ensure the achievement of the total cumulative target for energy savings in final consumption for the period 1 January 2021 – 31 December 2030.

The difference between the total cumulative target and the projected energy savings to be achieved through the implementation of alternative measures is allocated as individual targets for energy savings amongst the following obligated parties:

1. end suppliers, suppliers of last resort, traders licensed for the business of trade in electricity, which sell more than 20 GWh of electricity annually to final customers;
2. heat transmission companies and heat power suppliers which sell more than 20 GWh of heat power annually to final customers;
3. natural gas end suppliers and traders, which sell more than 1 million m^3 annually to final customers;
4. traders in solid fuels, which sell solid fuels in amounts exceeding 500 tonnes per year to final consumers;
5. traders in solid fuels, which sell more than 13 000 tonnes of solid fuels per year to final customers.

The new annual energy savings in final energy consumption expected to be achieved through the Obligations Scheme, allocated per year, are as follows:

- 11.07 ktoe per year (2021-2022)
- 11.85 ktoe per year (2023-2024)
- 14.72 ktoe per year 2025-2030)

Expected cumulative savings in final energy consumption for the period 2021-2030 — 697.21 ktoe

Alternative measures

1) Grant assistance for the implementation for energy efficiency and renewable energy measures under operational programmes (Operational Programme Environment and Operational Programme Innovation and Competitiveness)

Type of policy measure	**Financial instrument**

Short description of the policy measure	The operational programmes are co-financed by the European Union through the European Regional Development Find and Bulgaria's national budget. Grant assistance intensity is between 50 % and 100 %.
Planned or estimated budget	The estimated budget of the two operational programmes for the period 2021-2030 is BGN 1 398 579 million
Expected cumulative savings in final energy consumption	712.32 ktoe
Projected new annual energy savings in final energy consumption	11.31 ktoe p.a. (2021-2022) 12.12 ktoe p.a. (2023-2024) 15.03 ktoe p.a. 2025-2030)
Ensuring that all public bodies, participants or stakeholders fulfill their obligations relating to policy measure implementation	Managing Authority of Operational Programme Environment — Directorate-General Operational Programme Environment of the Ministry of Environment and Water Managing Authority of Operational Programme Innovation and Competitiveness — Directorate-General EU Fund for Competitiveness of the Ministry of Economy
Target sectors	Household, industry, services

2) Introducing a national mechanism for financing energy efficiency

Type of policy measure	**National mechanism for financing energy efficiency (NMFEE)**
Short description of the policy measure	The aims of the mechanism are in line with the aims of European financial institutions to expand access to competitive financing by enhancing: • the process of mobilising private financing; and • the efficient use of grant assistance. The national mechanism envisages financing through different mechanisms and financial instruments, including credit lines, guarantees or combinations of the two, etc. The NMFEE also envisages technical assistance for the implementation of energy efficiency projects. The financing of integrated measures and the development of appropriate instruments for financing individual energy efficiency measures under the mechanism is further envisaged. The assistance will target the achievement of energy efficiency in: • the industrial sector; • transport and infrastructure; • the public sector; • The sector of residential and non-residential buildings. The necessary financing will be provided 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, Invest EU, etc. The engagement of local banks and international financial

	institutions in this financial initiative is a key requirement for the successful implementation of the Mechanism because it can significantly simplify the lending process.
Planned or estimated budget	The estimated budget of the measure for the period 2021-2030 is BGN 7 800 million
Expected cumulative energy savings in final energy consumption	2 948.02 ktoe
Projected new annual energy savings in final energy consumption	46.8 ktoe p.a. (2021-2022) 50.1 ktoe p.a. (2023-2024) 62.3 ktoe p.a. 2025-2030)
Target sectors	Households, Industry, Services, Transport

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

In order to achieve the target for decarbonisation and high energy efficiency of building stock, a long-term strategy for support of the renovation of the national residential and non-residential building stock until 2050 is currently being developed. The strategy will envisage measures for the construction of new buildings and the conversion of existing buildings into nearly zero-energy buildings, improvement of the energy characteristics of residential and non-residential buildings and promotion of the introduction of smart technologies in buildings.

Table 27: *Existing measures, which will be extended beyond 2021*

Measure	**Savings achieved 2014—2018: GWh p.a.**	**Expected contribution to the achievement of the national energy efficiency target 2020 GWh p.a.**
Non-residential buildings		
1. Central and local government energy efficiency improvement programmes and energy efficiency management in public buildings(1)	792.5	911.9
Total non-residential buildings*	792.5	911.9

Measure	Savings achieved 2014—2018: GWh p.a.	Expected contribution to the achievement of the national energy efficiency target 2020 GWh p.a.
Including net energy savings from:		
1.1. Buildings of the central government administration[2]	*71.61*	*119.4*
1.2. Energy Efficiency and Renewable Sources Fund[3]	*28.9*	*40.32*
1.3. Operational programme Regional Development 2007–2013/Regions in Growth 2014–2020[3]	*177.2*	*248.1*
1.4. National Trust Eco Fund — Climate Investment Programme[3]	*21.2*	*42.4*
1.5. Kozloduy International Decommissioning Support Fund (KIDSF)	*98.9*	*98.9*
1.6 Programme BG04 Energy efficiency and renewable energy (the Programme);[4]	*-*	*12.8*
Residential buildings		
1. National Energy Efficiency of Multi-Family Residential Buildings Programme (2016–2020)[5]	679.8	975.6
2. Residential Energy Efficiency Credit Line Programme[3]	54	75.6
3. Project 'Demand Side Residential Energy Efficiency through Gas Distribution Companies in Bulgaria' (DESIREE GAS)	-	70
Total for residential buildings	733.8	1 121.2
Total for all measures in buildings	1 526.3	2 033.7

**To prevent double accounting of the effect of implementation of energy efficiency measures in the sector of public buildings of the central and local government, [the sector] has been included in measure 'Programmes for improvement of the energy efficiency to be implemented by central government institutions and local authorities and for energy efficiency management in public buildings'. The implementation of measures under the financial mechanisms put in place will be reported by the obligated administrations in their respective annual reports on energy efficiency management.*

The projected energy savings to be achieved as a result of the implementation of policy measures for the improvement of energy efficiency in the period 2019-2020 rely on the following assumptions:

(1) The implementation of the measure and the energy savings to be achieved during the period 2019-2020 will be consistent with the levels achieved during the period 2014-2018.

(2) The projection is based on the calculations set out in the National plan for improving the energy performance of heated and/or cooled State-owned buildings occupied by the public administration;

(3) Energy savings will continue to be achieved at a rate consistent with that during the period 2014-2018.

(4) The estimation is based on

- the following parameters set in the Programme. improving the energy performance of 8 buildings — maximum grant assistance amount per project BGN 1.2 million
- BGN 1 500 / MWh energy saved (estimated on the basis of actually implemented projects for energy efficiency improvement)

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

The rules governing the provision of energy performance services are stipulated in the ZEE. According to the ZEE energy services aim to combine energy supply with an energy efficient technology and/or an action encompassing the operation, maintenance and management required for the delivery of the service and lead to energy efficiency improvement and/or saving of primary energy resources that can be verified, measured or estimated. Energy efficiency services are provided on the basis of written contracts concluded with final energy consumers. The ZEE also identifies the persons entitled to carry out energy efficiency services: natural or legal persons which are merchants within the meaning of the Commerce Act or within the meaning of the law of another Member State of the European Union or of another State which is a contracting party to the Agreement on the European Economic Area.

Energy performance contracts are an essential incentive for the continued development the market for energy efficient services. Under this type of contract, investments are recovered and the fees payable to the energy service companies (ESCOs) are paid from energy savings achieved. ESCOs provide a performance guarantee which also guarantees the energy savings to be achieved as a result of the project implementation.

The buildings owned by the central government and/or the municipalities and subject to energy performance contracting must comply with Regulation No RD-16-347 of 2 April 2009 laying down the requirements and procedure for determining the amount and disbursing funds under energy performance contracts leading to energy savings in

buildings owned by the central government and/or municipalities. The AUER participates in the examination and approval of funds for the execution of energy performance contracts in buildings owned by the state and/or municipalities, sends reasoned proposals to the Ministry of Finance for funding and payment of the funds and certifies that no certificate has been issued for the respective building as a result of activities completed under other programmes.

The AUER is the national administrator of the European Code of Conduct for EPC. The Code was developed under the 'Increasing transparency of energy service markets (Transparense)' project financed by the EC under the Intelligent Energy Europe programme. The Code combines values and principles that are necessary for the successful preparation and implementation of EPC projects in European countries and governs the principles of conduct of the EPC suppliers in particular. Documents relating to the Code are available on the AUER website.

A standard ESCO contract for the industry sector, which contains a set of the minimum requisite standard clauses, has been developed within the framework of a project financed by Operational Programme Innovation and Competitiveness 2014-2020 with a view to facilitating the contracting parties to ESCO agreements. A model contract and methodology for assessment of the energy savings achieved under ESCO contracts have additionally been developed, along with a indicative bill of quantities and repayment schedule. All documents have been published on the AUER website.

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

To achieve the national target for a share of renewable energy in gross final energy consumption by 2030, both existing and additional policies and measures will be implemented:

- **Promote the exemplary role of public buildings**

In accordance with Directives 2010/31/EU and 2012/27/EU public authorities at national, regional and local level should lead by example in the area of energy efficiency. In this regard, Bulgaria has set a more ambitious target for renovation of buildings owned and used by the central administration, setting out in Article 23(1) of the ZEE a legal requirement that measures shall be taken on an annual basis to improve the energy performance of at least 5 % of the total gross floor area of all heated and cooled state-owned buildings used by the public administration. The reasons to impose a more ambitious target include both the need to reduce energy consumption in the buildings due to its long-term impact and the fact that the buildings owned by the public

authorities serve as an incentive because they account for a large share of the building stock and have high visibility in public life.

In addition, the following measures will be taken to support the achievement of a highly efficient and decarbonised building stock:

- Developing and conducting periodic reviews of the minimum requirements for the energy performance of buildings at optimal cost and alignment of the technical requirements for design, construction and maintenance of structurally sound, healthy, high-tech and energy efficiency buildings with relevant EU law; Improvement of the life cycle of buildings for the period 2015—2030;
- Applied research in the area of energy efficiency of buildings to be undertaken in the period 2015-2030 to ensure that the energy performance standards of buildings are developed on the basis of scientific knowledge.
- Improvement of the conditions for the uptake in the construction sector of products that ensure compliance with the basic requirements laid down in Regulation (EU) 305/2011 of the European Parliament and of the Council of 9 March 2011 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 2019 on the mutual recognition of goods lawfully marketed in another Member State and repealing Regulation (EC) No 764/2008; Development of national standards for construction products harmonised with EU technical legislation, including the requirements for energy saving, heat conservation, sustainable use of natural resources, recycling and re-use of construction products in the period 2015-2030;
- Improvement of the functioning of the contact point for construction products (CPCP) in accordance with Regulation (EU) 305/2011 and Regulation (EU) 2019/515 and improvement of the conditions for the free movement of construction materials by further developing and maintaining the CPCP information platform in the period 2015—2030;
- Preparation and launch of a digital platform for the Bulgarian construction sector in the period 2021—2030:
    - Development and implementation of a strategy and national plan for digitalisation of the construction sector;
    - Development of standards and regulations for the implementation of digitalisation and building information modelling (BIM) in the construction sector, including the necessary accompanying analyses;
    - Implementation of the digital reform in the construction industry;

- Upgrading existing building stock to a level of optimal energy consumption to achieve the standards for buildings with near zero-energy consumption with a time horizon 2021—2030;
- Implementation of the optional Smart Readiness Indictor for Buildings of the Community and adapting the methodology for SRI calculation established by the European Commission by taking national specificities into account, including an assessment of existing national schemes for energy performance certification with a time horizon 20212030;
- Strengthening the capacity and expanding the activity of the National expert council with a view to promoting and increasing the number of buildings with nearly zero-energy consumption in an effective way with a time horizon 2021-2030.

- **Energy-efficient public procurement**

According to Article 30a of the ZEE in the case of award of public procurement contracts public contracting entities must purchase only products, services and buildings with high energy efficiency indicators, including:

1. products that meet the criterion of belonging to the highest energy efficiency class;
2. office equipment that is included in and meets the requirements of Appendix C of the Agreement between the Government of the United States of America and the European Community on the coordination of energy-efficiency labelling programmes for office equipment (OJ L 63/7 of 6.3.2013);
3. tyres that meet the criterion of belonging to the highest fuel efficiency class, as stipulated 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 22.12.2009), hereinafter referred to as 'Regulation (EC) No 1222/2009';
4. buildings meeting the minimum requirements for energy performance, as attested by an energy performance certificate.

- **Energy audits and management systems**

All of the following shall be subject to mandatory energy efficiency audit:

- all enterprises in the manufacturing sector other than small and medium-sized enterprises within the meaning of Article 3 of the Small and Medium-Sized Enterprises Act;

- all enterprises in the services sector that are not small and medium-sized enterprises within the meaning of Article 3 of the Small and Medium-Sized Enterprises Act;
- industrial systems with annual energy consumption in excess of 3000 MWh;
- all outdoor artificial lighting systems located in settlements with population exceeding 20 000 inhabitants.

Energy audits shall be performed at least once in every 4 years.

The enterprises and the owners of industrial systems, which implement energy management or environmental management systems subject to certification by an independent body for conformity with European or international standards, are exempted from the requirements for mandatory energy efficiency audit, provided that the management system implemented thereby includes an energy audit of the enterprise or the industrial system concerned.

Within one month of acquiring the certificate, said enterprises and owners of industrial systems must notify the AUER that they apply an energy or environmental management system and provide evidence that the management system implemented meets the minimum energy audit requirements.

The owners of enterprises, industrial systems and systems for outdoor artificial lighting have obligations for energy efficiency management. Energy efficiency is managed by maintaining databases of the monthly energy generation and consumption by type of energy, carrying out annual analyses of energy consumption and implementation of other energy efficiency improvement measures. For the purposes of energy efficiency management, the obligated parties are required to prepare annual reports based on a model approved by the AUER and submit them to the Agency not later than 1 March of the year following the reporting year.

In accordance with Directive 2010/31/EU Bulgaria has put in place a system for energy efficiency audit and certification of buildings with a total gross floor area exceeding 250 m^2. The energy performance certificate of a building in use shall be updated when any of the following activities are performed and result in altering the energy performance of the building:

- refurbishment;
- reconstruction, major renovation or overhaul when more than 25 per cent of the building envelope are covered.

The owners of buildings with a total gross floor area exceeding 250 m^2 must implement the measures for achieving the minimum required energy consumption class prescribed by the first audit within three years from the date of accepting the results of the audit.

State and municipal administrations, which own public buildings in the tertiary sector are obliged to manage energy efficiency. The management is carried out by implementing programmes, activities and measures for energy efficiency improvement and conducting

annual analyses of energy consumption. For the purpose of energy efficiency management, the owners of enterprises, similarly to the owners of buildings, are also obligated to draw up annual reports based on a model and submit these to the AUER.

A completed energy efficiency audit or applying a certified energy management or environmental management system is one of the criteria to be met by enterprises when applying for support under Regulation No E-RD-04-06 of 28 September 2016 on lowering the burden relating to renewable energy costs (the Regulation). Enterprises that apply for such assistance are also required to manage their energy efficiency and submit to the AUER a report on their energy efficiency management activities. The Regulation was issued pursuant to Article 4(2)(21) of the ZE and is in line with the Guidelines on State aid for environmental protection for the period 2014-2020. It lays down the requirements and procedure for granting aid to enterprises in sectors at risk due to the costs arising from the financial support for energy from renewable sources, aiming to help the enterprises presence their competitiveness.

- **Metering and billing**

Electricity metering

According to the ZE the electricity supplied to final consumers must be metered by means of commercial metering devices owned by the operator of the electricity transmission network or the operator of the respective electricity distribution network and located next to or on the boundary of the customer's property. The electricity customers shall not pay a fee for the commercial metering devices.

The structure of the electricity market and the conditions for participation in that market are laid down in the Rules for Trading in Electricity issued by the Energy and Water Regulatory Commission.

Heat metering

One of the main methods used to measure the heat used by households is 'heat accounting'. The system was introduced in Bulgaria in 1999 with the adoption of the ZE as one of the energy efficiency measures Bulgaria was required to implement as a condition for its accession to the EU. Heating cost share allocation devices (heat allocation devices, water meters and apartment heat meters) allow the total space- and water-heating energy to be allocated among individual properties. Heat allocation in buildings with residents' associations is based on the methodology set out in an annex to Regulation No 16-334 of 6 April 2007 on heat supply. Substations in Bulgaria are equipped with heat metering devices from which readings are taken on a monthly basis. On the basis of the readings, the energy used for heating is allocated among the customers according to the energy consumption of each property for the previous heating season. The heat distribution utility bills consumers on a monthly basis and issues invoices indicating these data. After the readings are taken from the meters at the

end of the heating season, the heat accountant draws up a balancing invoice. Calculations are made on the basis of the actual consumption by each property.

Following the implementation of this measure, individual heat distribution devices and appliances that allow heat supply to be regulated were installed on practically all heating fixtures.

With regard to the fact that common heating systems and household hot water systems exist in most of the buildings, the legal framework provides for both transparency and accuracy of accounting for individual consumption and transparent rules on the allocation of the costs for consumption of heat energy and hot water in multi-functional buildings supplied from a district heating source.

The building supply systems of customers are connected to the heat transmission network by means of a connecting heating pipeline and a subscriber substation. Where a new building is connected, a competitively priced individual heat meter is installed in each separate property in the building. Where an existing building is connected after major renovation and remodelling of the building heat-supply systems from vertical to horizontal distribution, a competitively priced individual heat meter is installed in each separate property in the building.

Natural gas metering

The natural gas transmitted via a gas distribution network is measured in the gas metering points owned by the gas distribution company. These points are located along the gas distribution network in line with the regulatory requirements for network design, construction and operation.

The natural gas transmitted via a gas distribution network is metered by gas meters owned by the gas distribution company and installed before the gas pipeline reaches the customer's premises. The operator of the network is responsible for servicing the commercial measuring devices along the gas transmission and gas distribution networks in accordance with the legal framework for commercial measuring: Measurements Act and Rules for trading in natural gas.

Invoicing

The methods and requirements for billing end users are stipulated in the ZE. The energy companies must provide to their users of energy services information about:

- the payment, the prices of stopping or resuming supply, the prices of services for carrying out maintenance and the prices of other services related to the licensed activity;
- the procedure for change of supplier and information that users of energy services do not owe additional payments when changing their supplier;
- the actually consumed quantities and expenses incurred without obligation for additional payment for this service;

- the preparation of a final balancing bill each time when the supplier is changed;
- the share of each energy source in the total energy supplied during the previous calendar year in an understandable and clearly comparable manner;
- the existing sources of publicly accessible information about the environmental impact in relation at least to emissions of carbon dioxide and radioactive wastes resulting from production of electricity from various energy sources in the total energy supplied by the provider during the previous year;
- the dispute settlement mechanisms available.

The information must be presented in the invoices or in information materials accompanying them and published on the websites of the energy companies. In accordance with this procedure, the suppliers of energy and natural gas shall also provide to the users of energy services a checklist adopted by the EC, containing practical information about their rights.

The ZE also requires from the end supplier to inform the customer, together with the invoice for the last month of each 6-month period, when the metered consumption of electricity or natural gas of the end customer for this 6-month period exceeds by over 50 per cent the consumption metered for the respective 6-month period of the previous calendar year.

In addition, many energy suppliers provide on their websites detailed information on the content of invoices they issue to end users. Some launch additional initiatives such as e-mailing or mailing their clients explanations about the content of energy consumption invoices.

- **<u>Improving energy efficiency in transport</u>**

The main measures Bulgaria implements with a view to improving energy efficiency in transport can be summarised as follows:

a) Increasing the share of public electric transport

The measure includes:

- railway infrastructure upgrade;
- renewal of the rolling stock of electric rail transport.

For the period 2014—2020 more than EUR 1 billion in financing from the EU funds has been made available for the completion of the Serbia – Sofia – Plovdiv – Burgas railway line.

Tenders will be launched for the purchase of rolling stock to ensure that at least the following rolling stock will be put into operation in the period 2021–2030:

- approximately 15 medium-distance trains; and
- 30 to 50 new wagons.

This is expected to be sufficient to ensure travel to more than 4 000 short- and medium-distance destinations.

The project for extension of the Sofia metro, Line 3: Vladimir Vazov Blvd. – City Centre – Ovcha Kupel – Ring Road is implemented with EU funding. The third metro line is expected to become operational by the end of 2020.

b) Training in fuel-efficient driving

The Ministry of Transport, Information Technology and Communications promotes and facilitates special courses aiming to improve the fuel-efficient driving skills of drivers. The courses will include a module on the driving of motor vehicles which, in line with safety requirements, includes topics such as skills for fuel efficiency optimisation by making full use of the vehicle design and fuel-efficient driving techniques.

c) Increasing the share of electric and hybrid motor vehicles and expanding charging stations infrastructure for electric and hybrid vehicles in urban areas

Charging stations for electric vehicles are still a fledgling industry in Bulgaria, with infrastructure currently being built by private investors at municipal level. As at September 2019, a total of 149 charging stations have been installed. In September 2018, there were only 82 charging stations. It is necessary to introduce appropriate financial incentives and administrative measures, including incentives for the deployment of adequate charging infrastructure that is commensurate to needs.

Since 2016, a pilot scheme has been implemented for the purchase of electric and hybrid vehicles in the public administration. The scheme is administered by the National Trust Eco Fund and entails the grant of dedicated subsidies.

The National framework for the development of the market of alternative fuels in transport and the deployment of the relevant infrastructure envisages a number of potential measures for the entry of electric vehicles.

- Establishing standards for energy consumption in motion (applicable to both initial vehicle registration but also for any subsequent sale/registration of motor vehicles);
- Establishing limit values for the emissions from passenger vehicles (applicable to both initial vehicle registration but also for any subsequent sale/registration of motor vehicles);
- Introducing areas (particularly in city centres) accessible solely by energy-efficient low-emission motor vehicles;
- Introducing progressive taxation aiming to promote the use of energy efficient, low emission motor vehicles;
- Granting direct subsidies for the purchase of new zero-emission vehicles (subject to restrictions such as a minimum number of vehicles being reached over a certain period of time);

- Granting tax credits for the purchase and use of zero-emission motor vehicles (subject to restrictions such as a minimum number of vehicles being reaches over a certain time);
- Providing access to bus lane to zero-emission vehicles (subject to restrictions such as a minimum number of vehicles being reaches over a certain time);
- Use of electric vehicles for the purposes of the public administration and local authorities;
- Promotion of the take-up of zero-emission vehicles in car-pooling;
- Providing incentives for the transition of taxi companies and public transport operators to zero-emission vehicles.

As at 31 December 2018, the number of electric vehicles increased by 50 % on an annual basis (from 981 vehicles to 1 471 vehicles) and the number of hybrid vehicles increased by 55 % (from 4 009 vehicles to 6 226 vehicles) compared to the end of 2017.

Municipalities have to develop investment programmes for electric transport. By way of example, there are plans to purchase up to 30 high-speed standard low-floor electrical buses and 12 charging stations under the Electric Mobility Programme of Sofia Municipality.

In 2017, the Central European Project was approved under the Connecting Europe Facility. The project aims to finance the construction of a network of ultra-fast charging stations (up to 350 kW) for electric vehicles in Central Europe. The project envisages the installation of a total of 118 charging stations within the perimeter of the TEN-T network.

- **Consumer information and training programmes**

The measure aims to raise consumer awareness of the electricity, energy for heating and natural gas they use and of the benefits of implementing energy efficiency measures. Electricity retails publish on their websites energy saving tips and maintain online archives of e-invoices. The companies have consultants on energy efficiency to help customers reduce their energy consumption without expensive investments and complex repairs.

In addition to being applied by energy traders across the country as part of their awareness campaigns and initiatives, the measure is supported by regional and local governments countrywide. Different initiatives to raise consumer awareness are included in the energy efficiency enhancement programmes of regional and local authorities drawn up in fulfilment of the obligations referred to in Article 12 of the ZEE. The initiatives envisage the establishment of consumer councils, organising consumer days and a number of campaigns in regional and municipal centres where customers can learn how to save energy.

Information campaigns and implementation of behavioural measures are listed as eligible measures in Regulation No E-RD-04-3 of 4 May 2016 on the eligible energy saving

measures at FEC level, the methods to prove achieved energy savings and the requirements to the methodologies and methods to asses and verify the savings.

To support the implementation of the measure, specialised methodologies were developed for assessing energy savings after the application of different behavioural measures pursuant to Regulation No E-RD-04-3 of 4 May 2016. The methodologies are developed on the basis of a model approved by the Regulation and are subject to discussion by expert groups set up by AUER in line with the same Regulation.

- **Availability of qualification, accreditation and certification schemes**

The conditions and procedure for acquisition and recognition of qualifications for energy efficiency audits of buildings and industrial systems and certification of buildings are laid down in the ZEE. Energy efficiency audits, certification of buildings, conformity assessments of investment projects and energy saving assessments are carried out by persons registered in public registers maintained by the AUER. The ZEE sets out the requirements to be met by the relevant persons and detailed requirements are set out in Regulation No RD-16-301 of 10 March 2014 on the information subject to entry in the registers kept by the persons performing audits and certification of buildings and energy efficiency audits of industrial systems, the procedure for obtaining information from the registers, the terms and procedure for acquiring qualification and the technical devices required for the performance of audit and certification activities.

The persons registered in the public register of AUER hold a certificate of successfully passed examinations for upgrading their qualifications to perform audits and certification of buildings and energy efficiency audits of industrial systems.

- **Mandatory staged decommissioning of solid-fuel heating devices that do not meet the requirements of the Eco-design Regulations (EU) 2015/1185 and (EU) 2015/1189 and replacing said devices with other heating devices;**

The draft National Programme for Improving the Ambient Air Quality 2018—2020 includes a measure relating to household heating: mandatory staged decommissioning from 2020 to 2024 of solid-fuel stoves and boilers that do not meet the requirements of the Eco-Design Regulations and implementation of alternative heating measures to contribute with 78 % to the expected reduction in PM_{10} emissions in the residential heating sector. The final objective of the measure is the staged decommissioning of inefficient solid-fuel heating devices.

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

Currently not applicable

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

To ensure efficient use of energy in production, transmission and distribution, the ZE lays down requirements to be taken into account by the Energy and Water Regulatory Commission when setting the prices of electricity, heat and natural gas. In the course of exercising its powers under this Act, the KEVR:

- determines maximum amounts of technology costs in the generation, transmission and distribution of electricity, the generation and transmission of heat and the transmission, distribution and storage of natural gas which can be recognised in pricing regulation in accordance with a methodology or instructions adopted by the Commission;
- requires from electricity and gas network operators to make an assessment of the energy efficiency potentials of the networks concerned through reduction of technical losses; said assessment shall include an analysis of transmission, distribution, load management, network functioning and access possibilities for distributed energy production;
- requires from network operators to include measures and to plan relevant investments for energy efficiency improvement of gas and electricity networks when developing network development plans and provide a timeframe for their implementation.

The KEVR has also powers to assess the cost-effectiveness of the implementation of intelligent metering systems proposed by the operators of the networks. Where the implementation is cost-effective, the KEVR draws up schedules for the implementation of intelligent metering systems and guarantees the interoperability of the said systems taking into account suitable standards, best practices and their significance for the development of the domestic market of electricity and natural gas.

In addition, according to the ZE the KEVR is guided by the following general principles in the exercise of its regulatory powers:

- promotion of the improvement of energy efficiency in energy and natural gas production, transmission and final consumption; and
- provision of incentives for transmission and distribution network operators to make available system services to final customers permitting them to implement energy efficiency improvement measures with the deployment of smart grids, taking into account the costs and benefits of each measures, while ensuring the security of the system.

With regard to price regulation, the KEVR aims to ensure that electricity transmission and distribution prices do not restrict energy efficiency improvement in energy production, transmission and distribution, (demand response participates in balancing markets and ancillary services procurement, and network tariffs reflect cost savings in networks

achieved by consumers, decentralisation of energy generation, reduction of cost of supply or for network investment and the more optimal operation of the networks.

As regards demand response, the KEVR is guided by the principle that electricity transmission and distribution prices should allow increased final customer participation in the efficiency improvement of the grid system through demand response. The KEVR also aims to encourage transmission and distribution network operators to make available system services for electricity demand response measures, demand management and distributed generation on organised electricity markets and to improve efficiency in network design and operation, in particular:

- shifting of the load from peak to off-peak times by final customers taking into account the availability of renewable energy, energy from cogeneration and distributed generation;
- energy savings from demand response of distributed generation sources through a combination of making available energy-efficient services and participation in the balancing market for electricity;
- demand reduction to be achieved by energy efficiency measures undertaken by energy efficiency service providers;
- connection and dispatch of electricity generation sources at medium and low voltage levels;
- connection of electricity generation sources from closer location to the point of consumption;
- providing access to the networks for energy storage facilities.

Another objective is to introduce dynamic pricing for demand response measures by final customers by means of:

- time-of-use prices;
- critical peak pricing;
- real time pricing;
- peak time rebates for lower consumption.

Measures at the level of gas distribution companies

Gas distribution companies apply the following energy efficiency measures:

1. Measures relating to control and diagnostics of the technical condition of networks:

- grouping of gas pipelines by age since commissioning and introducing a shorter control period for patrolling and searching for natural gas leakages in the older sections;
- grouping of gas pipelines by frequency of bursting and leakage; analysing the balance of entry-exit from the gas distribution network.

2. Locating natural gas leakage.
3. Measures for preventing damages caused by third parties: analysis and prevention of third-party actions that break the integrity of the network and result in natural gas leakage: restricting the access to and guarding the facilities.
4. Measures during construction and filling of gas distribution networks: using certified materials and contractors.
5. Operational measures:
    - pressure control;
    - natural gas odourisation;
    - patrolling of the gas distribution network at regular intervals;
    - building a system for remote observation of the values of electrochemical safeguards of metal gas pipelines;
    - new subscribers will be connected by wedge under pressure in order to reduce technical losses;
    - introducing intelligent metering systems in gas distribution networks.

Measures at the level of electricity distribution companies

As regards measures for reducing technical losses in electricity transmission and distribution via the electricity distribution network, the network operators carry out the following activities:

1. Reducing technical losses in electricity transmission and distribution by means of:
    - increasing the cross-section of medium- and low-voltage conductors in cable and overhead networks;
    - building new transformer units to reduce the length of outlets of low voltage networks and/or redistribute power loads;
    - replacing installed power transformers by new ones, with lower losses of energy in no-load condition and short circuiting;
    - thermal imaging audit of transformers, medium and low voltage units to detect problem areas with rising temperature.
2. Increasing the reliability of measuring the quantity of electricity that is received in or leaves the electricity distribution grid and limiting the option for its unauthorised use through:
    - replacement of commercial metering devices;
    - securing and re-locating commercial metering devices on the boundary of ownership;
    - building SMART GRID networks.

Measures of district heating companies

The potential for energy efficiency of the central heating and cooling infrastructure can be achieved by rehabilitation of heat transmission networks and replacing obsolete direct subscriber district heating stations with modern highly efficient automated indirect stations which would reduce heat transmission and distribution losses and would result in reduction of GHG emissions. The best practices associated with the use of pre-insulated pipes in district heating systems help reduce losses to 3 %. A similar loss level can be achieved for high-power density systems. In the context of the national conditions in Bulgaria, it is assumed that the average power density of district heating systems will make it possible to reduce heat losses to 10 % by using the best available technology.

In order to reduce losses to 10 % (against current average losses of 23.7 %), district heating networks need to be modernised so as to reduce annual losses from 2.77 TJ/km to 1.17 TJ/km. As the length of the heat transmission network (1 898 km) is closely related to the amount of transmission losses, it can be assumed that the requirement to reduce losses per one kilometre of network to 1.17 TJ/km should apply to all district heating systems in the country. The potential of district heating systems based on energy efficiency improvement is estimated at 1.6 TJ, or 30.3 % of the heat which is currently lost in the transmission of the heat exchange medium.

vii. Regional cooperation in this area, where applicable

Not applicable

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

The planned amendments to the ZEE will introduce a requirement according to which the schemes and mechanisms developed to promote energy efficiency in buildings must take into account the estimated or achieved energy savings, taking into account one or several of the following criteria:

1. the energy performance of the equipment or materials used in implementing energy efficiency measures in the building, installation of the equipment or materials by persons who are properly qualified for the task in accordance with the requirements laid down in the Vocational Education and Training Act;

2. standard values for the calculation of energy savings in buildings;

3. comparative analysis of energy performance certificates issued before and after the upgrade of the energy performance of the building.

4. the results from the energy efficiency audit or another transparent and proportionate method, which demonstrates an improvement of energy performance.

The policy measures set out in the INECP will be funded from the budgets of the relevant ministries, bodies and other government agencies for the respective year. The implementation of energy efficiency measures will be supported via well-designed and effective financial instruments. At the same time, co-operation between public and

private stakeholders for the development of large-scale investment programmes and financing mechanisms will be promoted. To this end, both EU funds and other schemes for financing energy efficiency measures will be used.

1. Structural funds for the period 2021-2027

During the period covered by the next Multi-annual financial framework (2021-2027) Bulgaria intends to make use of EU Structural Funds as an instrument to finance energy efficiency measures.

In connection with this, the following investment priorities have been determined:

- Support for improvement of the energy efficiency of public, industrial and residential buildings through complete renovation;
- Support for the implementation of measures to improve the energy efficiency of small and medium enterprises, large enterprises and the local authorities.

2. Invest EU Programme;
3. Modernisation Fund;
4. Energy Efficiency and Renewable Sources Fund
5. National Programme for Energy Efficiency of Multi-Family Residential Buildings;
6. National Trust Eco Fund – Investment Climate Programme;
7. Renewable energy, energy efficiency, energy security programmes financed by the European Economic Area Financial Mechanism 2014–2021

3.3 Energy security dimension

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

The security policy measures in Bulgaria's energy sector may be grouped along two main priority axes: diversification of the sources and routes for natural gas supply, efficient use of indigenous energy resources and improvement of interconnections in the energy system, and enhancing the flexibility of the national energy system, energy storage solutions and information security.

Diversification of the sources and routes for supply of natural gas through implementation of the following projects:

- The gas interconnector Greece-Bulgaria (IGB)

The interconnector has a total length of 182 km and capacity for the transportation of 3 up to 5 billion m^3 of natural gas per year. Given sufficient interest, the capacity can be increased up to 10 billion m^3 per year. The interconnector will be built between Komotini, Greece, and Stara Zagora, Bulgaria. It will connect the transmission grids of DESFA and

TAP in Komotini, Greece, and the transmission system of Bulgartransgas EAD in Stara Zagora.

The project for the construction of an interconnector between Greece and Bulgaria has been included in the PCI list of the European Union with accordance with Regulation (EU) No 347/2013 on guidelines for trans-European energy infrastructure. It is one of seven priority gas projects implemented within the framework of the Central and South East Europe Energy Connectivity (CESEC) initiative.

The project is expected to be completed by the end of 2020.

The direct effects of project implementation include real diversification of the sources of natural gas supply to Bulgaria, creating an opportunity for the supply of natural gas via the Southern Gas Corridor and from LNG sources, and connecting and transforming Bulgaria and its gas transmission system into a major part of the infrastructure for gas supply from alternative sources for the entire region of Central and Southeast Europe.

The project will ensure that Bulgaria is able to import the contracted quantity of 1 billion m^3 of natural gas per year after the launch of the Shah Deniz 2 gas field in Azerbaijan. The interconnector will also provide a possibility for gas supply via the LNG terminal in Alexandroupoli from producers like the United States, Qatar, Algeria, Nigeria, etc., including Israel and Egypt in the future.

- Construction of a gas interconnector between Bulgaria and Serbia (IBS)

The planned reversible gas interconnector between Bulgaria and Serbia (IBS) will connect the national gas transmission networks of the two countries. With a total length of 170 km, it will run from Novi Iskar in Bulgaria to Nis in Serbia along a route that comprises a 62.2 km section in Bulgaria. The gas interconnector will be reversible, allowing two-way gas transmission of: 1 billion m^3 per annum up to 1.8 billion m^3 per annum from Bulgaria to Serbia and 0.15 billion m^3 per annum from Serbia to Bulgaria. The project is expected to be completed in mid-2022.

The construction of the interconnector between Bulgaria and Serbia is a project of common interest for the European Union in accordance with Regulation (EU) No 347/2013 on guidelines for trans-European energy infrastructure and a project of common interest for the Energy Community. It is also an element of the infrastructure necessary for the implementation of the Balkan Gas Hub project. It is one of seven priority gas projects implemented within the framework of the Central and South East Europe Energy Connectivity (CESEC) initiative.

The implementation of the project will ensure the diversification of routes via an interconnector, enabling the transmission of natural gas to Serbia from the new entry points at Bulgaria's border with Turkey and Greece, as well as significant spare capacity in the Bulgarian gas transmission network. At the same time, it will allow the importation of natural gas from Serbia in crisis situations.

- Project for the construction of an LNG terminal in Alexandroupoli

The terminal has a rated annual capacity of 6.1 billion m³ and a storage capacity of 170 000 m³. It is a modern technological project involving the construction of an offshore floating unit for the reception, storage and re-gasification of LNG and a system comprising a subsea and an onshore gas transmission pipeline through which the natural gas will be shipped into the Greek national natural gas system and onwards to final consumers. The LNG terminal is strategically situated in proximity to the gas transmission network of the Greek national gas operator DESFA S.A.

The European Commission has included the project in the list of projects of common interest in accordance with Regulation (EU) No 347/2013 on guidelines for trans-European energy infrastructure, including in the third and fourth lists of the European Commission. Bulgaria has been a strong advocate for the inclusion of the LNG terminal in the PCI list.

The terminal is expected to start commercial operations in 2022.

The rated annual capacity and LNG storage capacity of the terminal will enable Greece but also Bulgaria, Romania, North Macedonia, Serbia and Hungary to balance needs on their respective domestic markets. Bulgaria considers the Alexandroupoli terminal project as complementing the gas interconnector with Greece and the Trans Adriatic Pipeline (TAP). It will give it access to producers and suppliers of liquefied gas from the United States, Qatar and Algeria as well as Israel and Egypt, among other countries, in the future.

Bulgartransgas EAD will acquire a 20 % share in the LNG terminal construction project and Bulgargas EAD will participate in the legally binding stage by booking transmission capacity. Bulgaria's participation in the project for the construction of a liquefied natural gas terminal near Alexandroupoli is of key importance for the country and the entire region of Southeast Europe. The synergy between the LNG terminal and the construction of the interconnector between Greece and Bulgaria will contribute to the security and diversification of energy supply.

- The Balkan Gas Hub

The concept developed with assistance from the European Commission envisages the construction of a gas distribution centre (gas hub) in Bulgaria, including the necessary transmission infrastructure, and a natural gas exchange. The gas hub will connect the natural gas markets of all Member States in the region — Bulgaria, Greece, Romania, Hungary, Croatia and Slovenia, linking the region to Central and Western Europe, and to Serbia, North Macedonia and Bosnia and Herzegovina, which are members of the Energy Community. The concept for the construction of a gas distribution centre for South East Europe in Bulgaria is based on the idea of creating a gas trading platform by building infrastructure that will enable the supply of significant quantities of natural gas from different sources intended for further transportation via several physical entry points.

The Balkan gas hub has been included in the PCI list of the European Union in accordance with Regulation (EU) 347/2013 as a group of projects that contribute to the

development and enhancement of gas infrastructure. The projects for the interconnectors between Bulgaria and Greece and Serbia, respectively, and for the upgrade and rehabilitation of the gas transmission network of Bulgartransgas EAD have also been included in this group.

In the context of the European objectives for developing an interconnected and single European gas market, the implementation of the gas hub concept fits in with the projects for the development of the Southern Gas Corridor and in line with the plans for gas infrastructure development in Europe. The Balkan gas hub would be able to rely on natural gas supplied via the newly constructed submarine pipeline in strict compliance with the requirements for the Third Liberalisation Package of the EU and along the existing route; natural gas extracted from the Bulgarian and Romanian sections of the Black Sea shelf; natural gas from the Southern Gas Corridor (Caspian area, Middle East and Eastern Mediterranean), and LNG terminals in Greece and Turkey.

Since 9 December 2019 a gas exchange has been operating in Bulgaria on which natural gas will be traded via gas release auctions — a possibility already envisaged in the Energy Sector Act. The exchange segment will be operated by Gazov Hub Balkan EAD, a subsidiary of Bulgartransgas EAD.

During the initial stage of operation of the exchange, Gazov Hub Balkan EAD will provide the participants in the natural gas market in Bulgaria and the wider region with the possibility to use a platform with integrated software solutions for wholesale energy trading developed in accordance with the requirements laid down in Article 10 of Commission Regulation (EU) No 312/2014 establishing a Network Code on Gas Balancing of Transmission Networks.

On 2 January 2020, multilateral trade was launched via the trading platform of Balkan Gas Hub EAD, including the so-called short-term (spot) and long-term segments of the market and via gas brokers.

- Expanding the capacity of the Chiren Underground Gas Storage (UGS) facility

The project for expansion of the capacity of Chiren Underground Gas Storage (UGS) facility involves the staged increase of the capacity of the only gas storage facility in Bulgaria in order to increase gas storage volumes and pressures in the gas reservoir and achieve higher average gas extraction and pumping capacity over 24 hours. The project envisages an increase in working gas volume up to 1 billion m^3 and an increase in gas extraction and pumping capacity up to 8–10 million m^3 per day. The extension of the Chiren UGS facility is a project of common interest for the European Union within the meaning of Regulation (EU) 347/2013 on guidelines for trans-European energy infrastructure and is an element of the Balkan Gas hub concept.

The expanded UGS facility is expected to become operational in 2025.

The Chiren UGS facility is a major instrument enabling the functioning of the gas market in Bulgaria, which will compensate seasonal variations in domestic natural gas

consumption, providing the flexibility necessary to balance the differences in supply and demand and serving as an emergency reserve.

The project is highly important for the security of gas supplies. In the mid-term, the Chiren UGS facility will assume an important commercial role for the development of competition in the regional gas market, enhancing the flexibility of regional gas transmission systems and contributing to the management of excessive load and the seasonal optimisation of gas transmission networks.

- Rehabilitation, upgrade and expansion of the Bulgarian gas transmission network

The project is a comprehensive multi-component project for the upgrade, rehabilitation and expansion of the existing gas transmission infrastructure in Bulgaria. It will involve three stages during which the following activities will be implemented: upgrade and rehabilitation of compressor stations; repair and replacement of pipes in certain sections following inspection; expansion and upgrade of the existing network; inspections to ascertain and report on the condition of gas pipelines; implementation of systems for pipeline technical condition management optimisation.

The project for the rehabilitation and expansion of the gas transmission infrastructure in Bulgaria has been included in the list of projects of common interest for the European Union in accordance with Regulation (EU) No 347/2013 on guidelines for trans-European energy infrastructure as an element of the infrastructure necessary for the implementation of the Balkan Gas Hub. It is one of seven priority gas projects implemented within the framework of the Central and South East Europe Energy Connectivity (CESEC) initiative.

The facilities included in the second phase of the project are expected to become operational in 2022.

The Bulgarian gas infrastructure will ensure the transmission of Azeri natural gas and gas from LNG sources via the IGB to IBR and IBS, i.e. to Romania and Serbia, and onwards to Hungary and Central Europe.

Efficient use of indigenous energy resource;

Diversification of the supply of fresh nuclear fuel

Nuclear power is currently part of the energy mix of many EU Member States, including Bulgaria.

Nuclear power plants are a major component of baseload power generating capacity and ensure the reliable supply of zero-emission electricity, thereby playing an important role in energy security.

An essential aspect of nuclear power is ensuring full compliance with Euratom's policy on diversification of fresh nuclear fuel supply in line with the European Energy Security Strategy adopted on 28 May 2014, which requires a completely diversified fresh nuclear fuel supply portfolio. The policy is based on the following four pillars:

1) Diversifying the procurement of natural uranium, its conversion and enrichment;
2) Diversifying the producers of nuclear fuel elements (cartridges);
3) Maintaining a sufficient fuel reserve within the perimeter of the nuclear power plant.
4) Concluding long-term contracts for fresh nuclear fuel supply.

In line with the EU policy and goal for lowering the dependence of Bulgaria's energy sector on a single supplier, a process has been launched for the diversification of fresh nuclear fuel supply and the construction of a new nuclear plant, which will comply, as a matter of utmost priority, with the highest nuclear safety standards. Within the framework of diversification policy implementation, better financial and economic conditions will be considered an important advantage.

NPP Kozloduy EAD follows both national policy and EU guidelines on nuclear supply diversification in strict compliance with applicable national and EU law and co-ordinates its actions with the [Euratom] Supply Agency.

The plant has developed a diversification programme, which has been co-ordinated with EURATOM (Supply Agency).

In accordance with the requirements of the Nuclear Regulatory Agency (AYaR) and the power plant's QUALITY GUIDELINE Transition to New Nuclear Fuel the process of diversification will take place in three stages:

Stage 1 – conducting a feasibility study for the purpose of obtaining a licence and switchover to an alternative nuclear fuel in Units 5 and 6;

Stage 2 – drawing up report, which sets out an analysis of the safety of Units 5 and 6 during the switchover to an alternative nuclear fuel;

Stage 3 – conducting a tender for the manufacturing and supply of fuel elements (cartridges).

