MINISTRY

ECONOMIES
THE SLOVAK REPUBLIC

Update of the integrated national energy and climate plan 2021-2030

processed under Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action

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CONTENT:

List of abbreviations:

EUR AEA AMIF AO AP boe BMVI BSK CEF CESEC CNG CO	Euro Annual Emission Allowances Asylum, Migration and Integration Fund Action Measure Action plan Oil equivalent barrel (5.7 GJ) Instrument for financial support for border management and visa policy Bratislava Self-Governing Region Connecting Europe Facility Central and South Eastern Europe Energy Connectivity Compressed natural gas Carbon monoxide
CO_2 CPS CZ	Carbon dioxide Compact-PRIMES model for Slovakia Czechia
CZT ČEPS DS EAP EDC EDEPI EED ERDF EEX EC EMO EOU EMFAF ENTSO-E	Central Heat Supply Czech energy přenosová soustava Distribution system 7th Environment Action Programme Energy data centre European Domestic Energy Poverty Index Energy Efficiency Directive European Energy Exchange European Regional Development Fund European commission Mochovce power plant Nováky power plant European Maritime, Fisheries and Aquaculture Fund European Network of Transmission System Operators
EP ESD ESF+	The European Parliament Effort Sharing Decision – Effort Sharing Decision European Social Fund Plus
ESR Est	Effort Sharing Regulation Electric Station
ETS	Emission Trade Scheme – Emissions Trading Scheme
EU	European Union
EU ETS	European Emissions Trading System
EUCO scenarios	Scenarios developed by the European Commission
EURATOM	European Atomic Energy Community/European Atomic Energy Community
FCR aFRR mFRR JTF	Primary power control Frequency with automatic activation Frequency with manual activation of the Just Transition Fund

GES Gg GWh	Guaranteed energy service Gigagram Gigawatt-hour
H_2 GDP HU	Hydrogen Gross domestic product Hungary
CH_4 IAD	Methane Individual car transportation
IEA IEP IHA IMS IROP IS ISF IT ITI KEC KO ktoe KHP kW LPG LCA LNG LULUCF m^2	International Energy Agency Institute for Environmental Policy Institute for Economic Analysis Smart metering systems Integrated Regional Operational Programme Smart grids Internal Security Fund Information technology Integrated territorial investment Final energy consumption Municipal waste Thousand tonnes of oil equivalent (41,868 TJ) Combined Heat and Power kilowatt Life Cycle Analysis Liquefied Petroleum Gas Land use-Land use change and forestry Square metre
m^3	Cubic metre
MF SR	Ministry of Transport of the Slovak Republic
MINISTRY OF	Ministry of Economy of the Slovak Republic
MIRRI SR	Ministry of Investment, Regional Development and Informatisation of the Slovak Republic
MPaRV SR	Ministry of Agriculture and Rural Development of the Slovak Republic
SMES	Small and medium-sized enterprises
MSF	Market Stability Reserve
MŠVVaM SR	Ministry of Education, Science, Research and Youth of the Slovak
Mtoe	Republic
MW	Million tonnes of oil equivalent (1000 ktoe)
MINISTRY OF	Megawatt
THE	Ministry of Environment of the Slovak Republic
N_2O	Nitrous oxide
NBS	National Bank of Slovakia
NECPS	Integrated National Energy and Climate Plan
NES	National emission ceilings
NON-	Non-repayable financial contribution
NH_3	Ammonia
NJZ	New nuclear source

NLC NMVOC
NOx
NRP
THE NATIONAL COUNCIL OF THE SLOVAK

National Forest Centre
Non-methane volatile organic substances
Nitrogen oxides
national Reform Programme
National Council of the Slovak Republic
Low-carbon strategy of the Slovak Republic

O_3 Ozone
OECD Organisation for Economic Cooperation and Development
OH Circular economy
OP AL Operational programme Quality of Environment
OPII Operational programme Integrated Infrastructure
UN United Nations Organisation

RES PES PM
DSO RES
POPs PPC
TSO PpS
PS & D
R & D SAV
SAŽP

Renewable sources of energy
Projects of common interest
Distribution system operator
Primary energy consumption
Particular matter – Particulate matter
Persistent Organic Pollutants
Steam-gas cycle
Transmission System Operator
Support services
Transmission network
Pure pumped storage plants
Research & Development (Research & Development)
Slovak Academy of Sciences
Slovak Environmental Agency

SEA Strategic Environmental Assessement – Environmental Impact Assessment of Strategic Documents

SET-Plan Strategic Energy Technology Plan Slovak Hydrometeorological Institute
SHMÚ SIEA SK Slovak Innovation and Energy Agency Slovakia

SO_2 Sulphur dioxide
SOI Slovak Commercial Inspection
SR Slovak Republic
SRV Secondary power control
R & D SO State Science and Research Plan
ŠÚ SR SR Statistical Office of the Slovak Republic