The diversification programme of NPP Kozloduy is implemented according to schedule and the first stage is already under way. On 20 February 2019, a contract was signed for the feasibility study to be conducted as a requirement for the issuance of a licence and switching over to a new type of nuclear fuel from alternative producers of water-water energetic reactor fuel elements (WWER-1000). The feasibility study is expected to be completed in May 2020.

Extension of the operational life of Units 5 and 6 of the Kozloduy Nuclear Power Plant

The Kozloduy Nuclear Power Plant, being a baseload plant, plays is essential for the sustainability of reserves in the electricity system. It has a share of approximately 33 % of total electricity generation and is thus a guarantee for Bulgaria's energy security.

A project has been successfully implemented, which will allow the operational life of Units 5 and 6 of the Kozloduy NPP to be extended following an upgrade of the two reactors to

ensure that they meet the latest global safety requirements for nuclear power plants. The implementation of the project is a strong argument for the planned long-term operation of the nuclear plant. In accordance with Bulgaria's Energy Strategy for the period until 2020 2020, adopted by the National Assembly on 1 June 2011, in 2017 and 2019 the Bulgarian Nuclear Power Regulatory Agency extended the operating licences of Units 5 and 6 for a period of ten years in accordance with the provisions laid down in national law.

The project for the extension of the operational life of the two units was implemented in two stages due to the large scale of the project:

- During the first stage, which involves activities relevant to both units, a comprehensive survey and assessment of the remaining operational life of Units 5 and 6 of NPP Kozloduy was conducted by an international consortium. The compelling justification of project feasibility relied on rigorous application of a methodology of a high standard, which is fully consistent with the requirements for an EU Member State.

The results of the comprehensive survey demonstrated that the technical condition of the structures, systems and components of Units 5 and 6 conform to all applicable requirements laid down in statutory instruments and design and construction specifications for the operation of NPP Kozloduy.

- During the second stage programmes were implemented to prepare the facilities for long-term operation, which included specific measures determined on the basis of the results of the comprehensive survey. A total of 240 measures were implemented to upgrade Unit 5 and 200 measures were implemented to upgrade Unit 6. The process of drafting the justification of the feasibility of extending the operational life of Unit 6 entailed safety analyses, projections and qualitative assessments of the remaining operational life of the facilities and equipment that ensure the safe and reliable operation of the Unit.

In parallel to the upgrade undertaken to extend the operational life of the two units, the regular safety review of the two units was conducted. It involved a systematic review of all safety factors having an effect on the project and on the operation of the entire nuclear power plant. The safety review is a mandatory requirement for the licensing of the plant. The results of the latest periodic review confirmed that the two Units satisfy all safety parameters and are therefore fit for operation during the next period covered by the licence. They have also demonstrated a high level of nuclear, radiation and technological safety comparable to that of the most advanced power plants.

The construction of a new 2 000 MW power plant, which will enhance Bulgaria's energy security, along with that of the entire region, is envisaged.

Utilisation of the potential of indigenous coal in Bulgaria in compliance with applicable environmental legislation

Bulgaria will make maximum use of the existing potential of indigenous coal in the country in compliance with applicable environmental legislation. The coal has the potential to provide feedstocks for electricity generation in the next 60 years.

The use of indigenous coal reserves has the potential to act as a stabilising source of energy in the future. The power plants using indigenous coal account for approximately 48 % of total electricity generation and guarantee Bulgaria's energy security and the competitiveness of the Bulgarian economy. They are the baseload electricity generating facilities in the Bulgarian electricity system and the main supplier of balancing services in the system. As such, they are a key factor for the security of Bulgaria's electricity system. This determines the role of indigenous coal as a strategic energy resource for Bulgaria's energy and national security.

Network development and enhancing the flexibility of the electricity system

To increase the flexibility of the energy system through energy demand response, Bulgaria plans to enact legislation with a view to establishing conditions that promote active consumer behaviour, opportunities for associations through aggregators or energy communities and their active participation in demand response in different market segments.

During the period in question, Bulgaria envisages to introduce interim measures to enable the implementation of the following reforms:

- Introducing price limits on the balancing market in order to send correct price signals to investors. Maximum and minimum prices consistent with the day-ahead and intraday time intervals and in line with the Balancing Regulation.
- Creating appropriate conditions and increased participation of demand response, in individual or aggregated terms, both in the wholesale market and in the balancing market.
- Upgrade of Bulgaria's transmission network to alleviate internal overloads and increase interconnection capacity.
- In view of the new EU energy and climate targets and the need to ensure system adequacy and achieve a high level of security of supply, a mechanism to enhance the capacity of the electricity market will be established for the next ten-year period.

The leading principles to be taken into account in elaborating an electricity network development plan stem directly from the European Union's energy policy, notably:

- security of electricity supply to consumers;
- integration of the internal and external electricity market;
- lowering the harmful environmental impact through development of the renewable energy sector;

- enhancing the electricity transmission network efficiency.

The Bulgarian electricity transmission network is part of the integrated transmission network of the countries in continental Europe and its development is closely related to the development of the networks neighbouring countries.

The market calculations made on the basis of the electricity supply and demand forecast of each electricity system operator show significant differences as compared to the previous regional plan. The latest plan is the first to take into account Turkey's influence on the region. The Turkish system operator forecasts a significant increase of new generation sources (more than 140 GW installed capacity by 2040), along with low prices of electricity and capacity for year-round export. At the same time, the Bulgarian electricity system will rely on investments in new large-scale, zero-emission sources of electricity that are available on a 24-hour basis. This is increase electricity transit flows through the national grid from the East to the West and could create bottleneck at the Bulgarian-Turkish and Bulgarian-Serbian borders, which may jeopardise free trade. Electricity transit through Bulgaria will increase even further following the potential closure of units of the Maritsa Iztok power plant.

To ensure safe network operation and its network reliability and sustainability in accordance with the above principles, the following power lines will be constructed:

- 400 kV power line from Maritsa substation (Bulgaria) to Nea Santa substation (Greece);
- power line from Plovdiv substation to Maritsa Iztok substation;
- 400 kV power line from Maritsa Iztok substation to Maritsa Iztok 3 power plant;
- 400 kV power line from Maritsa Iztok substation to Burgas substation;
- 400 kV power line from Burgas substation to Varna substation.

The interconnecting power lines have been recognised by the European Commission as projects of common interest (PCIs). An in-depth cost analysis has been conducted in connection with their construction in accordance with the ENTSO methodology. The analysis contains an assessment of both economic indicators and technical parameters. The results of the analysis show that in view of the planned development of generation capacity and electricity consumption in the region, the construction of the power lines is justified from a technical and economic point of view. The economic benefits are mainly associated with the expected drop in electricity prices as a result of the removal of barriers to cross-border trade and the decrease in technological transmission costs. The technical advantages of the power lines are related to the improved operational efficiency of the transmission grid, which will be able to rely on uninterrupted supply. This will improve trading conditions and facilitate the procedures for obtaining various documents necessary for the purpose of obtaining construction permits. The electricity system operator has signed financing agreements under the Connecting Europe Facility for two of the abovementioned projects.

A new 400 kV power line connecting Bulgaria and Greece is expected to be constructed after 2030.

A concept has been developed according to which the 220 kV transmission grid will no longer be developed for general system purposes, unlike the 400 kV and 110 kV grids, with the exception of completing the project for the second district electricity supply network of Ruse.

The development of the 110 kV network has primarily local significance and is borne out of the need to:

- improve the security of electricity supply to consumers;
- improve the electricity exchange with distribution networks;
- connect clients with high electricity consumption, requiring a correspondingly high level of security of supply to the grid;
- connect to the grid electricity generation modules with a capacity of more than 20 MW.

Energy storage

Bulgaria plans to develop several projects for electricity storage with a view to balancing and ensuring the flexibility of its system, enhancing its position as exporter and ensuring cross-border flexibility. These projects will also facilitate the further development of renewable sources and their integration into the national energy system, taking into account the variability inherent in such sources. In connection with this, the following projects are planned to be implemented:

- Increasing the operational capacity of the Chaira Pumped Storage hydropower plant through the construction of the Yadenitsata reservoir, which will enable power generation equipment optimisation. Investment needs are estimated at approximately EUR 220 million
- Approximately EUR 200 million is to be invested in frequency regulation batteries with a total capacity of 180 MW.
- Approximately EUR 200 million is to be invested in new energy sources combined with electricity storage facilities, taking into account the most appropriate technological solution for each project (approximately 200 MW in total).

Prospecting and deep-sea exploration for natural gas in the Black Sea

The permits for prospecting and exploration for natural gas issued by the Ministry of Economy are expected to lead to an increase in the share of local production thereby decreasing Bulgaria’s dependence on the import of natural gas. As of date, there are two active permits for prospecting and exploration of natural gas in the offshore area of the Black sea in Unit 1-21 Han Asparuh and Unit 1-14 Han Kubrat. The permits granted

include both the maritime areas and the shelf and deep-sea areas of the Black Sea. Both units are situated within Bulgaria's exclusive economic zone in the Black Sea.

Since July 2012, the company Total, in partnership with Repsol and OMV, has had a permit for deep-sea exploration of oil and natural gas in Unit 1-21 Han Asparuh in the Black Sea.

In November 2019, the Ministry of Energy published a call for the submission of proposals for granting permits for exploration of oil and natural gas in Unit 1-26 Tervel, which is part of Unit Burgas – deep sea area.

Network and information security (cybersecurity)

The Network and information security of the energy system comprises the security of electronic communication systems and the information systems for the management of the energy system. It is a vital element of national security. The management of power networks to ensure that supply and demand are in a constant state of balance creates a continually growing need for further digitalisation. This carries certain novel risks because digitalisation exposes the energy system to the risk of cyberattacks and incidents that may jeopardise the security of energy supply.

Bulgaria will continue to make efforts to upgrade and enhance the network and information security of its energy system through strategic co-operation and exchange of information with other Member States. In accordance with Directive (EU) 2016/1148 concerning measures for a high common level of security of network and information systems across the Union, which has been transposed into the Bulgarian Cybersecurity Act, electricity and natural gas undertakings and digital service provides have an obligation to apply measures that ensure a high level of network and information security to prevent and mitigate network and information system incidents. In connection with this, a national body competent for network and information security in the energy sector was established under the jurisdiction of the Minister of Energy by a decision adopted by the Council of Ministers in April 2019 pursuant to the Cybersecurity Act. The national competent body is responsible for the organisation, co-ordination and control of the activities and measures in the area of network and information security [on the part of] the Ministry of Energy and the essential service operators in the energy sector designated in accordance with the Cybersecurity Act.

In view of the crucial importance of cybersecurity for the management and functioning of the energy sector, the necessary high-tech solutions at the level of licensed hardware and software for monitoring and active cyber protection are planned to be additionally implemented in Bulgaria's energy system, along with information systems for electricity system management and operation. In parallel, the process of personnel recruitment and training at regular intervals will be accelerated.

ii. Regional co-operation in this area

As a Member State of the European Union, Bulgaria works actively for the establishment

of a robust and sustainable Energy Union, aiming to increase the potential for regional co-operation. Bulgaria has a tradition of maintaining the best possible relations with other countries in the region, both on a bilateral basis and within the framework of broader international initiatives, such as: the Southeast European Cooperation Process, the Stability Pact and its successor the Regional Cooperation Council and the High Working Group set up under the Central and South Eastern Europe Energy Connectivity initiative (CESEC).

In accordance with Regulation (EU) No 347/2013 and within the framework of the Central and South Eastern Europe Energy Connectivity initiative CESEC) the following projects of common interest for the European Union are implemented: Greece – Bulgaria gas interconnector project; Bulgaria – Serbia gas interconnector project; and the project for the rehabilitation, upgrade and expansion of the Bulgarian gas transmission network. They are part of the EU's seven top priority gas projects and will contribute to the diversification of the sources and routes of natural gas supply while improving interconnectivity between countries in the region.

The long-term and mutually beneficial development of energy relations between countries in the region also require, as a matter of priority, the adoption of single set of rules and regulations for the energy sector at EU level.

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

To finance key projects in the area of electricity transmission infrastructure, Bulgaria plans to use funds from the Connecting Europe Facility, the new facilities for financing low-carbon innovations and energy sector modernisation within phase 4 of the EU Emissions Trading Scheme and other programmes with European and national financing.

Key projects in the gas distribution infrastructure are partially financed through the European Energy Programme for Recovery, Operational Programme Innovations and Competitiveness 2014—2020 (OPIC), Operational Programme Development of the Competitiveness of the Bulgarian Economy and the Connecting Europe Facility programme.

More detailed information about the financial measures is set out in point 5.3.

3.4 Dimension Internal energy market[11]

3.4.1 Electricity infrastructure

i. Policy measures to achieve the targeted level of interconnectivity set out in Article 4(d)

In accordance with Article 16 (8) of Regulation (EU) No 2019/943 on the internal market

[11] Policy measures must be in line with the principle 'energy efficiency first'

for electricity 'transmission system operators shall not limit the volume of interconnection capacity to be made available to market participants as a means of solving congestion inside their own bidding zone or as a means of managing flows resulting from transactions internal to bidding zones'. Compliance with this requirement has been ensured by reaching the minimum threshold of at least 70 % of transmission capacity between gas trading zones thereby guaranteeing compliance with the safety standards for network operation, including the safety standard in emergency situations (N-1). Direct obligations under the Regulation currently arise for Greece, Bulgaria and Romania, which have taken the necessary technical and organisational measures to ensure implementation. However, there is a lack of clarity as regards third countries, which requires the conclusion of additional agreements to ensure implementation of Article 16 (8) of Regulation (EU) No 2019/943.

Please see the project information set out in sections 2.4.1 and 4.5.1.

ii. Regional co-operation in this area

Bulgaria fully recognises the role of the projects of common interest pursuant to Regulation No 347/2013 concerning the trans-European energy infrastructure for the completion of the EU's internal energy market and achieving the targets of the EU energy policy in order to ensure the security of electricity supplies for the country and the region of South-Eastern Europe.

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

Financing key projects for modernisation and expansion of the electricity transmission network in Bulgaria:

To finance key projects in the area of electricity transmission infrastructure, Bulgaria plans to use funds from the Connecting Europe Facility, the new facilities for financing low-carbon innovations and energy sector modernisation within phase 4 of the EU Emissions Trading Scheme and other programmes financed by the EU and from the national budget.

See the information set out in section 5.3.

3.4.2 Electricity and gas transmission infrastructure

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

The Bulgarian electricity transmission network is part of the integrated transmission network of the countries in continental Europe and its development is closely related to the development of the networks neighbouring countries.

In the context of the European objectives for establishing an interconnected and single European gas market, the development of Bulgaria's infrastructure is directly linked to the country's positioning as one of the gas distribution hubs in Eastern Europe and is in line with the projects for development of the Southern Gas Corridor and with the plans for development of the gas infrastructure in the region and in Europe. The strategic objectives for improved security of supply and diversification of the sources of natural gas supply have an important role in the European energy policy.

For the purpose of achieving these goals, a number of measures designed to ensure the effective implementation of projects that are essential for the development of electricity and gas transmission infrastructure have been planned.

For more information, see sections 2.4.2 and 4.5.2

ii. Regional cooperation in this area[12]

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

To finance key projects in the area of electricity transmission infrastructure, Bulgaria plans to use funds from the Connecting Europe Facility, the new facilities for financing low-carbon innovations and energy sector modernisation within phase 4 of the EU Emissions Trading Scheme and other programmes with European and national financing.

Key projects in the gas distribution infrastructure are partially financed through the European Energy Programme for Recovery, Operational Programme Innovations and Competitiveness 2014—2020 (OPIC), Operational Programme Development of the Competitiveness of the Bulgarian Economy and the Connecting Europe Facility programme.

See section 5.3

3.4.3 Market integration

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

In order to ensure compliance with Directive (EU) 2019/943 on the internal market for electricity the Energy Sector Act and the implementing regulations thereto will be amended. This will create conditions enabling the launch of full electricity market liberalisation. The process is expected to commence in 2020 and develop with progressive deregulation of the prices for household consumers and small non-household consumers over the next 3 to 5 years. The derogation under Article 5(6) of Directive (EU) 2019/943 will be applied as a temporary measure until full liberalisation of the retail market for electricity.

The policy measures will aim to:

[12] *Regional groups other than the PCIs established under Regulation (EU) No 347/2013*

- Promote local energy communities by creating incentives for more active and efficient participation of energy consumers in the market and enabling the smooth transition of active customers to an open and fully liberalised market for electricity.
- Granting consumers the right to conclude dynamic electricity price contracts and consumption aggregation and optimisation contracts as incentives to promote the more active and efficient participation of energy consumers in the market and enable the smooth transition of active customers to an open and fully liberalised market for electricity.
- Developing a platform of tools enabling customers to compare the offers of retails that additionally promotes their active participation in the market and supports them in the selection of service aggregation contracts while ensuring transparency of relations within civilian energy communities. The measure should at minimum cover household consumers and micro enterprises with a projected annual electricity consumption of less than 100 000 kWh.
- The Bulgarian electricity transmission grid operator has applied for a derogation under Article 16(9) of Regulation (EU) 2019/943. The decision to grant the derogation is subject to approval by the regulatory authority following consultations with the regulatory authorities of other countries in the region. The derogation may be granted for a maximum period of 1 year.
- Taking steps to ensure that Bulgarian electricity market joins the Manually Activated Reserves Initiative (MARI);
- Taking steps to join the Platform for the International Coordination of Automated Frequency Restoration and Stable System Operation (PICASSO) for the purpose of connecting the balancing market.
- integrated gasification combined cycle (IGCC) — the electricity system operator is a full member of the platform and actively participates in its work.
- Implementation of a market-based electricity system capacity mechanism for a period of 10 years. Regulation (EU) No 2019/943 on the internal market for electricity allows Member States to implement a capacity mechanism, where concerns arise as regards the adequacy of national resources. This mechanism should function in line with market principles and comply with the requirements for CO_2 limit values of 550 gCO_2 of fossil fuel per kWh of electricity and the limit value of 350 kgCO2 of fossil fuel on average per year per installed kW from 1 July 2025.

In order to integrate the electricity market into the single European energy market, the country's exchange market will couple with the exchange markets of neighbouring countries.

Day-ahead market

As an EU Member State, Bulgaria is currently implementing all procedures relating to Single Day-ahead Coupling (SDAC). The electricity transmission grid operator and the Bulgarian market operator (BNEB EAD) are full members of the Single Day-ahead Coupling [allocation mechanism]. Despite Bulgaria's technical readiness for the day-ahead market coupling, it remains isolated from the integration processes under way at Community level due to specifics of the electricity markets in neighbouring countries.

- Romania is part of the 4M MC market coupling (the local coupling of Romania, Hungary, the Czech Republic and Slovakia). Prior to the launch of the international project for market coupling at the German, Austrian and Polish borders with 4M at the end of 2018, the launch of a markets coupling project at the Bulgarian-Romanian border was impossible due to the technical incompatibility between 4M MC and MRC market couplings,

Following the launch of the international project, at the beginning of 2020 the local project for a market coupling between Bulgaria and Romania has been launched. The participants in the project have approved a road map according to which the market coupling between Bulgaria and Romania should become operational in December 2020.

- Greece has not established an operational day-ahead market in accordance with the requirements laid down in EU law. In view of the forthcoming launch of a local market and in order to accelerate the process of implementing a market coupling project, the Bulgarian and Greek grid and market operators, supported by the regulatory authorities of the two countries, have submitted an application for the Bulgarian-Geek border to be integrated into the Italian borders working table (IBWT) initiative. This step will enable a market coupling with Greece at the earliest possible stage after a local market is established and becomes operational. The transmission system operator has completed the formalities necessary to join the IBWT and will commence work on the coupling of the Bulgarian market with Greece on 1 March 2020 as full project member.

In line with the road map adopted by the two countries, the market coupling at the Bulgaria-Greek border is expected to become fully operational during the first quarter of 2021.

- In 2018, the Bulgarian electricity system operator, the exchange operator and the Energy and Water Regulatory Commission (KEVR) signed a memorandum on the coupling of the Bulgarian and Macedonian day-ahead markets with the Macedonian electricity system operator (MEPSO) and the Energy Regulation Commission of North Macedonia. The initiative was implemented within the framework of the Western Balkan 6 Initiative (WB6) for coupling the energy markets of West Balkan countries. Following several meetings under the project, the parties currently agree that amendments to North Macedonian legislation are required to ensure that market organisation will comply with the requirements laid down in Regulation (EU) 2015/1222.

- In 2018, negotiations were launched for a trilateral coupling between Bulgaria, Serbia and Croatia. In 2019, the three countries conducted a project feasibility analysis. The implementation of project activities continues and the next steps to be taken involve amendments to Serbian legislation to ensure that compliance with the requirements for market organisation laid down in Regulation (EU) 2015/1222.

The efficient functioning of a single internal market in Europe requires that the day-ahead and intraday markets of EU Member States and European Energy Community members operate in accordance with a single set of rules and requirements for market organisation. Bulgaria, which has borders with non-EU Member States has a strong interest in the development of common rules to ensure effective market coupling.

Intraday market

XBID is the only intraday market coupling project in Europe at present. In line with the EU target model for full intraday market coupling, the process is planned to take place in three waves: The first and second wave have been operational since June 2018 and November 2019, respectively, in 21 countries. The third wave is expected to become operational at the end of 2020.

The Intraday market coupling is implemented through Local Implementation Projects (LIPs).

The electricity operator and the exchange operator participated in LIP 15, which was part of the second wave of intraday market coupling. The second wave entailed the implementation of two local projects — LIP 15 and LIP 16 The project involved the exchange operators and the transmission system operators of Bulgaria, Romania, Hungary, Croatia, Slovenia, the Czech Republic, Poland, Austria and Germany

Following the launch of the second wave on 19 November 2019, Bulgaria is already part of the Singe Intraday Coupling (SIDC) via the coupling at the Bulgarian-Romanian border.

In 2020, the third wave of the intraday market coupling is expected to become operational. The third wave includes LIP 14, i.e. all Italian borders and the Bulgarian-Greek border. The electricity operators have successfully completed all formalities necessary to join LIP 14 and has been working on project implementation since February 2020. The intraday market coupling on the Bulgarian-Greek border is expected to become operational by the end of 2020.

Demand response

By introducing amendments to national law, Bulgaria plans to establish suitable conditions for creating active consumers, opportunities for associations through aggregators or energy communities and their active participation in demand response in 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 metering devices as an incentive for the active and effective participation of consumers in the market;
- Wishing to modernise its energy sector and in accordance with Article 10(c) of Directive (EU) 2018/410 [amending Directive 2003/87/EC] to enhance cost-effective emission reductions and low-carbon investments and Decision (EU) 2015/1814, Bulgaria will further use the possibility for transitional free allocation of greenhouse gas emission allowances to electricity generation during the fourth stage of EU ETS transition period 2021-2030. To this end, the National Investment Framework for the period 2021-2030 will be implemented, which envisages a possibility to free allowances to be allocated to operators against an obligation to invest in energy sector modernisation.

During the period in question, Bulgaria envisages to introduce interim measures to enable the implementation of the following reforms:

- Introducing price limits on the balancing market in order to send correct price signals to investors. Maximum and minimum prices consistent with the day-ahead and intraday time intervals and in line with the Balancing Regulation.
- Creating appropriate conditions and increased participation of demand response, in individual or aggregated terms, both in the wholesale market and in the balancing market.
- Upgrade of the transmission network to alleviate internal overloads. Increased interconnection capacity.

The implementation of the Yadenitsa project aimed at increasing the volume of the lower reservoir of Chaira Pumped Storage Plant (PAVETs) by the construction of Yadenitsa reservoir and a reversible pressure tunnel connection with Chaira reservoir will ensure a balancing capacity in the country's electricity system and allow further development of electricity generation from renewable energy sources according to the long-term strategies for energy development in Bulgaria and the European Union.

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

Regulatory framework development to ensure that consumers have the right to use renewable electricity obtained from auto-production. The framework should ensure that the consumers of such electricity, either individually or through aggregators, have the right to act as auto-producers of electricity from renewable sources, including for their

own use, accumulate and sell surplus electricity from renewable sources, including through agreements for the purchase of electricity from renewable sources, electricity suppliers and [under] commercial agreements between partners, without being subjected to any assessment [for the purpose of] pending or disproportionate procedures and charges [sic].

iv. Policy measures to protect consumers with a focus on vulnerable consumers and, where applicable, consumers at risk of energy poverty, and to improve the competitiveness and affordability of the retail electricity market.

At present assistance is provided to vulnerable consumers on a means tested basis. Pursuant to the Social Assistance Act and Regulation No RD-07-5 of 16 May 2008 on the terms and procedure for allocation of targeted heating assistance, targeted heating assistance is provided to some socially vulnerable groups during the heating season. The programme covers the persons and families that meet the legally established conditions and requirements for income, property and health status, marital status, age, training and job employment, etc. The regulation defines 17 risk groups with differentiated minimum income that are eligible for heating assistance depending on the degree of risk and the priorities set. At present, about 250 000 individuals and families are recipients of such assistance.

The assistance mechanism is as follows: Heating allowances are provided for the respective heating season (1 November—31 March), i.e. for 5 months, in an amount determined by an order of the Minister for Labour and Social Policy adopted before the beginning of the season, taking into account the electricity price for household customers determined by the KEVR on the basis of a projected consumption of 385 kWh electricity, including 280 kWh at the daytime rate and 105 kWh at the night-time rate (the quantity of energy required for heating one room). There is an option to select the type of fuel: solid fuel, electricity, gas or heat. This type of assistance will continue to be applied as a measure to support energy poor people.

The electricity market in Bulgaria is partly liberalised, with a regulated share of 40 %. In line with Third Liberalisation Package of the EU, Bulgaria took steps toward full liberalisation of its electricity market. The phasing out of regulated prices for all final consumers will boost competition among electricity suppliers but it will also expose consumers to greater price volatility. Bulgaria's objective is to ensure adequate protection to vulnerable household consumers of electricity. In this regard, on the basis of a detailed analysis, policy measures were developed to ensure that the transition to a liberalised retail electricity market will be smooth and staged for household consumers. The transition will involve a partial regulation of the price in the beginning until the regulated component of the price is completely eliminated. Before the process of full liberalisation of the electricity market commences, a mechanism for protection of vulnerable consumers of electricity will be implemented; it will include criteria for identification of such customers and financial and non-financial measures for their

protection. The mechanism for protection of vulnerable consumers will be implemented [sic]. The mechanism for protection of vulnerable consumers of electricity aims to ensure all-year cover of minimum electricity needs other than heating needs.

In addition to these short-term measures, long-term measures for investment in energy efficiency or lowering consumption and demand for heating and cooling in the household sector are being sought. Energy efficiency measures will lead to a decrease in the number of consumers who currently satisfy the criteria for energy poverty. An improvement in energy efficiency is likely to have several positive effects, including by lowering energy poverty. In the long-term, the entire EU building stock must undergo (deep) renovation and conversion into near zero-energy consumption buildings and national renovation strategies must facilitate a cost-efficient transformation, taking into account that some households are energy poor. There is a need for the development of national action plans or other appropriate frameworks to overcome energy poverty and Member States must ensure the necessary supply of energy to vulnerable clients by adopting appropriate social policies or improving the energy efficiency of buildings. (Http://enr-network.org/wp-content/uploads/ENERGYPOVERTY-EnRPositionPaper-January-2019.pdf)

A National programme for energy efficiency of multi-family residential buildings, the requirements and procedure for providing grant assistance under the programme and for the designation of the bodies responsible for its implementation was adopted by Regulation No 18 of 2 February 2015. The programme is aimed at the renovation of multi-family residential buildings by implementing energy efficiency measures to create better living conditions for citizens in multi-family residential buildings and ensure heat comfort and higher quality of the living environment.

v. Description of measures to enable and develop demand response including those addressing tariffs to support dynamic pricing13

The 'enter—exit' method has introduced to determine natural gas transmission tariffs in accordance with the European regulation. It provides an opportunity for tariff setting.

3.4.4 Energy poverty

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

In addition to the measures designed to encourage the active participation of consumers in the electricity supply market, measures designed to protect consumers will also be applied. In connection with this, the policy for full electricity market liberalisation will include measures guaranteeing a smooth and gradual transition for household

[13] In accordance with Article 15(8) of Directive 2012/27/EU.

customers. During this gradual transition the retail prices of electricity will be deregulated in several stages until fully liberalised.

Full electricity price liberalisation in the household sector will be given the green light only after a mechanism for the protection of vulnerable consumers of electricity has been put in place. These are the household consumers in a state of energy poverty due to a combination of low income, high energy costs and low energy efficiency of the homes they live in.

The mechanism for protection of vulnerable consumers will include criteria for their identification, and financial and non-financial measures for their protection. It aims to ensure that the minimum quantity of electricity, other than the quantity of energy for heating for which consumers in this group are entitled to receive a separate allowance, are covered throughout the year.

In the long term, measures to improve the energy efficiency of the homes of energy poor consumers in order to lower their energy costs and improve their living comfort will be implemented in addition to the above measures.

At present assistance is provided to vulnerable consumers on a means tested basis. Pursuant to the Social Assistance Act and Regulation No RD-07-5 of 16 May 2008 on the terms and procedure for allocation of targeted heating assistance, targeted heating assistance is provided to some socially vulnerable groups during the heating season. The programme covers the persons and families that meet the legally established conditions and requirements for income, property and health status, marital status, age, training and job employment, etc. The regulation defines 17 risk groups with differentiated minimum income that are eligible for heating assistance depending on the degree of risk and the priorities set. At present, about 250 000 individuals and families are recipients of such assistance.

The assistance mechanism is as follows: Heating allowances are provided for the respective heating season (1 November—31 March), i.e. for 5 months, in an amount determined by an order of the Minister for Labour and Social Policy adopted before the beginning of the season, taking into account the electricity price for household customers determined by the KEVR on the basis of a projected consumption of 385 kWh electricity, including 280 kWh at the daytime rate and 105 kWh at the night-time rate (the quantity of energy required for heating one room). There is an option to select the type of fuel: solid fuel, electricity, gas or heat. This type of assistance will continue to be applied as a measure to support energy poor people.

The electricity market in Bulgaria is partly liberalised, with a regulated share of 40 %. In line with Third Liberalisation Package of the EU, Bulgaria took steps toward full liberalisation of its electricity market. The phasing out of regulated prices for all final consumers will boost competition among electricity suppliers but it will also expose consumers to greater price volatility. Bulgaria's objective is to ensure adequate protection to vulnerable household consumers of electricity. In this regard, on the basis of a detailed analysis, policy measures were developed to ensure that the transition to a

liberalised retail electricity market will be smooth and staged for household consumers. The transition will involve a partial regulation of the price in the beginning until the regulated component of the price is completely eliminated. Before the process of full liberalisation of the electricity market commences, a mechanism for protection of vulnerable consumers of electricity will be implemented; it will include criteria for identification of such customers and financial and non-financial measures for their protection. The mechanism for protection of vulnerable consumers of electricity aims to ensure all-year cover of minimum electricity needs other than heating needs.

3.5 Research, innovation and competitiveness dimension

i. Policy measures related to the elements set out in point 2.5.3

The Bulgarian government's policy in the area of innovation aims to create incentives and support the adoption of new technologies with a view to achieving overall energy cost savings, introducing new energy efficiency standards and enabling the transition to lower and more sustainable energy consumption in Bulgaria. In connection with this, the Innovation Strategy for Smart Specialisation 2014—2020 identifies as a priority area the development of clean technologies with a focus on transport and energy (energy storage, energy saving and efficient distribution, electrical vehicles and eco-mobility, hydrogen-based models and technologies, waste-free technologies, technologies and methods that include the use of by-products and materials from one production in other productions). With a view to achieving these goals, the Ministry of Economy has launched a process of preparation of the Innovation Strategy for Smart Specialisation 2021–2027, along with an Action Plan to it.

- Over the last decade research and innovation have evolved into a key policy priority for the EU. Bulgaria therefore considers research and innovation as a genuine opportunity to improve the competitiveness of the national economy, transforming them into a driver for economic growth and job creation. The Bulgaria government's policy on research, innovation and competitiveness aims to promote:
- the deployment of highly efficient energy technologies;
- the deployment of smart grids and energy storage technologies;
- research in the area of nuclear technology;
- research into the possibilities to deploy electrochemical power sources, such as rechargeable batteries, hydrogen and fuel cell technologies.

With a view to implementing innovation policy, the following measures will be taken:

- increasing the number of innovative start-ups (innovation implementation and development) in high-tech and intensive sectors in line with the Strategy for Smart Specialisation;
- increasing the competitiveness and effectiveness of research by placing an emphasis on results and providing incentives (such as better working

conditions, international co-operation and mobility, co-operation with business) with a view to attracting high-skilled research teams;

- Developing skills at the level of universities and research institutions that enhance the commercial viability and market importance of their research projects and ability to participate in research consortiums;
- Support for co-operation between research organisations and businesses, technology transfer and exploitation of research results;
- Promoting business investments in research and the deployment of innovation in the form of industrial and household applications;

A pilot project for a hydrogen plant with total installed capacity of 20 MW will be developed. On the basis of project results an analysis of the further development of hydrogen power plants after 2030 will be conducted.

In addition, Bulgaria intends to participate in the following research and development initiatives:

- CROSSBOW — Cross-border management of variable renewable energies and storage units enabling greater flexibility of the energy system as regards the production of renewable energy;
- FLEXITRANSTORE — an Integrated Platform for increased flexibility in smart transmission grids with storage entities and large penetration of renewable energy sources, which will increase flexibility on the internal energy market;
- INTERRFACE — Consumer interface architecture to provide innovative grid services for an efficient power system thereby increasing flexibility on the internal energy market;
- SDN-microSENSE-SDN — microgrid resilient electrical energy system, a project aiming to enhance security on the internal energy market;
- FORESIGHT — Advanced cyber-security simulation platform for preparedness training in aviation, naval and power-grid environments aiming to enhance security on the internal energy market;
- X-FLEX — Integrated energy solutions and new market mechanisms for an extended flexibility of the European grid;
- FARCROSS — Facilitating regional cross-border electricity transmission through innovation, extending IEM system flexibility, facilitating regional cooperation and enhancing system security;
- TRINITY — Increasing transmission capacity across regional borders through smart market technologies, extending IEM system flexibility to expand regional co-operation;
- Financial compensation mechanism to support the competitiveness of industries at risk, aiming to reduce the harmful emissions they release;

- National research programmes of the Ministry of Education and Science — Low-carbon economy for transport and life (EPLUS) and Environmental protection and lowering the risk of adverse events and natural disasters, aiming to generate know-how with a focus on the storage and conversion of renewable energy, hydrogen-based technologies and eco-mobility, conducting fundamental and applied research. The programmes will be implemented over a period of 3 to 5 years.

In the coming years, the government will focus its efforts on the implementation of new energy saving technologies with a significant contribution to lowering carbon emissions in the air, combating the greenhouse effect and preventing buildings from overheating. The use of advanced innovative technologies with a potential to significantly reduce the penetration of ultraviolet and infrared radiation with a harmful impact on human health into buildings through glass surfaces will be stimulated. The aim is to significantly reduce energy costs ensuring a relatively rapid return on investment with a view to improving the living and working environment for Bulgarian citizens.

The low-carbon economy will have a major contribution to achieving the target for the lowering noxious substances released in the atmosphere. In connection with this, steps will be taken to lower the noxious atmospheric emissions from transport, agriculture and the industry. For this purpose, innovative air aspiration and filtering systems will be implemented that conform to the highest EU requirements for the capture of more than 90 % of noxious gases, steam and particulate emissions released during energy production, metal production and processing, inert material excavation and processing (cement, lime, asphalt, marble etc.), the pharmaceutical industry, the chemical industry (acid gases, hydrogen sulphide, hydrogen cyanide, hydrochloric acid, etc.), the food industry (NOx, carbon monoxide, formaldehyde, etc.). Technologies and innovative products, varying from portable industrial units for temporary suction of pollutants from the air to centralised systems for large sectors and manufacturing operations may also be used. The Bulgarian government will support the deployment in working environments of energy saving innovations and solutions that reduce the harmful emissions of particular matter released into the atmosphere in order to ensure healthier and safer living and working conditions for citizens. Options for the use electrochemical sources of power, such as chargeable batteries, hydrogen energy and fuel elements will continue to be explored.

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

In view of the importance of innovations for the future development of a clean and highly efficient energy sector, the attention and efforts of the Bulgarian government will be focused on the implementation of projects for the deployment of innovations in energy sector in line with the Strategic Energy Technology Plan for Europe. Changes to the overall energy sector model are currently deliberated, including the penetration of smart

grids, energy storage systems and highly efficient energy technologies and systems in the economy and daily life with a view to lowering energy costs for consumers. The passive design of a green living environment will require a branch new approach, including finding a balance between building orientation, glass elements in construction, ventilation systems and the implementation of highly efficient insulation technologies, systems and materials. The implementation of advanced highly efficient technologies and new generation systems for buildings and glass panelling will significantly lower energy costs for final consumers and contribute to finding solutions to the challenge of decarbonisation while improving living and working conditions. In order to promote the cost-effective development of low-carbon technologies in Bulgaria, the government will also rely on the SET Plan developed at EU level, which promotes cross-sector co-operation on innovation, and on the European Innovation Fund.

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

Bulgaria finances public research institutions on the basis of effectiveness criteria and has developed national research programmes with the aim of consolidating research potential and resources. EU funding has a significant share in Bulgaria's total public investment. In the multi-annual financial framework for the period 2014—2020, the financial envelope from the EU Structural and Investment Funds earmarked as support intended to help Bulgaria address reform challenges is in the amount of EUR 11.7 billion or approximately 2.8 % of Bulgaria's GDP per year. At the same time, many Bulgarian research institutions, innovative companies and researchers have received grants from other sources and EU programmes, such as the Horizon 2020 Programme. Their currently stands at approximately EUR 65 million EU financing helps companies and research institutions mobilise additional private investments. Grant assistance from the European Regional Development Fund alone has generated approximately EUR 113 million in additional private capital for companies. A total of 5.2 % of the financing available under the European Regional Development Fund has been earmarked for RD&I and SMEs, entrepreneurship, energy efficiency, urban development and environmental management. These funds will help raise an additional EUR 247 million in public and private investment. Six infrastructure and innovation projects in which Bulgaria will participate have been approved to date. Their total amount is EUR 302 million, which in turn is expected to generate EUR 769 million in investments.

The energy and energy efficiency infrastructure projects are financed under an Innovation Strategy by Bulgaria's Operational Programme for Smart Specialisation 2014—2020. For this purpose, grant assistance in the amount of BGN 76.2 million was provided for the construction of the Greece—Bulgaria interconnector. The implementation of this project will enable the construction of gas transmission infrastructure for the Southern Gas Corridor and ensure the security of gas supply for Bulgaria by enhancing transit capacity to the countries of South East Europe. This will help diversify imported gas through additional sources of supply from the Caspian region, the Middle East and the Eastern Mediterranean.

SECTION B: ANALYTICAL BASIS

4. CURRENT STATUS AND PROJECTIONS UNDER EXISTING POLICIES AND MEASURES

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

i. Macroeconomic forecasts (GDP and population growth)

Table 28: *Population change, million inhabitants*

Year	2015	2020	2025	2030	2035	2040
Population	7.178	6.953	6.776	6.607	6.448	6.302

Source: (B)EST model, E3-Modelling

Table 29: *GDP at current prices, million EUR*

Year	2015	2020	2025	2030	2035	2040	2045	2050
GDP	45676	54045	62291	71057	78721	84833	89379	93322

Source: (B)EST model, E3-Modelling

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

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

Table 30: *Global energy trends, international fossil fuel prices, EU ETS carbon prices, EUR/toe*

	2020	2025	2030	2035	2040	2045	2050
Liquid fuels	88	104	115	119	125	129	132
Natural gas	57	65	70	75	78	79	80
Coal	17	20	23	25	26	27	28
Carbon emissions prices	30	45	60	60	60	60	60

iv. Technology cost developments

4.2 Decarbonisation

4.2.1 GHG emissions and removals

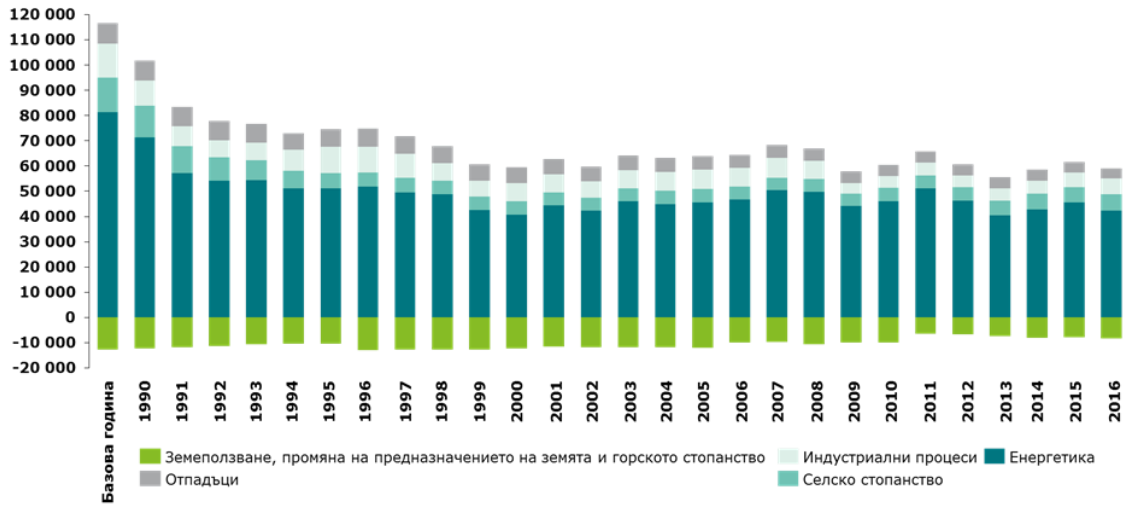
i. Current share of renewable energy in gross final energy consumption and in different sectors (heating and cooling, electricity and transport) as well as per technology in each of these sectors

In 2016, GHG emissions in Bulgaria amounted to 59 060 Gg CO_2, excluding the LULUCF sector. Emissions have decreased by 49.41 % compared to 1988 (baseline) and by 4.4 % compared to the emissions in the previous year (2015).

The main reasons for the reduction of GHG emissions in Bulgaria are:

- the structural reforms in the economy that resulted from the transition from planned to market economy;
- the reduced electricity generation by thermal power plants (and increased shares of water and nuclear energy);
- the structural changes in industry (including the lower output of energy-intensive enterprises and the improved energy efficiency);
- implementing energy efficiency measures in the housing sector;
- shift from solid and liquid fuels to natural gas in energy consumption;
- the decline in the populations of bovine animals and sheep and in the use of fertilisers.

Figure 19: *Total emissions in Bulgaria by sector, 1988—2016, Gg CO_2eq.*



Baseline year	Land Use, Land Use Change and Forestry (LULUCF)	Industrial processes	Energy
	Waste	Agriculture	

Source: National Greenhouse Gas Inventory Report

The Energy sector (GHG emissions from combustion of fuels) held the highest share in total GHG emissions in 2016: 71.8 %. The Agriculture sector ranked second, with 11.0 %, the Industrial Processes and Use of Solvents sector (IPUS) ranked third with 10.3 % and the Waste sector came next with 6.9 %.

The share of emissions covered by the emissions trading scheme in total GHG emissions stood at 56.6 % in 2016, and the share of emissions outside the scheme stood at 42.2 %.

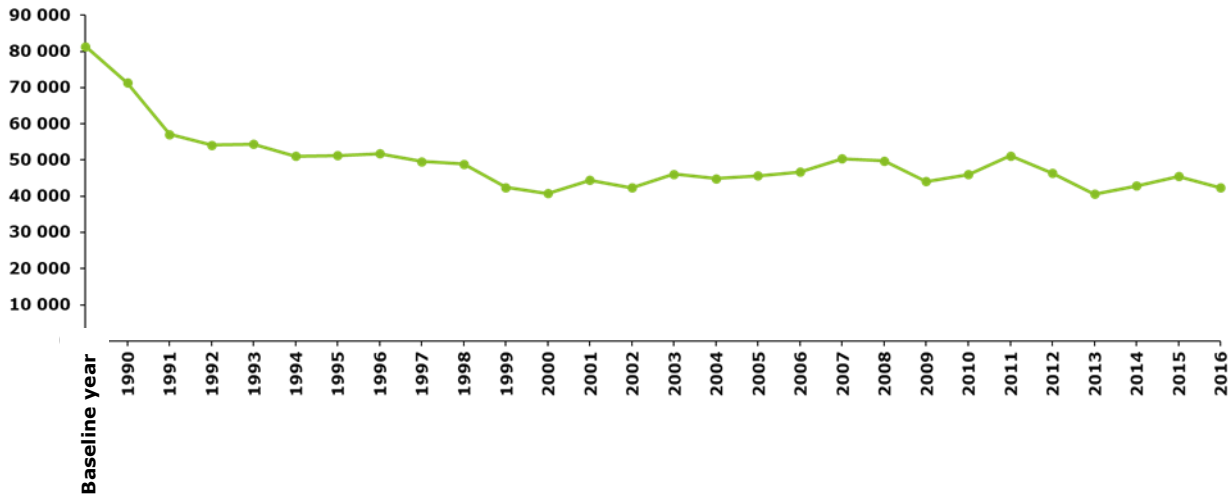
Energy sector

In 2016, the emissions from the Energy sector decreased by 47.9 % compared to the baseline year (42 386 Gg CO_2eq in 2016 compared to 81 320 Gg CO_2eq in 1988). Compared to the previous year, in 2016 the emissions decreased by 6.9 % due to the lower electricity output from fossil fuels.