T TEN-E TEN-T
TU TRV TUR
TYNDP UA

Tonne
Trans-European Networks for Energy
Trans-European Transport Networks
Terrajoul
Current power control
Sustainable development
Ten-year gas and electricity network development plan
Ukraine

UNFCCC UMR
V4
CPR
NN
VVN WAM
WEM ŽP

Sustainable urban development
United Nations Framework Convention on Climate Change
Regulatory Office for Network Industries
Visegrad Group countries (Slovakia, Czechia, Hungary, Poland)
High voltage
Low voltage
Very high voltage
Scenario with further measures
Scenario with existing measures
Environment

Part 1 General framework

SECTION A: NATIONAL PLAN

1. OVERVIEW AND PROCEDURE FOR ESTABLISHING THE PLAN

1.1. Summary

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

The Slovak Republic (SR) was created in 1993. In 2000, it became a member of the Organisation for Economic Co-operation and Development (OECD), has been a member of the European Union (EU) since May 2004 and has been a member of the International Energy Agency (IEA) since 2007. In January 2009, Slovakia adopted the common European currency, the euro.

The Integrated National Energy and Climate Plan is a strategic document on energy and environment setting out national objectives for each of the five dimensions of the Energy Union. It was approved at the end of 2019 by Government Resolution No 606/2019. The energy policy, which set targets and priorities for the energy sector for 2035 with an outlook to 2050, was approved by the government in 2014. With the adoption of this strategic document in 2019, energy policy was updated.

The update of the plan is based on the requirement of Article 14 of Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action, according to which a Member State shall submit a draft update of the plan to the Commission by 30 June 2023 or inform the Commission of the reasons why it does not consider it necessary to update the plan. It is updated by the Ministry of Economic Affairs. The approval of the update of this plan will also ensure compliance with the legislative requirement which imposes on the Ministry of the Economy the responsibility for drawing up an energy policy for a period of at least 20 years and for updating it in a five-year cycle.

The period from 2020 to 2023 can be considered non-standard due to the COVID-19 pandemic and the war in Ukraine. This was also reflected in the energy sector, where the economic downturn caused by the pandemic measures led to low energy prices in 2020-2021. In the following year, following the opening up of the economies and the difficulties in obtaining natural gas for storage, EU energy prices recorded record high levels. Compensation for household prices for 2023 and 2024 has entailed significant financial costs.

Diversification of energy supplies has become a necessity for EU countries. EU countries are shifting away from Russian fossil fuels with gas imports from Russia going from 40 % of the total imports in 2021 to 15 % in 2023. Diversification is a lengthy and costly process, requiring investment in infrastructure, for example building new pipelines and liquefied natural gas (LNG) terminals.

In the European context, the path towards meeting the climate goals of the Paris Agreement and achieving climate neutrality by 2050 is a priority. All relevant policies and measures at EU level are strengthened to meet the 2030 targets as agreed in the Fit for 55 package.

The Slovak Republic attaches great importance to air quality, greenhouse gas emission reduction, climate change mitigation, security of supply and affordability of all types of energy. In 2019, Slovakia made a commitment to carbon neutrality by 2050.

The main objective of the Fit for 55 package is to reduce greenhouse gas emissions by at least 55 % by 2030 compared to 1990 at EU level. Other Union-level targets contributing to that climate target are at least 42.5 % of the share of energy from renewable sources ('RES') in gross final consumption of energy, the national energy efficiency contribution, a 11.7 % reduction in primary and final energy consumption and electricity interconnectivity of at least 15 %.

The main quantified target of the NECPs in Slovakia by 2030 is to reduce greenhouse gas emissions for non-ETS sectors by 22.7 % compared to 2005 levels. The energy targets expressed in the table also represent an update of the energy policy objectives.

Table 1: EU-wide and national targets

EU and Slovak targets for 2030	***EU 2030***	***SR 2030***
Greenhouse gas emissions (as at 1990) excluding LULUCF	**— 55 %**	**— 64.3 %**
Emissions in the ETS sector (as of 2005)	**— 62 %**	**No specific deadline1**
Non-ETS GHG emissions (as of 2005)	**— 40 %**	**— 22.7 %**
Net removals from LULUCF (compared to 2016-2018 average)	**— 310 000 kt**	**— 504 kt**
Share of renewable energy sources (RES)	**42.5 %**	**25 %**
Energy efficiency (change from 2020 EU Reference Scenario)2	**—11.7 %**	**PES/FCEC + 2.6 %/-1.8 %**
Electricity interconnection	**15 %**	**≥ 50 %**

Source: COMMISSION, MINISTRY OF THE ECONOMY, MINISTRY OF THE ENVIRONMENT (IEP)

The targets for Slovakia are the result of modelling through the Compact-PRIMES model for Slovakia (CPS) linking to the macroeconomic model GEM-E3-SK. The CPS builds on the well-known PRIMES model used for European Reference Scenarios (EUREF 2020) as well as in the European Commission's impact clauses.