The main source of emissions in the sector is the incineration of solid fuels which accounted for 57.8 % of the emissions in the sector in 2016, followed by liquid fuels at 29.0 % and gaseous fuels at 12.2 %.

GHG emissions between 1988 and 2016 were driven by the significant reduction in emissions from fuel combustion in the energy industries (35.7 %) and in the use of energy in the manufacturing industry and construction (83.4 %) and in other sectors (commercial, residential, forestry) — 72.3 %, as well as by the clear increase in GHG emissions from transport by 30.2 %.

Figure 20: *GHG emissions from the Energy sector, 1989-2016, Gg CO2eq*



Source: National Greenhouse Gas Inventory Report

Energy industries

Fuel consumption from the following sub-sections is included in this section:

- electricity generation and transmission, including cogeneration;
- heat generation and transmission for public needs;
- natural gas transmission (maintaining the pressure of compressor stations).

For 2016, the overall trend in category 1.A.1 is a reduction of emissions by 35.7 % as compared to the baseline year and by 10.5 % as compared to the previous year.

Table 31: *Emissions trend in the Energy industry subsector, in Gg CO_2eq.*

Year	1988	1990	2016
Aggregated emissions, Gg CO_2 eq.	42.179	38.677	27.128

Manufacturing industry and construction

The Manufacturing industry and construction subsector includes the following groups:

- Iron and steel;
- Non-ferrous metals;
- Chemicals;
- Paper, pulp and printing services;
- Food, beverages and tobacco;
- Non-metallic mineral products;
- Other.

Following the restructuring of Bulgaria's industrial sector, the general trend in this category shows a trend of reduction in emissions by 83.4 % as compared to the baseline year and a small increase by 1.7 % as compared to the previous year. Practically all sub-categories in the industry sector registered a continual decrease until 2009, remaining at the same level for several years, and registering a small increase after 2014.

Table 32: *Projected emissions in the Manufacturing industry and construction subsector, Gg CO_2 eq.*

Year	1988	1990	2016
Aggregated emissions, Gg CO_2 eq.	17.503	17.768	2.910

Transport

In the period between 1988 and 1991 fuel consumption in the transport sector fell by 48 % as a result of the collapse of the economy. Fuel consumption has been steadily increasing since 1991 mainly due to road transport. Despite the decline in 2013, since 2014 the use of road transport fuels once again started to increase.

Table 33: *Projected emissions in the Transport subsector, Gg CO_2 eq.*

Year	1988	1990	2016
Aggregated emissions, Gg CO_2 eq.	7 179	6 605	9 350

Other sectors

Other sectors include the following categories:

- services and public buildings;
- the household sector;

- agriculture, forestry and fisheries.

Table 34: *Projected emissions in the Other sectors subsector, Gg CO_2 eq.*

Year	1988	1990	2016
Aggregated emissions, Gg CO_2 eq.	6.918	8.103	1.915

Industrial Processes and Use of Solvents sector (IPUS)

A steady downward trend in emissions in this sector has been observed since 1988. Emissions in 2016 decreased by 54.9 % as compared to the baseline year 1988.

In 2016, the IPUS sector had a share of 10.3 % of total national emissions of greenhouse gases (excluding LULUCF) as compared to 11.5 % in the baseline year 1988. in 2016 GHG emissions from IPUS stood at 6 062 Gg CO_2 as compared to 13 438 Gg CO_2 in the baseline year 1988.

In 2016, the most important category were mineral products (mainly production of clinker and lime) with a 40.44 % share in total emissions from IPUS. The second category was the chemical industry (production of ammonia and nitric acid) with 30.32 %, followed by the use of products intended as substitutes for ozone-depleting substances with a share of 23.1 % and the manufacturing of metals (steel) with a share of 3.69 %.

The GHG emissions from the IPUS sector vary over time and reached a record low in 2009. The reduction in 2016 for the entire sector was 54.9 % of the baseline year value, with the highest reduction of 94.4 % in metals manufacturing.

This was mainly due to the economic crisis and the 2009 global economic crisis in particular. After 1996, a process of privatisation began, which led to lower output of enterprises. This process was followed by restructuring and modernisation of production while some enterprises discontinued their operation.

The overall decline in emissions over the years was also influenced by the deployment of better technologies at company level.

Table 35 *Trend in emissions in the Industrial Processes and Use of Solvents sector, Gg CO2eq*

Year	1988	1990	2016
Aggregated emissions, Gg CO_2 eq.	13.438	10.047	6.062

Agriculture sector

The total reduction of emissions in the sector for the period since 1988 was 52.6 %. In 2016, agriculture generated 11.0 % to total GHG emissions in Bulgaria (excluding LULUCF).

The emissions reduction was mainly due to the consistent decrease in agricultural land as a result of abandoned cropland and lower livestock population. The decreased use of fertilisers was another driver of emissions reduction.

Table 36: *Projected GHG emissions in the Agriculture sector, Gg CO_2eq.*

Year	1988	1990	2016
Aggregated emissions, Gg CO_2 eq.	13.768	12.462	6.583

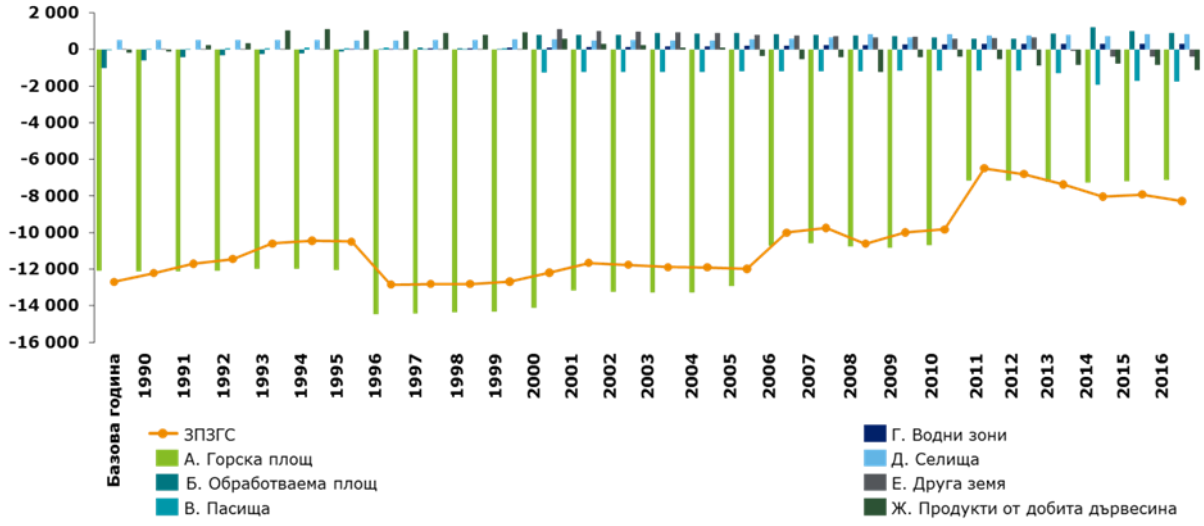
Land Use, Land Use Change and Forestry (LULUCF) sector

The LULUCF sector plays the role of greenhouse gas remover for Bulgaria through the CO_2 removal categories 'Forests' and 'Grassland'. All other categories (Cropland, Settlements, Wetland) are sources of CO_2 emissions. Net CO_2 removals from the LULUCF sector decreased by 57.1 % as compared to 1988 (baseline). The main reason for the drop in CO_2 emission removals was the drop in removals by Forests and the small increase of emissions from the categories Cropland, Settlements and Wetland.

The key reason for the reduced removals by the Forests category was the reported decline in the growth of forests as the average age of forests has been consistently increasing during the reporting period. Despite the drop, the share of removals in total GHG emissions (in CO_2 eq) is still significant. This is because the emissions in the other sectors have decreased too. The share of removals in the baseline year was 15.01 % of the total CO_2 emissions, and in 2016 their share stood at 12.44 %.

Compared to the baseline year, an increase in cropland, settlements and wetland is observed. Total emissions from cropland fluctuated throughout the period. Emissions from settlements increased in recent years due to changes from other land uses near settlements to accommodate increased infrastructure activities after Bulgaria's accession to the EU.

Figure 21: *Emissions and removals in LULUCF 1989 – 2016, Gg CO2 eq.*



Baseline year	*LULUCF*	*D. Water areas*
	A. Forest areas	*E. Settlements*
	B. Arable land	*F. Other land*
	C. Grassland	*G. Harvested wood products*

Source: National Greenhouse Gas Inventory Report

Waste sector

The waste sector generates CO_2, CH_4 and N_2O emissions. The main share of CH_4 emissions from the sector is due to municipal solid waste disposal. N_2O emissions are generated in waste water treatment and biological treatment and incineration of waste. CO_2 comes from waste incineration.

The trends reflect the current state-of-play in waste management in accordance with applicable legislation with the aim of reducing the quantity of waste going to landfills and in line with the waste management hierarchy.

Planned measures for GHG emission reduction in the sector involve mainly the management of municipal solid waste.

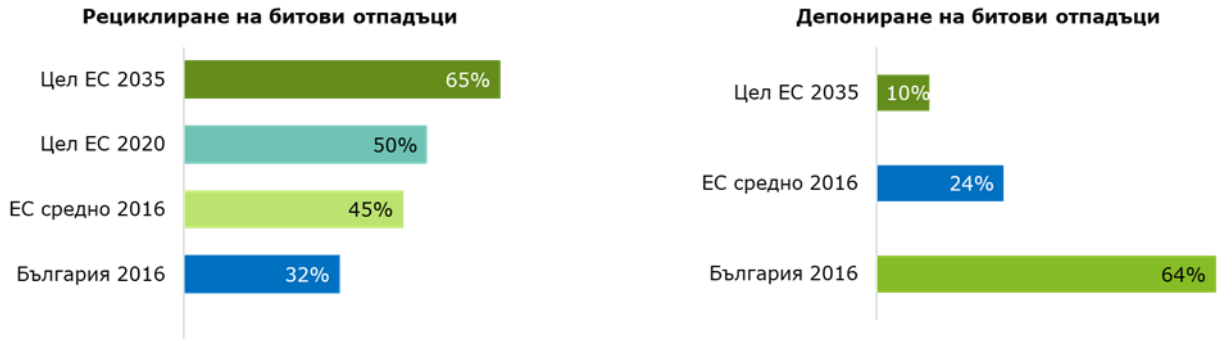
Bulgarian waste management policy is implemented in strict compliance with the waste hierarchy principle:

Prevention -> Preparation for re-use -> Recycling -> Other use -> Landfilling

Good waste management lowers pressure from waste disposal and mitigates the effects of landfilling. The European Environmental Agency (EEA) has estimated that improved waste management significantly lowers annual net GHG emissions, with the greatest share of emissions reduction being achieved after 2000. The main factors contributing to this positive development are the lower methane emissions from landfills and the avoidance of emissions through recycling. An additional instrument for expanding recycling is that demand for certain materials is largely satisfied by recycled materials. Waste constitute a loss of material resources (through metals and other recyclable materials) as they have a potential as energy sources. Waste management is beset by major challenges. Waste treatment activities such as re-use and recycling are environmentally-friendly and lead to landfill diversion.

In 2016, the total municipal waste produced per person in Bulgaria was 404 against the EU average of 483 kg)

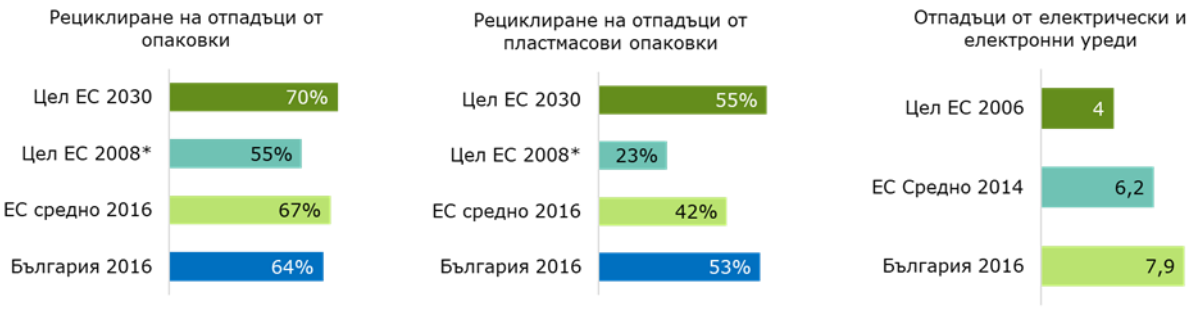
Figure 22: *Progress achieved in waste management in Bulgaria as compared to EU average (1/2)*



Municipal waste recycling	Municipal waste landfilling
EU target 2035	EU target 2035
EU target 2020	EU average 2016
EU average 2016	Bulgaria 2016
Bulgaria 2016	

Source: Eurostat news release

Figure 23 *Progress achieved in waste management in Bulgaria as compared to EU average (2/2)*



*България следваше да изпълни целите си през 2014 г.

Recycling of packaging waste	Recycling of plastic packaging waste	Electric and electronic waste
EU target 2030	EU target 2030	EU target 2006
EU target 2008*	EU target 2008*	EU average 2014
EU average 2016	EU average 2016	Bulgaria 2016
Bulgaria 2016	Bulgaria 2016	
*Bulgaria was expected to achieve its goals in 2014.		

Source: Eurostat news release

The measures to reduce GHG emissions in the sector are mainly related too solid municipal waste management and to the continual fall in population in the last 10 years.

The respective measures are set out in two plans — the National Waste Management Plan and the Third National Climate Change Action Plan. Both plans have a time horizon until 2020.

In 2016, emissions from the waste sector decreased by 50.39 % (4 081.82 Gg CO_2 eq. in 2016 against 8 227.31 Gg CO_2 eq. in 1988) as compared to baseline levels.

Table 37: *Trend in projected emissions in the waste sector, Gg CO_2eq.*

Year	1988	1990	2016
Aggregated, Gg CO_2 eq.	8.227	7.977	4.082

Summary of historical GHG emissions trends

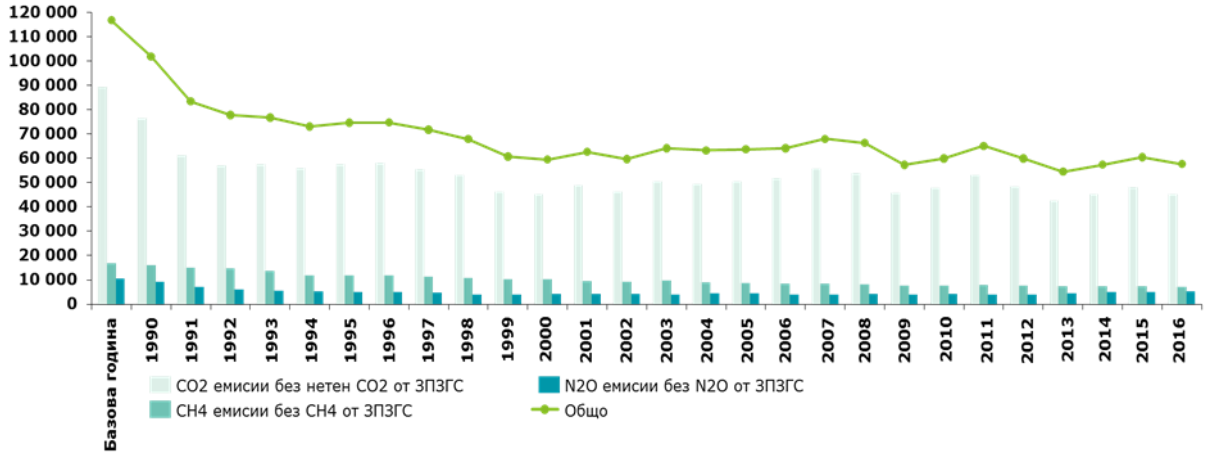
The total emissions reduction of the sector compared to the baseline year is 2016 % is 49.4 %.

Table 38 *Bulgaria's emissions and removals by sector, Gg CO_2eq.*

Sectors	1988	1990	1995	2,000	2005	2010	2016	Change 1988/ 2016, %
Energy	81.320	73.503	51.180	40.772	45.673	46.044	42.386	-47.9
IPUS	13.437	10.046	10.453	7.210	7.683	4.444	6.062	-54.9
Agriculture	13.767	12.461	5.933	5.205	5.170	5.454	6.529	-52.6
LULUCF	-15.234	-14.870	-13.533	-9.427	-8.894	-9.121	-6.536	-57.1
Waste	8.227	7.977	6.999	6.380	5.380	4.604	4.081	-50.4
Total (excluding LULUCF)	116 753.3	103 989.2	74,567.1	59 568.9	63 906.7	60 547.9	59 059.7	-49.41

In 2016, GHG emissions from the energy sector accounted for more than 70 % of total emissions, meaning that sector transition plays a major role in overall emissions reduction.

Figure 24: *Total GHG emissions, 1988 – 2016 CO_2 eq.*



Baseline year	CO_2 emissions without net CO_2 from LULUCF	N_2O emissions without N_2O from LULUCF
	CH_4 emissions without CH_4 from LULUCF	Total

Source: National Greenhouse Gas Inventory Report

ii. Projections by sector with the existing national and Union policies and measures by 2040 (including 2030) (recast)

Projected GHG emissions for the Energy sector

Projected GHG emissions for the energy sector are based on an analysis of the change in Bulgaria's energy balance until 2030 as a result of the existing measures planned and used as basic assumptions. The analysis is based on the (B)EST modelling software for long-term assessment of energy needs and energy planning. The projections take into account all existing measures for greenhouse gas emissions reduction and the existing measures to achieve the targets for energy from renewable sources and energy efficiency set out in detail in the relevant sections of this Plan.

The general trends for the energy sector are as follows:

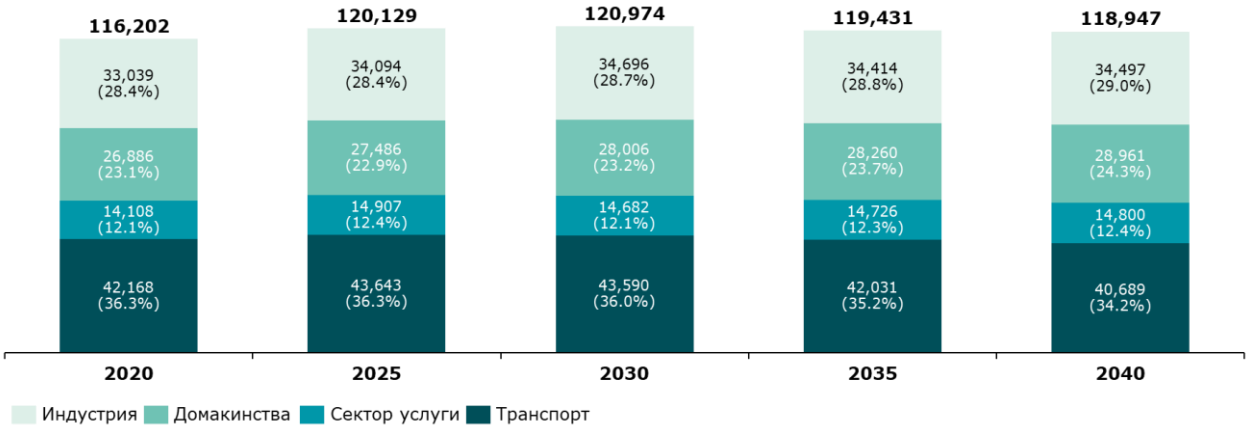
Table 39: *Projected emissions in the Energy sector, CO2 eq.*— ktoe

Emissions	2015	2020	2025	2030
CO_2 emissions, in ktoe CO_2 eq.	45 428.60	44 516.48	43 590.16	37 923.98
CH_4 and N_2O emissions, ktoe CO_2 eq.	1 822.85	2 085.07	2 102.87	2 065.62
Total GHG emissions, ktoe CO_2 eq.	47 251.45	46 601.55	45 693.02	39 989.60

Source: (B)EST model, E3-Modelling

The results of the modelling set out in the table above show that by 2030 GHG emissions will decrease by 15.4 % as compared to emission levels in 2015 (baseline). The main factors for the reduction are the changes in Bulgaria's energy system, and more specifically the fact that during the period analysed primary energy production decreased by 8.5 TWh. This s largely due to the projected continual decrease in the production of energy from solid fuels in the period 2020-2030, which the main source of GHG emissions in the energy sector. The shares of wind, hydro- and geothermal power are projected to remain the same against an increase in the share of natural gas from 1.06 % in 2020 up to 2.34 % in 2030. Solar power is projected to increase from 1.18 % in 2020 to 3.95 % in 2030. In 2030, nuclear energy is expected to continue to play an important role in energy production. More information about the changes in the energy mix contributing to a reduction in the greenhouse emissions analysed in this section is set out in the sections on the increase in the use of energy from renewable sources, energy efficiency, the internal energy market and energy security.

Figure 25: *Final energy consumption by sector, GWh*



Industry	Households	Services	Transport

Source: (B)EST model, E3-Modelling, Deloitte analysis

The energy industries sub-sector covers the following:

- electricity generation and transmission, including cogeneration;
- heat generation and transmission for public needs;
- natural gas transmission (maintaining the pressure of compressor stations).

The sector of energy industries consists of large-scale electricity and heat generation plants. This sector generates the bulk of GHG emissions and according to projections the situation will persist in the future.

Table 40: *Projected emissions in the Energy industries sector, CO2 eq.*— ktoe

Emissions	2015	2020	2025	2030
CO_2 emissions, ktoe CO_2 eq.	29 376.24	28 487.87	27,489.18	22 413.15
N_2O emissions, ktoe CO_2 eq.	117.30	96.8	94.15	71.91
Total GHG emissions, ktoe CO_2 eq.	29 493.54	28 584.67	27 583.33	22 485.06

Source: (B)EST model, E3-Modelling

The table above shows that by 2030 the total quantity of GHG emissions from the energy industries is projected to decrease by approximately 23.5 % as compared to GHG emission levels in 2015 (baseline).

Manufacturing industry and construction sub-sector

The projections for this sector are based on the expectations and forecasts for economic development, the shares of individual subsectors, the projected use of fuels, and the general projections for the use of some primary energy sources.

Table 41: *Projected emissions in the Manufacturing industry and construction subsector, Gg CO_2 eq., ktoe*

Emissions	2015	2020	2025	2030
CO_2 emissions, ktoe CO_2 eq.	2 817.40	4 933.75	4 920.45	4 753.33
N_2O emissions, ktoe CO_2 eq.	26.69	28.84	32.11	33.22
Total GHG emissions, ktoe CO_2 eq.	2 844.09	4 962.59	4 952.57	4 786.55

Source: (B)EST model, E3-Modelling

The table above shows that by 2025 as compared to 2015 (baseline) an insignificant reduction of the GHG emissions from the Manufacturing industry and construction subsector is projected by approximately 2 %, which can be attributed to the expected positive development of the sector.

A further reduction in emissions from the subsector is projected by 2030 as a result of the implementation of existing promote energy efficiency measures and the incentives for the use of renewable energy in industry. GHG emissions are projected to decrease by 5.3 % as compared to 2015 (baseline).

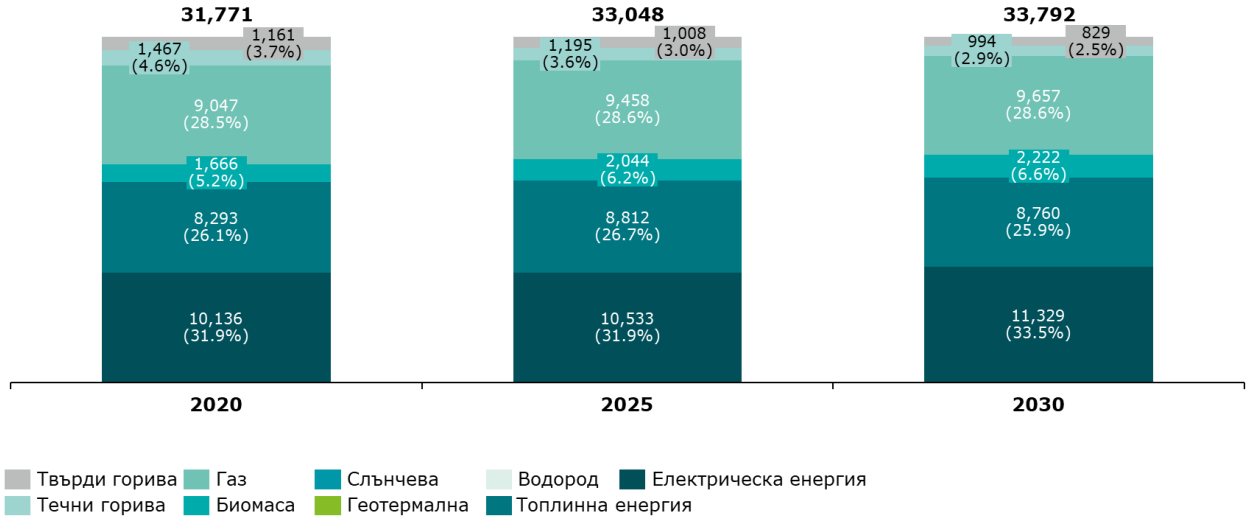
In the period until 2040, the final consumption of energy by the different sectors of industry will remain at relatively constant levels as shown in the chart below.

Figure 26: *Final energy consumption by the different sectors of the economy (GWh)*

Iron and steel	Construction materials	Machine building
Ferrous metals	Paper and pulp	Textile
Chemistry	Food, beverages and tobacco	Other industries

Source: (B)EST model, E3-Modelling, Deloitte analysis

Figure 27: *Final energy consumption by type of fuel and energy in the Processing industry and Construction sectors, GWh*



Solid fuels	Gas	Solar	Hydrogen	Electricity
Liquid fuels	Biomass	Geothermal	Heat	

Source: (B)EST model, E3-Modelling, Deloitte analysis

Transport sector

In the period between 1988 and 1991, fuel consumption in transport dropped by 48 % as a result of the collapse of the economy. Since 1991, fuel consumption has been steadily increasing mainly due to road transport and the transit traffic of heavy goods vehicles. Despite the decline in 2013, since 2014 the use of road transport fuels has been increasing.

The projection for the development of the Transport subsector is based on the projected use of fuels in the sector.

The CO_2 emissions from the Transport subsector are calculated on the basis of projected energy consumption in the transport sector. The transport sector is divided into four subsectors: road traffic, air traffic, rail traffic and navigation.

Table 42: *Projected emissions in the Transport subsector, Gg CO_2 eq. — ktoe*

Emissions	2015	2020	2025	2030
CO_2 emissions, ktoe CO_2 eq.	8 903.71	8 983.93	9 179.60	8 868.88
CH_4 and N_2O emissions, ktoe CO_2 eq.	110.32	113.56	113.85	107.18
Total GHG emissions, ktoe CO_2 eq.	9 014.03	9 097.49	9 293.45	8 976.06

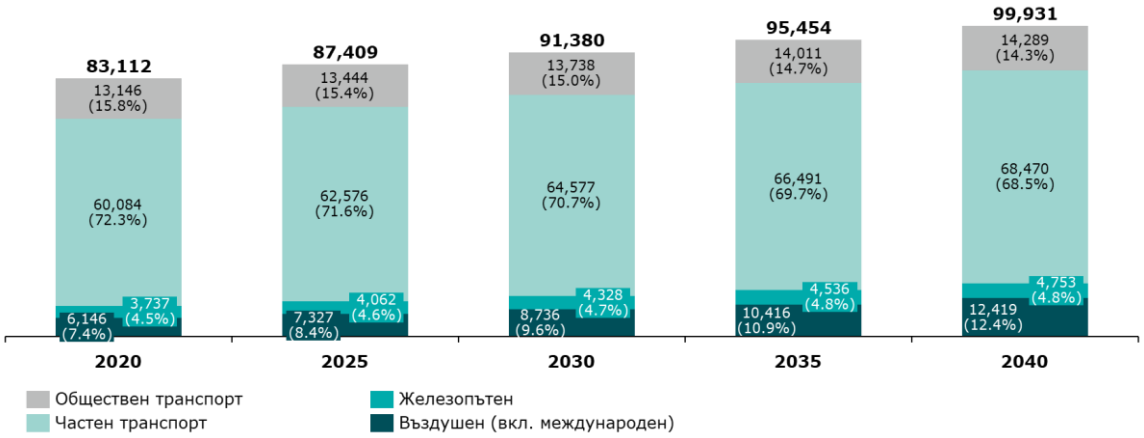
Source: (B)EST model, E3-Modelling

As regards GHG emissions from the Transport sector, by 2030 an insignificant reduction by approximately 0.4 % as compared to 2015 (baseline) is expected.

Despite an overall increase in final energy consumption in transport owing to aviation, higher greenhouse gas emissions reductions by approximately 35 % are expected in 2030 as compared to 2020. [The volume of] private passenger road transport is projected to continue to increase throughout the period, remaining a major part of the sector.

As regards the use of renewable energy in transport, diversification of sources is expected through the introduction of new generation biofuels (352 GWh in 2030) and hydrogen 34 GWh in 2030). In addition, by 2030 the share of electricity in renewable energy is expected to double as compared to 2020.

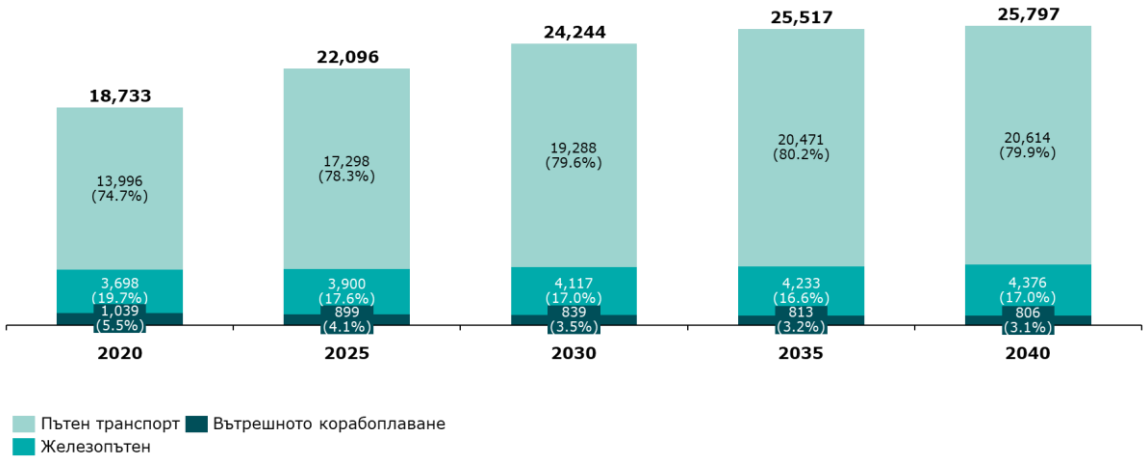
Figure 28: *Passenger transport (Mtkm)*



Public transport	Rail transport
Private transport	Air transport (incl. international)

Source: (B)EST model, E3-Modelling, Deloitte analysis

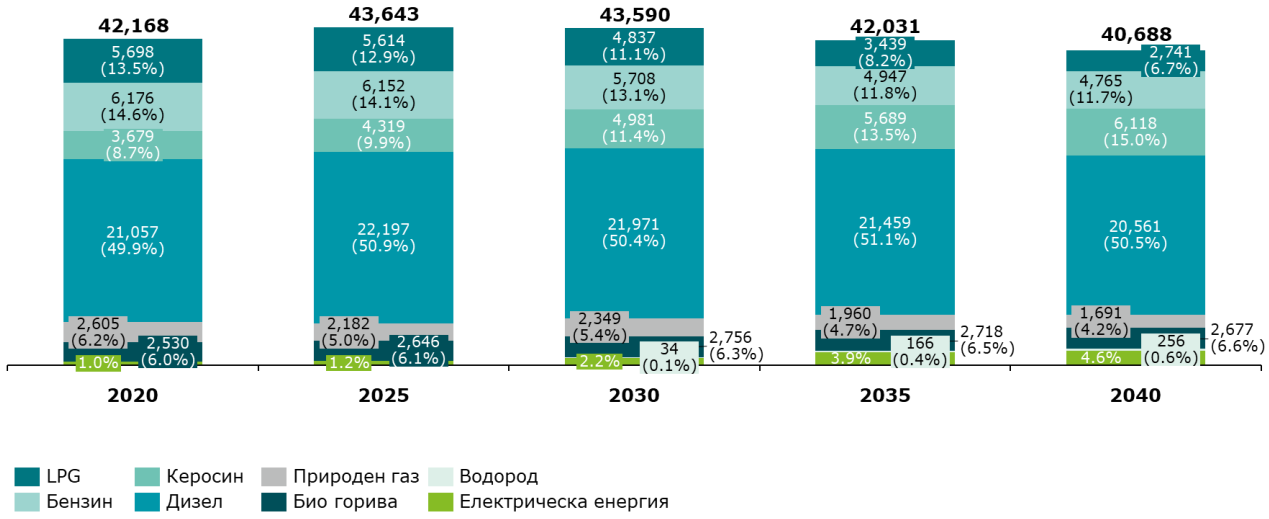
Figure 29: *Freight transport (Mtkm)*



Road transport	Inland navigation
Rail transport	

Source: (B)EST model, E3-Modelling, Deloitte analysis

Figure 30: *Distribution of energy consumption in transport by type of fuel used (GWh)*



LPG	Kerosene	Natural gas	Hydrogen
Petrol	Diesel fuel	Biofuels	Electricity

Source: (B)EST model, E3-Modelling, Deloitte analysis

In the years leading up to 2030 as compared to 2015 (baseline), an insignificant increase in the quantities of kerosene in transport and the levels of LPG used has been projected. The increase of the share of motor vehicles using biofuels and electric vehicles is in turn expected to significantly contribute to a reduction in GHG emissions from the Transport subsector.

Projected GHG emissions in the Industrial Processes and Use of Solvents sector

The projection for the development of the sector reflects expectations for recovery and a gradual growth after the decline driven by the economic crisis. The change in the industrial structure reflects the projected change in the structure of subsectors.

Table 43: *Projected emissions in the Industrial processes sector, Gg CO_2 eq. — ktoe*

Emissions	2015	2020	2025	2030
CO_2 emissions, ktoe CO_2 eq.	4 383.57	4 631.74	4 834.26	4 988.98
N_2O and HFC_s, emissions in ktoe CO_2 eq.	1 322.30	1 495.91	1 990.08	2 431.41
Total GHG emissions, ktoe CO_2 eq.	5 705.87	6 127 65	6 824.34	7 420.39

Source: (B)EST model, E3-Modelling

In view of economic growth forecasts, an increase in GHG emissions from sector Manufacturing processes is projected by approximately 30 % as compared to 2015 (baseline).

Projected GHG emissions in the Agricultural sector

This sector has not implemented any measures for emissions reduction. The reduction is the direct result of the overall decline in agriculture since 1988. Emission reduction from livestock breeding reflects the reduced number of cattle.

Table 44: *Projected GHG emissions in the Agricultural sector, Gg CO_2 eq. – ktoe*

Emissions	2015	2020	2025	2030
CH_4 emissions CO_2 eq.	1 633.94	1 889.72	1 950.00	2 036.54
N_2O emissions, ktoe CO_2 eq.	4 409.58	4 465.18	4 872.92	5 280.78
Total GHG emissions, ktoe CO_2 eq.	6 043.52	6 354.90	6 822.92	7 317.32

Source: (B)EST model, E3-Modelling

A significant increase in projected GHG emissions from agriculture by approximately 20 % is expected on account of the projected growth of the sector according to the forecast received from the Ministry of Agriculture, Food and Forests. In addition to the decarbonisation measures set out in the Third National Climate Action Plan 2013-2020, which will continue to be implemented during the period 2020-2030 with a view to achieving the targets set in the INECP, the WEM scenario also takes into account the measures envisaged for the agricultural sector in the National Air Pollution Control Programme 2020-2030, which albeit primarily aimed at lowering air pollution, will also have a positive impact on GHG emissions.

Projected GHG emissions and removals in the LULUCF sector

Projections made have a time horizon until 2030 and take into account the targets set out in the following strategic documents:

- Third National Climate Change Action Plan (2013—2020)
- National Strategy for Development of the Forestry Sector in the Republic of Bulgaria 2013—2020
- National Strategy for Development of the Forestry Sector in the Republic of Bulgaria 2013—2020
- Strategic Plan for the Development of the Forestry Sector 2014—2023
- Common Agricultural Policy 2014—2020.
- National Forest Inventory Report of Bulgaria 2021-2025

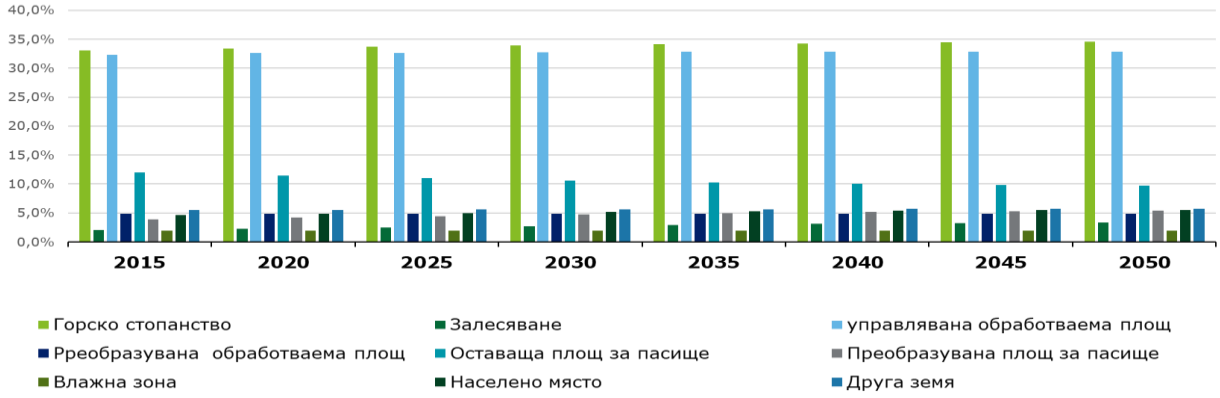
GHG removals are mainly attributable to forests. All other categories (Cropland, Settlements, Wetland) are sources of CO_2 emissions. The overall reduction of CO_2 emission removals by the LULUCF is mainly due to the lower removals by the Forests category and the small increase of emissions from the Cropland, Settlements and Wetland categories.

The reasons for the decrease in removals by the Forests category is the slowdown in forest growth due to the average age of forests.

The increase in the use of biomass is projected to have a neutral impact on land and therefore the LULUCF sector because no significant increase in the land allocated to energy crop cultivation is projected. For biomass production, Bulgaria is expected to rely on the unutilised potential of biomass, which includes the biodegradable fraction of products, waste and residues from biological origin from agriculture (including vegetal and animal substances), forestry and related industries, fisheries and aquaculture, and biodegradable waste fraction, including industrial and municipal waste from biological origin that meet the sustainability criteria stipulated in Article 29 of Directive (EU) 2018/2001.

Overall, no significant changes in land use are projected to occur in the next 10 years.

Figure 31: *Shares in land use*



Forestry and logging	Afforestation	Arable land under management
Converted arable land	Remaining grassland area	Converted grassland area
Wet area	Urban agglomeration	Other land

Source: (B)EST model, E3-Modelling, Deloitte analysis

Projections indicate that Bulgaria continues to fulfill its obligation not to reduce GHG removals capacity below the reference level until 2025. The reference level has been determined in Bulgaria's National Forest Inventory Report for the period 2021-2025.

Table 45 *Projected emissions and removals by LULUCF category, CO^2eq., ktoe*

LULUCF categories	2015	2020	2025	2030
Total for LULUCF, ktoe CO_2 eq.	**-8.488**	**-8 641**	**-8 594**	**-8.542**
Forests, ktoe CO_2 eq.	-7 305	-7 109	-6 924	-6 744
Arable land, ktoe CO_2 eq.	936	680	678	676
Grassland and meadows, ktoe CO_2 eq.	-1 730	-1 825	-1 939	-2.050
Wetland, ktoe CO_2 eq.	277	277	277	277
Settlements, ktoe CO_2 eq.	781	805	827	847
Other land, ktoe CO_2 eq.	-590	-575	-576	-578
Forestry products, ktoe CO_2 eq.	-857	-896	-937	-970

Source: (B)EST model, E3-Modelling

Forest systems have a major contribution to GHG removals compared to all other ecosystems. However, the projection based on the model and on the National Forest Inventory Report show that a decrease in the removals capacity of forests may be expected in Bulgaria.

Projected GHG emissions in the Waste sector

The main GHG emissions from the waste sector are CO_2, CH_4 and N_2O. The main share of CH_4 emissions from the sector is due to municipal solid waste disposal. N_2O emissions are generated in waste water treatment and biological treatment and incineration of waste. Projections take account of the current status of waste management in compliance with the effective legislation.

In order to achieve the targets set in the INECP, the respective measures set out in the National Waste Management Plan and the Third National Climate Action Plan will be extended until 2030 and will be updated and further developed, depending on the programmes achieved in their implementation.

The main targets in the Waste sector are set out in detail in the National Waste Management Plan (NPUO) 2014-2020 and in the detailed programmes and measures put in place to ensure their achievement. The main targets are projected to significantly increase the share of waste for recovery and recycling over the years.

The NPUO plays a key role in achieving resource efficiency and sustainable waste management. This is so because current situation in Bulgaria reveals a significant potential for improvement in both waste prevention and waste management, better utilisation of resources, opening new markets and job creation in parallel to lowering the harmful impact of waste on the environment.

The fourth NPUO is a plan for the transition to efficient waste utilisation as a resource and sustainable development through waste prevention, to the degree possible. The successful implementation of the plan will help prevent and reduce the harmful effects of

waste on the environment and human health and will reduce the use of primary natural resources.

The implementation of a Programme for achieving the targets and ensuring compliance with the requirements for biodegradable waste, including biowaste, has a significant contribution to the achievement of the targets for lowering GHG emissions in accordance with the Third National Climate Action Plan until 2020 because the achievement of the targets for biodegradable waste also contribute to the reduction of methane emissions from municipal waste landfills.

The continued implementation of the National Waste Management Plan and the Third National Climate Change Plan will result in a significant reduction in GHG emissions.

Projected emissions in the sector entail the implementation of programmes for reduction of biodegradable waste going to landfills and landfill methane capture and incineration. However, the implementation of good practices may also contribute to the capture and combustion of approximately 50 % of gas emissions.

Table 46: *Projected emissions in the Waste sector, CO_2, eq. – ktoe*

Emissions	2015	2020	2025	2030
Aggregated emissions, ktoe CO_2 eq.	4 157.64	3 759.01	3 410.54	3 062.84

Source: (B)EST model, E3-Modelling

Conclusion

The tables below set out the projected GHG emissions reduction in Bulgaria until 2040 with existing measures (WEM), respectively expressed as ktoe CO_2 eq. and %.

Table 47: *Projected reduction in GHG emissions, CO_2 eq. – ktoe*

Emissions	2015	2020	2025	2030	2035	2040
GHG emissions (CO_2 eq.), incl. LULUCF	54 656	53 467	53 611	48 871	39 410	30 147
LULUCF	-8 489	-8 641	-8 594	-8.542	-8 476	-8 403
GHG emissions (CO_2 eq.), excl. LULUCF	63 145	62 108	62 206	57 413	47 886	38 550
Total CO_2 emissions from the Energy sector (ktoe CO_2)	44 574	43 986	43 135	37 589	27 959	18 508
Total CO_2 emissions, excl. the Energy sector (ktoe CO_2)	4 912	5 133	5 314	5 460	5 549	5 638

Source: (B)EST model, E3-Modelling

Table 48: *Projected GHG emissions reduction (%)*

Emissions	2015	2020	2025	2030	2035	2040
Total GHG emissions (% change compared to 1990)	-42.64	-43.58	-43.50	-47.85	-56.50	-64.98
Total CO_2 emissions from combustion processes (% change compared to 2005)	-9.26	-10.46	-12.19	-23.48	-43.09	-62.32

In conclusion, the continued implementation of existing policy measures for GHG emissions reduction in the Energy sector (WEM) will allow Bulgaria to achieve a reduction in emissions by 47.85 % in 2030 as compared to 1990.

4.2.2 Renewable energy

i. Current share of renewable energy in gross final energy consumption and in different sectors (heating and cooling, electricity and transport) as well as per technology in each of these sectors[14]

In accordance with the requirements laid down in Directive 2009/28/EC, the National Renewable Energy Action Plan (NPDEVR) sets a binding national target of a 16 % share of energy from renewable sources in gross final consumption in the country by 2020. In line with the scenario for 'additional energy efficiency' adopted in the NPDEVR, the projected gross final energy consumption for 2020 is 10 738 ktoe, meaning that to achieve the binding national target, renewable energy consumption should be 1 718 ktoe.

The Second national report on Bulgaria's progress in the promotion and use of energy from renewable sources, which was submitted to the European Commission at the end of 2013, stated that in 2012 Bulgaria had overachieved the binding national target of a 16% share of energy from renewable sources in gross final energy consumption for 2020. The next national reports (Third and Fourth national reports on Bulgaria's progress in the promotion and use of energy from renewable sources) indicate an ongoing growth of the energy use from renewable sources and in 2018 a 20.5 % share of energy from renewable sources in the country's gross final energy consumption was achieved. Gross final consumption of energy from renewable sources exceeds the quantity estimate set out in the National Plan for 2020, having reached 2 230.1 ktoe in 2018. In 2018, an increase by 37.2 % compared to 2012 was achieved. Over the period 2012-2018 consumption in the heating and cooling and electricity sectors increased by 22.0 % and 42.0 %, respectively. The use of energy from renewable sources increased significantly in the Transport sector from 5.1 ktoe in 2012 to 151.1 ktoe in 2018.

[14]SHARES tool 2018 data.

Figure 32: *Gross final energy consumption of energy from renewable sources for the period 2012-2018, ktoe*

The breakdown of energy from renewable sources by sector is as follows:

- Heating and cooling;

The sector has the highest contribution to the achievement of the binding national target, with gross final consumption of energy from renewable sources reaching 1 349.2 ktoe in 2018. The share of renewable energy consumption in gross final consumption of energy from renewable sources in the sector is 60.5 %.

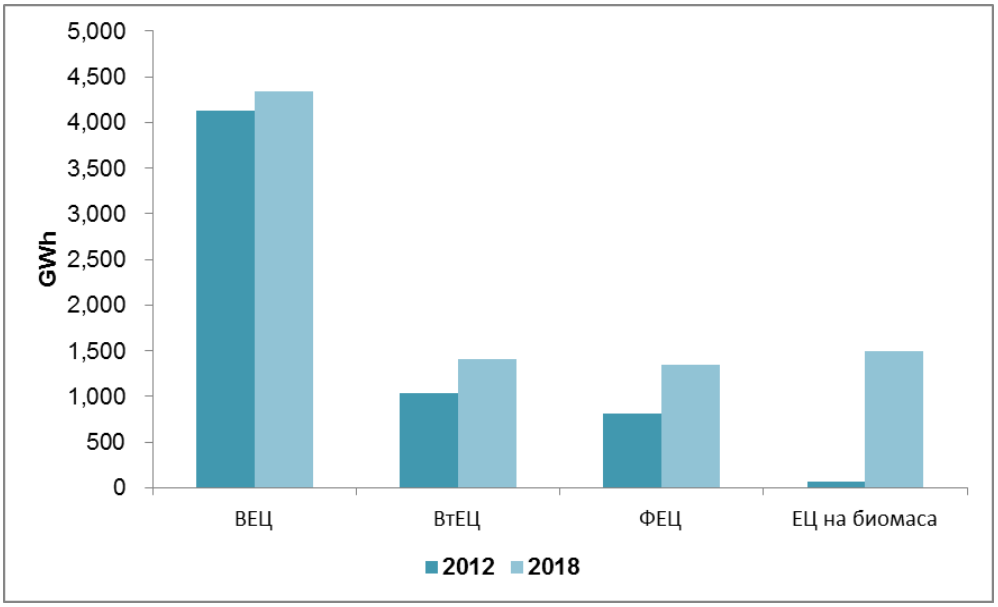
Table 49: *Overall actual contribution (final energy consumption) of each technology used for production of renewable energy in the Republic of Bulgaria to the binding targets for 2020 and to the indicative trajectory for the shares of energy from renewable sources in heating and cooling, ktoe*

	2012	2013	2014	2015	2016	2017	2018
Geothermal (excluding low-temperature geothermal heat used in heat pump systems)	**33.4**	**33.4**	**33.4**	**33.4**	**34.6**	**34.6**	**34.6**
Solar energy	**15.4**	**19.1**	**19.7**	**21.8**	**22.4**	**23.5**	**24.9**
Biomass	**1 008.5**	**1 012.2**	**964.9**	**1 012.0**	**1 038.8**	**1 054.5**	**1 160.9**
solid biomass	1 008.5	1 011.7	963.0	1 007.6	1 013.1	1 043.4	1 148.0
biogas	0.0	0.5	1.9	4.3	25.7	11.1	12.9
bioliquids	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewable energy from heat pumps	**47.0**	**64.5**	**65.0**	**74.9**	**81.2**	**87.4**	**92.4**
of which aerothermal	0.0	0.0	0.0	59.0	62.8	68.0	71.3
of which geothermal	0.0	0.0	0.0	0.0	0.0	0.0	0.0
of which hydrothermal	0.0	0.0	0.0	15.9	18.4	19.5	21.1
TOTAL	**1 104.2**	**1 129.1**	**1 083.0**	**1 142.0**	**1 177.0**	**1 200.0**	**1 312.8**
of which for district heating systems							
of which energy from biomass used in households	758.7	749.6	733.3	716.1	758.0	759.6	738.7

The share of biomass was 91 % in 2012 and despite its decrease to 88 % in 2018, it remained the renewable source with the greatest application in this sector. In 2018 as compared to 2012, a positive trend was that the use of renewable energy from heat pumps increased by 96.6 %, followed by solar energy with a 61.7 % increase and geothermal energy with a 3.6 % increase. Solid biomass continues to be the renewable source of highest importance to this sector and with the greatest application in the Household sector. In recent years the use of wood wastes, other plant wastes and biomass from agriculture and sewage sludge increased, although not at the expected rate.

- electricity sector;

In 2018, the production of electricity from renewable sources stood at 8 583 GWh[15], which represents an increase by 42 % as compared to 2012. The increase is attributable to the commissioning of new solar plants, wind farms and biomass power plants and the transition of power plants using conventional fuels to biomass. The structure of electricity generation is shown in the figure below:



HPP	WF	PhvP	Biomass-powered power plants

Figure 33: *Gros generation of electricity from renewable sources in the period 2012-2018 (electricity generation by hydropower plants and wind farms has been normalised), GWh*

During the period 2012-2018 electricity generation by all plants registered an increase, which was most significant in biomass power plants (from 66 GWh to 1 492 GWh) and in solar plants (from 814 GWh to 1 343 GWh).

[15]Production of electricity by hydropower plants and solar plants has been normalised in accordance with the requirements laid down in Directive 2009/28/EC.

In the same period installed capacity also increased for all types of types using energy from renewable sources both on account of the rehabilitation of existing power plants (mostly hydropower plants) and the commissioning of new plans and the transition of thermal plants from conventional fuels to biomass. In 2018, installed capacity stood at 5 305.4 MW. As compared to 2012, this represents an increase by 8.6 % (from 4 885 MW).

The consumption of energy from renewable sources in the electricity sector has a contribution of 33.1 % in gross final consumption of energy from renewable sources in 2018.

Table 50: *Overall actual contribution (expressed in installed capacity and gross electricity generation) of each technology for renewable electricity generation used in the Republic of Bulgaria to the targets for 2020 and to the indicative trajectory for the shares of energy from renewable sources in electricity*

	2012		2013		2014		2015		2016		2017		2018	
	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh
HPP (normalised generation)	3181	41263	3203	41904	3219	4 247 6	32190	42221	32230	41699	3 371.6	42807	3 3790	4 339 0
off-pump (normalised generation)	2168	3711.1	2 190	3780.1	2206	3 837.8	2206.0	3814.7	2210.0	3748.2	2 358.6	3859.9	2366.0	3900.9
PAVETs (non-normalised generation)	864	7981	864	758 9	864	560 8	8640	4918	8640	6875	864 0	664 8	8640	276.2
With combined heat and power mode of operation (normalised generation)	149	4152	149	4103	149	409 7	1490	407 4	1490	4217	1490	420 8	1490	4381
Geothermal power plants														
Solar power plants	1,013	813.9	1020	1360.9	1026	12525	1 029.0	1 383.3	1028.0	1 386.3	1 035.6	1403.0	10327	13428
Wind farms (normalised	*677*	10392	*683*	12202	699	1 300 6	6990	1 3656	6990	1 407 7	698 4	1427.7	6989	1 408 8
Biomass	14	65.8	34	111.7	40	200.8	54.0	270.2	57.0	353.6	520	396.0	194.8	14923
solid biomass	14	652	30	95.0	30	138.8	34.0	151.1	19.0	1628	23.0	1802	158.4	1 280.0
biogas	0	0.6	4	16.7	10	620	20.0	119.1	38.0	190.8	29.0	215.8	36.4	2123
TOTAL	**4885**	**6045.2**	**4940**	**6 883.2**	**4984**	**7001.4**	**5001.0**	**7241.2**	**5007.0**	**7317.5**	**5157.6**	**7507.4**	**5305.4**	**8 583.0**
of which Combined Heat and Power (CHP)		65.8		1099		182.2		233 9		2544		289 4		685 9

- Transport sector

In 2012, the use of biofuels was not taken into account on account of the failure to transpose the requirements for sustainability into national environmental legislation. This is reason for the reported quantity of energy from renewable sources in transport in 2012 (5.1 ktoe), which only takes into account electricity consumption. In the period between 2013 and 2018, the final consumption of energy from renewable sources in transport increased significantly, reaching 151.5 ktoe in 2018. Consumption of biodiesel and bioethanol — in 2018, a total of 11.25 ktoe of new generation biofuels were used (Part A of Annex IX to Directive 2009/28/EC).

Table 51 *Overall actual contribution of each technology for renewable energy generation used in Bulgaria to the binding targets for 2020 and to the indicative interim trajectory for the shares of energy from renewable sources in the transport sector (ktoe)*

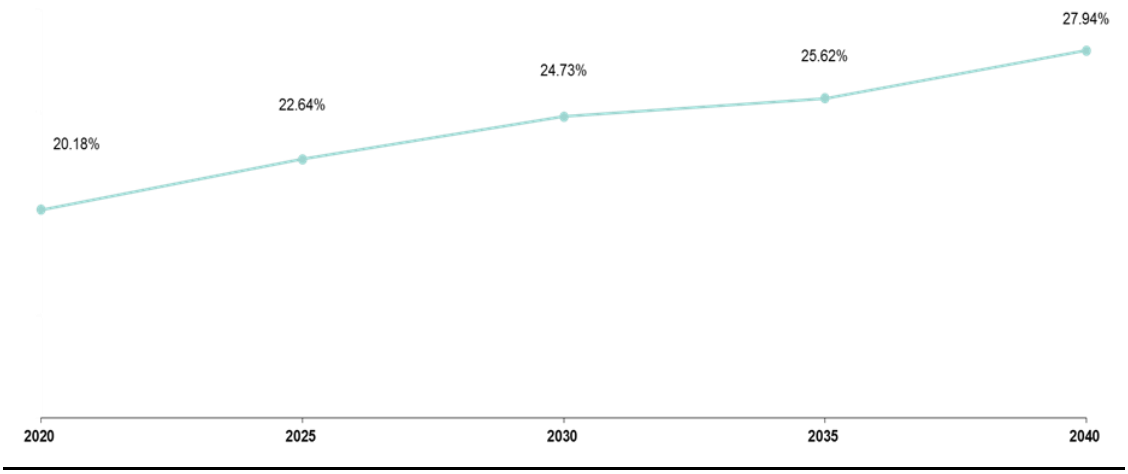
	2012	2013	2014	2015	2016	2017	2018
Bioethanol	**0**	**8.4**	**14.8**	**32.2**	**32.9**	**26.6**	**28.6**
Biodiesel (FAME)	**0.0**	**92.2**	**93.8**	**110.0**	**127.3**	**136.4**	**114.3**
Total biofuels produced in a sustainable manner, incl.		**100.5**	**108.7**	**142.2**	**160.2**	**163.0**	**142.9**
biofuels, produced in a sustainable manner from resources specified in section A of Annex IX							11.3
other biofuels produced in a sustainable manner that may be taken into account in connection with the target under Article 3(4)(e)							
biofuels, produced in a sustainable manner from resources specified in section B of Annex IX							42.3
biofuels, produced in a sustainable manner, the contribution of which to achieving the target for energy from renewable sources is subject to the limitation stipulated in Article 3(4)(d)		100.5	108.7	142.2	160.2	1630	89.4
Import from third countries	**0.0**	**0.0**	**2.7**	**3.0**	**5.4**	**15.9**	**17.6**
Hydrogen, produced on the basis of RES							
Electricity from RS	**5.1**	**5.2**	**6.2**	**7.7**	**8.4**	**9.4**	**8.2**
consumed in road transport	0.7	1.0	1.7	1.2	1.3	1.3	0.9
consumed in rail transport	3.9	3.6	3.9	5.9	6.5	7.5	6.9
consumed in other transport sectors	0.5	0.5	0.5	0.6	0.6	05	0.4
Total energy from RS	**5.1**	**105.7**	**114.9**	**149.9**	**168.6**	**172.4**	**151.1**

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

The method used to calculate the share of energy from renewable sources in gross final consumption of energy from renewable sources is based on the requirements laid down in Directive 2009/28/EC and on the amendments introduced by Directive (EU) 2018/2001.

During the period 2020-2030, the share of energy from renewable sources in gross final energy consumption ranged from 20.18 % up to 24.73 %. In the period between 2020 and 2025 the increase will be mainly attributable to the commissioning of new plants and in the period between 2025 and 2030 to the implementation of measures to increase energy efficiency in final energy consumption. A further increase is expected in the period after 2030, with the share of energy from renewable sources reaching nearly 28 % by 2040.

Figure 34: *Indicative trajectory of the share of energy from renewable sources in gross final consumption of energy in the period 2020-2040*



Source: (B)EST model, E3-Modelling, Deloitte analysis

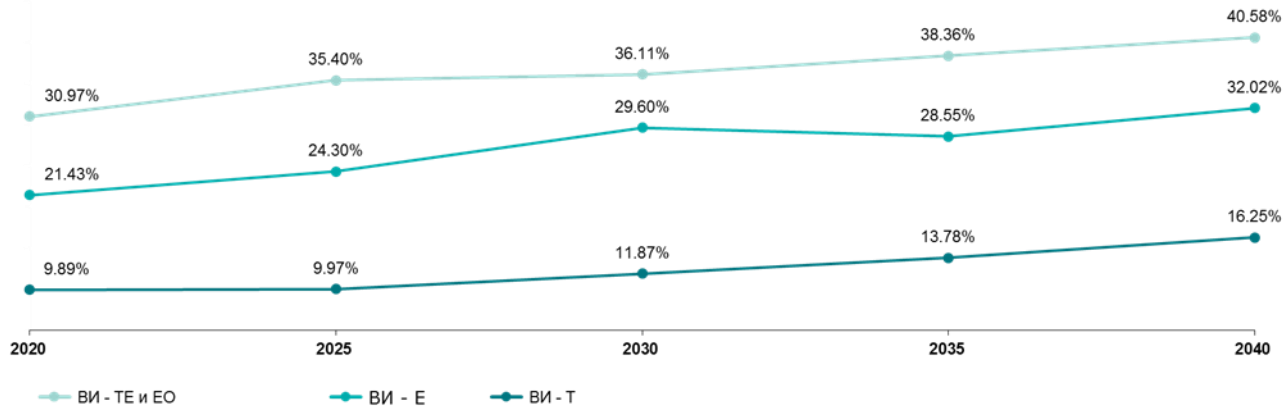
The current policy measures have a positive impact on the share of energy from renewable sources in all sectors. The highest increase is expected in the electricity sector where the share of electricity from renewable sources may reach 29.60 % in 2030 and 32.02 % in 2040.

The continued implementation of existing policy measures over the period 2020-2030 will enable Bulgaria to achieve an annual increase of the share of energy from renewable sources in the heating and cooling sector of approximately 1 percentage point (calculated as the difference between the share of energy from renewable sources for the period 2020-2030, divided by the number of years), which is lower than the targets set in Directive (EU) 2018/2001.

The cited Directive sets a target for a share of energy from renewable sources in gross final energy consumption in transport of at least 14 % to be achieved by each Member State. WEM scenario projections indicate that this share will not be achieved by 2030.

This means that additional policy measures are required to promote the consumption of energy from renewable sources in accordance with Directive (EU) 2018/2001.

Figure 35: *Indicative trajectory of the share of energy from renewable sources in final energy consumption in the electricity and heating and cooling sectors and transport for the period 2020-2040 (%)*

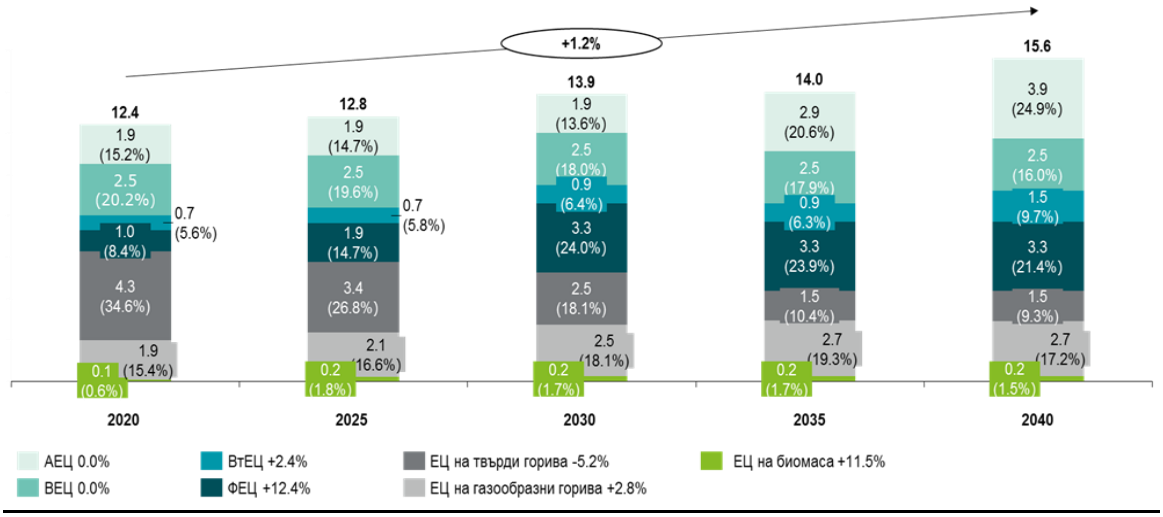


RS-Heating and cooling	RS-Electricity	RS-Transport

Source: (B)EST model, E3-Modelling, Deloitte analysis

With existing policy measures, in the period 2020-2030 installed capacity for electricity generation will increase by an annual average of 1.1 %, reaching total installed capacity of 13.9 GW in 2030. Projections for 2030 show a significant increase in the installed capacity of biomass-fired power plants (annual average growth rate of 11.5 % for the period 2020-2030 and solar plants (annual average growth rate of 12.4 % for the period 2020-2030). On the other hand, a decrease in the installed capacity of power plants fired by solid fuels at an annual average rate of 5.2 % over the period 2020-2030 is projected, with nuclear and hydropower plant capacity remaining relatively stable.

Figure 36: *Indicative trajectory of net installed capacity for electricity generation for the period 2020-2040, GW*

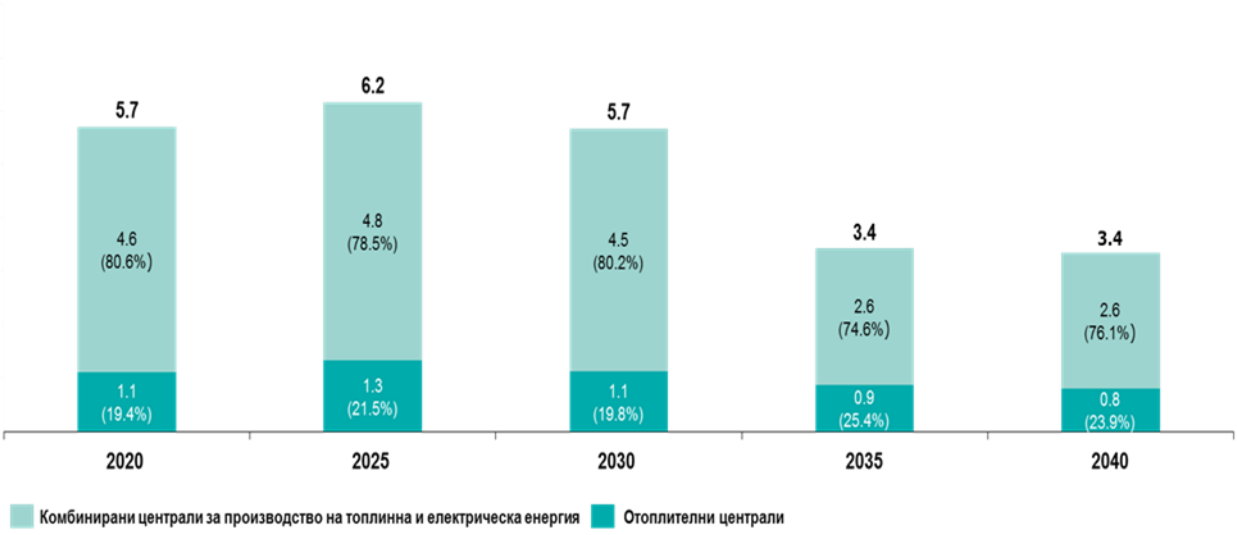


Nuclear power plant 0-0 %	Wind farms +2.4 %	Power plants fired by solid fuels - 5.2 %	Biomass-fired power plants +11.5 %
Hydropower plants 0.0%	Solar plants +12.4 %	Power plants fired by gaseous fuels +2.8 %	

Source: (B)EST model, E3-Modelling, (% in the key shows the annual average rate of increase for the period 2020 – 2030

As regards the production of energy for heating, installed capacity is projected to increase in 2025, followed by a significant decrease due to the decommissioning of cogeneration plants and heating plants. As a result, net installed capacity in 2030 is projected at a total of 5.7 GW. Until 2030 the ratio between heat and electricity cogeneration plants and district heating plants is expected to remain stable (80 % for cogeneration plants and 20 % for heating plants). In the period 2030-2040, cogeneration plants and heating utilities are expected to be decommissioned, which will result in a decrease of the net installed capacity of the two types of plants to 3.4 GW in 2040.

Figure 37: *Indicative trajectory of net installed capacity for the production of energy for heating in the period 2020-2040, GW*



Combined heat and electricity plants;	Heat generation plants

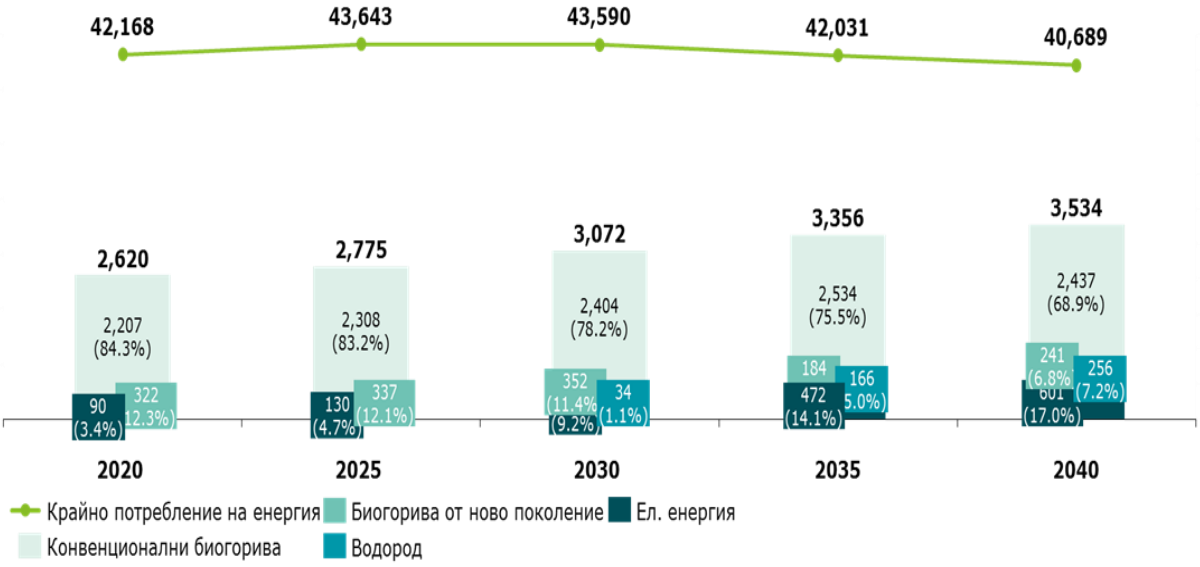
Source: (B)EST model, E3-Modelling

Final consumption of energy by sector and use of energy from renewable sources

The increase in final energy consumption in transport is attributable on air transport, which is projected to grow by approximately 35 % as compared to 2020. In the period 2020-2030, private passenger transport by road is expected to decrease. A small increase of the volume of rail transport is projected. After 2030, final energy consumption will decrease until 2040 as a result of the implementation of energy efficiency measures.

A diversification of sources is expected in terms of the energy from renewable sources used in transport as a result of the use of new generation fuels (30.3 ktoe in 2030) and hydrogen (3 ktoe in 2030). The share of electricity from renewable sources is projected to increase threefold in 2030 as compared to 2020.

Figure 38: *Projected final consumption of energy and energy from renewable sources in transport for the period 2020-2040, GWh*



Final energy consumption	New generation biofuels	Electricity
Conventional biofuels	Hydrogen	

Source: (B)EST model, E3-Modelling

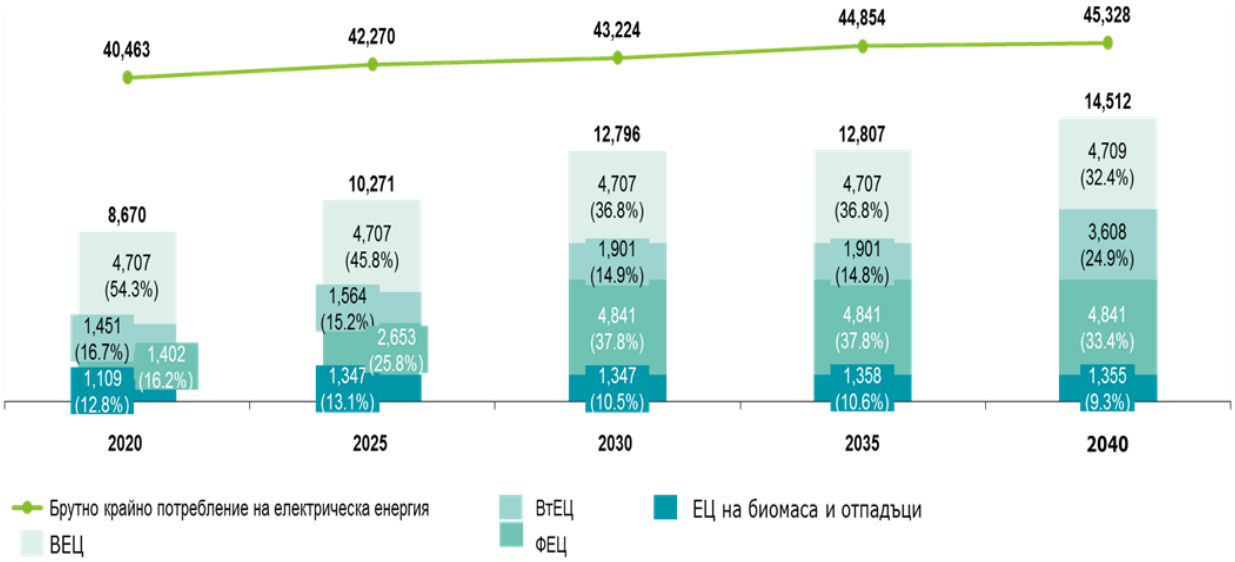
The projected gross production of electricity is based on the following assumptions:

- an increase in the consumption of electricity in Bulgaria to nearly 35 600 GWh in 2030;
- a reduction of losses in transmission and distribution as a result of the implementation of energy efficiency measures;
- a projected increase of losses in storage and supply and demand management by 12 % in 2030 as compared to levels in 2020;
- a decrease in the own energy own needs of power plants as a result of the implementation of energy efficiency measures;
- consumption of electricity for hydrogen production by Power to X plants of 47 GWh (the entire quantity is projected to be consumed in 2030).
- export of electricity will remain relatively stable throughout the period at a level of 8 000 GWh per year.

WEM projections for the use of energy from renewable sources take into account the expected construction of new wind farms and solar plants by 2030. Thus, electricity generation by wind farms is expected to reach 15 % of gross production of electricity from renewable sources, with the production of electricity from renewable sources by solar plants projected to exceed 37 %. In addition, new biomass-fired power plants are

expected to be commissioned, with the electricity they generate projected to reach 1 347 GWh by 2030. The electricity generated by hydropower plants is projected to remain at the same level until 2030. In the period leading up to 2040 an increase in electricity generation is projected solely for wind farms, with the electricity output of installed capacity relying on other renewable sources remaining at the same levels.

Figure 39: *Projected development of gross electricity production and gross electricity generation by power plants using energy from renewable sources for the period 2030-2040 (GWh)*

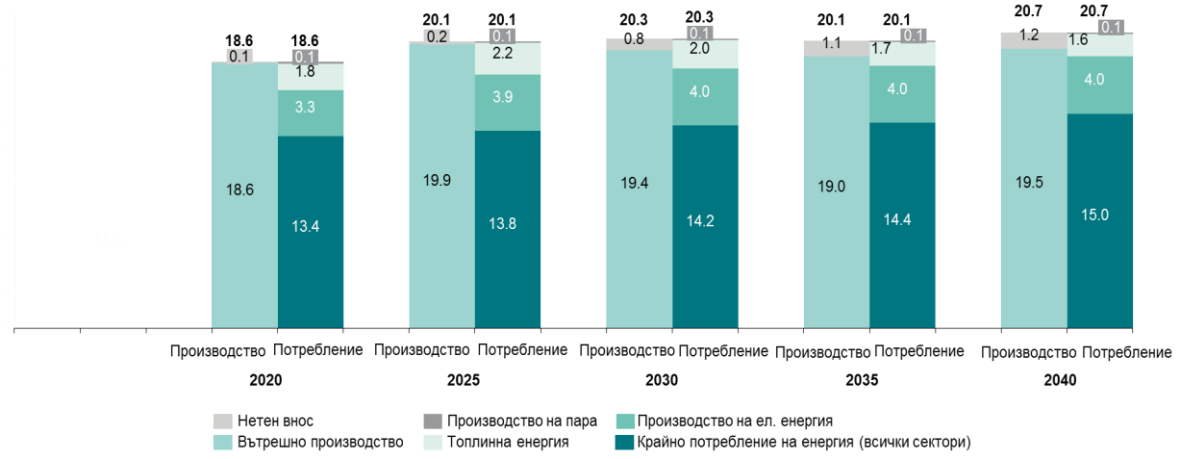


Gross final consumption of energy from renewable sources	WF	Power plants using biomass and waste
HPP	PhvP	

Source: (B)EST model, E3-Modelling

With existing measures (WEM), a small increase in energy consumption in the heating and cooling sector is projected with an average annual rate of increase by 0.1 % in the period 2020-2040. Despite the expected increase in solar plant installed capacity, the share of solar energy will remain low (approximately 2.6 % in 2040). The quantity of biomass used will continue to increase in absolute terms over the entire period, but its share in gross consumption of energy for heating from renewable sources will decrease, reaching 82 % in 2040 from 88 % in 2020. The use of heat pumps for heat generation will continue to develop, reaching 2 444 GWh in 2040.

Figure 40: *Curve showing the production and consumption of energy from biomass disaggregated by origin and use for the period 2020-2040, TWh*

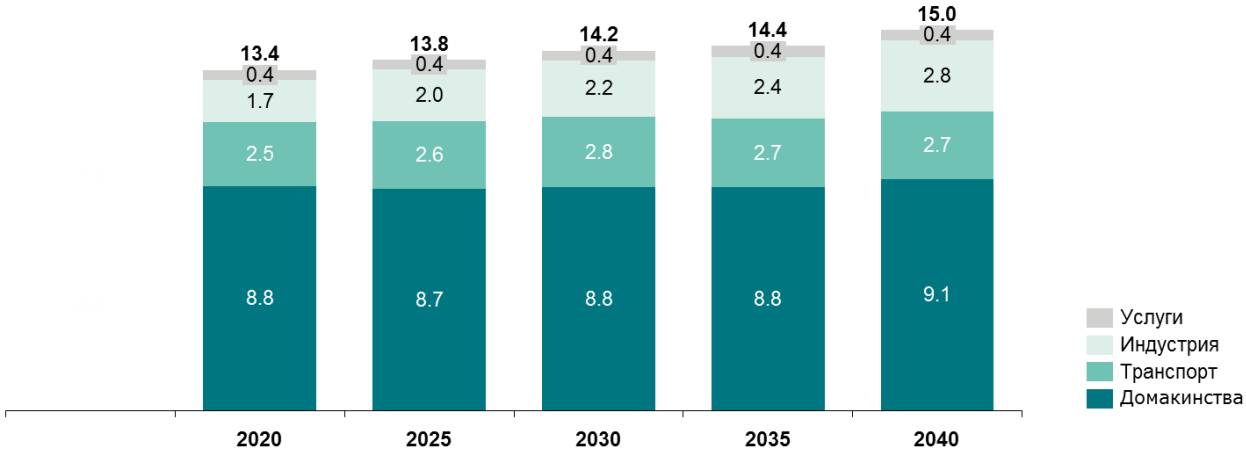


Generation / Consumption 2020	Generation / Consumption 2025	Generation / Consumption 2030	Generation / Consumption 2035	Generation / Consumption 2040
Net import	Steam generation	Electricity generation		
Domestic generation	Heat	Final energy consumption (all sectors)		

Source: (B)EST model, E3-Modelling

During the period 2020-2040 the demand for energy from biomass is expected to increase on account of the increase in final consumption and in the use of biomass for the production of electricity. Meeting demand for biomass will require 9 % increase in biomass production in Bulgaria in the period 2020-2030. Net import should also increase from 58 GWh in 2020 to 835 GWh in 2030, reaching 1 168 GWh in 2040.

Figure 41 *Final consumption of energy from biomass by sector for the period 2020-2040, TWh*



Services	Industry	Transport	Households

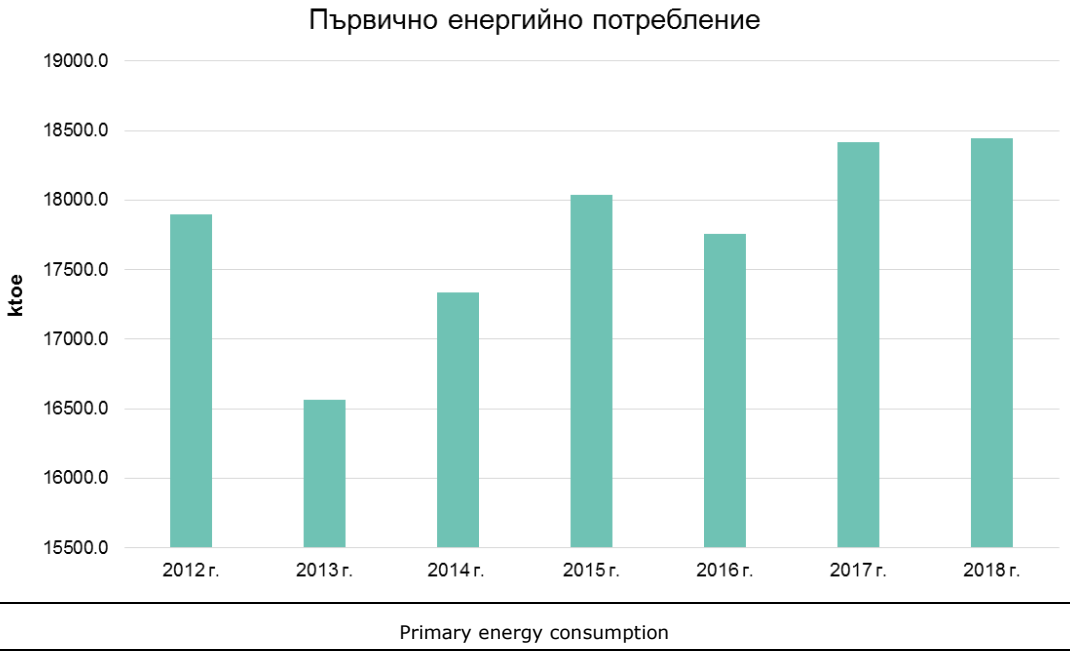
Source: (B)EST model, E3-Modelling

In the period 2020-2040 final consumption of energy from biomass is projected to increase in all sectors of the economy, with the exception of the services sector where it is projected to remain relatively stable. The largest increase by 65 % is projected for the industry sector, followed by the transport sector (8 %) on account of the higher demand for biofuels. The households sector, which has the highest share of consumption of energy from biomass as compared to all other sectors (more than 66 % in 2020), is projected to see a slowdown in the rate of increase in consumption to result in an overall increase by 3.4 % in the period 2020-2040.

4.3 Energy Efficiency dimension

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

Figure 42 *Primary energy consumption2012 -2018, ktoe*



Source: NSI data

In the period 2012-2018, primary energy consumption (PEC) was uneven and reflected the impact of the global economic crisis in Bulgaria. The lower PEC level was registered in 2013 (16 564 ktoe) due to the decrease in coal consumption by 969 ktoe (a decrease of 14 % as compared to 2012), oil and petroleum products by 326 ktoe (a decrease by 9 % as compared to 2012), and nuclear power by 353 ktoe (a decrease by 9 % as compared to 2012). Exported electricity also decreased from 917 ktoe to 862 ktoe. An increase by 843 or 50.5 % as compared to 2012 ktoe was registered in RES.

With the exception of 2016, when PEC decreased due to lower coal consumption, primary energy consumption was on an upward trend, increasing to 18 450 ktoe in 2018. In 2018, PEC registered an increase by 3.2 % as compared to 2012.

Final energy consumption (except for 2016) followed the PEC trend, increasing by 7 % over the period 2012-2018. The lowest primary energy consumption was registered in 2013 (8 671 ktoe). The decrease is mainly due to the lower consumption of petroleum products (by 319 ktoe or 11 % compared to 2012), energy for heating (by 78 ktoe or 8 % compared to 2012) and coal and fuels manufactured from coal (by 46 ktoe or 11 % compared to 2012). In 2013, an increase by 47 ktoe (or 4 % compared to 2012) was registered in renewable energy.

In 2013, the year in which the lowest primary energy consumption was registered (8 671 ktoe), final energy consumption increased continually, reaching 9 747 ktoe in 2018.

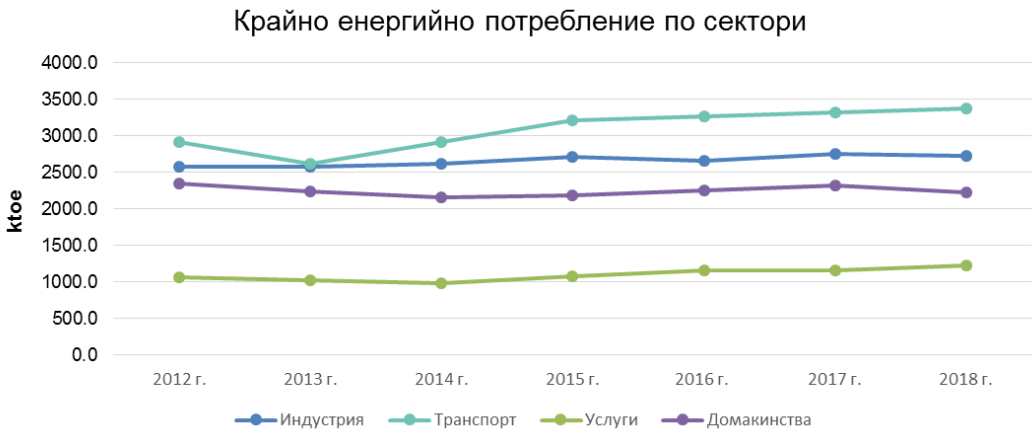
Figure 43: *Final energy consumption 2012-2018, ktoe*

Source: NSI data

Final energy consumption by sector

The distribution of final energy consumption by sector is shown in the figure below.

Figure 44: *Final energy consumption by sector, 2012–2018, ktoe*



Final energy consumption by sector			
Industry	Transport	Services	Households

Source: NSI data

In 2013, primary energy consumption decreased in all sectors, except for the Industry sector, which registered a small increase by 2 %.The most significant decrease by 294 ktoe (or 10 % compared to 2012) was registered in the transport sector, followed by the households sector with 112 ktoe (5 % compared to 2012) and the services sector by 46 ktoe (4 % compared to 2012). In 2014, primary energy consumption in the transport sector began to increase while continuing to decrease in the households and services sectors, reaching its lowest levels in the period 2012-2018 of 2 165 ktoe and 991 ktoe, respectively.

In the period 2012-2018, the transport sector retained its dominant share in primary energy consumption in keeping with the trend registered in 2009. With a share of more than 34 % in 2018, transport was the most energy and fuel intensive sector, with more than 94 % of the fuels used being imported.

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

Post power plants (63 %) have electricity and heat cogeneration capacity, i.e. can operate as a combined cycle power unit, but only 814 MW of heat generation capacity conforms to the criteria for high efficiency cogeneration.

According to the assessment of Bulgaria's potential to use high efficiency cogeneration and efficient district heating and cooling conducted in accordance with the requirements laid down in Article 14 of Directive 2012/27/EU the technical potential for high efficiency cogeneration, in light of current regulatory and market conditions, is estimated at 46 627 GWh per year.

The potential for new high efficiency cogeneration plants is assessed on the basis of the population without district heating and of the climatic indicators in the areas with such population. The applying of the following criteria:

- population above 42 000 inhabitants and
- Heat consumption exceeding 10 GWh per year

The average heat load (based on the average duration of the heating season and the share of heat for heating, assumed ratio of ft=0.9) is determined taking into account the heat supplied to these settlements. The total heating load plus losses is determined by taking into account the load for household hot water and applying the expected losses of heat in transmission. The average minimum and the average outside temperatures show the peak heat load for the respective settlements.

When the potential is calculated, the change in GDP and the energy intensity are taken into account.

The net present value is calculated for each potential new high efficiency cogeneration facility, taking into account:

- the electricity and heat required to satisfy the base heat load;
- the operational hours;
- the lifetime of the installation;
- the fixed and variable costs;
- the capital expenditure required for the construction of the facility;
- the type of fuel.

The technology is selected on the basis of the highest net present value and the area where it should be deployed (which is generally a condition for access to various fuels).

The heat quantities from the new facilities should be connected to new local district networks. Additional high efficiency gas-fired facilities are envisaged to be built in the places with existing cogeneration facilities and the difference to peak load is to be covered by boilers. In places without existing cogeneration, gas-fired boilers will be constructed.

The total potential for expanding high-efficiency electricity and heat cogeneration capacity in the district heating system by 2025 is estimated at 355 MW, of which 235 MW in new capacity and 120 MW in replacement capacity.

The potential for heat generation in new cogeneration installations can be realised mainly through:

- switching from separate heat generation to high efficiency cogeneration;
- switching from Rankine steam cycle to combined gas and steam cycle;
- waste use potential.

iii. Projections considering existing energy efficiency policies, measures and programmes as described in point 1.2.(ii) for primary and final energy consumption for each sector at least until 2040 (including for the year 2030)

Taking existing policy measures into account, the table below sets out gross domestic consumption projections (per type of fuel and energy), PEC projections (per type of fuel/energy/sector) and projected non-energy consumption for the period 2020-2040.

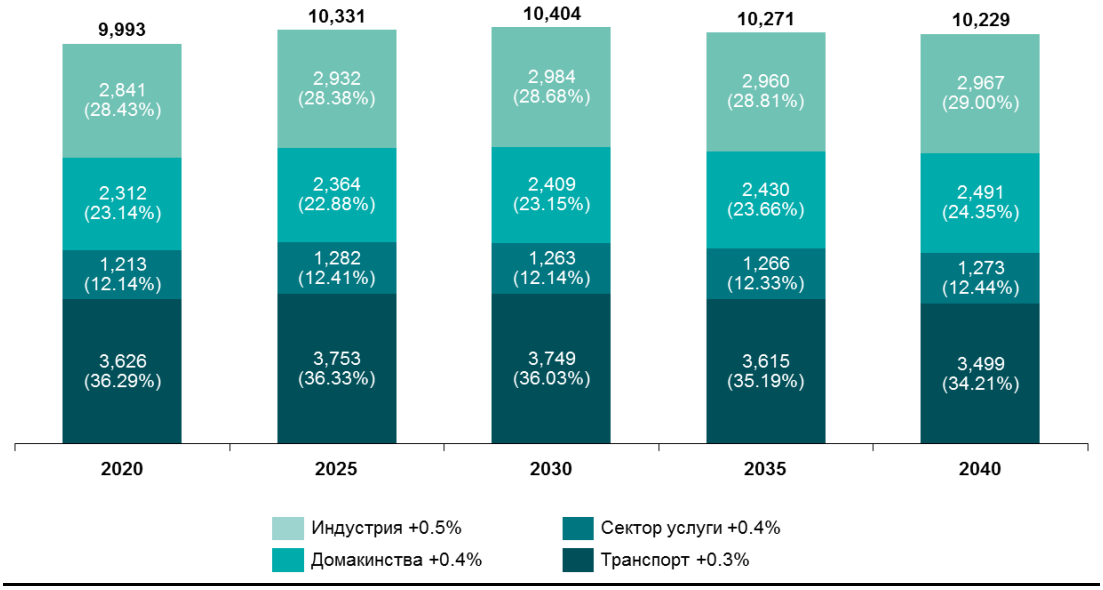
Table 52: Projected gross domestic consumption (by type of fuel and energy), projected PEC (by type of fuel/energy/sector) and projected non-energy consumption for the period 2020-2040, ktoe

Indicator	2015	2020	2025	2030	2035	2040
Gross domestic consumption	**18.589**	**19.142**	**19.238**	**18.367**	**17.936**	**17.677**
Solid fuels	6 638	6 420	6 315	4 809	2 698	753
Oil and petroleum products	4.355	4.341	4.271	4.049	3.822	3.687
Natural gas	2.572	2.740	2.765	3.391	3.378	3.052
Electricity	-909	-687	-688	-688	-688	-688
Nuclear energy	3.912	4.019	4.019	4.019	5.951	7.883
Hydropower	487	405	405	405	405	405
Biomass and waste	1.236	1.601	1.726	1.743	1.728	1.780
Wind power	125	125	135	164	164	310
Solar energy	141	143	253	442	443	459
Geothermal power	33	35	36	34	35	36
Non-energy consumption	**607**	**631**	**735**	**773**	**800**	**838**
Final consumption of energy per fuel type	**9 502**	**9.993**	**10.331**	**10.404**	**10.271**	**10.229**
Solid fuels	332	360	333	292	236	135
Oil and petroleum products	3.378	3.478	3.581	3.483	3.288	3.158
Natural gas	1.300	1.356	1.319	1.346	1.303	1.323
Electricity	2.437	2.612	2.794	2.960	3.145	3.255
Steam	818	819	863	868	846	845
Renewable energy sources	1.238	1.368	1.441	1.454	1.453	1.514
Final consumption of energy by sector	**9 502**	**9.993**	**10.331**	**10.404**	**10.271**	**10.229**
Industry	2.715	2.841	2.932	2.984	2.960	2.967
Households	2.195	2.312	2.364	2.409	2.430	2.491
Services	1.197	1.213	1.282	1.263	1.266	1.273
Transport	3.394	3.626	3.753	3.749	3.615	3.499

Source: (B)EST model, E3-Modelling

Projected consumption in Bulgaria includes an increase in primary energy consumption as a result of expected economic growth. With existing policy measures (WEM), PEC in the different sectors is projected to increase.