In addition to the above quantified targets, it is crucial for Slovakia to focus on security of supply and affordability of energy for the years to come. These are qualitative objectives fulfilling the strategic objective of energy policy.

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

Slovakia's objective is to achieve emission reductions in line with the obligations under the Fit for 55 package and to contribute to achieving EU climate neutrality by 2050.

The strategic objective of Slovakia's Energy Policy in 2014 is **to achieve competitive low-carbon energy**

1Directive 2023/959 does not set national targets for individual Member States in the sectors covered by the EU ETS, for which reason it has not been set at national level either in Slovakia.

2The calculation of the change in energy efficiency compared to the 2020 EU Reference Scenario is detailed in Annex 3.

ensuring a secure, reliable and efficient supply of all forms of energy at affordable prices, taking into account customer protection and sustainable development. The update of energy policy is reflected in the new objectives, measures and priorities presented in this document (see chapter 1 for more. 2 *i. National and Union energy system and policy context of the national plan)*

Decarbonisation dimension

The underlying decarbonisation strategy in the long term, which also meets the objectives in the other dimensions, is to have a sufficient source base for low-emission electricity generation, in particular with a focus on stable generation (nuclear, water and heating plants with renewable fuel), and to reduce greenhouse gas emissions through the electrification of the sectors. At the same time, all available innovative technologies, renewable energy sources and all decarbonised fuels and energy carriers (including hydrogen) need to be used to decarbonise industry. In order to decarbonise the heating industry, it is necessary to use, in addition to renewable energy sources, the heat from nuclear power plants, which is currently 'frozen' in the cooling towers.

Slovakia's priority in energy is to ensure synergies between sub-policies, cost-effectiveness, enforcement of the principles of sovereignty in the energy mix, maintaining competitiveness and energy security. In this context, we consider the replacement of high-emission energy sources as low-emission as well as the development of renewable energy sources (RES) and energy efficiency measures as a means to achieve the emission targets. In Slovakia, as in several other Member States, safe and sustainable nuclear energy will play a very important role in the transition to a low-carbon economy. Extending the lifetime of existing nuclear resources is an efficient tool for achieving climate objectives (with a minimum impact on electricity end prices).

Energy efficiency dimension

Energy efficiency contributes in synergy to reducing the energy intensity of the economy, contributes to increasing energy security and also has an impact on reducing the operating costs of energy companies, and not least savings in primary energy sources contribute to mitigating the environmental impacts of energy. Energy efficiency is cross-cutting across all dimensions of energy policy.

Energy security dimension

From the point of view of energy security, an efficient energy architecture that will create conditions for increased energy security for the benefit of the customer and its protection through the use of indigenous energy sources, a favourable environment for the construction of low-carbon heat and power generation, with the possibility of exporting electricity, and an optimal energy mix with low-carbon technologies in each sector will be promoted. Ensuring grid flexibility through sufficient frequency and non-frequency ancillary services is essential to ensure the security of the electricity system. In the medium term, the production of synthetic fuels based on renewable hydrogen will be supported, reducing dependence on imports of a primary energy carrier.

Key areas are the diversification of transport routes, energy sources and suppliers, the improvement of nuclear security and the reliability and security of energy supply.

Internal energy market dimension

The Slovak Republic will seek to maximise the use of existing infrastructure in accordance with the rules adopted in new or amended EU documents included in the “Clean Energy for All Europeans” package. In particular, the deployment of smart energy and electricity storage systems to ensure system flexibility in view of the efficient functioning and liquidity of the internal electricity market is considered very important in this context.

Research, innovation and competitiveness dimension:

The National R & D & I Strategy 2030 was approved by the government in March 2023 with an action plan, which also covers measures related to the implementation of SK RIS3 2021+. The Research and Innovation Strategy for Smart Specialisation of the Slovak Republic SK RIS3 2021+ is a strategic document setting out the objectives, a system of research, innovation and human resources policies and measures that will stimulate the structural change of the Slovak economy towards growth based on increasing research and innovation capacity and excellence. The content of the strategy makes the absorption of a significant part of the resources for Policy Objective 1 A more competitive and smarter Europe conditional on promoting innovative and smart economic transformation and regional ICT connectivity[3] and the implementation of the relevant investment priorities financed in the 2021-2027 programming period, as well as the measures to which Slovakia committed itself in the Slovakia Programme (hereinafter referred to as the “PSK”).

Building a competitive decarbonised economy requires focusing this dimension on the entire value chain in low-carbon technologies, in particular nuclear, RES, storage, electromobility, hydrogen and renewable fuels of non-biological origin.

3For policy objective 1, as set out in Article 3(1)(a) of Regulation 2021/1058, compliance with SK RIS3 2021+ is an enabling condition for operations corresponding to the specific objectives referred to in points (i) and (iv) of that point (a). Under OP SK, this condition applies to specific objective 1.1 (Development and expansion of research and innovation capacities and use of advanced technologies) and 1.4 (Development of skills for smart specialisation, industrial transformation and entrepreneurship)

III. *Overview in the form of a table with key objectives, policies and measures of the plan*

Table 2: Key objectives, policies and measures for 2030

Strategy/Policy	Key objectives	Measures
RES Development Policy	25 % RES	Investment and operating support for the production of electricity from RES, including in cogeneration RES heat investment support Promoting blending of biofuels and renewable gases Supporting households, self-consumers and RES communities
Reduction of greenhouse gas emissions	Reducing greenhouse gas emissions by 64.3 % (at least 55 %) compared to 1990 In the area of climate change, Slovakia will reduce non-ETS greenhouse gas emissions by at least 22.7 % compared to 2005	Introduction of the Emissions Trading System from 2027 in the buildings and transport sector (ETS2) with an estimated price in 2030 of around EUR 59.2 per tonne of carbon.
Increasing energy efficiency	Reduction of final and primary energy consumption in line with Article 4 of Directive 2023/1791 on energy efficiency (PES + 2.6 %; FEC -1.8 %) Continuously reducing public sector consumption and increasing energy savings in public buildings Increasing energy savings in all end-use sectors, with an emphasis on households affected by energy poverty	In particular, fiscal and legislative measures aimed at reducing energy intensity in the industrial, household, transport and trade and services sectors.

Strategy/Policy	Key objectives	Measures
Internal market	Proper and uninterrupted functioning of the internal energy market	Increasing the integration of renewable electricity (RES-E) into the electricity grid and electricity markets Ensuring further integration and interconnection of electricity markets, including meeting forward-looking targets and targets, as part of building a single EU electricity market in line with directly applicable European legislation, as well as addressing transmission system bottlenecks Increasing the flexibility of Slovakia’s electricity system from the point of view of the functioning of the internal electricity market in view of the expected increase in RES electricity production by 2030 Development of smart metering systems and smart grids
Improving energy security	improving the reliability and security of supply of all kinds of energy	Applying the energy efficiency first principle and reducing the consumption of all types of energy Ensuring resource adequacy and self-sufficiency in electricity generation with an adequate pro-export balance of the Slovak electricity system Ensuring the flexibility of the electricity system from the point of view of the security of electricity system operation by ensuring that the frequency and non-frequency ancillary services are sufficient Ensuring a high level of preparedness to prevent and address electricity, gas, oil and nuclear fuel supply crises Diversification of transport routes and sources of fuel carriers Diversification of a refinery to process different types of crude oil Diversification of nuclear fuel suppliers
Strategy/Policy	Key objectives	Measures

		Creating conditions for access to gas infrastructure for low-carbon and renewable gases Alternative fuels infrastructure developments
Research, development and competitiveness	ensuring sustainable energy in Slovakia	Exploration of indigenous deposits of energy raw materials, geothermal energy and their efficient use Development of new technologies for energy generation and storage Development of new types of smart materials Human resources development for the energy sector

1.2. Overview of current policy situation

On 11 December 2018, the European Commission (EC) approved the Regulation of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action. The establishment of the Energy Union is part of the EC's ten political priorities and this regulation is an important element of the Energy Union strategic framework.

- . *The national and Union energy system and the policy context of the national plan*

The Ministry of Economy is the central government body for energy, including nuclear fuel management and radioactive waste storage.

Under Section 88 of Act No 251/2012 on energy and amending certain acts, as amended, the Ministry of the Economy is responsible for drawing up an energy policy for a period of at least 20 years and for updating it in a five-year cycle. The integrated national energy and climate plan drawn up pursuant to Article 9 or its update drawn up pursuant to Article 14 of Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action is an update of the energy policy approved by Slovak Government Resolution No 548/2014 of 05. 11. 2014.

The energy policy of the Slovak Republic (EP SR) was initially based on four basic pillars – energy security; energy efficiency; competitiveness and sustainable energy. Science, research and innovation were also part of the EPSR. This plan updates the existing energy policy, which is extended to include the decarbonisation dimension.

The priorities of Slovakia's energy policy are:

- optimal energy mix;
- improving the security and quality of energy supply at reasonable prices;
- development of energy infrastructure;
- diversification of energy sources and transport routes;
- maximum use of transmission networks and transit systems crossing Slovakia;
- application of the principle of 'energy efficiency first';

- reducing energy intensity;
- a functioning energy market with a competitive environment;
- protection of vulnerable customers;
- tackling energy poverty;
- an adequate pro-export balance in the electricity sector;
- promotion of high-efficiency cogeneration;
- promoting the use of efficient central heating systems (CZTs);
- promoting the use of RES for electricity, hydrogen, biomethane, heating and cooling production;
- the use of nuclear energy as a low-carbon source of electricity;
- promoting the production and use of zero- and low-carbon hydrogen in industry and transport
- improving the safety and reliability of the operation of nuclear power plants.