Figure 45 *Final energy consumption by sector, ktoe*

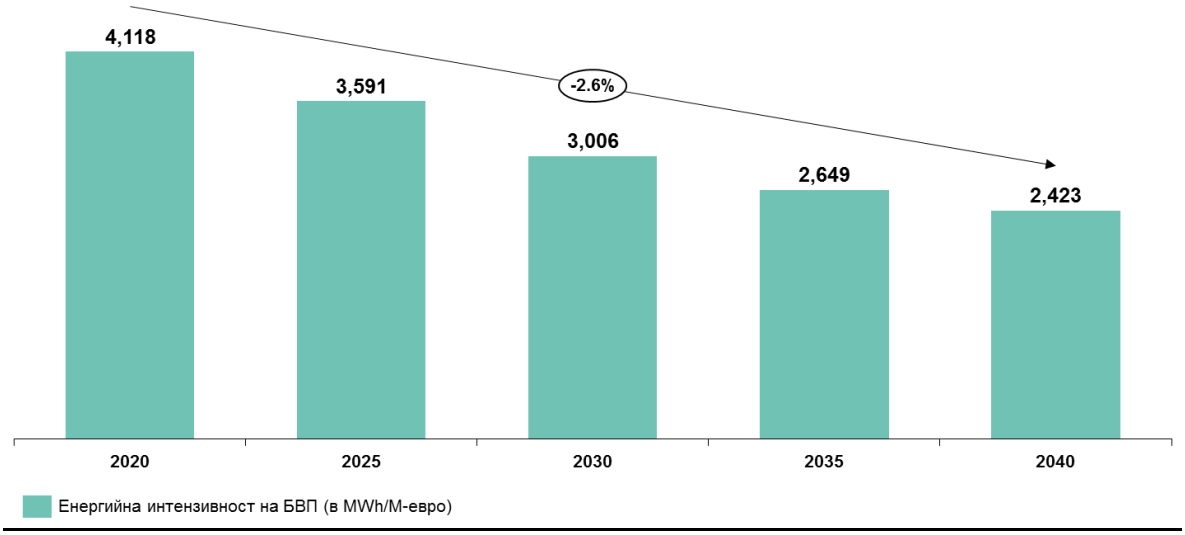


Industry +0.5 %	Services +0.4 %
Households +0.4 %	Transport+0.3 %

(B)EST model, E3-Modelling

Final energy intensity

Figure 46: *Final energy intensity*



Energy intensity of GDP (MWh/EUR million)

(B)EST model, E3-Modelling

In the period 2005-2018, a significant decrease in final energy intensity was registered in Bulgaria as a result of changes in the structure of the economy and the implementation of energy efficiency measures in all sectors. Bulgaria will make efforts to maintain a continuous downward trend in final energy intensity during the period 2020-2040, with a projected average annual decrease by 2.6 %.

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

In accordance with Article 5(2) of Directive 2010/31/EU on the energy performance of buildings and Article 6 of Commission Delegated Regulation (EU No 244/2012 supplementing Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings by establishing a comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements a report on the calculation of cost-optimal levels of minimum energy performance requirements for buildings in Bulgaria has been drawn up. The report sets out the requirements for reference buildings for different categories of existing buildings. In national law, the different types of public service buildings are classified in Regulation No 1/2003 of the Ministry of Regional Development and Public Works on the nomenclature of buildings. Public service buildings are classified into nine categories:

1. buildings used for education and science;
2. buildings used in the area of public health and veterinary medicine;
3. buildings used for social service delivery;
4. buildings used for culture and the arts;
5. churches and buildings used by other religions;
6. administrative buildings, buildings used for wholesale and retail trade; public catering, services and gambling;
7. buildings used for the purposes of transport and electronic communications and sports facilities.

The category of public service buildings includes administrative buildings, the buildings used by banks and non-banking institutions, office buildings to manufacturing plants, buildings serving representative functions, buildings used by the postal service, the buildings used by the central and local departments of government bodies and agencies, government buildings, congress and conference centres, court buildings and the buildings used by the prosecution service, etc.

In accordance with Article 4(1) of Directive 2010/31/EU Member States may differentiate between new and existing buildings and between different categories of buildings. Bulgaria has not made such a differentiation nor has it established reference buildings as required by Commission Delegated Regulation (EU) No 244/2012 and the guidelines thereto. The reason for this is that according to national law the only differentiation between new and existing buildings is in the energy performance class of the respective categories of buildings. The criteria for establishing a reference building in each category are the type of construction used, the number of storeys in the building; the age of the building and the heating system. The approach to be used to establish reference buildings will combine the virtual model with representative parameters of existing buildings from a respective category.

Energy efficiency measures have been determined for the reference buildings. In addition, packages of measures have been proposed and a combinatory methodology based on a matrix model of the possible measures for a given reference building has been applied.

The necessary primary energy has been calculated, taking into account the implementation of measures and/or packages of measures for reference buildings. The report clearly states that the method for calculation of the energy performance of buildings applied in Bulgaria is based on a European model introduced by a dedicated national standard and supplemented by models that take into account humidity exchange due to the fact that the European model only takes into account apparent temperature, which does not allow the energy necessary for cooling the building in the case of air exchange in the area that is being cooled to be estimated. For the purpose of calculating the cost-optimal levels of the energy performance of buildings and the development of national definitions for buildings with near zero-energy consumption in Bulgaria, the technical regulations adopted in 1999 have been used as a basic standard. The results of the calculations to determine the energy needs of reference buildings are set out in an annex to the report.

The report sets out global cost calculations on the basis of a costs analysis that covers the entire life-cycle of a reference building at financial level. The input parameters used to calculate global costs and the cost items included (initial investment costs, operational costs and waste disposal costs). Cost-optimal levels have been calculated for all reference buildings established, following an approach at system level, i.e. on the basis of an analysis of the ratios of heat transfer passage through the surrounding structures and elements of the building on energy consumption.

In order to assess the reliability of key input parameters an analysis has been conducted of the sensitivity of the net present value index using the factors real interest and products and energy price escalation.

The determination of minimum requirements for the energy consumption of buildings by using summary scales with numerical values for energy consumption classes was introduced into national law in 2016 by Regulation No E-RD-04-2 of 22 January 2016 on

the energy consumption indicators and the energy performance of buildings. The Regulation lays down the requirements for determining and the single methodology for calculating the energy cost indicators and energy performance of buildings, the parameters of the energy consumption classes arranged on a scale for the different categories of buildings and the numerical limit values of the integrated indicator 'specific annual primary energy consumption' in KWh per m^2, determined on the basis of the scale of energy consumption classes for different categories of buildings.

4.4 Energy security dimension

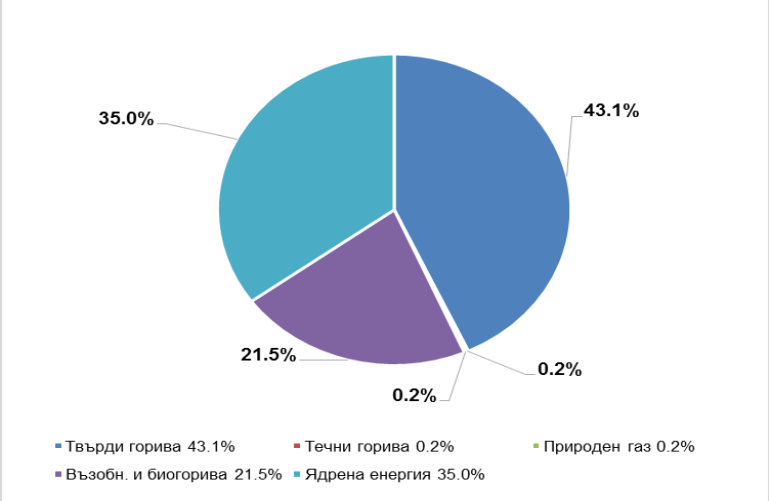
i. Current energy mix, domestic energy resources, import dependency, including relevant risks

- **Current energy mix**

According to 2018 data of the National Statistical Institute (published in January 2020), the production of primary energy in Bulgaria in 2018 was 11 910 ktoe and met 63 % of the gross inland consumption; its structure remained comparatively unchanged in recent years and its dynamics was driven by domestic energy consumption.

In the structure of primary energy production by type of fuel and energy, solid fuels (indigenous lignite and brown coal) have the highest share of 43.1 %, followed by nuclear energy with a share of 35.0 %. The breakdown of the other fuels and energy is as follows: renewable energy at 21.5 %, natural gas at 0.2 % and liquid fuels at 0.2 %.

Figure 47: *Structure of primary energy production, %*

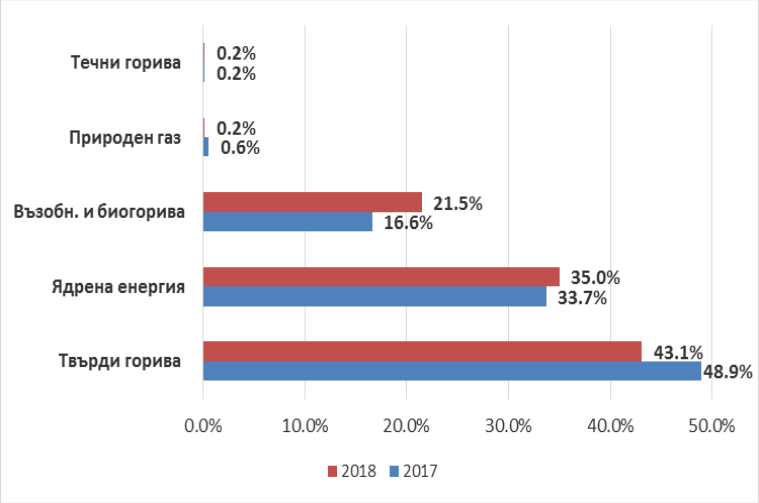


Solid fuels 43.1 %	Liquid fuels 0.2 %	Natural gas 0.2 %
Renewable sources and biofuels 21.5 %	Nuclear energy 35.0 %	

Source: NSI data for 2018

In 2018, primary energy production increased by 2.0 % as compared to 2017 on account of the increase in energy from renewable sources and nuclear power by 32.2 % and 5.8 %, respectively. All other energy sources, notably solid fuels, natural gas and liquid fuels, registered a decrease.

Figure 48: *Structure of primary energy production in 2018 as compared to 2017, %*

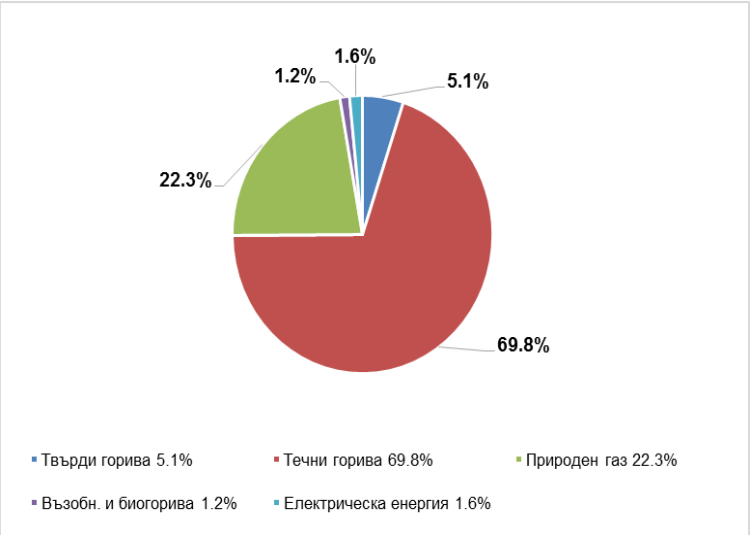


Liquid fuels
Natural gas
Renewable sources and biofuels
Nuclear energy
Solid fuels

Source: NSI data for 2018

In 2018, imports of fuels and energy amounted to 11 606 ktoe. Oil and petroleum products had the largest share of 69.8 %, followed by natural gas with a share of 22.3 %. The breakdown of the other fuels and energy is as follows: solid fuels with a share of 5.1 %, electricity with a share of 1.6 %, and renewable energy with a share of 1.2 %.

Figure 49: *Import of fuels and energy, %*



Solid fuels 5.1 %	Liquid fuels 69.8 %	Natural gas 22.3 %
Renewable sources and biofuels 1.2 %	Electricity 1.6 %	

Source: NSI data for 2018

In 2018, imports decreased by 12.8 % compared to 2017. The import of electricity also decreased by 40.0 % and the import of liquid fuels (oil and petroleum products) and natural gas also decreasing by 15.5 % and 4.9 %, respectively. An increase was registered in the import of solid fuels and fuels from renewable sources and biofuels by 1.1 % and 34.7 %, respectively.

In 2018, imports of fuels and energy in Bulgaria stood at 4 662 ktoe. Liquid fuels and electricity had the largest shared of 76.9 % and 18.5 %, respectively. The breakdown of the remaining fuels is as follows: fuels from renewable sources and biofuels, solid fuels, and natural had a share of 4.0 %, 0.4 % and 0.2 %, respectively.

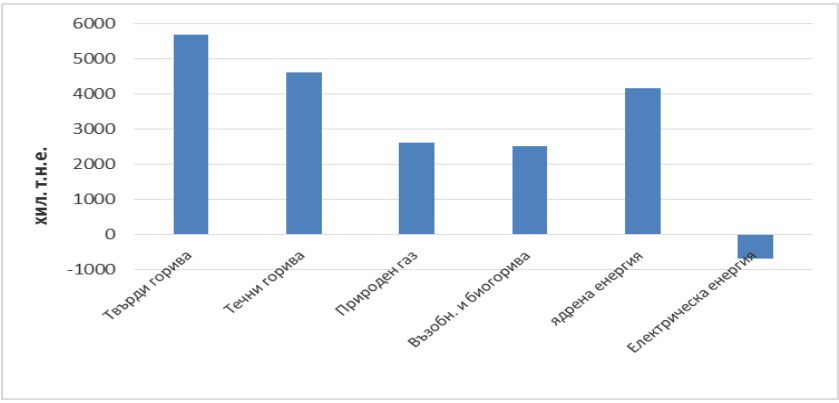
Figure 50: *Export of fuels and energy, %*

Solid fuels 0.4 %	Liquid fuels 76.9 %
Natural gas 0.2 %	Fuels from renewable sources and biofuels 4.0 %
Electricity 18.5 %	

Source: NSI data for 2018

Gross domestic consumption of fuels and energy in Bulgaria in 2018 stood at 18 945 ktoe.

Figure 51: *Gross domestic consumption by fuel and energy*



Thousand tonnes eq.	Solid fuels	Liquid fuels	Natural gas	Renewable sources and biofuels	Nuclear energy	Electricity

Source: NSI data for 2018

In 2018, gross domestic energy consumption stood at 9 750 ktoe. Liquid fuels had the highest share in the structure of final energy consumption (36.3 %), followed by electricity (26.4 %). The breakdown of the other fuels and energy is as follows: renewable energy from renewable sources – 14.4 %; natural gas – 13.3 %; energy for heating – 5.5 %; and solid fuels and non-renewable waste – 4.1 %.

Figure 52: *Structure of primary and final energy consumption, %*

Solid fuels 4.1 %	Liquid fuels 36.3 %
Natural gas 13.3 %	Fuels from renewable sources and biofuels 14.4 %
Electricity 26.4 %	Energy for heating 5.5 %

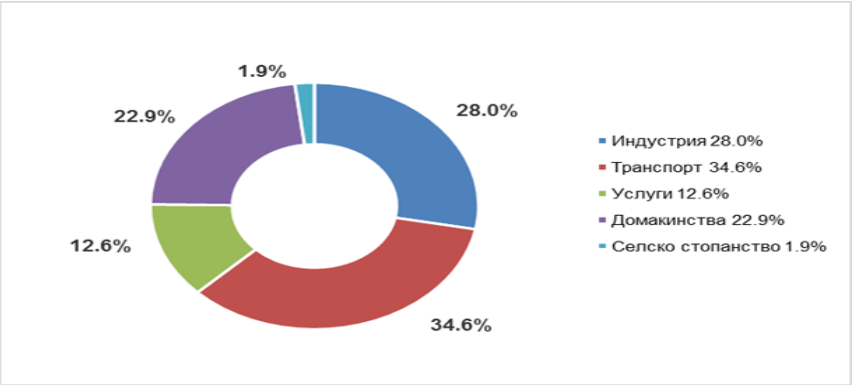
Source: NSI data for 2018

In most sectors, final energy consumption increased, except in the Households sector and the Industry sector in which a decrease by, respectively, 3.8 % and 0.8 % was registered in 2018 as compared to 2017. An increase was registered in the sectors of Services, Agriculture and Transport by 5.5 %, 4.5 % and 1.4 %, respectively.

In 2018, the Transport sector had a share of 34.6 % in final energy consumption and retained its 10-year position of a leading sector in final energy consumption, followed by

the Industry sector with a share of 28.0 %. The shares in final energy consumption of the Household, Services and Agriculture sectors were 22.9 %, 12.6 % and 1.9 % respectively. The structure of final energy consumption by sector in 2018 was identical to that in 2017.

Figure 53: *Structure of final energy consumption by sector, %*



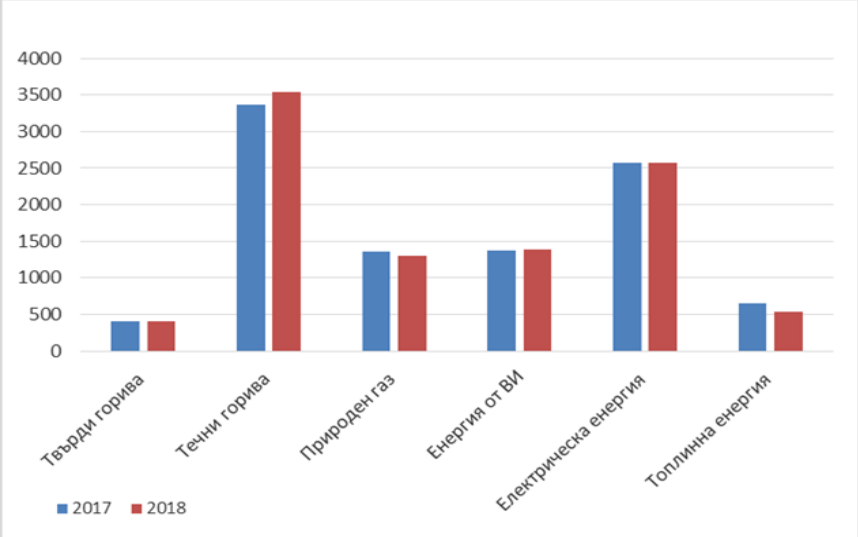
Industry 28.0 %
Transport 34.6 %
Services 12.6 %
Households 22.9 %
Agriculture 1.9 %

Source: NSI data for 2018

With a 36.3 % share in 2018, liquid fuels which are mainly used in road transport (83 %) were the most common energy carrier in final energy consumption. In 2018, electricity consumption stood at 2 570 ktoe, with a share of 26.4 % in final energy consumption. In 2018, renewable energy use increased by 1.6 %. The main renewable energy source in Bulgaria, primarily used in the heating and cooling sector, is biomass.

In 2018, the share of liquid fuels in final energy consumption increased by 5.0 % and the share of energy for heating decreased by 18.0 % on account of, among other things, the warmer winter. The shares of solid fuels, non-renewable waste and natural gas decreased by 4.4 %, 2.7 % and 3.9 %.

Figure 54: *Final energy consumption in 2018 compared to 2017*



Solid fuels	Liquid fuels	Natural gas	Renewable energy	Electricity	Heat

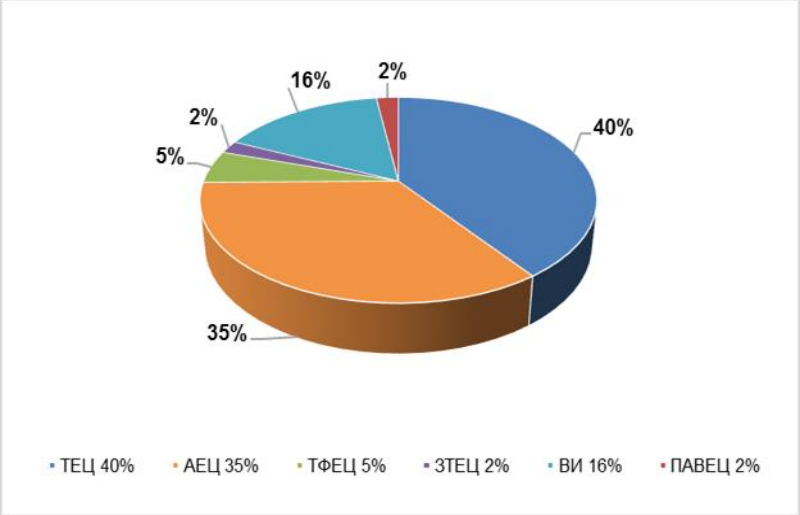
Source: NSI data

Bulgaria has a diverse electricity generation mix, including nuclear and thermal power plants and power plants generating energy from renewable sources (hydropower plants, wind farms and solar plants and biomass plants).

According to Ministry of Energy data for 2018, gross electricity generation stood at 46.7 TWh, which represents an increase by 2.7% compared to 2017.

Thermal power plants (TPPs) had the highest share of 40 %in electricity generation in 2018, followed by the Nuclear power plant (NPP) with a share of 35 %, renewable energy plants with a share of 16 %, district heating plants with a share of t 5 %, factory thermal power plants with a share of 2 % and pumped-storage hydropower plants with a share of 2 %.

Figure 55: *Structure of gross electricity generation by type of plant*



HPP 40 %	NPP 35 %	District Heating Plants 5 %	Factory TPP 2 %	RES Plants 16 %	Pumped storage plants 2 %

Source: NSI data for 2018

The share of indigenous energy carriers input in electricity generation was 96 % and the share of imported energy carriers was 4 % (nuclear energy is reported as an indigenous energy carrier).

- own energy sources

Bulgaria makes maximum use of the existing potential of its indigenous resources in compliance with environmental requirements. The main energy sources of energy generation are solid fuels and nuclear energy.

The power plants using indigenous coal account for approximately 48 % of total electricity generation and guarantee Bulgaria's energy security and the competitiveness of the Bulgarian economy. Indigenous coal can provide resources for electricity generation in the next 60 years.

Nuclear energy is a key energy carrier that ensures base electricity generation at predictable and competitive prices. The Kozloduy Nuclear Power Plan generates more than 33 % of electricity in Bulgaria and guarantees Bulgaria's energy security.

Renewable energy is the third most important local energy resource and its use has been increasing in recent years. The main reason is associated with the higher deployment of biomass and solar and wind energy in electricity generation.

- import dependency

According to Eurostat data, in 2017 Bulgaria's energy dependency on fuels and energy in gross final consumption stood at 39.5 % and was much lower than the average figure for the EU Member States (55.1 %). This is due to the methodology adopted by Eurostat, according to which nuclear energy is reported as indigenous energy source.

- relevant risks

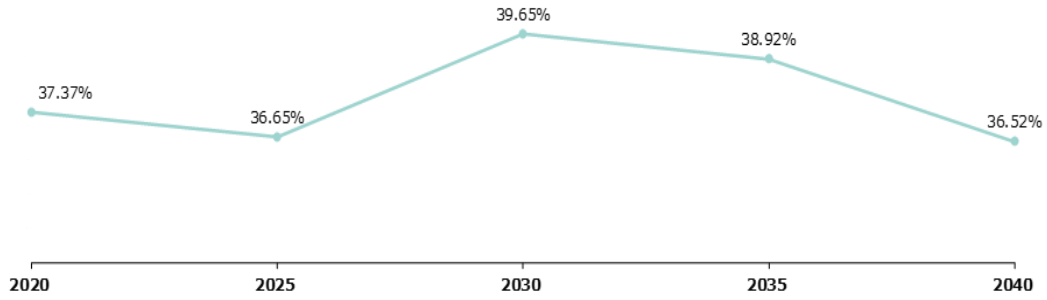
In terms of natural gas, the most significant risk is Bulgaria's dependence on a single source of supply. In connection with this, Bulgaria has taken steps to diversify the sources and routes for supply of natural gas.

ii. Development projections with existing policies and measures until at least 2040 (including the year 2030)

In accordance with the requirements laid down in Regulation (EU) 2018/1999 two scenarios — WAM (with additional policy measures) and WEM (with existing policy measures) — have been developed. The projections set out in this section are solely based on existing national and EU policy measures. The targets set in the INECP will not be achieved with existing measures. The WEM scenario has been developed as a basis for comparison to the WAM scenario (in which the national targets will be achieved). The latter is described in detail in points 2 and 3 and in Annex I to this Plan.

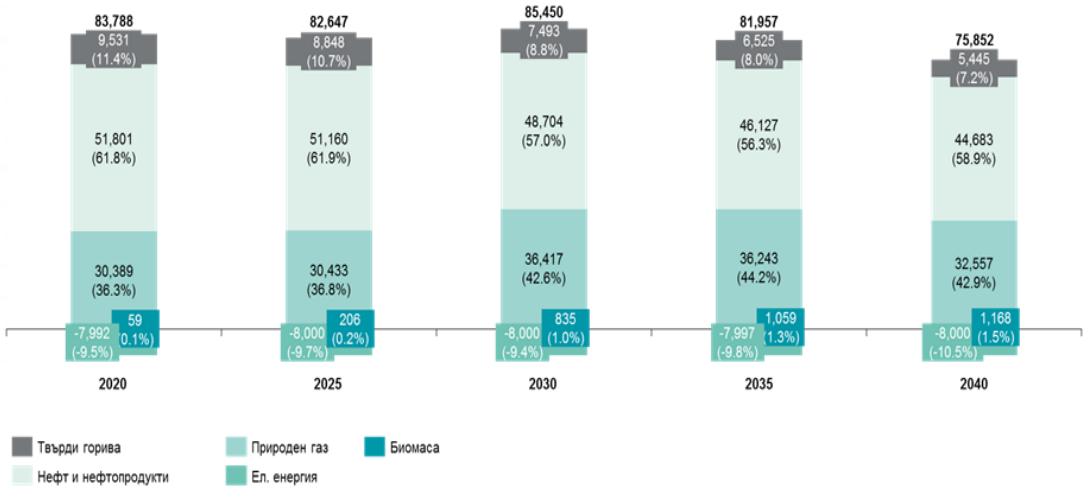
In the WEM scenario, Bulgaria's dependence on imports increases from 37.37 % to 39.65 % in the period 2020-2030. This is largely due to an increase in natural gas imports as a result of higher primary energy generation using natural gas, particularly after 2025. However, this is partially offset by the fact that Bulgaria remains a net exporter or electricity. Another important factor that contributes to Bulgaria's dependence on imports is it is a net importer of liquid fuels, with the share of imports projected at approximately 60 % for the period 2020-2030. Despite this, Bulgaria's dependence on energy import is still lower in comparison to other Member States. From 2030 onwards, dependence on imports will begin to improve on account of lower gross consumption, lowering the trend and reaching 36.52 % in 2040, which will have a positive impact on dependence on import.

Figure 56: *Energy dependence)%), WEM*



Source: (B)EST model, E3-Modelling

Figure 57: *Net import by type of fuel (%), WEM*



Solid fuels	Natural gas	Biomass
Oil and petroleum products	Electricity	

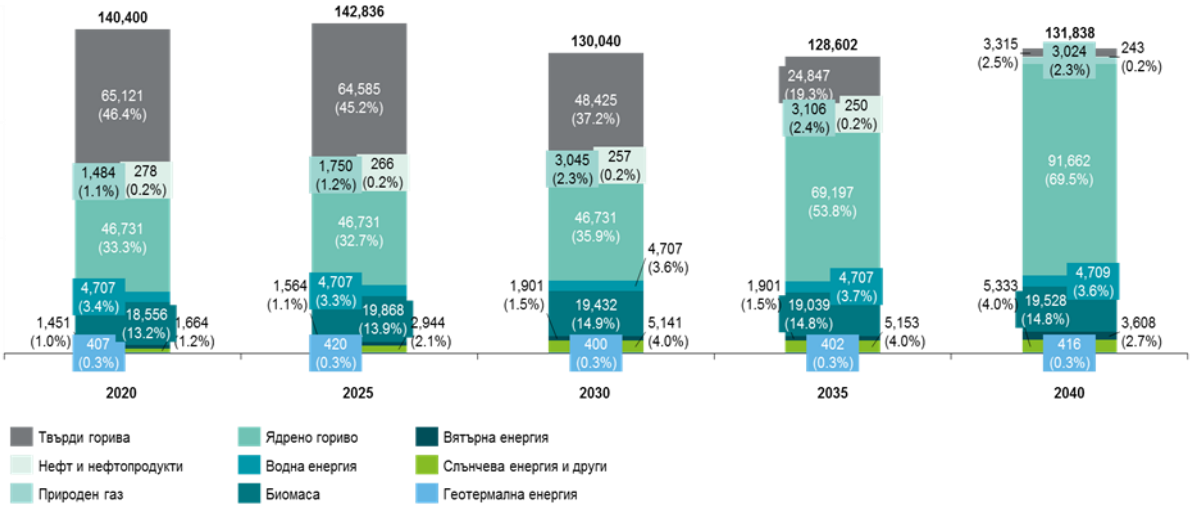
Source: (B)EST model, E3-Modelling

Energy generation from local fuels

Electricity generation under the WEM scenario is projected to decrease by 8 562 GWh. This is largely attributable to the projected continual decrease of energy production from solid fuels over the period 2020-2040 and the fact that no new lignite coal plants will be commissioned, meaning that in 2040 their capacity will be only 3 315 GWh. In 2040, nuclear power is also expected to play an important part in energy production, with a share of nearly 70 %. The share of biomass has been continually increasing on account of a growing number of power plants using biomass in fuel blends.

The shares of wind power and geothermal power will remain the same while natural gas is projected to increase from 1.1 % in 2020 to 2.3 % in 2040. The share of solar power is also projected to increase from 1.2 % in 2020 to 4 % in 2040.

Figure 58: *Primary energy production, WEM*



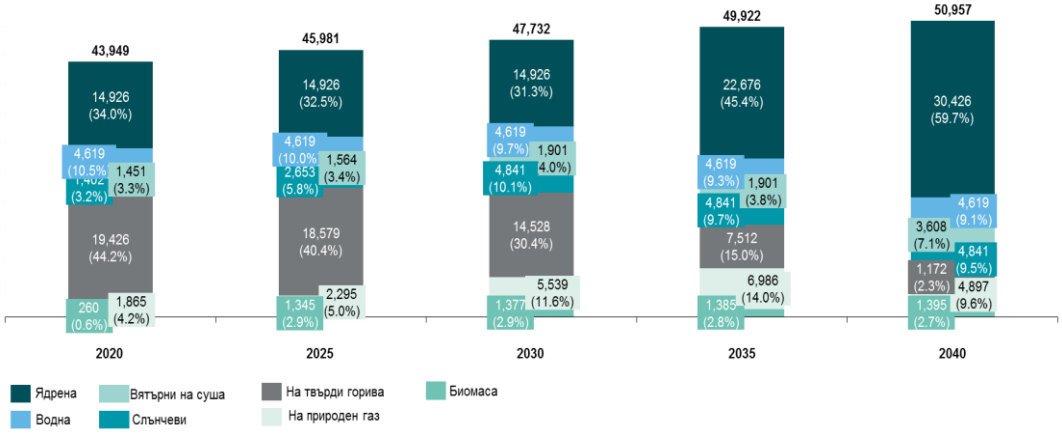
Solid fuels	Nuclear fuel	Wind power
Oil and petroleum products	Hydropower	Solar and other types of energy
Natural gas	Biomass	Geothermal power

Source: (B)EST model, E3-Modelling

Electricity generation by plant type

Electricity generation will increase from 43 949 GWh in 2020 to 50 957 GWh in 2040, with the share of electricity generated by gas-powered plants projected to increase more than twofold between 2025 and 2030. The share of solar power is also projected to increase nearly twofold over the same period. There has been a significant decrease in electricity generation by waste incineration plants in keeping with the downward trend in the production of fossil fuels and the increase in energy generated from renewable sources. Nuclear power will continue to play an important part in electricity generation, particularly after 2035 when a new nuclear power plant is expected to be commissioned.

Figure 59: *Net electricity generation, WEM*



Nuclear	Wind (onshore)	Solid fuels	Biomass
Hydropower plants	Solar plants	Plants fired by natural gas	

Source: (B)EST model, E3-Modelling

4.5 Internal energy market dimension

4.5.1 Electricity interconnectivity

i. Current interconnection level and main interconnectors

The Bulgarian electricity system (EES) operates in parallel with the electricity systems of the countries in continental Europe. Our EES is interconnected with the united European EES through the following interconnectors:

- 400 kV interconnecting power line from the Kozloduy Nuclear Power Plant (BG) to Cancarene substation (RO);
- 400 kV interconnector from Kozloduy Nuclear Power Plant (BG) to Cancarene substation (RO);
- 400 kV interconnecting power line from Varna substation (BG) to Stupina substation (RO);
- 400 kV interconnecting power line from Dobrudzha substation (BG) to Rahman substation (RO);
- 400 kV interconnecting power line from Sofia zapad substation (BG) to Nish substation (RS);
- 400 kV interconnecting power line from Chervena Mogila substation (BG) to Štip substation (MK);
- 400 kV interconnector from Blagoevgrad substation (BG) to Thessaloniki substation (GR);
- 400 kV interconnector from TPP Maritsa Iztok 3 (BG) to Hamitabat substation (TR);
- 400 kV interconnector from TPP Maritsa Iztok 3 (BG) to Hamitabat substation (TR).

The current level of electricity interconnection is:

- 21.7 % of transmission capacity in imports, taking into account the security criteria;

- 22.6 % of transmission capacity in exports, taking into account the security criteria;

- 144 % of rated heat transmission capacity against peak load;

- 265 % of total rated heat transmission capacity against the installed renewable generation capacity.

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

Interconnectivity development prospects until 2030:

Construction of the following new electricity interconnectors is envisaged:

- 400 kV interconnector from Maritsa Iztok substation (BG) to Nea Santa substation (GR);

The new electricity interconnector between Maritsa Iztok and Nea Santa is a project of common interest (PCI).

The development of transmission networks and interconnectors of the countries in the South-Eastern part of continental Europe is planned in the regional investment plan and is approved every two years in the ten-year network development plan drawn up by ENTSO-E with a long-term horizon until 2040.

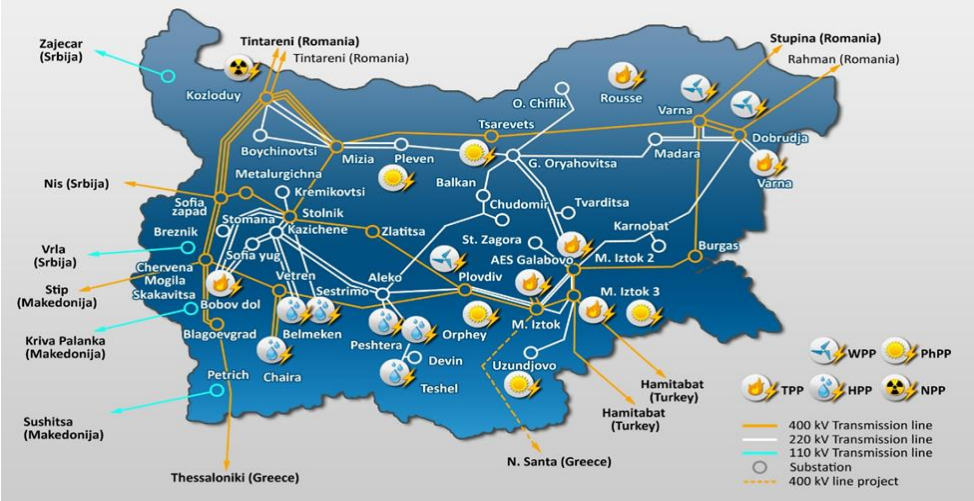
Bulgaria, Greece and Turkey are implementing a trilateral project to assess the possibilities for construction of a third interconnector between Bulgaria and Turkey. The work has not been completed yet.

4.5.2 Electricity and gas transmission infrastructure

i. Key characteristics of the existing transmission infrastructure for electricity and gas

Bulgaria's electricity transmission infrastructure is owned by ESO EAD, an independent transmission operator, which has been certified by the European Commission. The Bulgarian electricity system (ES) operates in parallel with the electricity systems of the countries in continental Europe. Bulgaria's EES is interconnected with the common European EES via four interconnectors with Romania, two interconnectors with Turkey and one each with Serbia, Macedonia and Greece.

Figure 60: *High-voltage (HV) grid map*



Source: ESO EAD

The existing electricity transmission infrastructure covers: 2 571 km of 400 kV power lines, 400 km of 220 kV power lines, 9 960 km of 110 kV power lines, 34 system substations and 263 reduction substations.

Overhead power lines of the national electricity grid

- 400 kV PLs with a total length of 2 519 km;
- 220 kV PLs with a total length of 2 812 km;
- 110 kV PLs 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;

Distribution stations:

- one 400 kV distribution station;
- one 110 kV distribution station;

Optical network:

- with a total length of 3 118 km.

In accordance with Article 16(8) of Regulation (EU) 2019/943 of 5 June 2019 on the internal market for electricity 'transmission system operators shall not limit the volume of interconnection capacity to be made available to market participants as a means of solving congestion inside their own bidding zone or as a means of managing flows resulting from transactions internal to bidding zones'. Compliance with this requirement has been ensured by reaching the minimum threshold of at least 70 % of transmission capacity between gas trading zones thereby guaranteeing compliance with the safety standards for network operation, including the safety standard in emergency situations (N-1). ESO EAD has submitted to the KEVR a reasoned application for a derogation from the requirements laid down in Article 16(8) for a period of one year, with a possibility for extension for another year up to the maximum period of two years, in accordance with Article 16(9) of Regulation (EU) 2019/943.

Structure of the gas transmission network:

Bulgaria's national gas transmission network is owned by Bulgartransgas EAD, which is an independent transmission operator certified by the European Commission. The national gas transmission network has a length of 2 788 km, including an underground storage facility in Chiren, gas mains and high pressure transmission branches, nine compressor stations, gas pressure regulation stations, gas metering stations, an electrochemical protection system, gas purifiers, a communication and information system and other ancillary facilities. The network is used for the transmission of gas for consumption by households Bulgaria and transmission to the neighbouring countries Turkey, Serbia and North Macedonia. Bulgaria's technical transmission capacity is

7.4 b;n.m^3 per year and the overall natural gas transmission capacity of the three neighbouring countries is 17.8 billion m^3 per year. The maximum operating pressure of the network is 54 bar.

The national gas transmission network (NGTN) comprises 9 compressor stations (CS) — Kardam 1, CS Valchi Dol, CS Polski Senovets, CS Kardam 2, CS Provadia, CS Lozenets, CS Strandzha, CS Ihtiman and CS Petrich, with total installed capacity of 319 MW. The main entry and exit points of the gas transmission network of the operator are:

- Entry/exit interconnection points (IP) Negru Voda 1 / Kardam and Negru Voda 2. 3 / Kardam between the national gas transmission network operated by Bulgartransgas EAD and the gas transmission system operated by Transgaz S.A. (Romania) on the Bulgaria-Romanian border in the Negru Voda/Kardam area;
- Entry/exit interconnection point (IP) Kulata / Sidirokastro between the national gas transmission network operated by Bulgartransgas EAD and the gas transmission system operated by DESFA S.A. (Greece) on the Bulgaria-Greek border in the Kulata/Promahonas area;
- Entry/exit interconnection point (IP) Strandzha / Malkoclar between the national gas transmission network operated by Bulgartransgas EAD and the gas transmission system operated by Botas (Turkey) on the Bulgarian-Turkish border in the area of Strandzha Village, Bolyarovo Municipality.
- Entry/exit interconnection point (IP) Kyustendil / Zidilovo between the national gas transmission network operated by Bulgartransgas EAD and the gas transmission system operated by GA-MA (North Macedonia) on the border between Bulgaria and North Macedonia in the area of Gyueshevo Village, Kyustendil Municipality.
- Entry/exit interconnection point (IP) Ruse / Giurgiu between the national gas transmission network operated by Bulgartransgas EAD and the gas transmission system operated by Transgaz S.A. (Romania) on the Bulgaria-Romanian border in the Ruse/Giurgiu area;
- GMS Ihtiman and GMS Lozenets — reverse-flow stations measuring natural gas flows, which enable the operator to transfer natural gas to users via different routes;
- GMS Galata — entry point for locally produced natural gas into the national gas transmission network;
- GMS Dolni Dabnik — entry point for locally produced natural gas into the national gas transmission network;
- Entry/exit point Chiren GMS — connection between the national transmission network and Chiren UGS;

The Chiren Underground Gas Storage is built in the land of the village of Chiren and is based on the already exhausted gas condensing storage with the same name. It is equipped with the required specialised underground and ground devices to ensure compression, extraction and quality of gas storage. Chiren UGS has 24 drilling wells and a compressor station with a total installed capacity of 10 MW. The current capacity of the facility can ensure storage of 550 million m^3 of natural gas. The withdrawal and injection capacity is directly dependent on the formation pressure and on the degree to which the storage facility is filled. The minimum extraction capacity is 0.5 million m^3/day and the maximum extraction capacity is 3.4 million m^3/day. Where necessary, the so-called forced (emergency) extraction can be carried out and the extraction capacity may reach up to 4.2 million m^3/day. However, the emergency mode of operation can be implemented provided the gas storage is full and for a period of maximum 30 days. Chiren UGS is used to cover the seasonal fluctuations in consumption in the Republic of Bulgaria.

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

Electricity transmission infrastructure:

The following new 400 kV internal power lines (PLs) are envisaged to be constructed:

- 400 kV PL from Plovdiv substation to Maritsa Iztok substation;
- 400 kV PL from Maritsa Iztok substation to Maritsa Iztok 3 Thermal Power Plant;
- 400 kV PL from Maritsa Iztok substation to Burgas substation;
- 400 kV PL from Burgas substation to Varna substation.

The new internal power lines mentioned above are projects of common interest (PCI).

Next in order of importance are the new 400 kV power lines in the North—South direction (Vetren—Blagoevgrad and Tsarevets—Plovdiv). A renovation of a substantial part of the 110 kV network has been planned. Modernisation and expansion of many substations will take place through replacement of equipment and protection relays, telecommunication devices and method of management. Stationary compensating devices will be provided to offset high pressure in minimum modes in the area of Maritsa River basin and Dobrudzha substation. New communication routes will be built.

If a positive decision for the construction of a new nuclear facility is granted, the electricity transmission network in the North—South direction will be developed further and the northern part of the 400 kV ring will be reinforced.

Gas transmission infrastructure:

The planned activities of the gas transmission operator will ensure the infrastructure required to enable acceptance of gas flows for transfer to and from different regions. The operator will provide the required cross-border capacity that would allow transmission

diversity in gas flow directions. The actual use of this capacity and the specific flow directions will depend directly on the outlook for gas market development in Europe and in the country.

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

In accordance with European law, after 2020 transmission capacity must be at least 10 % of the installed generation starting from and at least 15 % of the installed generation after 2030, taking into account the security, the (N-1) criterion and the reliability margin.

In order to achieve this target and diversify the sources and routes for natural gas supply, Bulgaria has launched the implementation of the projects described in section 2.4.4.

4.5.3 Electricity and gas markets, energy prices

i. Current situation of electricity and gas markets, including energy prices

Electricity

With regard to restructuring the activities relating to production, transmission and energy system management, in accordance with Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC (Directive 2009/72/EC) the Republic of Bulgaria chose the 'independent transmission operator' model. In this model the transmission operator and grid assets are allocated to a separate legal entity within a vertically integrated undertaking that performs the functions of production and supply.

In line with the requirements of Directive 2009/72/EC, after the procedure for separation of ESO EAD from NEK EAD was completed in 2014, ESO EAD is the owner and operator of the entire electricity transmission network in the Republic of Bulgaria.

ESO EAD was certified as an independent transmission operator by a decision of the KEVR adopted in 2015. Thus, compliance was ensured with the requirements laid down in Articles 10 and 11 of Directive 2009/72/EC and Article 3 of Regulation (EC) No 714/2009.