New priorities complementing the above priorities:

- promoting smart energy systems;
- support for energy storage to increase the flexibility of the electricity grid;
- increasing the energy recovery of waste that cannot be recycled (notably through the production of high-quality solid fuel and secondary fuel) and increasing the use of waste heat.

Those priorities lead to the achievement of the strategic objective by ensuring security, reliability and stability of energy supply, efficient use of energy at optimal cost, affordability of different types of energy and ensuring climate and environmental protection.

The new measures needed to meet the objectives and priorities are:

- removing existing barriers and streamlining planning and approval procedures;
- the application of the principle of overriding public interest and public security of energy infrastructure;
- application of the status of significant investment for investments in energy infrastructure;
- prioritising and supporting the construction and operation of power and heat generation facilities from zero-emission generation and the development of related grid infrastructure in the planning and permit-granting process.

Measures to ensure environmental sustainability:

- ensure financial mechanisms and use Slovakia's revenues from auctioning allowances under the emissions trading scheme to support the energy and industrial sectors, focusing on priority areas in accordance with the principles of sustainable development as set out above;
- step up action to reduce CO2 emissions, in particular in the transport sector;
- the use of natural gas as a transitional fossil fuel;
- promoting decarbonised gases, including hydrogen;
- implementing the actions of the Action Plan for the successful implementation of the National Hydrogen Strategy to ensure the development of a hydrogen ecosystem aimed at decarbonising industry, transport and energy;
- setting up fiscal incentives and policies that will ensure economic growth based on a low-carbon, circular, energy and less materially demanding economy.

The measures will respect the energy efficiency first principle, and RES should not be the primary objective, but only one of the tools for such a transition.

Updated energy policy objectives:

Energy development is aimed at optimising the energy mix so as to reduce emissions of greenhouse gases and pollutants as much as possible while maintaining or increasing energy security and affordability of different types of energy. In order to ensure the objectives of decarbonisation and a competitive economy, it is essential to reconcile the need for stable low-carbon electricity generation and target setting for those forms of renewable energy from which variable electricity generation originates.

The optimal use of renewable energy sources, nuclear energy, decarbonised gases and innovative technologies that will contribute to the efficient use of energy sources is key to achieving a low-carbon economy. The use of waste gases and wastes in the circular economy can also contribute to this. From the point of view of security of energy supply and diversification efforts, it is now important for Slovakia to consider and prepare for new innovative technologies. In Small Modular Reactors (SMRs), the potential is in their ability to meet the need for flexible energy supply in the form of electricity, hydrogen and heat for heating and industrial uses.

Based on SMR project proposals, manufacturers declare the implementation of safety features to improve the safety of these nuclear installations. However, it will only be possible to confirm these assumptions on the basis of a licensing process that will be carried out only after the first types of SMRs have been completed. SMR is one of the appropriate solutions to ensure security of supply and stability of the electricity transmission system in eastern Slovakia following the shutdown of TE Vojany.

Due to the high share of nuclear resources in electricity production and the high share of natural gas in the heat sector, Slovakia has one of the least emitting energy in the EU. The closure of coal mining in Bani Nováky at the end of 2023 and the subsequent shutdown of the Nováky Coal Power Plant in December 2023 and of the Vojany Coal Power Plant in March 2 024 marks an important milestone for the phase-out of coal in energy. In 2024, the Slovak Republic phased out coal-fired electricity production in power plants (a small part of coal-based electricity is still produced in heating plants).

There is a transition to renewable energy sources in the heat sector and coal is planned to be phased out in heating plants (not mined in Slovakia, only imported) by the end of 2028. A high degree of centralisation of heat supply creates good technical conditions for the use of biomass, biomethane and geothermal energy. It also shows the appropriateness of including heat pumps in district heating systems. One way to reduce natural gas dependency for heating is through increased use of energy recovery of waste, heat from the Bohunice nuclear power plant and the start of the use of heat from the Mochovce nuclear power plant in the districts of CZT and, after 2030, heat from small modular reactors.

There is scope for further decarbonisation by 2030, in particular in energy efficiency measures and in the decarbonisation of industry and transport. Given the low-carbon electricity generation mix, the challenge is the gradual electrification of transport, in particular public passenger transport, as well as the development of alternative fuels, primarily hydrogen, in areas where decarbonising industry and transport is challenging (steel and metallic industries, rail and heavy freight). The decarbonisation of industry requires the use of all available innovative low-carbon technologies and all decarbonised fuels and energy carriers.