Electricity distribution is carried out by operators of electricity distribution networks for designated territories: CEZ Razpredelenie Bulgaria AD (CEZ Distribution Bulgaria AD), Elektrorazpredelenie Sever AD (Electricity distribution North AD), Elektrorazpredelenie Yug EAD (Electricity distribution South AED) and Elektrorazpredelenie Zlatni Piasatsi AD (Electricity distribution Zlatni Piasatsi AD).

In accordance with Directive 2009/72/EC and the ZE, the electricity market in Bulgaria was liberalised from 1 July 2007. The liberalisation process is staged and electricity in Bulgaria is traded on two market segments: at freely negotiated prices and at regulated prices.

The electricity market in Bulgaria is identified as national. Its structure and organisation are laid down in Rules for Electricity Trading. The electricity market includes an electricity market based on bilateral contracts entered into on the exchange platform, a balancing energy market, a market for reserve and ancillary services and a market for interconnection capacity.

Commercial players are electricity producers, traders in electricity, coordinators of balancing groups, final customers, the public electricity provider, end suppliers of electricity, the independent transmission operator, the exchange market operator, the operators of electricity distribution networks, the suppliers of last resort and the traction electric power distribution company.

The electricity exchange is organised by BNEB EAD which holds the licence for that activity. BNEB administers all transactions in the Day Ahead and Intraday segments and in the centralised market for electricity purchases and sales based on bilateral contracts.

Following amendments to the ZE, which entered into force in 2018, the transactions in electricity concluded at freely negotiated prices include the transactions to compensate technological transfer costs, respectively the distribution costs of the electricity grid and electricity distribution network operations. Article 100(4) of the ZE stipulates that the transactions are concluded on an organised electricity exchange.

Furthermore, following the legislative amendments adopted in 2018 transactions in electricity between electricity producers with a total installed capacity of 4 MW and above 4 MW are concluded at freely negotiated prices on the organised electricity exchange. This is a step towards increased market liquidity. In 2019, the scope of this obligation was expanded and it now also applies to the electricity plants with total installed capacity of 1 MW and more than 1 MW.

Table 53: *Wholesale trade in electricity*

Exchange segment	Electricity traded in 2017 (MWh)	Electricity traded in 2018 (MWh)	Change (%)
CBAM	22 711 566	10 788 404	210 %
Day-ahead	4 232 922	6 058 743	43 %
Intraday		170 773	

Source: EWRC Report to the European Commission, 2019

According to BNEB data the total physical quantity of electricity imported and traded on the electricity exchange in Bulgaria in 2018 was 2.2 million MWh of which 94 % originated from Romania. Total physical export for the same period stood at 10 million MWh and was distributed as follows: Serbia (23 %), North Macedonia (23 %), Greece (21 %), Turkey (21 %) and Romania (12 %).

Most transactions are concluded in the Centralised Bilateral Contracts Market (CBCM) segment. In 2018, the volumes of electricity traded in this segment expanded significantly. The volumes of electricity traded in the Day-ahead segment also increased,

registering an annual increase by 43 %. Trading in the Day-ahead segment was launched in April 2018.

In 2018, there were approximately 612 000 non-household clients in the regulated price segment of the electricity market, which represents a small increase from 606 000 in 2017). Their total electricity consumption stood at 13 TWh. Household consumers in the regulated price segment are approximately 4.5 million and their total consumption is approximately 11.1 TWh.

Observations in 2017 showed that the balancing energy market was operating soundly and ensured a predictable environment for the commercial players covered.

In 2017, the following were registered with the balancing energy market:

- 57 coordinators of standard balancing groups, which is double the number in the previous year;
- 15 coordinators of special balancing groups;
- 14 coordinators of combined balancing groups.

Pursuant to the ZE, every year the KEVR sets a maximum price for execution of transactions on the balancing energy market. For each settlement period, two prices of balancing energy are determined. As from 1 January 2019 the following price caps apply to transactions concluded on the balancing energy market:

1. The price at which transactions can be concluded on the balancing power market in respect of energy shortages balancing services is capped at 2.5 time of the CBCM price, where the CBCM price is equal to the baseload price on the Da-ahead market segment of the Bulgarian Independent Electricity Exchange EAD.

2. The price at which transactions on the balancing power market may be concluded in respect of energy surplus balancing services is BGN 0.00 per MWh;

3. The price caps apply to balancing power transactions, when the energy is purchased/sold from/to neighbouring energy systems under bilateral agreements or from the regional balancing market.

Four operators of electricity distribution networks operate on the retail market. They are licensed to distribute electricity to customers connected to the low- and medium-voltage network in the respective designated territories.

In terms of supply, the retail market comprises three groups of suppliers:

- The supplier of last resort (SLR) is a provider that guarantees the provision of a universal service as a last resort, in line with a licence granted by the KEVR, and is obliged to deliver electricity to customers which are connected to the distribution network and have not selected a trader of commercial energy or to deliver electricity to customers where the trader they have selected does not carry out supply for reasons beyond the customers' control. The final selling

prices of the SLR are determined on the basis of the KEVR Methodology for setting electricity prices of supplier of last resort.

- The End Supplier of electricity supplies electricity at regulated prices set by the KEVR to sites of household and non-household final customers connected to the low-voltage electricity distribution network.
- Free market supplier is a trader providing electricity to household and non-household customers at prices based on demand and supply.

Household and non-household final customers connected to the electricity distribution network at low-voltage level purchase electricity from end suppliers at prices subject to regulation by the KEVR. In 2018, there were approximately 612 000 non-household clients in the regulated price segment of the market, which represents a small increase from 606 000 in 2017). Their total electricity consumption stood at 13 TWh. Household consumers in the regulated price segment are approximately 4.5 million and their total consumption is approximately 11.1 TWh.

Natural gas

Bulgartransgas EAD is certified as the independent transmission operator (ITO) of the Bulgarian transmission system. Natural gas is supplied to consumers in Bulgaria mainly via the national gas transmission network, which operates at a maximum pressure of 54 bars.

According to the national energy balance data published by the NSI in 2018 natural gas had a share in final energy consumption of 14.7 %, which represents a decrease by approximately 1.5 % as compared to 2017. The Bulgarian market is highly dependent in terms of natural gas supplies, with a share of imports of approximately 99.9 %.

In 2018, the operator transported 31.9 TWh of imported and local natural gas and local natural gas, including for final customers in Bulgaria and export to other countries. Out of the total, approximately 31.7 TWh were imported for domestic consumption.

In 2018, the quantities of natural gas sold on the domestic market at regulated prices reached 32.1 TWh distributed as follows: Chemical industry (33 %), Energy sector (31 %), Distribution companies (17 %) and Others (19 %).

In order to ensure the security of natural gas supply at prices that are affordable to consumers, Bulgaria established a natural gas exchange, which will create a competitive environment for both traders and consumers of natural gas. The exchange has been fully operational since 9 December 2019. On 2 January 2020, multilateral trade was launched via the trading platform of BALKAN GAS HUB EAD, including the so-called short-term (spot) and long-term segments and trade via gas brokers. This has largely eliminated State monopoly in the sector.

The main gas market participants are as follows:

- Bulgartransgas EAD — combined system operator licensed, operating under a licence for the transmission and storage of natural gas;
- Balkan Gas Hub EAD — natural gas exchange operator;
- Gas distribution companies — retails of natural gas that distribute and supply natural gas to the clients connected to their networks. By law they have an obligation to build and develop gas distribution networks in accordance with the long-term business plans and other conditions stipulated by the KEVR.
- Bulgartransgas EAD — the public supplier of natural gas in Bulgaria responsible for the supplies of natural gas at prices and upon conditions approved by the KEVR;
- Traders in natural gas — companies that trade in natural gas, supplying quantities to the public supplier, retailers, customers and other traders in natural gas, manufacturing companies, natural gas storage companies and the combined operator;
- Natural gas clients other than households that are not connected to the gas transmission networks;
- Non-household and household clients of natural gas, connected to the gas distribution networks.

The necessary infrastructure for natural gas distribution is still under construction and the number of household consumers connected to the distribution network is very small. According to the data published by distribution companies, in 2018 the total number of natural gas clients in Bulgaria was 107 669 (93 % household customers and 7 % non-household customers). In 2018, the number of household clients increased by 10 000 compared to 2017 as a result of the implementation of the Demand Side Residential Energy Efficiency Through Gas Distribution Companies in Bulgaria project (DESIREE GAS). The share of domestic supply of natural gas within Bulgaria is still very small compared to other EU Member States, despite the positive trend of increase in recent years. This is due to the fact that the enabling infrastructure for natural gas distribution is currently under construction.

The total length of distribution networks at present is 4 916 km, a major part of which has been built in the last twenty years. Taking into account that gas distribution networks are still under construction, they currently operate with load is below their rated capacity.

There is one underground gas storage facility (UGS) in Chiren, Bulgaria which is owned and operated by Bulgartransgas EAD. In 2018, a total of 319 million m^3 of natural gas were pumped and 324 million m^3 of natural gas were extracted from the storage facility.

Prices of electricity and natural gas

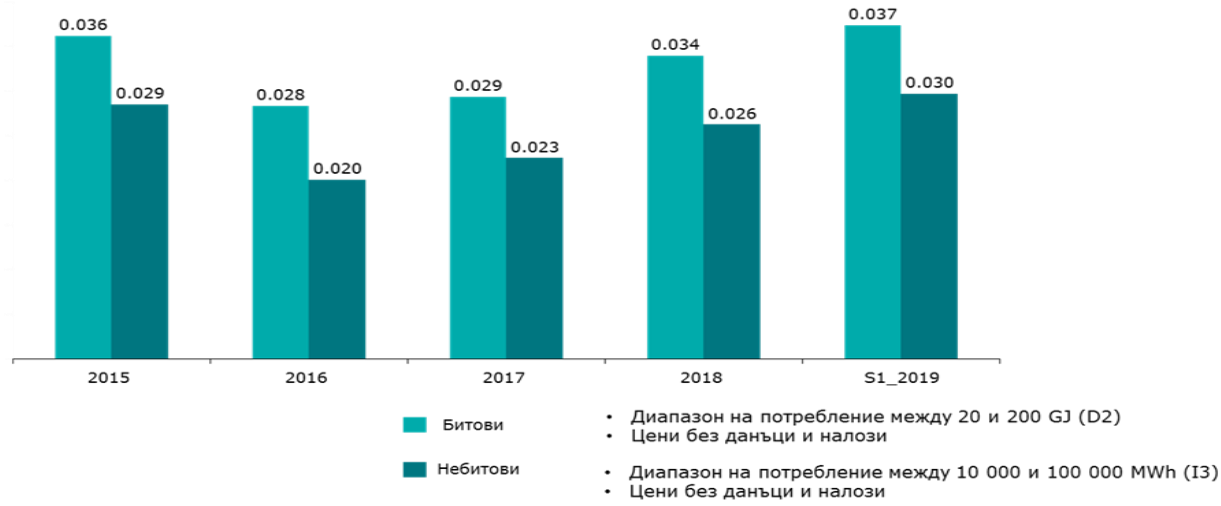
Figure 61: *Retail price of electricity per type of consumer*

Households	Consumption range between 2 500 kW and 5 000 kW (DC)
Non-household consumers	Consumption range between 500 MW and 2 000 MW (IC)

Source: Eurostat, electricity prices (excl. taxes and charges)

The final prices[16] paid by household consumers have continually followed an upward trend. The latest available data shows that during the first half of 2019 prices stood at EUR 0.083 kWh. The price of electricity for household consumers has increased by 5 % as compared to 2015. From 2015 until the first half of 2019 the price for non-household clients (S1) was in the range between EUR 0.073 and EUR 0.089 kWh.

Figure 62: *Retail price of natural by type of consumer, GJ*



Households	Consumption range between 20 MW and 200 GJ (D2)
Non-household consumers	Prices, excl. taxes and charges
	Consumption range between 10 000 MWh and 100 000 MWh (I3)
	Prices, excl. taxes and charges

Source: Eurostat, prices of natural gas (excl. taxes and charges)

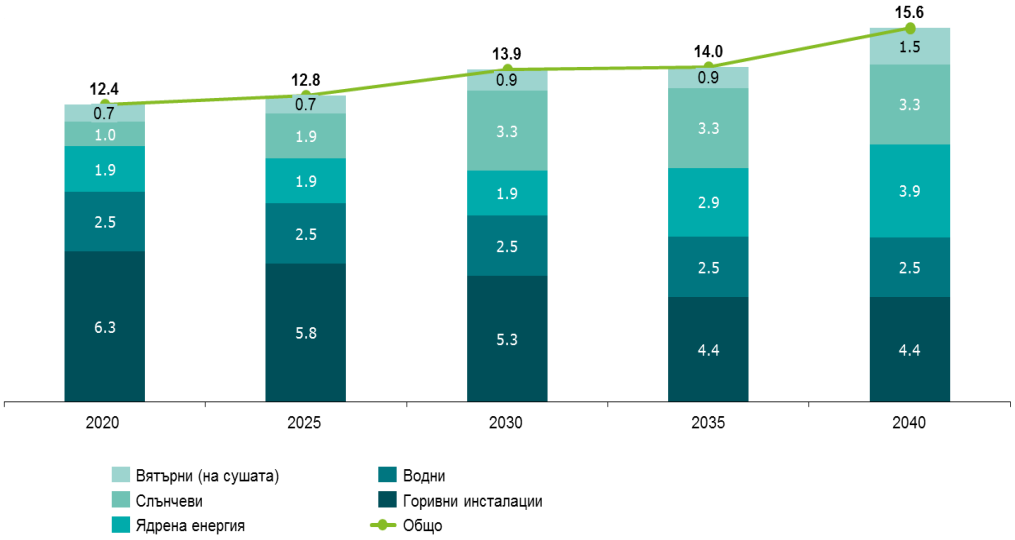
[16]*According to the ZE the final price includes the price of electricity, the prices for access to and transmission via the electricity grid and distribution networks and the public service obligation costs.*

Following a drop in 2016, the prices of natural gas for household and non-household consumers in the period between 2017 and the first half of 2019 decreased to nearly 2015 levels.

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

In accordance with the requirements laid down in Regulation (EU) 2018/1999 two scenarios — WAM (with additional policy measures) and WEM (with existing policy measures) — have been developed. The projections set out in this section are solely based on existing national and EU policy measures. Under the WEM scenario the targets set in this Plan will not be achieved. The scenario has been developed as a basis for comparison to the WAM scenario (in which the national targets will be achieved). The WA< scenario is described in detail in points 2 and 3 and in Annex I to this Plan.

Figure 63: *Net installed capacity, WEM scenario*



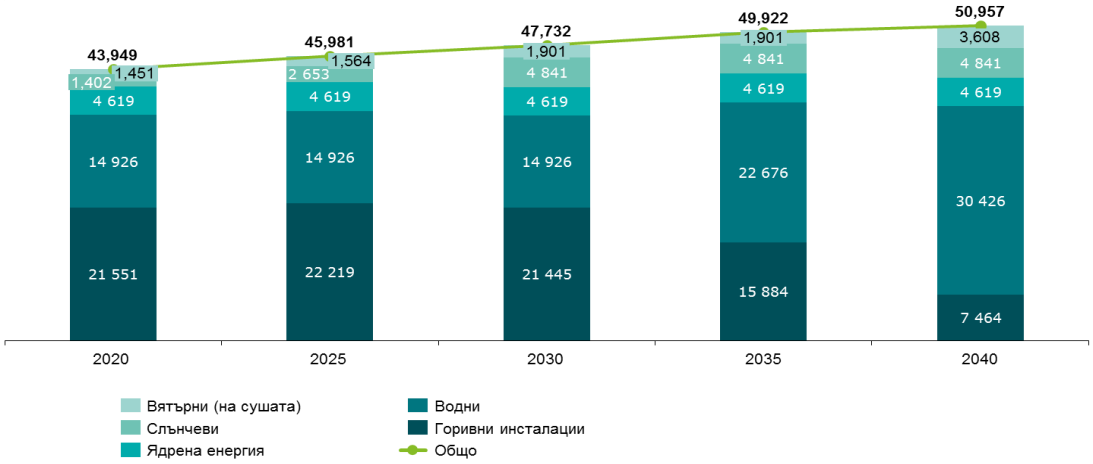
Wind (on-shore)	Hydro
Solar plants	Combustion plants
Nuclear energy	Total

Source: (B)EST model, E3-Modelling

According to WEM scenario projections the net installed capacity of power plants generating electricity from renewable sources (mostly wind and solar power) will increase by 12 % up to 59 %, reaching 13.9 GW (2030 as compared to 2020) and compensating the decrease in installed capacity of conventional combustion plants by 16 %.

The net installed capacity will increase by 26 % [to] 15.6 GW by 2040 (as compared to 2020). In order to overcome the drop in solid fuel production, the share of nuclear and wind power after 2030 will increase significantly.

Figure 64: *Net electricity generation by plant type, WEM*



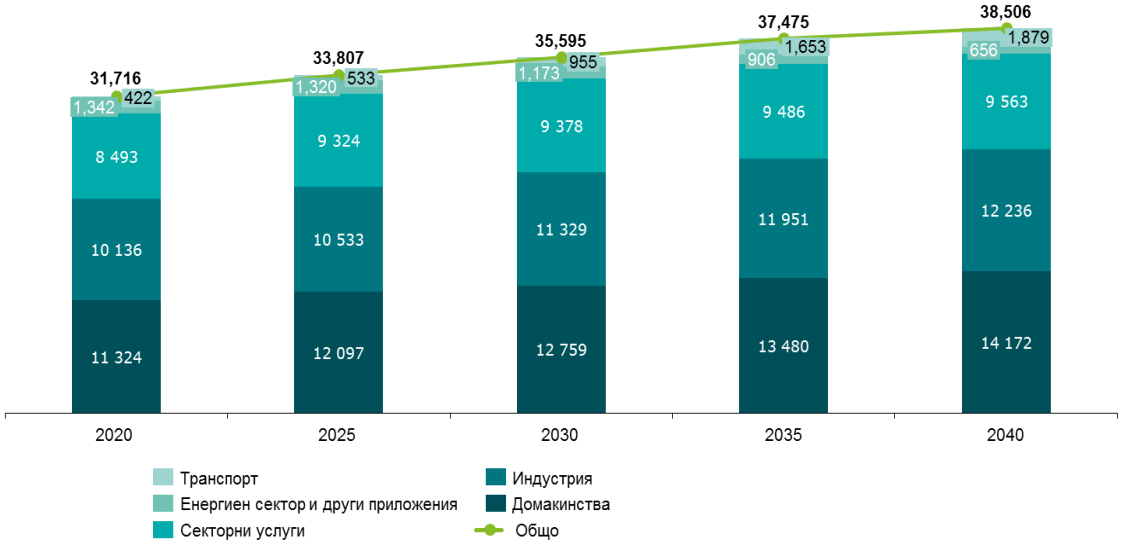
Wind (on-shore)	Hydro
Solar plants	Combustion plants
Nuclear energy	Total

Source: (B)EST model, E3-Modelling

Under the WEM scenario total electricity production is projected to reach 47.7 TWh in 2030 as compared to 43.9 TWh in 2020. Most of the increase attributable to electricity generation from renewable sources (52 % in 2030 as compared to 2020) will offset the downward trend in electricity generation from solid fuels, which becomes particularly prominent after 2025. The share of nuclear power is projected to remain stable over the period under consideration.

The new nuclear power and wind farm capacity will have a higher contribution to net electricity generation. The most prominent trend during the period 2030-2040 is the increase in the share of nuclear power, which is projected to reach 45 % and 60 % in 2035 and 2040, respectively, in total net electricity generation. In contrast to this trend, in 2020 the share of electricity generated by combustion plants will decrease by 50 % in 2020, reaching 15 % [of total net electricity generation] in 2040.

Figure 65: *Domestic consumption of electricity by sector, WEM scenario*



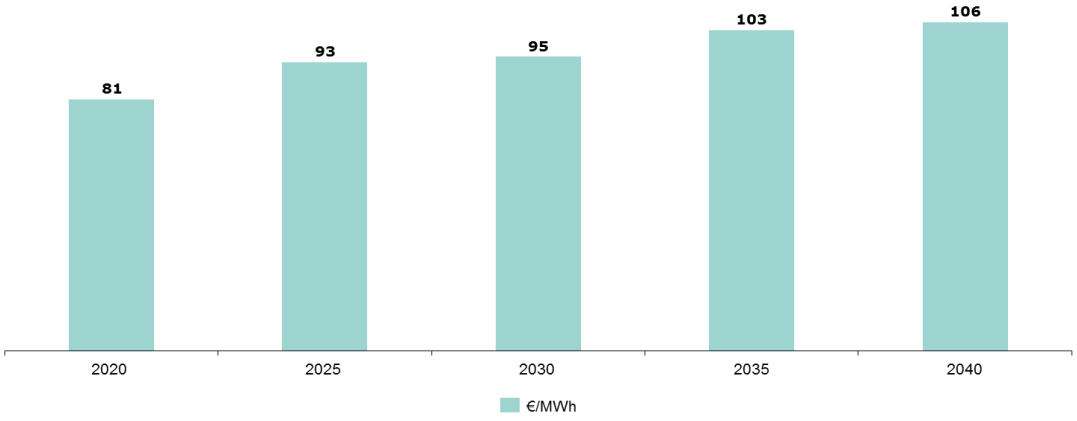
Transport	Industry
Energy sector and other applications	Households
Sectoral services	Total

Source: (B)EST model, E3-Modelling

During the period 2020-2030 domestic consumption of electricity will increase by 12 %, reaching 35.6 TWh. Consumption in the residential and industrial sectors will see similar increases and the two sectors will continue to have a share of two-thirds of total consumption. By 2030, electricity consumption will double to approximately 955 GWh.

In 2040, electricity consumption is projected to reach 38.5 TWh, which represents an increase by 8 % as compared to 2030. Consumption in the household sector is expected to register the highest increase to approximately 1.4 TWh while electricity consumption in transport will double to approximately 1.8—1.9 TWh.

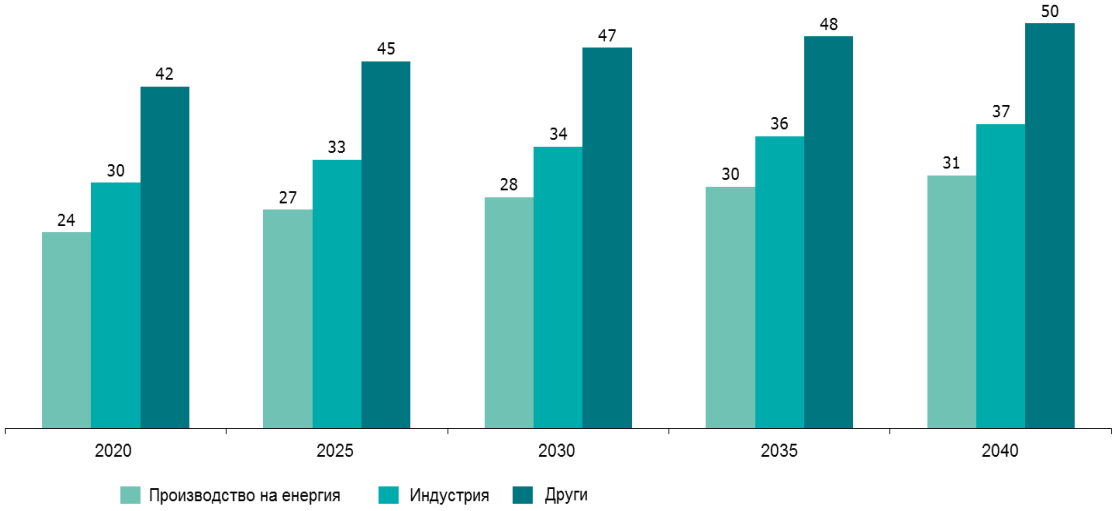
Figure 66 *Projected average prices of electricity before tax, WEM scenario*



Source: (B)EST model, E3-Modelling

During the period 2020-2030 the average price of electricity before tax is expected to vary within the range from EUR 81 MWh to EUR 95 MWh, reaching EUR 106 MWh in 2040.

Figure 67: *Projected prices of natural gas, WEM scenario*



Energy production	Industry	Other

Source: (B)EST model, E3-Modelling

The 'Others' segment includes agriculture, households, services and transport sectors. A gradual increase of natural gas prices until 2040 has been projected.

4.6 Research, innovation and competitiveness dimension

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)

Owing to the efforts of academic and technical communities in Bulgaria, energy saving technologies, which lead to significant energy cost reductions and improve comfort and living conditions, have been developing at a fast pace. Innovations in the energy sector will contribute both to achieving overall energy cost reductions and imposing new energy efficiency standards. They will also bring about a shift towards lower and more sustainable energy consumption. The Innovation Strategy for Smart Specialisation 2014-2020—2020 identifies as a priority area the development of clean technologies with a focus on transport and energy (energy storage, saving and efficient allocation, electrical vehicles and eco-mobility, hydrogen-based models and technologies, waste-free technologies, technologies and methods that include by-products and materials from one production in other productions). The Ministry of Economy has launched the development of the Innovation Strategy for Smart Specialisation 2021–2027, along with an Action Plan to it.

ii. Current level of public and, where available, private research and innovation spending on low-carbon-technologies, current number of patents, and current number of researchers

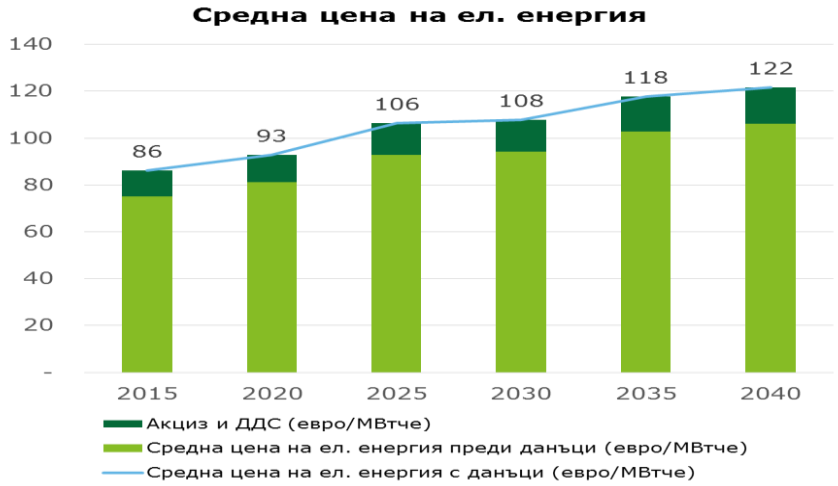
In 2018, total research and development (R&D) costs in Bulgaria in all sectors stood at 0.75 % of GDP (against an EU average of 2.11 % according to Eurostat data). In 2017, R&D costs in the private sector stood at 0.53 % (as compared to the EU average of 1.36 %), despite the significant improvement compared to 2007, particularly in the sector of Information and Communication Technologies. The share of large multinational companies in R&D investment account for more than half of total investments in the business sector. Regional concentration is also a prominent feature of the process, with more than 70 % of R&D activity concentrated in the Southwest region, and more specifically Sofia. In 2017, R&D costs in the public sector stood at 0.21 % of GDP as compared to the EU average of 0.69 %. In 2018, Bulgaria doubled its R&D budget with a view to supporting the implementation of the Scientific Research Strategy for the period 2017-2030 and had committed to gradually increase public spending on R&D to 1 % of GDP in 2025.

Bulgaria finances public research institutions on the basis of effectiveness criteria and has developed national research programmes with the aim of consolidating research potential and resources. EU funding has a significant share in Bulgaria's total public investment. In the multi-annual financial framework for the period 2014—2020, the financial envelope from the EU Structural and Investment Funds earmarked as support intended to help Bulgaria address reform challenges is in the amount of EUR 11.7 billion or approximately 2.8 % of Bulgaria's GDP per year. At the same time, many Bulgarian research institutions, innovative companies and researchers have received grants from other sources and EU programmes, such as the Horizon 2020 Programme. Their currently stands at approximately EUR 65 million EU financing helps companies and research institutions mobilise additional private investments. Grant assistance from the European Regional Development Fund alone has generated approximately EUR 113 million in additional private capital for companies. A total of 5.2 % of the financing available under the European Regional Development Fund has been earmarked for RD&I and SMEs, entrepreneurship, energy efficiency, urban development and environmental management. These funds will help raise an additional EUR 247 million in public and private investment. Six infrastructure and innovation projects in which Bulgaria will participate have been approved to date. Their total amount is EUR 302 million, which is expected to generate EUR 769 million in additional investments.

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

The projected prices of electricity under the currently prevailing conditions until 2040 are shown in the charts below.

Figure 68: *Projected average price of electricity, EUR/MWh, WEM scenario*

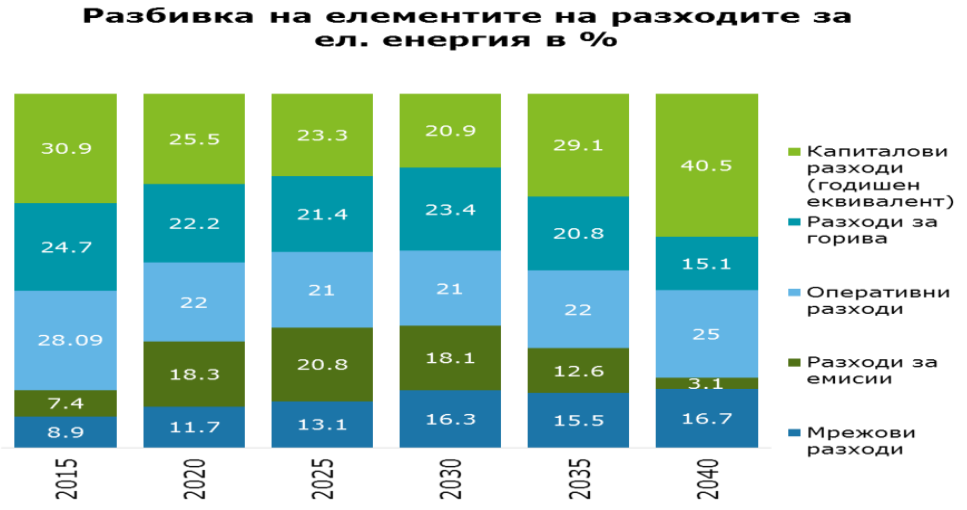


Average price of electricity
Excise duty and VAT (EUR/MWh)
Average price of electricity before tax (EUR/MWh)
Average price of electricity after tax (EUR/MWh)

Source: (B)EST model, E3-Modelling

Under the WEM scenario in the period 2020-2040 the price of electricity after tax is projected to increase, reaching EUR 122 per MWh. The projected average price of electricity before tax includes the price of electricity plus the prices for access to and transmission of electricity via the national grid and distribution networks. The price projections correspond to the values shown in Figure 67. The projection includes excise duty and VAT but does not include public service obligation costs.

Figure 69: *Breakdown of electricity price cost elements, %*



Breakdown of electricity price cost elements, %
Capital expenditure (equivalent per year)
Fuel costs
Operating expenses
Emission costs
Network costs

Source: (B)EST model, E3-Modelling

iv. Description of energy subsidies, including for fossil fuels

Bulgaria does not provide energy subsidies, including for fossil fuels.

In order to achieve the targets for the share of energy from renewable sources in gross final energy consumption and create incentives for heat and electricity cogeneration 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 and the provisions laid down in national law, along with the Guidelines on State aid for environmental protection and energy for the period 2014-2020, support is provided under the following schemes:

RES schemes

SA.44840 — Support for renewable energy generation in Bulgaria in accordance with the Renewable Energy Sources Act;

Under the scheme operational support is granted to the producers of electricity from renewable sources in the form of preferential prices for electricity from renewable sources in accordance with the provisions laid down in the ZEVI.

In Commission Decision No C (2016) 5205 final of 4.8.2016 regarding assisting the production of energy from renewable sources in Bulgaria – SA.44840 (2016/NN), the European Commission concluded that the measure represented State aid within the meaning of the Treaty on the Functioning of the European Union (TFEU).

The European Commission's conclusion is that the State aid is compatible with the internal market within the meaning of Article 107(3)(c) of the TFEU, provided that certain requirements are met. In order to ensure compliance with Commission Decision on State aid C(2016) 5205 final of 4.8.2016, Bulgaria its amended and supplemented the Renewable Energy Sources Act (SG No 91 of 2 November 2018).

The estimated budget of the State aid scheme is BGN 13 227 144 000 (EUR 6 772 419 550). The State aid measure has been notified in accordance with proper procedure. It entered into force on 3 May 2011 and will expire on 31 December 2021.

Support scheme for electricity from high-efficiency cogeneration — SA.56326

In 2019, the Energy Sector Act was amended in order to bring it in line with Articles 30 and 110 of the Treaty on the Functioning of the European Union (TFEU) and the Guidelines on State aid for environmental protection and energy for the period 2014-2020. In connection with this, a State aid scheme for electricity produced by combined high efficiency heat and power cogeneration (SA.56326) was notified to the European Commission. Under the scheme preferential prices/premiums are granted for electricity produced by combined high efficiency heat and electricity cogeneration plants, on the condition that the electricity has been registered by a certificate of origin issued by the Electricity and Water Regulation Commission.

Granting support under Article 10c [sic] of Directive 2003/87/EC

In accordance with Article 10(c) [sic] of Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas

emission allowance trading within the Community and amending Council Directive 96/61/EC Bulgaria has used the opportunity to allocate emission allowances free of charge to electricity plants during the period 2013-2020. By Decisions C92012) 4560 of 6.7.2012 and C (2013) 8455 final of 4.12.2013 [on State aid SA 34385 (2013/N)] the European Commission granted Bulgaria a derogation under Article 10(c)(5) [sic] of Directive 2003/87/EC. The National Investment Plan (NPI) covers all operators who meet the requirements for the derogation envisaged in Article 10(c) [sic] of Directive 2003/87/EC. The implementation of the investment projects set out in the NPI is to ensure a sustainable transition to a low-carbon economy by means of upgrading existing plants, deploying clean technologies, reconstructing and upgrading infrastructure, and diversifying the energy mix and sources of energy supply. A total of 54 168 005 GHG emission allowances have been earmarked for allocation over the entire NPI implementation period (2013-2020). In 2020, no allowances are to be allocated under the NPI because 2020 is a reporting year for the allowances allocated in 2019, when the last payments from the NPI account will be made.

Granting support under Article 10c of Directive*EU) 2018/410

Wishing to modernise its energy sector and in accordance with Article 10(c) of Directive (EU) 2018/410 [amending Directive 2003/87/EC] to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814, Bulgaria will use the possibility for transitional free allocation of greenhouse gas emissions allowances to electricity generation during the fourth stage of EU ETS transition period 2021-2030. To this end, the National Investment Framework for the period 2021-2030 will be implemented, which envisages a possibility to free allowances to be allocated to operators against an obligation to invest in energy sector modernisation.

Direct and indirect subsidies planned

In accordance with Directive (EU) 2018/410 of 14 March 2019 by 30 September 2019 Bulgaria fulfilled its obligation to notify the European Commission of its intention to derogate from Article 10(c) of said Directive by allocating, free of charge and on a transitional basis, greenhouse gas emission allowances to electricity generation plants with a view to enhancing cost-efficient reductions of GHG emissions and low-carbon investments during the fourth stage of EU ETS transition period 2021-2030. The total allowances to be allocated free of charge will not exceed 40 % of the allowances Bulgaria will receive in accordance with Article 10(2)(a) for the transition period 2021-2030, divided in equal annual quantities.

Implementation of a market-oriented capacity mechanism for a period of 10 years In accordance with Regulation (EU) 2019/943 on the internal market for electricity, which grants Member States the possibility to apply a capacity mechanism, where they have concerns in respect of the adequacy of national resources and the mechanism functions in line with market principles and the requirements for the limit values of 550 gCO_2 of fossil fuel per kWh of electricity and the limit value of 350 kg CO_2 of fossil fuel on average per year per installed kW from 1 July 2025.

Bulgaria will focus its efforts on developing and implementing a capacity mechanism that ensures the security and adequacy of the system and enables electricity producers to receive an additional income from participating in the market for electricity.

5. IMPACT ASSESSMENT OF PLANNED POLICIES AND MEASURES

5.1 Impacts of planned policies and measures described in section 3 on energy system and GHG emissions and removals, including comparison to projections with existing policies and measures (as described in section 4).

i. Projections of the development of the energy system and GHG emissions and removals as well as, where relevant of emissions of air pollutants in accordance with Directive (EU) 2016/2284 under the planned policies and measures at least until ten years after the period covered by the plan (including for the last year of the period covered by the plan), including relevant Union policies and measures.

Greenhouse gas emissions

Projections under the WEM scenario indicate that by 2030 total greenhouse gas emissions will decrease by 47.85 % as compared to 1990. Under the WAM scenario an accelerated decrease has been projected, with emissions decreasing by 49 % as compared to 1990. This warrants the conclusion that the target will be achieved under both scenarios.

In addition, under the WEM scenario in 2030 total greenhouse gas emissions (including from the LULUCF sector) are projected to reach 48 871 ktoe CO_2 eq., decreasing from 54 656 ktoe CO_2 eq, in 2015. Under the more ambitious WAM scenario, total emission will decrease to 47 553 ktoe CO_2 eq. Under both scenarios in 2030 LULUCF sector removals are projected at -8 593 ktoe CO_2 eq., which represents a small improvement compared to 2015 data (-8 489 ktoe CO_2 eq.).

With regard to CO_2 capture by the LULUCF sector, both scenarios envisage a significant change in LULUCF removals in the following decades. In some cases, LULUCF sector removals are even projected to decrease, the arable land category being a case in point. This may happen due to intensifying human activity, which constrains land use for plant cultivation, and the average age of forests, which account for the greatest share of LULUCF removals).

Share of energy from renewable sources

The national target of 27.09 % of energy from renewable sources in gross final energy consumption by 2030 set under the WAM scenario is in line with the European Commission's recommendation for Bulgaria to raise the level of ambition for 2030 by setting a target of at least 27 %. Under the WEM scenario the possible share of energy from renewable sources in gross final energy consumption will be significantly lower (24.72 %).

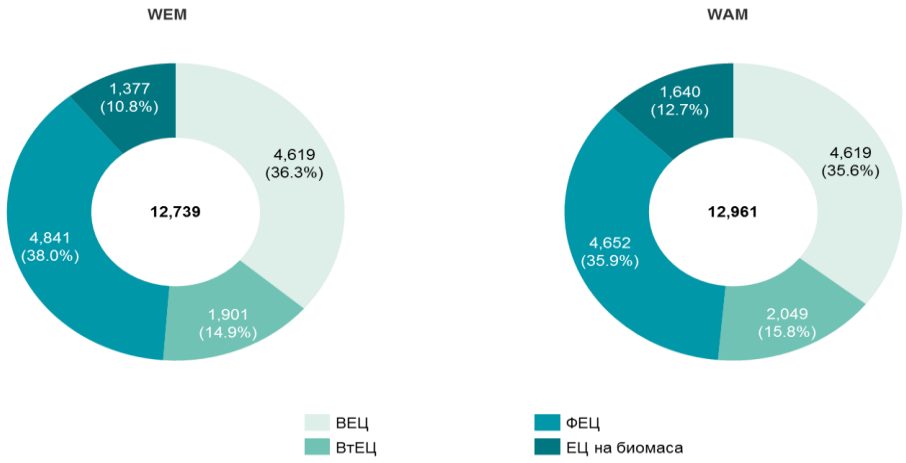
Furthermore, the shares of energy from renewable sources in gross final energy consumption in 2030 compared to 2020 are projected to register a higher increase in all three sectors: electricity, heating and cooling, transport. A comparison of the share of energy from renewable sources under the two scenarios is set out in the table below.

Table 54: *Comparison between scenarios*

	2020		2030	
	WAM	WEM	WAM	WEM
Share of energy from renewable sources, %	**20.20**	**20.18**	**27.09**	**24.73**
RS-Heating and cooling, %	31.07	30.97	42.60	36.11
RS-E, %	21.40	21.43	30.33	29.60
RS-T, %	9.89	9.89	14.20	11.87

Net electricity production under the WAM scenario will be 1.7 % higher compared to the WEM scenario owing to the planned increase in electricity generated by wind farms and power plants using biomass. The net electricity output of hydropower plants under the two scenarios is the same.

Figure 70 *Structure of net electricity generation from renewable sources in 2030 by plant type under the WEM and WAM scenarios (GWh)*



HPP	PhvP
WF	Biomass-powered power plants

Source: (B)EST model, E3-Modelling, Deloitte analysis

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

Most planned (additional) policy measures envisaged in this Plan supplement existing policy measures and aim to raise Bulgaria's level of ambition across all five dimensions of the Energy Union thereby contributing to the achievement of targets at EU level. In this sense, existing and planned (additional) policy measures complement each other as the latter aim to primarily expand the scope of the former by building on them and enhancing their impact.

With regard to energy efficiency, the analysis of key energy performance indicators, presented as primary and final energy savings and costed for the PRIMES 2007 scenario, show higher overall energy savings under the WAM scenario.

In 2030, planned (additional) policy measures are projected to result in additional energy savings of 1 TWh as compared to the energy savings projected to be achieved under the WEM scenario. Energy savings [in some sectors] will be lower on account of the projected increase in demand as a result of robust economic activity. I other words, taking into account the energy savings projected under the WAM scenario, which are partially offset by growing economic activity, no significant impact on the scale of the energy system is expected.

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 policy measures are consistent and complement Union energy and climate policy measures. Furthermore, all existing and planned policy measures implemented across the five dimensions of the Energy Union are fully in line with EU law and/or contribute to the achievement of EU targets in the area of energy and climate.

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

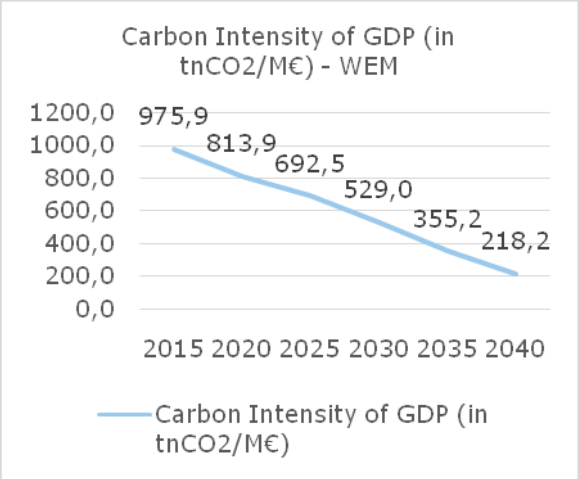
Both scenarios (WEM and WAM) have been developed on the basis of the same microeconomic data on GDP and GDP per capita in 2030. With a population of more than 6.6 million people and GDP of EUR 71.06 billion, in 2030 GDP per capital will reach EUR 10 775.

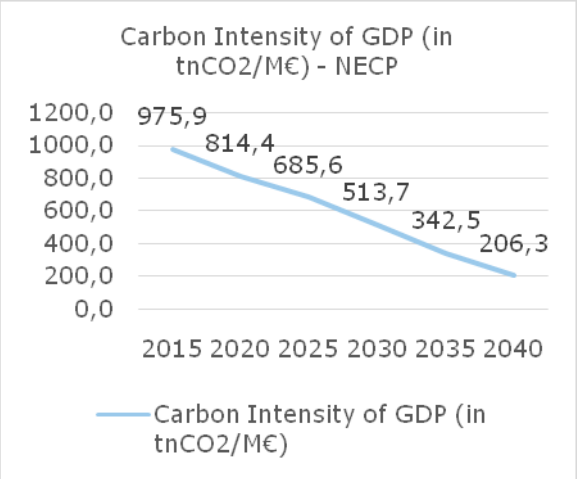
Energy transformation

With existing measures, the transition from fossil fuels to renewable sources will lead to a reduction in the carbon intensity of Bulgaria's GDP by 45.8 % by 2030 compared to 2015.

Figure 71: *Change in GDP carbon intensity (tnCO2 / M€)*

WE< scenario (left) and WAM scenario (right)





Despite this, WAM scenario implementation will lower this factor to 513.7 tonnes of CO_2 per million EUR in 2030, which corresponds to a decrease by 47.4 % as compared to 2015. The implementation of the WAM scenario as opposed to existing measures will result in a decrease in carbon intensity by an additional 3.5 % in 2030.

Net import

Bulgaria's energy transformation will have a significant impact fuel import under both scenarios.

Table 55 *Comparison between net import of fuels under the two scenarios*

	2020	2025	2030
Net import (в GWh)	**0.08%**	**-2.25 %**	**-5.21 %**
Solid fuels	-0.41 %	-5.00 %	-12.47 %
Oil and petroleum products	0.45 %	0.55 %	-0.44 %
Natural gas	-0.40 %	-3.48 %	-8.22 %
Electricity	0.06 %	0.00 %	0.00 %
Biomass and waste	-3.14 %	-40.06 %	-36.68 %

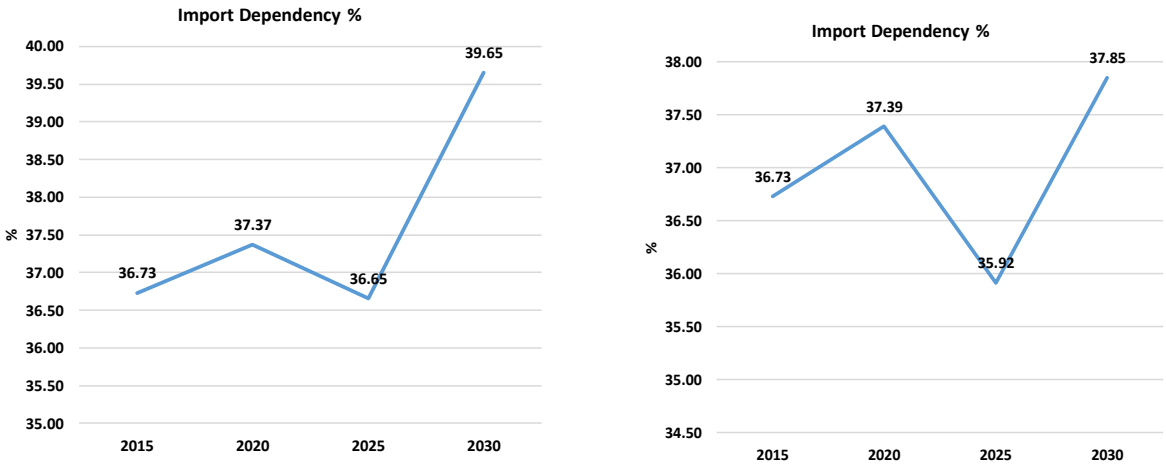
Source: (B)EST model, E3-Modelling, Deloitte analysis

The comparison between the two scenarios shows that WAM scenario implementation will result in net imports decreasing by 5.21 % in 2030 compared to the WEM scenario. More specifically, net imports of solid fuels, natural gas, and biomass and waste will decrease by, respectively, 12.47 %, 8.22 % and 36.68 %. The export of electricity remains the same under both scenarios.

Dependence on imports

Under the WEM scenario the overall dependence on imports increases by approximately 8 % — from 36.73 % in 2015 to 39.65 % [sic] in 2030.

Figure 72: *Change in dependence on fuel imports under the WEM scenario (left) and WAM scenario (right)*



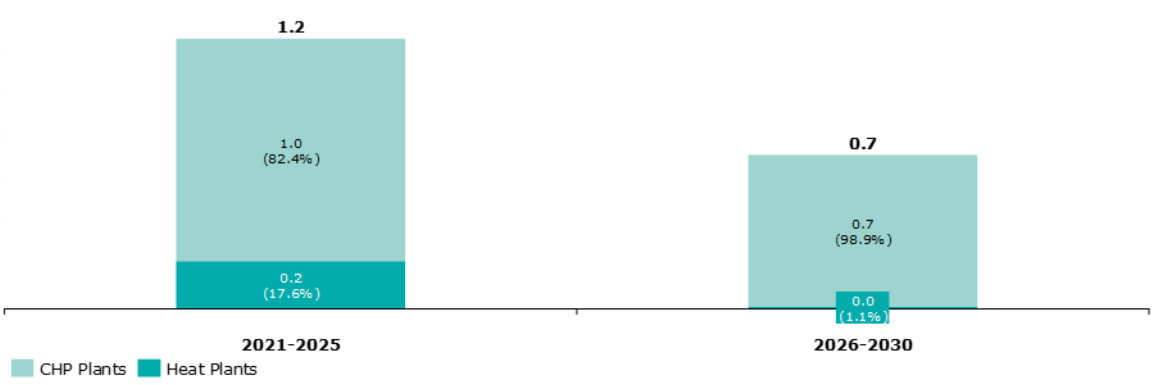
An analysis of the WAM scenario shows that in 2030 overall dependence on imports will register a lower increase by approximately 3 %.

Competitiveness

Both existing and additional policy measures will have a positive impact on the competitiveness of the Bulgarian market.

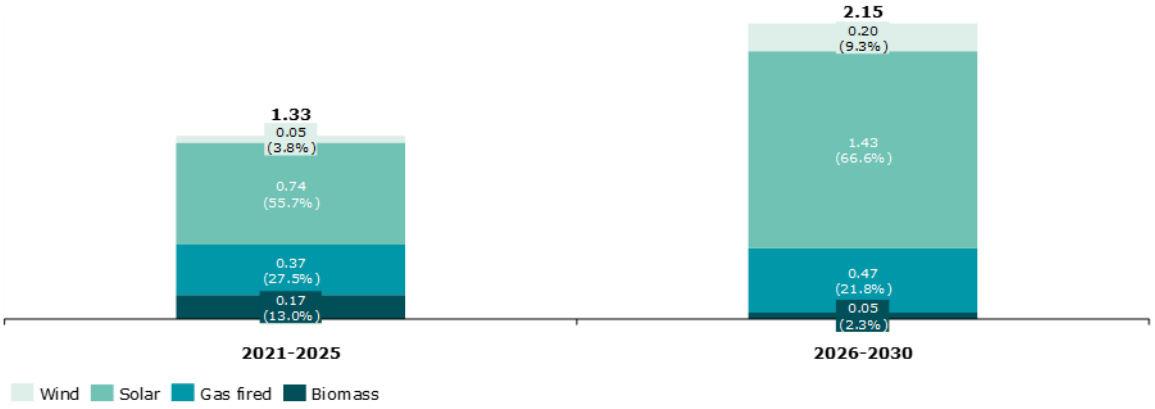
During the period covered by the analysis electricity and heat production will continue to develop, increasing the competitiveness of the sector and generating potential future benefits for final customers (for example lower prices). In connection with this, under the WAM scenario production capacity is projected to expand.

Figure 73: *Increase in heat generation capacity, WAM scenario (GW)*



Source: (B)EST model, E3-Modelling, Deloitte analysis

Figure 74: *Increase in electricity generation capacity, WAM scenario (GW)*



Source: (B)EST model, E3-Modelling, Deloitte analysis

The expansion plans mentioned above will entail old equipment replacement and upgrading production base thereby increasing competitiveness.

As regards electricity exports, Bulgaria will remain a net exporter of electricity, making available a stable net export volume of approximately 8 000 GWh of electricity under both scenarios (WAM and WEM), which will have a positive impact on the trade balance.

Furthermore, the liberalisation of the retail market in electricity — a process planned to commence at the beginning of the next regulatory period — will give an additional boost to market competitiveness. The use of dynamic pricing contracts and consumption aggregation and optimisation contracts will also enhance retail market competitiveness.

In addition to gradual market liberalisation, Bulgaria follows a clear strategy for regional market coupling supported by the construction of the requisite enabling infrastructure. This will have a positive impact on competitiveness, enhancing stability in the market and facilitating trade in electricity. The Balkan Gas Hub project, for example, will lead to the establishment of a gas exchange to meet the needs identified by the High-level Working Group of the Central and South Eastern Europe energy connectivity (CESEC) initiative. The gas distribution centre complements the projects for building interconnectors to Turkey, Greece and Serbia and expanding existing infrastructure, including the planned construction of new gas transmission infrastructure in the near future.

System costs

In terms of social impact, projections indicate that the policy measures to be implemented under the WAM scenario benefit lower income households because total system costs are lower as compared to those under the WEM scenario. In the period 2020-2030, total system costs will be lower by EUR 17 million under the WAM scenario.

In the same period, system costs per sector under the WAM scenario will be as follows:

- Industry: EUR 6 885 billion;
- Households: EUR 13 303 billion;
- Services: EUR 9 971 billion;
- Transport: EUR 9 043 billion

Social impact

The WAM scenario leads to a more effective emissions reduction (including particulate matter and SOx emissions) as compared to the WEM scenario, which will have a positive impact on the quality of the living environment.

The promotion of efficient energy use will lower consumption and therefore energy costs while having a positive impact on well-being and comfort. Efficient energy use will further enhance the competitiveness of the economy and boost investment. Savings in the energy sector will increase added value and create incentives for entrepreneurship.

A high level of investments, particularly in the RES sector will boost job creation. In the area of RES development, Bulgaria will need high-skilled professionals with sound technical knowledge of solar panel manufacturing and installation.

Decarbonisation policy poses significant social and economic challenges with a strong influence on emission-intensive sectors and regions. The latter are at risk of loss of wealth and jobs and therefore require targeted measures. The coal mining sector is currently concentrated in three provinces (Stara Zagora, Pernik and Kyustendil) but it

should be noted that 25 % of the workers and employees of the Maritsa Iztok Plant in Stara Zagora are residents of neighbouring municipalities with poorly diversified economies in the provinces Haskovo, Sliven and Yambol, which are closely integrated into the added value chain of the energy sector. Power plant decommissioning, a situation in which the respective capacities will no longer be part of the electricity system, may have serious social and economic implications.

The transition to a climate-neutral economy will also affect Bulgaria's industrial centres. All sectors with high levels of greenhouse gas emissions in gross industrial added value that are also major employers in the sectors mostly strongly affected by the transition will require support.

This creates a need for a social and economic analysis of the consequences of transition and requires specific transition enabling policies. For this purpose, by a decision adopted in January 2020, the national Parliament approved Bulgaria's application to join the Mining Areas in Transition programme. Consultations are currently under way that will enable Bulgaria to join other EU support initiatives for coal regions in transition to a low-carbon economy. Opportunities to use financing from the EU Structural Funds, the European Investment Bank, the European Bank for Reconstruction and Development, the World Bank and Innovations Fund and the Modernisation Fund are being considered.

Improving the skills and knowledge of the workforce in the area of digital technologies will play an important role in promoting the widest possible deployment of ICT and ICT-based services and the achieving digital growth.

Environmental impact

An environmental impact assessment of the Plan will be conducted in accordance with national legislation.

Impact on air quality

National and EU policies on air quality

National policy and regulatory framework for air quality, the current state of play and development projections, including the measures to be taken to improve the situation, are described in detail in the National Ambient Air Quality Improvement Programme 2018-2024 and the National Air Pollution Control Programme 2020-2030.

Ambient air quality control is governed by the Environmental Protection Act adopted in 2002 and the Ambient Air Quality Act adopted in 1996. The latter is particularly important as it contains dedicated provisions on ambient air quality management and planning in relation to air quality at national and municipal level. Following Bulgaria's accession to the European Union ambient air quality policies and the relevant legislation have been largely shaped by the country's obligations under EU law.

Directive 2008/50/EC on ambient air quality and cleaner air for Europe (CAFE Directive), which has the primary aim of protecting human life on the basis of expert guidelines published by the World Health Organisation, sets the maximum concentrations (limit

values, LV) for a number of pollutants, including particulate matter (and more specifically PM_{10}) to be attained by 1 January 2005. The Directive also sets the maximum number of exceedances of the average daily PM_{10} limit value. It also sets out requirements for the monitoring of ambient air quality and, where the limit values for ambient air quality in agglomerations and other zones determined by the Member States fail to be attained by the 2010 deadline (or are at risk of being exceeded), requires that 'national air quality plans set out appropriate measures so that the exceedance period can be kept as short as possible'.

In 2013, the European Commission conducted a review of the effectiveness of air quality legislation, which led to the development of the Clean Air Package. The package includes four instruments, including a new Clean Air for Europe Programme (CAEP) and the recast Directive on national emission ceilings. The Clean Air for Europe Programme sets new policy objectives for air quality for the period until 2030 to achieve a substantial health improvement, among other benefits. Although it does not make a recommendation for a review of the CAFE Directive, the Programme states that policies should be focused on achieving compliance by 2020 at the latest. It should be noted that current data indicates that PM_{10} has an adverse effect on health, even in concentrations that are lower than current limit values.

Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants (recast Directive on national ceilings), also related to emissions of atmospheric pollutants and their adverse effect on health, [recast Directive] modifies the regime for the national emission ceilings established under the previous Directive 2001/81/EC, bringing it in line with the commitments undertaken by the EU and its Member States under international treaties. The recast Directive additionally lays down national obligations for reducing atmospheric emissions of pollutants, including particular matter ($PM_{2.5}$), nitrogen oxides(NO_x), sulphur dioxide (SO_2) non-methane volatile organic compounds (NMVOC) and ammonia (NH_3), with emission reduction to be achieved in the period 2020-2029. Member States are required to transpose Directive *EU) 2016/2284 into their national law by 1 July 2018 and produce national emission inventory reports and estimates. The revised national emission ceilings will become mandatory in 2020. As $PM_{2.5}$ is a key component of PM_{10}, the requirement for Bulgaria to reduce $PM_{2.5}$ emissions creates an even greater need for prevention and control of PM_{10} emissions.

Bulgaria's policy on ambient air quality, prevention and control of atmospheric pollutants (including sulphur dioxide, nitrogen oxides, NMVOC, ammonia and PM_{25}) is mostly based on EU law. Bulgaria has fully endorsed the objectives set out in Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 for air quality and cleaner air for Europe (Directive 2008/50/EC) and Directive 2004/107/EC.

Bulgaria's policy on climate change, renewable energy and energy efficiency are also closely linked to EU law, strategies and objectives.

The Ministry of Environment and Water is the national competent authorities for environmental matters, including the prevention and control of atmospheric pollutants.

Although certain responsibilities for environmental protection have been delegated to other sectoral ministries and government agencies, the main responsibility for the planning and implementation of measures for ambient air quality rests with municipalities.

Bulgaria has designated three agglomerations (Sofia, Plovdiv and Varna) and three ambient air quality assessment and management zones (Southeast, North/Danubean and Southwest). Air quality monitoring shows that in one or several municipalities in each of the six [sic] air quality assessment and management zones the limit values for PM_{10} exceeded those set in the CAFE Directive. Such exceedances have been registered in a total of 28 municipalities, although three are currently considered to comply with requirements. Bulgaria's failure to comply with the requirements for PM_{10} has triggered an infringement procedure, which is currently pending before the Court of Justice of the European Union.

Air quality monitoring shows that Plovdiv Municipality does not comply with the requirements for the limit values of nitrogen oxide (NO_x) set out in the CAFE Directive. However, for most municipalities, particularly large ones, exceedances of the limit values for NO_x exist as a mere probability. In contrast, all Bulgarian municipalities currently experience major problems with PM_{10} pollution. In view of the widespread challenge of PM_{10} pollution and the significant exceedances of PM_{10} limit values, a National Programme for Ambient Air Quality Improvement for the period 2018-2024 has been developed with the specific aim of reducing PM_{10} pollution thereby achieving compliance with the requirements laid down in the CAFE Directive. Bulgaria has developed a National Air Pollution Control Programme for the period 2020-2030

Historical overview

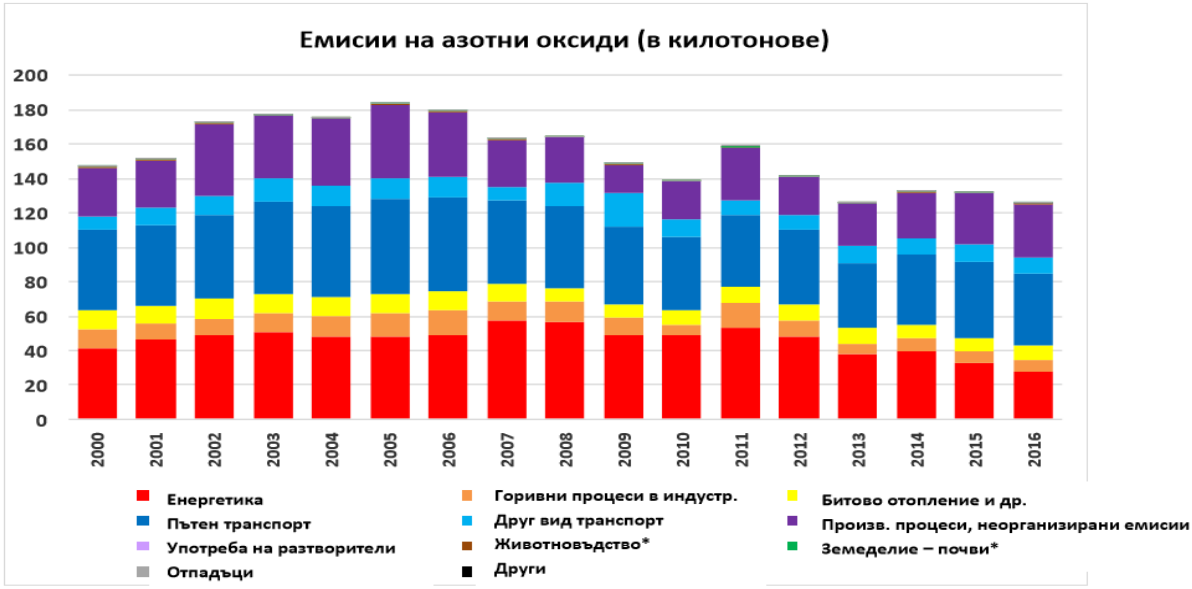
Bulgaria remained in full compliance with the national emission ceilings set out in Directive 2001/81/EC [on national emission ceilings for certain atmospheric pollutants] during the entire period throughout the period 2010—2016. Emission trends since 2005, as described in the national inventory of harmful atmospheric pollutants presented to the European Commission in 2018, largely reflect the policy measures implemented as a result of the transposition of EU law. In most cases, reported emissions, and more specifically sulphur dioxide emissions, decrease over time (see the charts below).

Figure 75: *Sulphur dioxide emissions, ktoe*

Sulphur dioxide emissions (ktoe)		
Energy	**Combustion processes in industry**	**Household heating, etc.**
Road transport	**Other modes of transport**	**Manufacturing processes, emissions from diffuse sources**
Use of solvents	**Livestock farming**	**Agriculture — soils**
Waste	**Other**	

Source: National Air Pollution Control Programme 2020—2030

Figure 76: *Nitrogen oxide emissions*



Nitrogen oxide emissions (ktoe)		
Energy	**Combustion processes in industry**	**Household heating, etc.**
Road transport	**Other modes of transport**	**Manufacturing processes, emissions from diffuse sources**
Use of solvents	**Livestock farming***	**Agriculture — soils***
Waste	**Other**	

Source: National Air Pollution Control Programme 2020—2030

Despite this, minimal progress has been reported in the reduction of the pollutants NMOS, ammonia and $PM_{2.5}$.

In 2016, six main sectors acted as emission sources. Residential heating was the main source of $PM_{2.5}$ and NMVOC while agriculture was the main source of ammonia emissions. The other major polluting sectors in 2016 included the energy sector (sulphur and nitrogen oxides); road transport (nitrogen oxide and NMVOC); industrial processes and diffused emissions (NMVOC and sulphur oxides); and use of solvents (NMVOC).

Combustion plants are the largest polluter in the energy sector. On 28 April 2017, the Commission adopted best available techniques (BAT) conclusions for large combustion plants in accordance with Directive 2010/75/EU on industrial emissions. With regard to new plants, the reference document entered into force on 17 August 2017 — the date on which it was published in the Official Journal of the European Union. It will enter into force four years after this date for operational plants. The adopted document introduces new, stricter emission limits for the sulphur dioxide, nitrogen oxide, mercury, etc. released by coal-fired plants. In addition to having an impact on the coal-fired plants in the East Maritsa River complex, the new limit values will also affect other plants in Bulgaria, including factory power plants and district heating plants with installed elutriators generating both electricity and heat. The plants in question will therefore be required to upgrade in order to meet the new stricter requirement for the emission levels of certain pollutants stipulated in Commission Implementing Decision (EU) 2017/1442 of 31 July 2017 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for large combustion plants. A derogation may only be applied when the assessment of a particular plant shows that the achievement of the new emission levels would generate costs that are excessively high compared to the environmental benefits achieved. The plants that applied for a derogation are listed in Annex B.

The above warrants the conclusion that since 2005 significant progress has been achieved in terms of the number of Ambient Air Quality Assessment and Management Areas (AAQAMA) without exceedances of the limit values for sulphur dioxide and the average hourly limit values for nitrogen oxides. Despite this, all six AAQAMAs continue to register exceedances of the limit values for PM_{10}. Although flue-gas (SO_2) desulphurisation systems have been installed by all electricity plants fired by indigenous coal, which has led to an overall improvement in compliance with the requirements for sulphur dioxide, the AAQAMA in which these plants operate are yet to achieve compliance with the air quality requirements for SO_2 emissions.

Projected development

According to the National Air Pollution Control Programme 2020-2030 Bulgaria will need to put in place additional measures in order to be in a position to meet the ambient air quality requirements laid down in EU and national law.

Table 56: *Projected emissions of air pollutants*

Pollutants	Emissions in ktoe according to 2016 inventory			% reduction in emissions as compared to 2005			Emission reduction commitment (%)	
	2005	2020	2030	2020	2025	2030	2020-2029	2030+
Nitrogen oxide	183.2	93.8	74.7	49 %	54 %	59 %.	41 %	58 %
VOC*	80.7	62.1	46.3	23 %	34 %	43 %	21 %	42 %
SO_2**	771.3	79.6	83.4	90 %	90 %	89 %	78 %	88 %
NH_3	51.6	45.0	43.8	13 %	15 %	15 %	3 %	12 %
$PM_{2.5}$	30.9	22.2	7.8	28 %	57 %	75%	20%	41 %
Date of emission assessment	27 January 2019							

Source: National Air Pollution Control Programme 2020—2030

The implementation of additional measures will ensure the achievement of all commitments for air pollutants in the period after 2030. Therefore, the main focus should be on achieving the projected improvements in efficiency with existing policy measures and on the strict implementation of additional measures. In the following years, when emission projections are to be updated (progress will be reported every two years) and the National Air Quality Pollution Programme is to be revised (every four years), a need may arise for new measures to be identified and implemented to ensure that Bulgaria fulfils its commitments for emissions reduction, if the projected decrease in emission levels is not achieved.

The projected improvement of ambient air quality (AAQ) under the WAM scenario, and more specifically the significant reduction of emissions of $PM_{2.5}$ by 75 % at national level to be achieved in the period 2005—2030 (from 30.9 ktoe per year to 7.8 ktoe per year), should ensure that all municipalities in which exceedances of the limit values for PM_{10} have been registered in recent years are able to achieve the requirements for particulate matter because $PM_{2.5}$ reduction measures lead reductions of PM_{10}. Therefore, with regard to PM_{10}, the projected decrease in emissions is expected to be accompanied by AAQ improvement and quality parameter normalisation in all AAQAMAs. The consistent implementation of the full package of policy measures for the residential heating sector would even accelerate the process, enabling many municipalities and AAQAMAs to achieve compliance with the standards by 2025 at the latest.

The projected reduction of emissions of other pollutants is expected to lead to AAQ improvement in Bulgaria and neighbouring countries and regions. Despite this, the

impact of such a reduction on the compliance of each AAQAMA cannot be measured perfectly accurately.

According to the WAM scenario based on the plan implemented to date an analysis of the emissions of polluting substances shows that emission reductions will be achieved under both scenarios (with existing and with additional measures) over the next decade but that these reductions will be higher under the WAM scenario.

The projections for the fulfilment of Bulgaria's commitments for 2030 under the WAM scenario are set out in the table below:

Table 57: *Projected decrease in emissions, WAM scenario*

Emissions under NECP scenario[17]					**% reduction compared to 2005**			**Emission reduction commitments compared to 2005 (%)**	
	2005	**2020**	**2025**	**2030**	**2020**	**2025**	**2030**	**2020-2029**	**2030+**
NO_x emissions (ktoe), of which	**183.2**	**85.7**	**81.4**	**67.8**	**53 %**	**56 %**	**63 %**	**41 %**	**58 %**
from the Energy sector		*19.8*	*19.3*	*15.4*					
outside the Energy sector		*65.9*	*62.1*	*52.4*					
SO_2 emissions (ktoe), of which	**771.3**	**103.5**	**99.2**	**68.6**	**87 %**	**87 %**	**91 %**	**78 %**	**88 %**
from the Energy sector		*71.9*	*62.1*	*45.1*					
outside the Energy sector		*31.6*	*37.1*	*23.5*					
$PM_{2.5}$ emissions (ktoe), incl.	**30.9**	**23.6**	**14.4**	**8.8**	**24 %**	**53 %**	**71 %**	**20 %****	**41 %****
from the Energy sector		*1.7*	*1.5*	*1.3*					
outside the Energy sector		*21.9*	*12.9*	*7.5*					
NH_3 emissions (ktoe), incl.	**51.6**	**45.0**	**44.1**	**43.8**	**13 %**	**15 %**	**15 %**	**3 %**	**12 %**
from the Energy sector		*n/a*	*n/a*	*n/a*					
outside the Energy sector		*45.0*	*44.1*	*43.8*					
NMVOC emissions* (ktoe), incl.	***80.7***	***62.8***	***53.9***	***47.0***	***22 %***	***33 %***	***42 %***	***21 %***	***42 %***
from the Energy sector		*0.8*	*0.7*	*0.8*					
outside the Energy		*62.0*	*53.2*	*46.2*					

[17]Rounding may result in differences between total and aggregated emissions per sector.

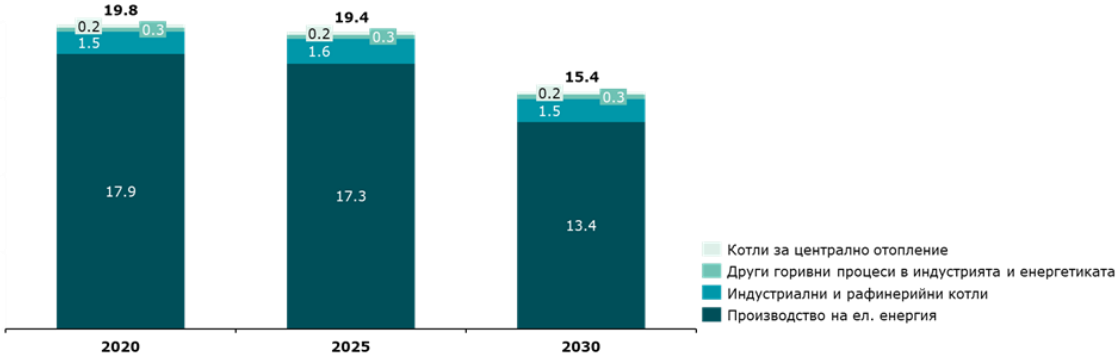
Emissions under NECP scenario[17]					% reduction compared to 2005			Emission reduction commitments compared to 2005 (%)	
	2005	2020	2025	2030	2020	2025	2030	2020-2029	2030+
sector									
**** Emissions from nitrogen oxides and 3B and 3D category non-methane volatile organic compounds (NMVOC) from agriculture have not been taken into account***									
*****Emission reduction commitments apply to $PM_{2.5}$ emissions only***									

Source: (B)EST model, E3-Modelling

The charts below set out the developments in emissions in relation to each air pollutant. In connection with this, the highest reductions in emissions are projected to occur in electricity generation as follows:

- NO_x — a reduction by 4.4 ktoe from electricity generation between 2020 and 2030;
- SO_2 — a reduction by 26.8 ktoe between 2020 and 2030 from electricity generation and by 8.1 ktoe between 2020 and 2030 from Other industrial combustion and energy sectors;
- $PM_{2.5}$ — a reduction by 0.4 ktoe from electricity generation in the period 2020—2030;

Figure 77: *NOx emissions in energy related sectors by 2030 according to WAM scenario modelling**18***

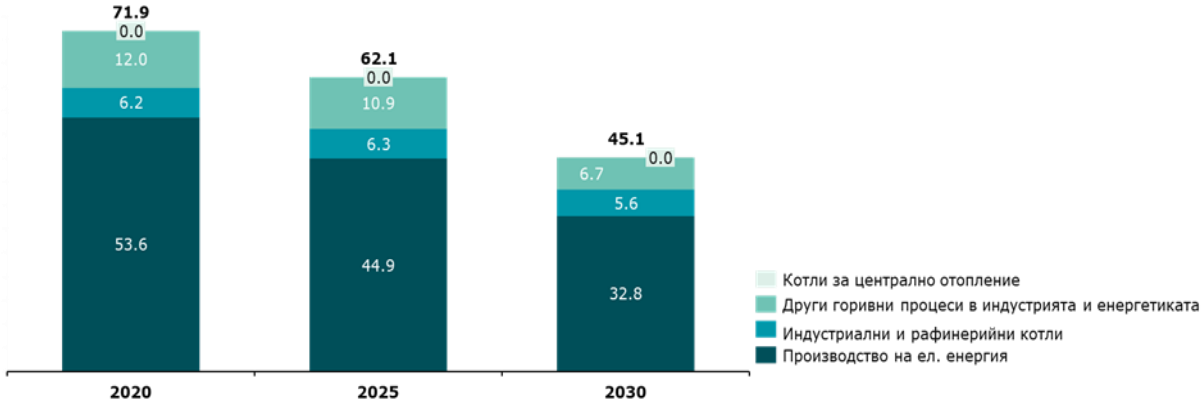


Boilers in district heating plants
Other combustion processes in industry and the energy sector
Boilers in industrial plants and refineries
Electricity generation

Source: (B)EST model, E3-Modelling

[18]Rounding may result in differences between total and aggregated emissions per sector.

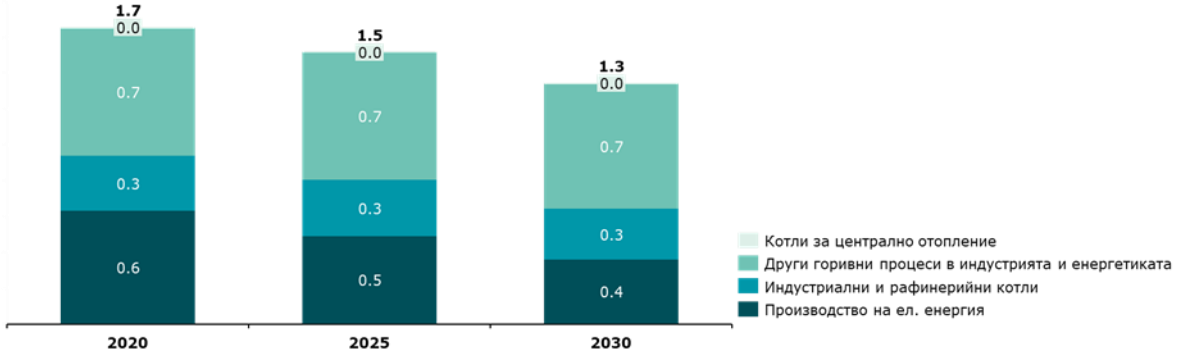
Figure 78: *SO_2 emissions in energy related sectors by 2030 according to WAM scenario modelling*[19]



Boilers in district heating plants
Other combustion processes in industry and the energy sector
Boilers in industrial plants and refineries
Electricity generation

Source: (B)EST model, E3-Modelling

Figure 79: *$PM_{2.5}$ emissions (ktoe) in energy related sectors by 2030 according to WAM scenario modelling*[20]



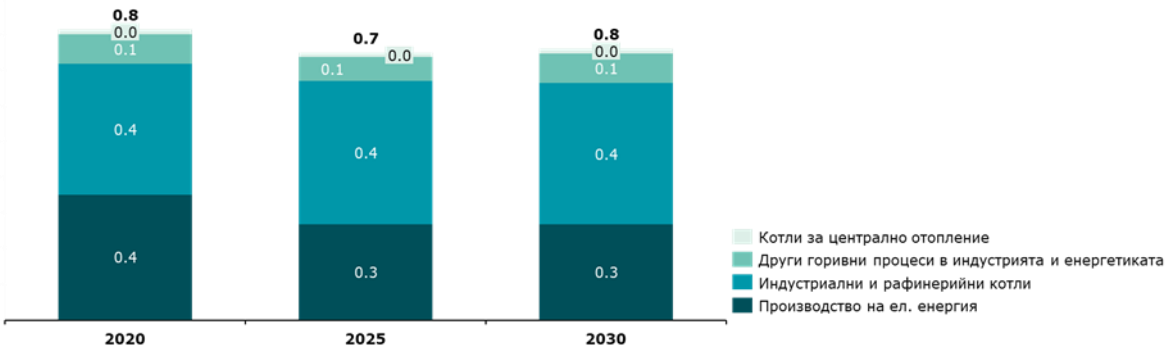
Boilers in district heating plants
Other combustion processes in industry and the energy sector
Boilers in industrial plants and refineries
Electricity generation

Source: (B)EST model, E3-Modelling

[19]Rounding may result in differences between total and aggregated emissions per sector.

[20]Rounding may result in differences between total and aggregated emissions per sector.

Figure 80: *VOC emissions (ktoe) in energy related sectors by 2030 according to WAM scenario modelling*



Boilers in district heating plants
Other combustion processes in industry and the energy sector
Boilers in industrial plants and refineries
Electricity generation

Source: (B)EST model, E3-Modelling

Emissions from the energy sector have been calculated on the basis of an average coefficient based on the latest available data reported by large combustion plants (LCP) in 2017. The model relies on standard projection assumption that LCPs will be granted derogations under Commission Implementing Decision (EU) 2017/1442[21].

The WAM and WEM scenario projections set out in this Plan assume compliance with all applicable environmental requirements and regulations and the implementation of all measures set out in the National Air Pollution Control Programme2020-2030, the National Ambient Air Quality Improvement Programme 2018-2024 and planned changes in the energy system under WAM scenario modelling, such as transition to high-efficiency cogeneration plants. The air quality measures relevant to greenhouse gas emission reductions and to the energy efficiency dimension have been taken into account for the purpose of the modelling exercise.

- Earlier entry into force of Regulation (EU) 2015/1185 [with regard to eco-design requirements for solid fuel for] local space heaters (Eco-Design Regulation 2015/1185 for stoves); and accelerated discontinuation of the use of traditional polluting solid fuel local space heaters (stoves);
- Introducing a standard for the fossil fuels burned for heat (coal) at national level; surrogate measures to lower the content of humidity in firewood in the municipalities that do not meet the quality criteria for PM_{10} by introducing limit levels for the humidity content of firewood;

[21]For combustion plants with total rated heat capacity of more than 300 MW, relying exclusively on indigenous lignite coal for which it can be demonstrated that best available technique-associated emission level (BAT-AEL) is unachievable due to technical and economic reasons.

- Households affected by the mandatory discontinuation of the use of traditional stoves and the transition to natural gas-fired heating systems (reconnection and building new branches of gas distribution networks); district heating (reconnection and building new branches) or use of eco-design compatible (Ecolabel) heating devices;

The implementation of the above measures and stricter compliance with the ambient air quality requirements laid down in national and EU law will ensure a continued positive trend in the reduction of emissions of air pollutants as shown in the charts above. The significant increase in biomass use will not lead to higher emissions of PM_{10} on account of biomass being used in high-efficiency cogeneration. The generation of electricity from biomass fuels under both scenarios (WEM and WAM) has been projected by taking into account the requirements laid down in Article 29 of Directive (EU) 2018/2001 according to which electricity is to be taken into account only if it fulfils one or more of the following requirements:

a. it is generated in installations with a total rated thermal input below 50 MW;

b. for installations with a total rated thermal input from 50 to 100 MW, electricity is generated applying high-efficiency cogeneration technology, or, for electricity-only installations, meeting an energy efficiency level associated with the best available techniques (BAT-AEELs) as defined in Commission Implementing Decision (EU) 2017/1142[22];

c. for installations with a total rated thermal input above 100 MW, it is generated applying high-efficiency cogeneration technology, or, for electricity-only installations, achieving a net-electrical efficiency of at least 36 %;

d. it is generated applying Biomass CO_2 capture and storage.

A direct comparison between the projections set out in the National Air Quality Control Programme 2020-2030 and WEM and WAM scenario projections cannot be made at this stage due to a lack of clarity as to the compatibility of the methods and assumptions underlying the projections set out in the National Air Quality Control Programme. Nevertheless, projections are similar and outline a trend of continued reductions in the emissions of air polluting substances.

RES development impact on Natura 2000 sites, biodiversity and natural resources, including waste

The restrictions on RES development in relation to the Natura 2000 network, other than renewable sources from biomass, are determined on the basis of the conditions set out in the opinion on the environmental assessment (EA) of the NPDEVI, the report setting out

[22] Commission Implementing Decision (EU) 2017/1442 of 31 July 2017 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for large combustion plants (OJ L 212, 17.8.2017, page 1);

an assessment of the compatibility of the NPDEVI with the object and aims of conserving protected areas, and the prohibitions stipulated in River Basin Management Plans (RBMPs) and in the orders on the designation of protected areas.

For the purpose of the INECP, the impacts assessed in the NPDEVI were reviewed and updated. The section below outlines only the impacts with a potential for significant long-term negative effects. The analysis set out below does not contain a comprehensive environmental assessment. It was conducted within the framework of the project with a view to informing decision-making on the potential impacts, restrictions and barriers to the development of certain renewable energy sources and outlining solutions to overcome, minimise, mitigate and manage these impacts at government level. The relevant recommendations set out in the NPDEVI have also been updated and further developed to ensure that they are better aligned with the aims of the INECP, where appropriate.

As regards long-term effects, potential mitigation measures or restrictions may be applied at the planning and operational stages. The significant impacts that may have long-term negative effects on Natura 2000 sites, protected areas, biodiversity and natural resources during the period of renewable energy sources utilisation are mainly the following:

With regard to wind power:

- Death of birds and bats among others (killed by wind turbines) — for rare or protected species (all bats are protected) at national and EU level and for species protected within the boundaries of Natura 2000 sites;
- Disturbance of species, including those protected within the boundaries of Natura 2000 sites;
- Impacts on the integrity and structure of Natura 2000 sites;
- Loss and deterioration of the condition of protected natural habitats.

Areas with proven wind potential along the Black Sea coast overlap with the Via Pontica migratory route. The same applies to the Via Aristotelis and other migratory routes. The analysis of RES potential must recognise these circumstances as legitimate restrictions.

According to WAM scenario projections between 2020 and 2030 the electricity output of wind farms will increase from 1 450 GWh to 2 049 GWh. This means that both new wind farms will be constructed and the capacity of existing ones will be expanded.

With regard to hydropower:

- Changes in the hydromorphology and flow of water bodies that may lead to loss of feeding areas or natural habitats, and habitats or aquatic and other species;
- Habitat deterioration;
- Loss or deterioration of protected natural habitats in or along riverbeds;

- Change and destruction of river habitats, aquatic and coastal fauna, destruction and fragmentation of habitats, barrier effect of riparian species; impacts on fauna due to river flow variations; disturbance during hydropower plant operation;
- Changes in hydromorphology are drive change in the environmental status of surface water and the ecosystems related to them on account of the effect of water abstraction and river barriers in the absence of constructed and properly functioning fish passages.

During the period 2015—2020, the electricity generated by hydropower plants is projected to decrease from 5 659 GWh to 4 707 GWh under both WEM and WAM scenarios. During the period 2021—2030, hydroelectricity is projected to stabilise at 2020 production levels. The INECP does not envisage the construction of new hydropower plants during the period.

The uncertainty associated with water quantities and levels in the context of climate change places a constraint on the development of hydropower plants in Bulgaria until 2030. According to current projections no impact on biodiversity is likely to occur. Despite this, depending on the nature of each project, potential impacts on drinking water are projected, reflecting the priority given to water supply.

Hydropower plants are susceptible both to the availability of water resources in the context of climate change and extreme events due to climate change, such as droughts, which may jeopardise water use for other purposes, i.e. water supply, irrigation, etc. in accordance with the priorities set out in Article 50 of the Water Act.

The impact on water and compliance with the requirements of Directive 2000/60/EC on the good environmental status of surface water, ground water and water protection areas (situated mostly but not only within the boundaries of the Natura 2000 network, for example protected areas for drinking water) should also be taken into consideration.

Regarding solar power:

- Fragmentation of natural habitats and habitats of species
- Deterioration of natural habitats and habitats of species
- Loss of flora and fauna species;
- Change in permanent land use in large areas;
- Loss of natural habitats and habitats of species.

The impacts identified concern solar plants outside urban agglomerations. No negative impacts associated with solar roofs have been identified. There is an abundance of low-productivity agricultural land with poor, rocky and infertile soil outside Natura 2000, which is well suited to the construction of photovoltaic plants without any environmental restrictions that have a genuine potential to trigger positive regenerative effects.

According to the WAM scenario solar power use is projected to increase from 1 664 GWh in 2020 to 4 998 GWh in 2030.

As regards biomass:

- Loss of natural habitats and habitats of species;
- Changes in river hydromorphology and inflow on account of deforestation in water catchment areas;
- Deterioration of forest ecosystems due to deforestation;
- Deterioration of soil quality and fertility due to single-crop cultivation;
- Soil erosion due to deforestation and loss of forestry waste;
- Change of the environmental status of forest habitats: loss/deterioration of protected habitats and habitats of species subject to conservation;
- Soil depletion and deterioration due to the cultivation of unsustainable energy crops and soil contamination resulting from the use of fertilisers and pesticides;
- Destruction of natural habitats and the habitats of plant and animal species as a result of the clearing of pastures;
- Biodiversity loss and biodiversity habitats (pastures, meadows and wetlands) conversion to energy crop cultivation;
- Introduction of non-indigenous species;
- Deforestation of water catchment areas leading to changes in the availability of water resources (the good environmental status of forests is an important factor for climatic conditions) and problems relating to floods and changes in water quality due to soil erosion in water catchment areas;
- Water is also droughts and floods die climate change, with forest use having the potential to exacerbate this effect;
- The use of surface waterbodies for the supply of drinking water from reservoirs and rivers is concentrated in mountain areas. This makes it imperative to preserve the associated catchment areas, which are traditionally covered by forests.

Gross domestic consumption of biomass and waste is expected to increase by 25 % by 2030 compared to 2020 figures and this higher demand will be covered by an increase in both primary production and import. Although no significant change in biofuel consumption is projected, there will be a significant increase in demand for conventional fuels (from 2 207 GWh in 2020 to 1 494 GWh in 2030), which will be offset by the growing consumption of new generation biofuels, with a projected threefold plus increase up to 1 100 GWh in 2030 compared to 2020 figures.

A significant increase in energy production from biomass is projected under the WAM scenario. According to energy balance report data Bulgaria currently exports 1 188 GWh

of biomass and imports 750 GWh of (conventional) biofuels. This trend is projected to remain stable during the period covered by the forecast, with biomass exports decreasing against an increase in domestic consumption. The import of conventional biofuels and new generation biofuels during the same period is projected to increase in order to meet growing domestic demand. In parallel, domestic production capacity is also projected to increase.

In 2030, 2 589 GWh of total biomass will be intended for biofuels for the transport sector, including 1 650 GWh in imported biomass.

Table 58: *Biomass and waste dynamic (GWh)*

	2020	2030
Gross domestic consumption of biomass and waste *incl.*	**18 634**	**23 280**
Biomass	15 072	17 684
Waste, *incl.*	826	2 326
Biodegradable waste	438	1 000
Non-biodegradable waste	388	1 326
Biofuels, *incl.*	2 529	2 589
Conventional	2 207	1 494
New generation	322	1 095
Biogas and off-gases	207	681
Total supply of biomass and waste, *incl.*	18 634	23 280
Primary production	18 576	22 751
Net import	58	529

Source: (B)EST model, E3-Modelling

The most intensive sector in terms of non-biodegradable waste utilisation is the cement industry, which is expected to utilise a total of 336 GWh of non-biodegradable waste in the process of conversion (or approximately 87 % of total consumption) in 2020. The corresponding projected amount for 2030 is 846 GWh (64 % of total consumption). The projected increase in biodegradable waste in the period 2020—2030 is also due to the progress in the implementation of the project for converting the Sofia district heating plant Toplofikatsiya EAD to refuse-derived fuel (RDF) utilisation.

On the other hand, gross electricity generation from non-degradable bio-waste is set to have a negligible share of less than 0.3 % of gross electricity generation throughout the entire period 2020—2030. Gross electricity generation per type of waste is set out in the table below:

Table 59: *Projected gross electricity generation from waste (GWh)*

Gross electricity generation (GWh)	2020	2025	2030
Non-biodegradable waste	12	123	152
Biodegradable waste	14	100	115
Total waste	**26**	**223**	**267**

Source: (B)EST model, E3-Modelling

In conclusion, the biomass necessary to achieve climate and energy targets in the energy sector may be obtained by unlocking the untapped potential for the use of large quantities of biomass from agriculture, aquaculture, livestock manure, etc. and biodegradable waste (with a projected total amount of 1 416 GWh in the period 2020—2030), which is also consistent with the principles of circular economy.

An increase in new generation biofuels is also projected, with the necessary quantities to be supplied in line with the approach detailed in section 2.1.1. According to the projections for land use, land use change and forestry (LULUCF) sector the land intended for the cultivation of crops for biofuels will decrease in keeping with the significant decrease in demand for conventional biofuels.

Most impacts identified can be managed at the stage of conducting an environmental assessment of the INECP. Taking the relevant recommendations into account will facilitate the process of INECP environmental assessment approval and the implementation of the Plan in the future.

The measures and recommendations set out in the NPDEVI have been reviewed to ascertain their relevance to the INECP. The recommendations set out below are based on the results of the conducted EA, which have been incorporated into the NPDEVI. Regarding biomass, the National Action Plan for Energy from Forest Biomass for the period 2018-2027 has been developed in addition to the NPDEVI.

The increase in the production of biomass for energy raises the question of how the necessary quantities will be obtained and what the link between biomass production and the forestry sector potential for GHG removals, which has been decreasing due to the slower rate of growth and the average age of forests, will be.

The NPDEVI, which will remain in force until the end of 2020, sets out the following targets for biomass:

- Increasing timber production sawn up to 7 million m^3 annually by 2020:
- Utilisation of up to 50 % of straw — a resource that has only been used since 2008; utilisation of up to 90 % of oilseed cake — a waste product from the production of sunflower oil;
- Consolidation of livestock farms in the next 3 to 5 years, which will enable the establishment of profitable biogas plants;
- Increasing capacity for the production of briquettes and pellets from wood waste, which will enable automated combustion plant management;

- Gradual replacement of conventional wood-burning stoves with heating devices using briquettes and pellets, which are more efficient.