Due to its natural conditions, the Slovak Republic has significant geothermal energy potential, which is an important element in the decarbonisation of heat. A key measure for its development is financial support (see chapter 3.1.2 above).

The construction of a new nuclear resource on the Jaslovské Bohunice site represents the most important long-term investment plan, which will ensure a significant increase in the production of stable low-carbon electricity and is consistent with the decarbonisation of Slovakia's economy (see Chapter 4. 4).

The achievement of Slovakia's decarbonisation objectives as a result of increasing the share of RES will entail significant financial costs. Therefore, Slovakia will introduce support mechanisms which, on the one hand, meet the objectives of increasing the share of RES and, on the other hand, contribute to meeting the greenhouse gas emission reduction targets while maintaining the 'Value for Money' principle. In line with this principle, modelling of objectives and measures to ensure the fulfilment of the triangle of "security", "sustainable development" and "energy affordability" objectives has been optimised with the requirement to minimise the cost of achieving them. This principle will also be applied in the context of the sustainability of supported solutions, as well as in setting up appropriate forms of funding for these support mechanisms.

Maximising the use of financial support mechanisms in 2021-2030 (in particular the Modernisation Fund, the Recovery and Resilience Plan, the Slovakia Programme (including the Just Transition Fund), REPowerEU, the Innovation Fund and the Social Climate Fund) will also be essential, and can make a significant contribution to the transition to a low-carbon economy if the priority projects are set up domestically.

The Slovak Republic has consistently placed emphasis on strengthening energy security and security of energy supply, as evidenced by the continuation of work on individual projects of common interest (PCI).

Given the current and further expected development of RES, maintaining the reliability of Slovakia's electricity system requires a sufficient level of flexible resources, although the level of cross-border interconnections with neighbouring countries is above standard compared to the EU average.

The use of existing gas infrastructure, due to a highly developed transmission and distribution network, paves the way for further decarbonisation of the economy.

Energy crisis and security of supply:

EU countries had to respond to rising energy prices and threats to EU energy security in 2022. The emergency measures adopted by the Council to ensure a sufficient and affordable energy supply have helped calm the markets.

EU coordinated measures have focused on:

- diversification of energy supply and routes
- securing gas in national reserves
- reducing energy bills for citizens and businesses
- strengthening solidarity between EU countries
- preventing price spikes
- moving faster towards cleaner energy

In summer 2022, while providing energy for the winter months and the following year, energy commodity prices in Europe reached historical peaks and Slovakia had to respond to high prices by various measures.

2022 showed a vulnerability to energy security and showed a problem of reliability to secure the necessary energy at affordable prices. This situation also influenced the security perspective when the plan was updated. A key safety requirement is to ensure that demand is covered in the winter months. Addressing sufficient energy is essential in the form of seasonal storage and sufficient stable capacity for the production of electricity in winter. Therefore, the continuation and further development of the safe use of nuclear energy, including the security of nuclear fuel suppliers, is a key prerequisite and essential safety interest of the Slovak Republic. Differences in energy prices and availability in winter and summer are to be expected to grow.

Seasonal price volatility is also a key challenge for Slovakia, linked to the increasing share of renewables in electricity production. Maintaining a competitive industry requires stable, predictable and competitive prices for low-emission electricity and energy raw materials or carriers. Ensuring sufficient low-emission power output (nuclear power plants and not variable RES) in the winter months will help reduce dependence on fossil fuel imports and decarbonise heat generation through heat pumps. Low-emission electricity and waste recovery installations are fully in line with energy policy. If the need to ensure the above-mentioned capacity from natural gas-based power plants is demonstrated, this is in line with the strategic objective. In this case, the Ministry of the Economy will assess and favour their use in high-efficiency cogeneration or that they will also be ready to burn hydrogen at the time of commissioning.

II. Current energy and climate policies and measures on all five dimensions of the Energy Union

The Slovak Republic has taken all necessary steps to improve mechanisms to monitor, evaluate and streamline instruments and measures to fulfil its obligations under the United Nations Framework Convention on Climate Change (UNFCCC). All relevant policies and measures at EU level are strengthened to meet the 2030 targets as agreed in the Fit for 55 package. This includes legislation introduced in the EU to reduce greenhouse gas emissions by at least 55 % by 2030 compared to 1990.

The overall policy framework in the Slovak Republic consists of national conceptual and strategic sectoral documents as well as European climate strategies and policies.

The European Green Deal

The European Green Deal is a set of policy initiatives that aims to put the EU on the path of a green transition with the ultimate goal of achieving climate neutrality by 2050.

Components of the Green Deal:

- Fit for 55 package
- European Climate Law
- EU strategy for adaptation to climate change
- EU Biodiversity Strategy for 2030
- Farm to Fork Strategy
- European Industrial Strategy
- Circular economy action plan
- Batteries and waste batteries
- Just Transition Mechanism
- Supplying clean, affordable and secure energy
- EU chemicals strategy for sustainability
- Forest strategy and deforestation

Fit for 55 package

The Fit for 55 package aims to translate the climate ambitions of the Green Deal into law. The package is a set of proposals to revise climate, energy, transport and other legislation.