The National Action Plan for Energy from Forest Biomass (NPDEGB) 2018-2027 is currently the only plan, which sets out estimates of biomass potential after 2020 at national level. The results of applying the three approaches for analysis and assessment of the potential of forest and off-cut biomass and waste biomass generated by the wood processing and furniture making industries used in the energy sector are set out in the table below:

Table 60: *Comparative table of the quantities of wood suitable for biomass and its energy potential by approach used to assess [energy generation] potential, average data for the period 2012—2016*

Approaches used to assess forest biomass potential	Quantities of wood for forest biomass, m^3	Energy equivalent (toe)*	Energy equivalent (GWh)*
'Optimistic' approach	4 291 842	1 056 400	12 286
'Formal' approach	4 142 877	1 038 400	12 077
'Realistic approach'	3 192 338	790 800	9 197
Calculated energy potential of biomass from wood waste generated by the timber processing and furniture making industry		244 300	2 841

Source: National Forest Biomass Energy Action Plan 2018—2027

** calculations converting toe into GWh — 1 toe (tonne oil equivalent) + 11.63 MWh*

The NPDEGB 2018-2027 takes into account the quantity of forest biomass equivalent to 15 127 GWh, following an optimistic assessment approach and relying additionally on the calculated energy potential of wood waste from the furniture making industry.

The optimistic scenario projections set out in the NPDEGB (12 286 GWh) indicate a shortfall in the quantities of biomass necessary in 2020 and 2030 (15 989 GWh and 19 633 GWh, respectively). According to the NPDEGB there is a significant potential to increase forest utilisation in Bulgaria up to 8.5 to 10 million m^3 of live tress by 2020 or up to 70 % to 75 % of the average annual forest growth.

The INECP considers this to be the only reliable source for providing the necessary quantity of biomass. In keeping with the assumptions set out in the INECP, in order to be counted towards the achievement of renewable energy targets, the entire quantity of biomass will have to conform to the sustainability criteria laid down in Directive (EU) 2018/2001.

The WAM scenario is achievable in the current circumstances because the model does not rely exclusively on forest biomass for the total quantity needed. The model uses EU average values, taking into account the specificities of the different sectors of the Bulgarian economy and considers the possibility of unlocking the untapped potential of other sources of biomass, such as the biodegradable fraction of products, waste and

residues from biological origin from agriculture (including vegetal and animal substances), forestry and related industries, fisheries and aquaculture, and biodegradable waste fraction, including industrial and municipal waste of biological origin. Biodegradable waste (biodegradable fraction of industrial and municipal waste of biological origin), not included in the table above is also counted towards the achievement of renewable energy targets.

It is considered that these resources will comply with the sustainability criteria set out in Directive (EU) 2018/2001. The integrated approach is applicable here. It entails reliance on the circular economy and utilisation of biodegradable waste and waste generated in the sectors of the economy which, instead of being discarded as being of no use, can be mobilised and returned into the economy as a resource for the Bulgarian energy system.

The NPDEGB admits that the calculations of potential have certain flaws in terms of sustainability and the environment. For instance:

- the plan recommends that biological and ecological studies of wood harvesting sites be conducted in order to determine the optimal share of harvested wood waste to be collected;
- the waste wood potential, which has been estimated as significant, may lead to certain economic and environmental challenges. Furthermore, according to the conclusion set out in the Plan the comparison between total annual growth and actual use shows that during the period 2010—2015 the total quantity of harvested wood actually used varies between 46.8 % in 2010 to 60 % of total annual growth in 2015. This means that according to the optimistic scenario 40 % to 60 % of annual growth will account for 4 291 842 m³. Doubling annual yield from forests would therefore correspond to 80 % to 120 % of their annual growth.

Such a percentage increase would be contrary to the principles set out in Section X of the Plan. The objective cited below is set in the strategic framework of the action plan for energy from forest biomass. It is relevant to Priority 1 'Sustainable production of biomass as a renewable energy source', and more specifically Activity 1.2.3 'Increasing the use of wood in Bulgaria in compliance with the principle of sustainability': 'Sustainable increase of the use of wood in quantities that do not exceed the average annual growth of forests in Bulgaria'.

Furthermore, the significant increase in biomass production projected on the NPDEGB is not supported by the conclusions of Bulgaria's National Forest Inventory for the period 2021—2025 drawn up in accordance with Article 8 of Regulation (EU) 2018/841 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework according to which neither a decrease nor a significant increase in forest yield can be expected in the next 10 to 15 years.

The National Forest Inventory 2019 further contains a reference to the National Forestry Sector Development Strategy 2013-2020, which introduces a number of requirements and conditions aiming to ensure the protection of sensitive areas, including Natura 2000

sites, and shift the interest of investors to the use of wood biomass from areas where there is no risk of adverse effects for the environment. The requirements in question envisage, *inter alia*:

1) conducting a survey, analysis and assessment of the potential of afforested areas in Bulgaria in terms of their potential for the production of wood biomass; and
2) developing a national scheme for sustainable production and consumption of wood biomass to be used for energy generation, which contains a set of sustainability criteria.

The absence of a reference to the National Forest Inventory in the NPDEGB warrants the conclusion that estimates for land use, land use change and forestry set out in the National Forest Inventory do not take into account either the projections set out in the NPDEGB or those [set out in] point 1 above, which refers to an analysis that has not yet been fully developed.

The second recommendation mentioned above is similarly yet to be implemented. It is assumed that it will contain and take into account the sustainability criteria stipulated in Directive (EU) 2018/2001 [23] so as to facilitate the government and investors in making decisions concerning projects for the production of biomass that satisfies sustainability criteria and can therefore be taken into account for the purpose of reporting on the achievement of renewable energy targets.

It is possible that the sustainability criteria in question were not taken into account during the course of developing the NPDEGB, meaning that the potential yield may not meet the criteria for being counted towards the achievement of renewable energy targets. Sustainability criteria include, but are not limited to

- a requirement not to use biomass from:
    - forest areas with high conservation value and other habitats and high-value land that play a role in protecting biodiversity and maintaining ecosystem functions, including residual biomass;
    - forests with a high level of biodiversity and other afforested areas rich in species or identified as forests with a high level of biodiversity by the relevant competent body, unless evidence is provided that the production of the raw material does not jeopardise the aims and objectives of environmental protection;
    - protected areas,
    - etc.
- The leading principle of forest management is sustainability;

[23]Articles 26 to 29 of Directive (EU) 2018/2001 of 11 December 2018 on the promotion of the use of energy from renewable sources (RED Directive) and Annex IX on the production of biofuels. Additional criteria for biofuels are set out in Commission Delegated Regulation (EU) 2019/897 of 13 March 2019

- According to various studies at least 5 % of deadwood should remain in forests after harvesting in order to avoid negative effects on biodiversity (deadwood is an important habitat or food substrate for certain species) and microclimate, including soil characteristics and the circulation of substances in nature. However, these matters should be examined in a separate study as envisaged in the NPDEGB;
- Forest plantations for accelerated biomass production, including from non-indigenous and invasive species, for example paulownia, may have a negative impact on forest ecosystems. Forest resilience to risks associated with climate change should also be studied separately along with the respective sites in order to demonstrate compliance with the sustainability criteria,
- etc.

According to the projections for the LULUCF sector set out in the National Forest Inventory, large-scale afforestation is an unlikely development. This is the reason why the WAM scenario does not project an increase in the forest areas for biomass production.

With regard to forest management, the report on the forest sector set out in an annex to the National Strategy for Climate Change Adaptation, should be taken into account in the process of developing sustainability criteria at national level because it contains recommendations for measures to be taken to ensure that forest adaptation needs are taken into account in the planning of forest activities, such as timber harvesting and afforestation. It is essential that sustainability criteria take into account climate change considerations and, in light of the arguments set out above, the need for alignment between the various strategic documents on forest management and use, for example the forest sector report (which contains specific guidelines on the management of forests and species, which must be implemented to ensure the sustained growth and development of Bulgarian forests), the National Action Plan for Energy from Forest Biomass, the National Strategy for Forest Sector Development and the National Forest Inventory determining the reference level for forests for the period 2021—2025.

In addition, the Plan for energy generation from biomass will be revised, taking into account the sustainability criteria for production laid down in Directive (EU) 2018/2001 in order to make a realistic assessment of the potential of biomass, which will be counted towards the achievement of renewable energy targets.

These considerations have been aligned with the modelling approach and require efforts to be focused on providing the additional quantities of biomass necessary from sources outside the forests sector and taking steps to adopt the circular economy approach in Bulgaria.

Hence the assumption set out in the section on the LULUCF sector that the biomass needed to achieve climate and energy objectives may be obtained by utilising the potential of using significant quantities of biomass from agriculture, aquaculture, livestock farming, etc., including biodegradable waste.

Furthermore, as already noted in the section on LULUCF, the total land necessary for bioenergy generation is not projected to increase by 2030. Changes will take place in forest land intended for biomass, with arable land used for the cultivation of energy crops for biofuels projected to decrease after the transition from conventional biofuels to new generation biofuels, which will require significantly less arable land.

This report builds on existing measures and commitments by introducing the holistic approach necessary to enable the implementation of the integrated plan and promoting transition to a low-carbon and circular economy at the same time. The main assumption is that Bulgaria is fully capable of a shift to using residual and waste biomass from agriculture and from biodegradable fractions of industrial waste and municipal waste, which will boost new circular business models and contribute to the reduction of greenhouse gas emissions from these sectors.

In this respect, incentives for the use of degraded land for the cultivation of single energy crops and the construction of renewable energy plants, including administrative and other incentives for the development of renewable energy sources in areas affected by human activity, including permanently degraded or contaminated (brownfield) land, may be introduced.

Bulgaria can achieve additional progress in transforming waste into a resource for building a circular economy by reducing waste, stepping up recycling and decreasing the quantities of waste going to landfills. The EU has ambitious targets and rules aiming to transform all Member States into leaders in waste management. Bulgaria must take steps to significantly improve its waste management system and ensure that sufficient biodegradable waste is available for its energy system.

Until the above policy measures for studying, analysing and assessing the potential for sustainable biomass from all relevant sectors are implemented, the Bulgarian government may rely on the forthcoming report on the biomass potential in several EU Member States, including Bulgaria, which is currently being drawn up by Wageningen Environmental Research (an Institute under the auspices of the Stichting Wageningen Research) in the Netherlands, as part of the H2020 CELEBio project.

The project aims to strengthen the enabling environment for bio-based businesses in eight countries of Central, Eastern and South-Eastern Europe that, according to the EU Innovation Scoreboard, are "moderate or modest innovators" and that register scarcer interest for the activities and opportunities offered by BIC and BBI-JU.

This goal will be pursued by compiling and sharing fact-based information as well as by promoting networking among stakeholders in a broader regional and continental scope.

The main objective of CELEBio is therefore to contribute to encourage the uptake of Bio-economy in Bulgaria, Czech Republic, Croatia, Hungary, Slovak Republic and Slovenia through the elaboration of evidence-based Action Plans for each of the targeted countries, as well as through the dissemination of information on the opportunities offered by BBI. To this end, the CELEBio project team will support the setting-up of a network of BBI info points (BBI Ambassadors). In order to set the grounds for further

action in support of the uptake of bio-based technologies and facilitate matchmaking between stakeholders in research and industry, the CELEBio project team will map Bio-economy stakeholders.

As an element of the project, a Report on Bulgaria will be published at the beginning of 2020. Chapters 2, 3 and 4 offer detailed information about biomass production and its current and potential additional use in agriculture and the waste sector. The first issue discussed is core traditional biomass production, the availability of biomass for food and feed, and forest biomass and wood products and their subsequent use in the processing industry and/or in the domestic market or export. The overview then focuses on the additional potential for biomass, which is currently unutilised or underutilised but nevertheless serves as a good basis for new opportunities for bio-based industries.

If the national analysis of the potential for sustainable biomass from all sectors [to be developed] taking into account the sustainability criteria laid down in Directive (EU) 2018/2001 reveals that insufficient quantities of biomass to be used for energy purposes are likely to be available, Bulgaria will have an opportunity to review and modify the policy measures implemented by 2023.

The achievement of those renewable energy targets that are primarily dependent on biomass may necessitate biomass imports earlier than expected, if domestic biomass from agriculture and from the biodegradable fraction of municipal and industrial waste is insufficient to fill the gap between the biomass quantities needed and those than can be obtained from sustainable sources in accordance with the sustainability criteria laid down in Directive (EU) 2018/2001. Another approach would be to reallocate shares of biomass from renewable energy sources to solar and wind power as the measures set out in the National Action Plan for Renewable Energy Sources (NPDEVI) and confirmed as appropriate for the achievement of the above target have a greater potential to help overcome barriers to RES development than those put in place for biomass.

With regard hydroelectricity generation, both scenarios (WAM and WEM) recognise the vulnerability of water resources and the risk of a decrease in availability as a result of climate change, correspondingly projecting a decrease in hydroelectricity generation in the period 2015—2020 by 17 % (from 5 660 GWh in 2015 to 4 707 GWh in 2020).

In the period 2020-2030, hydroelectricity generation is projected to remain at the same level. However, depending on future hydrological conditions, hydropower generation may need to be restricted with a view to guaranteeing that sufficient water is available to ensure uninterrupted supply of drinking water to the population. Such decisions will be made on a case by case basis following a careful review and appraisal by the relevant competent bodies, the MOSV imposing restrictions only where strictly necessary.

Impact on health

Since air pollution is a global health risk, the analysis of ambient air quality and emissions and the projections set out in the INECP, which take into account the policy measures introduced and compliance with EU environmental legislation, are used as an instrument for health impact assessment.

Air pollution is one of the top five risk factors for chronic diseases. According to estimates of the World Health Organisation in 2010 there were 11 787 premature deaths linked to ambient air pollution in Bulgaria. Ai pollution is the greatest environmental risk for the health of Europeans. Once released into the atmosphere, pollutants undergo various physical and chemical processes (transport, reactions, absorption, deposition on plant surfaces or into the soil with rainwater) that have an impact on ambient air quality and can be analysed by measuring the concentration of polluting substances. The main air pollutants that affect human health are particulate matter, nitrogen dioxide (NO_2) and ground-level ozone. Particulate matter emissions are the leading cause of pollution related deaths and have been proven to cause damage to the respiratory (lung cancer) and cardiovascular systems or brain problems (ischemic attacks). As regards ground-level ozone, although traditionally associated with damage to agricultural systems, O_3 has also been demonstrated to have a significant impact on health linked to respiratory diseases.

According to WAM scenario projections the implementation of additional measures will enable Bulgaria to reduce both GHG emissions overall and the emissions of primary air pollutants such as PM and NO_x in particular, which will lead to: (1) improvement in ambient air quality; (2) lowering the morbidity rate for respiratory, cardiovascular and other diseases linked to ambient air pollution; and (3) lowering the long-term economic costs for the healthcare system.

Energy efficiency measures such as thermal insulation, heating (control), ventilation, humidity, fuel consumption, area taken up by and spatial orientation of glass panelling are key factors for lowering excessive cold or heat and reducing air pollution and the health risks associated with it. The most significant economic and social benefits of building stock renovation are set to be achieved through better heating systems and thermal insulation solutions.

Climate change adaptation

The impact of climate change in Bulgaria and the opportunities for adapting to climate change were analysed as an element of the National Climate Change Adaptation Strategy and Action Plan for the period until 2030.

The macroeconomic analysis was developed on the basis of two climate scenarios — temperature increase by 2°C (optimistic scenario) and temperature increase by 4°C (pessimistic scenario) by 2050. Each climate scenario was tested for high and low vulnerability assumptions for each sector (as regards sensitivity to climate change and adaptability). Climate change may have a direct (or an indirect) impact on the cost and availability of materials and the industrial output of the economy, thereby affecting the quality and overall structure of the economy. The loss of real GDP growth in 2050 compared to baseline is estimated at 1 % in the optimistic scenario and 3.5 % in the pessimistic climate scenario. This would mean that the projected annual growth of approximately 1.7 percent until 2050 will be summarily cancelled in a scenario in which Bulgaria faces the full impact of a temperature increase by 2°C by 2050.

Taking into account the impact of climate change scenarios on the entire sector by 2050, the economic analysis shows that:

- Climate change has a direct negative impact on agricultural sector productivity (primarily horticulture) projected to lead to a decrease in production under all scenarios. The most significant negative impact of climate change will be felt in the production of wheat, cereals and other crops in the four river basin management districts in Bulgaria. The Danube river basin, where agricultural productivity is the highest, is the sub-district most strongly affected by climate change.
- Energy sector output is also projected to decrease under all scenarios. This is attributable to the lower economy side demand, translating into lower production.
- Projections for the transport sector are likewise negative, with an overall drop in economic activity (negative changes in GDP) leading to a drop in demand for the output of these sectors.
- Energy intensive sectors, including the chemical industry, the iron and steel and non-ferrous metals industries, and the cement and ceramic industries are projected to see an increase in output driven by the favourable environment for changes in trade, which facilitate an increase in export demand and are expected to mitigate lower domestic demand.

The general conclusions in respect of other macroeconomic and social parameters are as follows:

- The impact of climate change will lead to changes in the pattern of employment in Bulgaria, with workers shifting away from adversely affected sectors of the economy.
- The overall structure of trade will also change. It will result in an increase in the import of goods previously manufactured domestically by sectors strongly affected by climate change.
- The impact of climate change is projected to lead to an increase in price levels in the entire economy under all scenarios. These price increases may further lower real incomes and increase poverty on account of many households spending a significant share of their income on goods (including food products) the prices of which are projected to significantly increase.
- Overall, income levels of both high-skilled and low-skilled workers are projected to decrease under all scenarios. This, in combination with rising prices and falling incomes, is expected result in a greater number of people falling below the poverty line. These climate scenarios are likely to increase the poverty rate in Bulgaria by 2050. It is furthermore commonly understood that climate change, including extreme weather events, has a disproportionately

stronger impact on lower income and vulnerable groups, compounding the impact of rising prices and lower incomes on them.

The messages emerging from the analysis of climate change adaptation can be summarised as follows:

- Adaptation carries potentially great benefits, particularly in a scenario of higher levels of climate change.
- External resources, such as the European Union Funds or their successors, along with other bilateral or multilateral mechanisms focused on the financing of climate initiatives, may also be used for the purpose of adaptation, supplementing national resources.
- With regard to the allocation of climate adaptation financing, the analysis concludes that gearing funding towards sectoral adaptation (but not exclusively vulnerable sectors) will bring more benefits for the Bulgarian economy and citizens as it will enhance capital availability in manufacturing sectors, expanding production and increasing added value — benefits that will at least partially outweigh the negative effects of climate change.

5.3 Overview of investment needs

i. Existing investment flows and forward investment assumptions with regard to the policy measures planned

This section sets out an overview of investment needs in the national energy system overall and disaggregated by sectors or investment area.

The analysis shows that the achievement of the targets set in the INECP will require significant investment. During the period 2021-2030 total investment needs under the WAM scenario stand at EUR 42.7 billion — a figure that exceeds the estimates for achieving the targets under the WEM scenario over the same period by EUR 240 million This amount represents the investments needed in consumer sectors (industry, transport, services, households, etc.) and the need for investment in the sectors of electricity and heat generation in Bulgaria. Car fleet upgrade investments are planned in order to increase the number of less polluting vehicles, such as hybrid and electric vehicles. The investments needed to upgrade equipment and appliances in the household and service sectors, including direct investments to enhance energy efficiency, are estimated at EUR 11.8 and EUR 4.2 billion, respectively.

Investments in the total amount of EUR 15.3 billion will also be needed in the sector of electricity and heat generation, including EUR 3 billion for the upgrade of renewable electricity plants and EUR 10 billion for the construction of two new nuclear power units.

The table below sets out a summary of investment costs under the WAM scenario.

Table 61 *Total investment costs under WAM scenario, million EUR*

	2021-2025	2026-2030	2021-2030
Consumption sectors			
Industry[24]	1 172.38	924.4	2 096.78
Households	5 523.30	6 308.62	11 831.92
Services	2 216.95	2 023.33	4 240.28
Transport	3 677.95	5 365.29	9 043.24
Non-energy consumption	141.66	91.84	233.50
Total	**12 732.24**	**14 713.48**	**27 445.72**
Generation of electricity and heat			
Electricity plants	1 141.50	11 780.01	12 921.51
Cogeneration plants and heating utilities	92.08	56.06	148.14
Storage facilities		620	620.00
Power to X		3.45	3.45
Investments in grid development	747.99	839.04	1 587.03
Total — generation of electricity and heat	1 981.57	13 298.56	15 280.13
Total	**14 713.81**	**28 012.04**	**42 725.85**

Source: (B)EST model, E3-Modelling

Investments in industry

For modelling purposes, the industry sector has been divided into subsectors set out in the following table. Estimates show that during the period 2021-2030 a total of EUR 2.1 billion will be needed under the WAM scenario or EUR 24 million more as compared to the investment needed under the WEM scenario. Investment needs are mostly related to the generation of heat and electricity for own consumption and the processing and re-use of waste heat. The table below sets out a summary of investment needs under the WAM scenario for the industry sector:

Table 62 *Investment needs in the industry sector under WAM*

	2021-2025	2026-2030	TOTAL 2021-2030
Iron and steel industry	80.61	74.57	155.19
Non-ferrous metals	104.11	96.03	200.14

[24] Investment costs for factory plants for heat and electricity cogeneration for own use are excluded.

Chemical industry	231.38	132.06	363.44
Construction materials	123.28	121.41	244.70
Paper and pulp industry	280.93	62.89	343.81
Food, beverages and tobacco	94.77	101.03	195.80
Machine building	67.51	67.98	135.49
Textile industry	18.91	12.70	31.61
Other	170.88	255.72	426.60
Total	**1 172.38**	**924.40**	**2 096.78**

Source: (B)EST model, E3-Modelling

Electricity plants

As regards electricity power plants, investment needs during the period 2021-2030 stand at nearly EUR 13 billion under the WAM scenario or nearly EUR 35 million more as compared to the WEM scenario. Significant investments will be needed in technologies for electricity generation from renewable sources, such as wind farms and photovoltaic plants and biomass and gas fired combustion plants as shown in the table below:

Table 63: *Investments in electricity plants, WAM scenario, million EUR*

	2021-2025	2026-2030	2021-2030
RES, of which:	**669.03**	**1 286.48**	**1 955.51**
WF	56.65	213.01	**269.66**
PhvP	612.38	1 073.47	**1 685.85**
Combustion plants, of which:	**472.46**	**493.54**	**966.00**
Lignite plants without CO_2 capture and storage (CCS) systems		**99.23**	**99.23**
Combined cycle gas turbine (CCGT) plants without CO_2 carbon capture and storage (CCGT without CCS)		**320.81**	**320.81**
Open cycle gas turbine plants, combustion plants and gas turbine plants	**190.08**		**190.08**
Biomass plants without CO_2 capture and storage (CCS) systems	**282.38**	**73.50**	**355.88**
New nuclear power plants		**10 000.00**	**10 000.00**
Total	**1 141.49**	**11 780.02**	**12 921.51**

Source: (B)EST model, E3-Modelling

Cogeneration and heating plants

Total investment needs relative to cogeneration and heating plants for the period 2021-2030 is estimated at EUR 148.15 million, the bulk of investment targeting gas and biomass cogeneration and heating plants. Under the WEM scenario the amount is lower by EUR 16.5 million During the period 2026—2030 approximately EUR 7 million will be invested in solar thermal plants. The table below sets out a summary of investment

needs related to cogeneration and heating plants for the period 2021-2030:

Table 64: *Investments in cogeneration and heating plants, WAM scenario, million EUR*

	2021-2025	2026-2030	TOTAL 2021-2030
Cogeneration plants – CHP Plant CCGT without CO_2 CCS	-	39.65	39.65
Cogeneration plants – open cycle plants, combustion plants and gas turbine plants	23.49	-	23.49
Cogeneration plants – CHP Plant Biomass without CO_2 CCS	36.14	9.44	45.58
Total cogeneration plants	**59.63**	**49.09**	**108.73**
Gas fired heating plants	32.45	-	32.45
Solar thermal plants	-	6.97	6.97
Total heating plants	**32.45**	**6.97**	**39.42**
Total cogeneration and heating plants	**92.08**	**56.06**	**148.15**

Source: (B)EST model, E3-Modelling

Investments in renewable energy in the sector of electricity and heat generation

In order to achieve the targets for renewable sources set in the INECP, Bulgaria plans to make significant investments in the development of power plants for electricity and heat generation from renewable sources. During the period 2021-2030 investments under the WAM scenario will require a total of EUR 2.4 billion (almost EUR 75 million more as compared to the WEM scenario). According to estimates approximately EUR 1.7 million will be invested in the development of solar plants and approximately EUR 400 million in biomass plants. The table below sets out a summary of the investment needs for power plants generating electricity and heat from renewable sources for the period 2021—2030:

Table 65: *Investments in power plants generating electricity/heat from RES under WAM scenario, million EUR*

	2021-2025	2026-2030	2021-2030
Electric power plants			
WF	56.65	213.01	269.66
PhvP	612.38	1 073.47	1 685.85
Biomass plants with CO_2 CCS	282.38	73.50	355.88
Total electricity plants	**951.42**	**1 359.98**	**2 311.39**
Cogeneration and heating plants			
Cogeneration plants — CHP Plant Biomass without CCS	36.14	9.44	45.58

Solar thermal plants	-	6.97	6.97
Cogeneration and heating plants, total	**36.14**	**16.41**	**52.55**
Power plants – Power to X			
Hydrogen power plants	-	3.45	3.45
Total:	**987.56**	**1 379.84**	**2 367.39**

Source: (B)EST model, E3-Modelling

Investments in efficiency in the household and service sectors

During the period 2021-2030 significant energy savings are required for the household and service sectors, which will necessitate significant investments. Energy savings will result from the use of appliances with better energy performance. Under the WAM scenario, as compared to the WEM scenario, more appliances are projected to be upgraded to ones with better energy performance (for example standard Class A or A+ appliances are expected to replace Class B appliances or ones with poorer energy performance) as a result of higher consumer awareness. Under the WAM scenario this corresponds to investments in appliances that exceed those under the WEM scenario by EUR 33.3 million Building renovation is expected to continue in keeping with the dedicated policy aiming to promote building stock renovation (for example, the implementation of ESCO contracts, which lower the risk for individual consumers) and therefore boost energy efficiency as a cost-effective solution. The necessary investments in the households and services sectors are projected at EUR 557.15 million and EUR 138.6 million, respectively. Under the WAM scenario this represents a total investment of EUR 695.75 million for the period 2021-2030, which exceeds WEM scenario projections by nearly EUR 145 million

Table 66: *Investments in efficiency under WAM scenario, million EUR*

	2021-2025	**2026-2030**	**TOTAL 2021-2030**
Households			
Equipment	5 289.37	5 985.39	11 274.76
Direct investments in efficiency	233.93	323.22	557.15
Total households	**5 523.30**	**6 308.62**	**11 831.91**
Services			
Equipment	2 133.42	1 968.26	4 101.68
Direct investments in efficiency	83.53	55.07	138.60
Total services	**2 216.95**	**2 023.33**	**4 240.28**
Total	**7 740.25**	**8 331.94**	**16 072.20**

Source: (B)EST model, E3-Modelling

Overview of sources of funding

A non-exhaustive list of the potential sources of financing is set out below.

During the period covered by the next Multi-annual Financial Framework (2021—2027) Bulgaria intends to use financing from the Structural Funds for investments in energy sector decarbonisation with a view to enhancing climate change adaptation and ensuring a just transition. The priority investment needs identified are set out in Annex D to the Bulgaria Country Report. These include measures that promote energy and resource efficiency, waste management improvement and the transition to a circular economy. Bulgaria intends to gain access to financing under the ERDF and the Cohesion Fund.

I. Structural funds European Regional Development Fund and Cohesion Fund

A total of EUR 273 billion will be available from the ERDF and the CF under the new Multi-annual Financial Framework for the period 2021-2027. The new MFF will have a thematic focus, with Policy objective 2 'A greener Europe' and Policy objective 3 'A more connected Europe' being the most closely linked to the investments needs identified under the WAM scenario.

The Bulgarian energy sector is most comfortably accommodated within the framework of Policy objective 2, which promotes efforts to achieve a greener Europe with low-carbon emissions and a transition to clean and fair energy, green investment, the circular economy, climate change adaptation and risk prevention and management. Within the framework of Policy objective 2, the EFRD/CF seek to more specifically achieve the following goals:

Boosting energy efficiency and reducing greenhouse gas emissions

In connection with this, the following investment priorities have been determined:

1. Measures to boost energy efficiency for green investments and low-carbon dioxide emissions in the whole economy and along the entire energy chain;
2. Support to upgrade the energy performance of public, industrial and residential buildings through renovation, including the integration of a component for seismic risk consolidation;
3. Support to boost the energy efficiency of SMEs and local authorities.

Promoting energy from renewable sources

With regard to this, the following investment priorities have been identified: development and upgrade of energy storage capacity and backup systems, support for decentralised distribution, transmission and distribution adaptation, increasing the adequacy of the electricity grid.

Developing smart energy systems, grids and storage capacity outside TEN-E

In connection with this, the following investment priorities have been identified:

a. Digitalisation of the national energy system in all segments relevant to transport, distribution and consumption of energy and deployment of smart management systems to support the step-by-step implementation of the smart city concept.

b. Development of the transmission and distribution capacity of electricity grids to ensure that they have the requisite technical parameters to ensure reliable interconnectivity for trans-European electric energy infrastructure.

The **environmental** sector is most comfortably accommodated within the framework of Policy objective 2. The EFRD/CF objectives for this sector are as follows:

Enhancing adaptation to climate change, risk prevention and disaster resilience

In connection with this, the following investment priorities have been determined:

1. Adaptation to climate change measures, prevention and management of climate risks, floods, landslides, fires, storms, etc.
2. Prevention and management of the risk of non-climatic natural disasters (i.e. earthquakes) and risks relating to human activity (i.e. technological accidents), including awareness raising systems, better infrastructure, civil protection and disaster management.

Boosting transition to a circular economy

In connection with this, the following investment priorities have been determined:

1. Municipal waste management: prevention, minimisation, sorting and recycling measures
2. Municipal waste management: residual waste treatment
3. Management of commercial, industrial or hazardous waste
4. Promotion of the use of recycled materials as raw material

Improved conservation of nature and biodiversity, green infrastructure, particularly in urban areas, and reduction of environmental pollution.

The **transport sector** is most comfortably accommodated within the framework of Policy objective 3. The following investments will be supported under this Policy objective:

- Development of a sustainable TEN-T network that is well adapted to climate change, secure and intermodal;
- Development and enhancement of sustainable, flexible and intermodal national, regional and local mobility, including better access to the TEN-T network and cross-border mobility.

II. InvestEU

The InvestEU programme under the new MFF will provide an EU budget guarantee in the amount of EUR 38 billion The funds available under the programme will be invested via financial partners, including most prominently the EIB; Eligible investments will be made within the framework of several policy windows, the following being most closely linked to the INECP:

- **Sustainable infrastructure**

This area aims to boost the development of energy sector and transport sector infrastructure, innovative equipment and technologies, environmental protection and resource conservation and contribute to the development of digitally connected infrastructure. Eligible investments include:

  - Generation, supply and use of clean, sustainable and secure energy from renewable and other energy sources with near zero or low emissions;
  - Energy efficiency and energy savings;
  - Development and upgrade of sustainable energy infrastructure at the level of transport and energy distribution, storage and smart grids;
  - Development of innovative heating and cogeneration systems with low or zero emissions;
  - Production and supply of synthetic fuels from renewable or carbon neutral energy sources;
  - Enabling infrastructure for carbon dioxide capture and storage systems;
  - Alternative fuels infrastructure: electricity, hydrogen, liquefied gases and other low or zero emission technologies;
  - Projects targeting the efforts to combat or adapt to climate change;

- **Research, innovation and digitalisation**

This area aims to boost the digital transformation of EU companies, markets and Member States. It further aims to achieve a scientific, technological, economic and public impact by strengthening the scientific and technology base of the EU with the ultimate goal of fulfilling the EU's strategic priorities and providing support for the purpose of modernising innovative companies and deploying new technologies on the market.

- **Small and medium-sized enterprises**

This area aims to boost the global competitiveness of SMEs across the EU at each stage in their development.

- **Social investments**

The goals in this area are: reducing inequalities; enhancing inclusion and boosting social enterprises, social economy and social inclusion, improving the health, general well-being

and quality of life of Bulgarians, improving educational outcomes and supporting a just transition to a low-carbon economy.

Sources of Financing other than the 2021-2027 MFF:

III. Modernisation Fund

During the period 2021-2030, two percent (2 %) of total EU allowances will be auctioned off and the proceeds will be paid into an account of the Ministry of Finance in accordance with Article 10(1) of Directive (EU) 2018/410 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814. At least 70 % of the funds will be disbursed in the following areas:

- Generation and use of electricity from renewable sources;
- Enhancing energy efficiency including in transport, buildings, agriculture and the waste management), except the production of energy from fossil fuels;
- Energy storage;
- Modernisation of energy grids, including the pipelines of district heating systems, electricity transmission grids, increasing interconnectivity between Member States;
- Just transition of carbon-dependent regions with the aim of supporting their development and providing new employment opportunities to workers.

The aid intensity for such priority projects will be up to 100 % of eligible expenditure. The aid intensity for other lower priority projects will be up to 70 % of eligible expenditure. No support will be provided for projects based on solid fossil fuels, except for thermal power plants in Romania and Bulgaria. The EIB, as a member of the Investment Committee, will [be responsible for] assessing project eligibility, asset management and the revenue from auctioning allowances.

IV. Loans from the European Investment Bank

- Investments in energy efficiency, taking into account the EU target of 32.5 % by 2030, particularly for residential buildings, until the deployment of the new instrument for European building stock renovation, which will also focus on the energy efficiency of SMEs;
- Decarbonisation of energy supplies, taking into account the target for reduction of EU-wide emissions by 40 % compared to 1990 levels (in connection with this, the EIB will commit to supporting the integration of renewable energy projects and fostering stronger regional co-operation);
- Support for investments in innovative technologies and novel energy infrastructure;

- Security of energy infrastructure (the EIB continues to support projects of common interest in areas other than the use of fossil fuels).

From 2022 onwards, the EIB will no longer finance investments related to fossil fuels, including natural gas, except those with emissions of up to 250 gCO2/kWh.

The EIB will also co-operate with the European Commission in the development of the Just Transition Fund established to support regions encountering challenges in the transition to a carbon neutral economy. The EIB will fund up to 75 % of eligible costs. Projects will benefit from both financial support and project related consultancy services.

V. Private investment

It should be noted that currently available information about the financing from EU funds is provisional and subject to change because the INECP was developed while negotiations on MFF 2021-2027 were still ongoing.

ii. Sector or market risk factors or barriers in the national or regional context

The main potential sources of risk, which could hinder the achievement of the national targets and dampen the ambitious assumptions underlying the WAM scenario concern the timely and adequate implementation of planned policy measures. Bulgaria needs significant investments in both energy production and climate change, which are closely linked to the achievement of WAM scenario targets.

With regard to the development of renewable electricity, Bulgaria plans to invest more in wind farms and solar plants and increase the use of biomass in electricity generation, which creates a need to ensure a stable supply.

During the period 2021-2030 the transport sector will also play an important role in decarbonisation and the use of renewable energy. It will transition to the use of alternative fuels and new technologies such as hybrid and electric vehicles. Although these technologies are still expensive, their economic viability is expected to improve in the future. It is also necessary to meet the growing demand for travel, meaning that investment decisions in this area should not be delayed nor should they hinder the further development of the transport network and infrastructure. As the transition to vehicles using alternative fuel will require significant infrastructure changes, it will be particularly important for Bulgaria to develop infrastructure planning measures to enable the installation of charging stations for electric vehicles as well as LPG and hydrogen filling stations.

iii. Analysis of additional public finance support or resources to fill identified gaps identified under point [...]

A number of EU financing mechanisms are available under which support is provided for the development of sustainable mobility in Europe, including the Connecting Europe Facility. Financial measures to promote private investment, particularly in the area of energy efficiency, will be promoted. The financing available for the implementation of

projects of common interest and EIB loans are also important sources of funding that support the achievement of WAM scenario targets.

5.4 Impacts of planned policies and measures described in section 3 on other Member States and regional cooperation at least until the last year of the period covered by the plan, including comparison to projections with existing policies and measures

i. Impacts on the energy system in neighbouring and other Member States in the region to the extent possible

ii. Where relevant, impacts on regional cooperation

Electricity markets

In accordance with Regulation (EC) 2009/714 and the accompanying network codes and guidelines co-ordinated allocation of cross-border capacity through non-discriminatory market-based solutions must be achieved. The Joint Allocation Office is a service company that facilitates the electricity market by organising auctions for cross border transmission capacity. On 1 October 2018, the JAO became the Single Allocation Platform (SAP) for all European Transmission System Operators (TSOs) in accordance with Article 59 of Regulation (EU) 2016/1719. The JAO is owned by twenty-five Transmission System Operators (TSOs) from 22 countries.

ESO EAD acquired shares in the capital of the JAO at the end of 2019 and used the services of the company for the allocation of long-term capacity at Bulgaria's borders with Romania, Greece and Serbia. The national electricity system operator uses the services of the JAO for short-term capacity allocation at Bulgaria's borders with Greece and Serbia as well. Capacity allocation in the day-ahead time interval at the Romanian border is handled by the Romanian transmission operator. This arrangement will change following the coupling between the two trade zones at the end of 2020. At the border between Bulgaria and North Macedonia both long-term and short-term capacity is allocated by the Macedonian and Bulgarian transmission operators, respectively. At the Bulgarian-Turkish border, capacity is allocated by each operator for 50 % of the capacity agreed.

Since January 2019 daily explicit capacity allocation auctions have been conducted at the Bulgarian-Serbian border. These are arranged by the Serbian transmission operator. After 19 November 2019, i.e. after the launch of the market coupling between Bulgaria and Romania, daily capacity in the day-ahead market at the border between the two countries is allocated implicitly.

The Bulgarian independent electricity exchange administers the short-term day-ahead and intra-day market segments. The abolition of the export tariff for electricity in 2019 was an important step that will enable the forthcoming couplings between the Bulgarian electricity market and those of neighbouring countries.

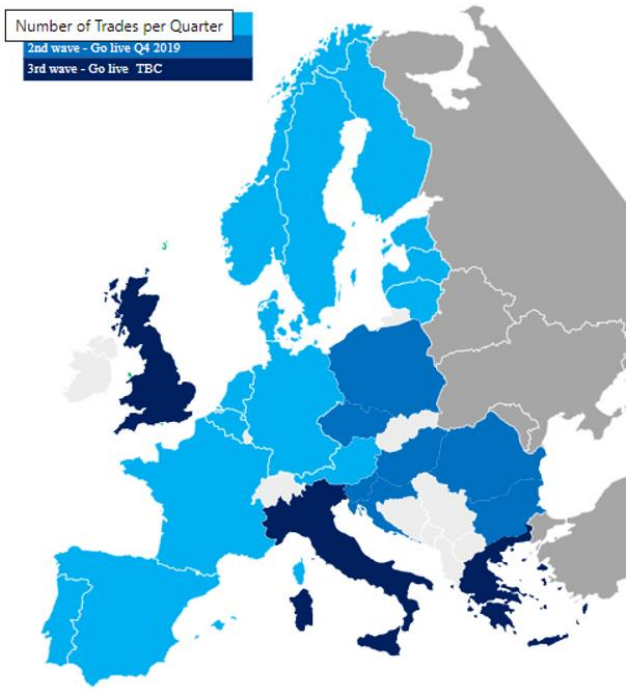
Projects are currently under way for market coupling of the national day-ahead market with the markets of Romania and Greece. The coupling with Romania is expected to become operational by the end of 2020 and that with Greece at the beginning of 2021.

In 2020, the coupling in the day-ahead segment on the Bulgarian-Greek border in the framework of the LIP 14 local project is expected to be completed.

As noted in the ENTSO-E recommendations set out in the Third report on day-ahead and intra-day coupling, the Bulgarian transmission operator (ESO) has signed a memorandum of understanding with North Macedonia and Albania. Bulgaria is currently implementing a project with North Macedonia, which is the most advanced compared to the projects implemented jointly with other third counties in the Western Balkans. Macedonia has amended its legislation to bring it in line with Regulation (EU) 2015/1222 and has established an electricity exchange company.

The CESEC Electricity Action Plan envisages a number of additional market coupling initiatives, including the day-ahead market couplings between Italy, Greece and Bulgaria and Croatia, Serbia and Bulgaria, respectively. Both projects are still at an early stage of implementation.

The intra-day markets of Bulgaria and Romania were coupled on 19 November 2019 within the framework of the LIP 15 local project, which was part of the second wave of intra-day market couplings. ENTSO-E estimates indicate that the need to transport continually growing renewable energy generation to the main customers will likely require s doubling of cross-border capacity by 2030.



Bulgaria's transmission system is well connected to those of neighbouring countries, having a particularly strong interconnection with Romania. Significant investments are under way to upgrade the system and ensure more efficient use of cross-border

capacities in accordance with the requirements laid down in Regulation (EU) 2019/943. In addition to the investments in domestic grid upgrade, Bulgaria is currently building a second 400 kV interconnector with Greece (Maritsa Iztok 1—Nea Santa), which will expand transmission capacity by a further 1 280 MW by 2021.

Natural gas markets

The diversification of the sources and routes of natural gas supply is a very important objective. Its achievement will guarantee the security of gas supplies to Bulgaria, the region and the EU.

The gas interconnector between Greece and Bulgaria (IGB) is of geostrategic importance for the diversification of supplies for Bulgaria and the region of South-Eastern and Central Europe. The IGB project will provide Bulgaria and other countries in Southeast and Central Europe with access to the Southern gas corridor and to the existing and planned new LNG terminal in Alexandroupoli, Greece.

The projects Bulgaria is currently implementing in the area of natural gas, notably the interconnector between Greece and Bulgaria (IGB), the interconnector between Bulgaria and Serbia (IBS), the LNG terminal in proximity to Alexandroupoli, the Balkan Gas Hub project, the expansion of the storage capacity of UGS Chiren and the project for the rehabilitation, modernisation and expansion of the Bulgarian gas transmission system are projects of common economic interest for the European Union in accordance with Regulation (EU) 347/2013 and contribute to the diversification of the sources and routes for supply of natural gas in Southeast and Central Europe.

Part 2

List of parameters and variables to be reported in Section B of National Plans[25][26][27][28]

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 [EUR million]

(3) Sectoral gross value added (including main industrial, construction, services, and agriculture sectors) [EUR million]

(4) Number of households [thousands]

(5) Household size [inhabitants/household]

(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 passenger-kilometres]

(8) Freight transport tonnes-kilometres: all modes excluding international maritime, i.e. split between road, rail, aviation, domestic navigation (inland waterways and national maritime) [million tonne-kilometres]

(9) International oil, gas and coal fuel import prices [EUR/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]

---

[25] For the plan covering the period from 2021 to 2030: For each parameter/variable in the list, trends over the years 2005—2040 (2005—2050 where appropriate) including for the year 2030 at five-year intervals should be reported in sections 4 and 5. Parameters based on exogenous assumptions v modelling output shall be indicated.

[26] As far as possible, reported data and projections shall build on and be consistent with Eurostat data and methodology used for reporting European statistics in the relevant sectoral law, as European statistics are the primary source of statistical data used for reporting and monitoring, in accordance with Regulation (EC) No 223/2009 on European statistics.

[27] Note: all projections are to be performed on the basis of constant prices (2016 prices used as base year)

[28] The Commission will provide recommendations for key parameters for projections, at least covering oil, gas, and coal import prices as well as EU ETS carbon prices.

(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 Production by fuel type (all fuels and energies that are produced in significant quantities) [ktoe]

(2) Net imports by fuel type and energy carriers (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 by fuel type source (including solids, all energy products: coal, crude oil and petroleum products, natural gas, nuclear energy, electricity, derived heat, renewables, waste) [ktoe]

2.2 Electricity and heat

(1) Gross electricity generation [GWh]

(2) Gross electricity generation by fuel (all energy products) [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 plants

(6) Heat generation from combined heat and power plants, including industrial waste heat

(7) Cross-border interconnection capacities for gas and electricity [definition for electricity in line with outcome of ongoing discussions on basis for 15 % interconnection target] and their projected usage rates

2.3 Transformation sector

(1) Fuel inputs to thermal power generation (including solids, oil, gas) [ktoe]

(2) Fuel inputs 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, tertiary, agriculture and transport (including split between passenger and freight transport, when 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 Investment

Investment costs in energy transformation, supply, transmission and distribution sectors

2.7 Renewables

(1) Gross final consumption of energy from renewable sources and share of renewable energy in gross final energy consumption and by sector (electricity, heating and cooling, transport) and by technology

(2) Electricity and heat generation from renewable energy in buildings; this shall include, where available, disaggregated data on energy produced, consumed and injected into the grid by solar photovoltaic systems, solar thermal systems, biomass, heat pumps, geothermal systems, as well as all other decentralised renewables systems

(3) Where applicable, other national trajectories, including those that are long-term or sectoral the share of food-based and advanced biofuels, the share of renewable energy in district heating, as well as the renewable energy produced by cities and renewable energy communities, pursuant to the definition given in Article 22 of Directive (EU) 2018/2001.

3. GHG EMISSIONS AND REMOVALS RELATED INDICATORS

(1) GHG emissions by policy sector (EU ETS, Regulation on effort sharing and LULUCF)

(2) Greenhouse gas emissions by International Panel on Climate Change (IPCC) sector and by gas (where relevant, split into EU ETS and effort sharing sectors) [tCO_2eq]

(3) Carbon Intensity of the overall economy [tCO_2eq/GDP]

(4) CO_2 emission related indicators

(a) GHG emissions intensity of electricity auto-production [tCO_2eq/MWh]

(b) GHG emissions intensity of final energy consumption by sector [tCO_2eq/toe]

(5) Non-CO_2 emission related parameters

(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 recovery in total CH_4 generation from landfills [%]