Components of Balika FF55:

- The EU Emissions Trading System
- Social climate fund
- Carbon Border Adjustment Mechanism
- Member states' emissions reduction targets
- Emissions and removals from land use, land use change and forestry
- CO2 emission performance standards for cars and vans
- Reducing methane emissions in the energy sector
- Sustainable aviation fuels
- Decarbonised fuels in shipping
- Alternative fuels infrastructure
- Renewable energy
- Energy efficiency
- Energy performance of buildings
- Hydrogen and decarbonised gas market package
- Taxation of energy

Table 3: Political context at EU level

Non-legislative/legislative act	*Type of act*	*Headline target*
The European Green Deal	*Non-legislative act*	*- European Commission's plan for the green transition of the European Union's economy* *- a climate-neutral continent by 2050 at EU level* *- decouple economic growth from resource use and ensure that the upcoming changes are fair and inclusive, leaving no individual or region behind.*

Fit for 55 pack	*Non-legislative act*	*— a set of proposals to revise and update EU legislation and introduce new initiatives to ensure that EU policies are in line with the climate targets agreed by the Council and the European Parliament to reduce net greenhouse gas emissions by at least 55 % by 2030.*
New Circular Economy Action Plan	*Non-legislative act*	*—a set of new initiatives for the whole life cycle of products to modernise and transform our economy while protecting the environment* *— sustainable products with a longer lifespan and making full use of the principles of the circular economy.*
New EU Forest Strategy for 2030	*Non-legislative act*	*— ensure healthy, diverse and resilient forests in the EU that contribute significantly to enhancing biodiversity and climate ambition.* *—forests are important for carbon capture and their protection is essential to achieve the EU's climate neutrality by 2050.*
EU strategy to reduce methane emissions	*Non-legislative act*	*— sets out measures to reduce methane emissions in Europe and internationally. Presents legislative and non-legislative measures in the energy and agriculture sectors (monitoring methane emissions at farm level, recovering waste and residues flows Z agriculture through anaerobic digestion, improving the quality of animal feed (innovating compound feed), feed additives and feeding techniques) and waste management, which account for approximately 95 % of methane emissions associated with human activities worldwide.*
Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law')	*Legislative act*	*-it introduces the objective set out inthe European Green Deal* to make Europe's economy and society climate neutral by 2050. *—sets a transitional target of reducing net greenhouse gas emissions by at least 55 % by 2030 compared to 1990 levels.* *—The aim of the law is to ensure that all EU policies contribute to this goal and that all sectors of the economy and society play their part.*

Regulation (EU) 2018/1999 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	*Legislative act*	*This Regulation establishes a governance mechanism for the implementation of strategies and measures designed to meet the objectives and targets of the Energy Union and the Union's long-term greenhouse gas emission commitments in line with the Paris Agreement, in particular the Union's climate-neutrality objective set out in Article 2(1) of Regulation (EU) 2021/1119 of the European Parliament and of the Council (1), and for the first ten-year period from 2021 to 2030, in particular the Union's 2030 targets for energy and climate; stimulate cooperation between Member States, including, where appropriate, at regional level, designed to achieve the objectives and targets of the Energy Union; ensuring timeliness, transparency, accuracy, consistency; comparability a completeness reporting by the Union and its Member States to the Secretariat of the UNFCCC and the Paris Agreement; contribute to greater regulatory certainty as well as contribute to greater investor certainty and help take full advantage of opportunities for economic development, investment stimulation, job creation and social cohesion.*
Regulation (EU) 2023/857 of the European Parliament and of the Council of 19 April 2023 amending Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement, and Regulation (EU) 2018/1999	*Legislative act*	*Sectors; the which SA applicable Regulation (EU) 2018/842 has been revised to achieve the Union's new target of reducing its greenhouse gas emissions in these sectors gradually until they achieve a 40 % reduction in 2030 compared to 2005 levels.* *This Regulation applies to greenhouse gas emissions from the IPCC categories of energy, industrial processes and product use, agriculture and waste established pursuant to Regulation (EU) No 525/2013, excluding greenhouse gas emissions from activities listed in Annex I to Directive 2003/87/EC.* *A target of 22.7 % is set for Slovakia.*
Regulation (EU) 2023/851 of the European Parliament and of the Council of 19 April 2023	*Legislative act*	*The Regulation includes a CO2 reduction target for passenger cars and light commercial vehicles. The emission reduction limit is 15 % from 1.1.2025 and 55 % for passenger cars and 50 % for light commercial vehicles from*

amending Regulations (EU) 2019/631 as regards strengthening the CO2 emission performance standards for new passenger cars and new light commercial vehicles in accordance with with the Union's increased climate ambition		*1.1.2030. At the same time, from 1.1.2035, this value is a 100 % reduction.*
Regulation (EU) 2019/1242 of the European Parliament and of the Council of 20 June 2019 setting CO2 emission performance standards for new heavy-duty vehicles and amending Regulations (EC) No 595/2009 and (EU) 2018/956 of the European Parliament and of the Council and Council Directive 96/53/EC	*Legislative act*	*The Regulation sets binding CO2 reduction targets for new heavy-duty vehicles, namely:* - *from 2025 onwards: 15 % reduction* - *from 2030 onwards: 30 % reduction*
Regulation (EU) 2023/839 of the European Parliament and of the Council of 19 April 2023 amending Regulation (EU) 2018/841 as regards the scope, simplifying the reporting and compliance rules, and setting out the targets of the Member States for 2030, and Regulation (EU) 2018/1999 as regards improving monitoring, reporting,	*Legislative act*	*The Regulation sets a target for the LULUCF section to meet the Union's target of reducing greenhouse gas emissions by 55 % by 2030 compared to 1990.* *Slovakia has set a target of -504 kt CO2 eq to reduce emissions in 2030 (i.e. to increase sinks as net emissions in LULUCF are negative).*

follow-up and review		
Directive (EU) 2023/959 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union and Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and Directive (EU) 2023/958 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC as regards aviation's contribution to the Union's economy-wide emission reduction target and appropriately implementing a global market-based measure	*Legislative acts*	*Directives adapt system trading with greenhouse gas emission allowances (EU ETS) for the overall ambition of reducing emissions by 2030 in the sectors covered by the EU ETS to 62 % compared to 2005 levels.* *—ship emissions are included in the scope of the EU ETS.* *—a new separate emissions trading system is established for buildings, road transport and other sectors (mainly small industry). The new system will apply to distributors supplying fuels to buildings, road transport and other sectors from 2027 onwards. Free allowances for the aviation sector will be phased out and full auctioning will be introduced as of 2026. As of 1 January 2024, monitoring and reporting of emissions is extended to the combustion of fuels in installations for the incineration of municipal waste with a total rated thermal input exceeding 20 MW to assess their inclusion in the EU ETS as of 2028.*
Regulation (EU) 2023/955 of the European Parliament and of the Council of 10 May 2023 establishing a Social Climate Fund and amending Regulation (EU) 2021/1060	*Legislative act*	*Specific funding will be made available to Member States through the Social Climate Footwear the support especially vulnerable households, transport users and micro-enterprises.*

Proposal for a Regulation of the European Parliament and of the Council establishing a carbon border adjustment mechanism	*Legislative act*	*That mechanism will phase out free allowances to the sectors covered by the mechanism, thereby replacing the current measures to prevent the risk of carbon leakage.*
Proposal for a Regulation of the European Parliament and of the Council on fluorinated greenhouse gases, amending Directive (EU) 2019/1937 and repealing Regulation (EU) No 517/2014 and Proposal for a Regulation of the European Parliament and of the Council on substances that deplete the ozone layer and repealing Regulation (EU) No 1005/2009	*Legislative act*	*The adoption of this Regulation would represent an important step towards limiting the increase in global temperature in line with the Paris Agreement. The proposal to limit F-gases will also contribute to reducing emissions by at least 55 % by 2030 and to making Europe climate neutral by 2050. Together with the proposal for a regulation establishing a carbon border adjustment mechanism, they could deliver overall greenhouse gas (GHG) emission reductions in the EU of 490 Mt (CO2 equivalent) by 2050.*
Proposal for a Directive of the European Parliament and of the Council on ambient air quality and cleaner air for Europe (recast)	*Legislative act*	*Set interim EU air quality standards for 2030 that will be more closely aligned with* HYPERLINK "https://apps.who.int/iris/handle/10665/345329"*World Health Organisation guidelines to move towards a zero air pollution trajectory by 2050 at the latest, in synergy with climate (effort-neutrality).*
Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652	*Legislative act*	*In October 2023, the update of the Renewable Energy Directive raised the target for the share of renewables by 2030 to 42.5 %, with Member States to strive to reach 45 %. The new directive speeds up permit-granting procedures for new renewable energy installations, such as solar panels or wind turbines, and sets a maximum deadline of 12 months for the approval of new installations in areas appropriate the manufacturing energy from renewable sources and for 24 months elsewhere. In the transport sector, it sets a target of either a 29 % share of renewable energy by 2030 or a 14.5 % reduction in greenhouse gas emissions by greater use of advanced biofuels and renewable fuels of non-biological origin, such as:*

		hydrogen. For industry, the Directive introduces a binding target for the share of renewable hydrogen in total hydrogen consumption of 42 % by 2030 and 60 % by 2035 and indicative target *an average annual increase of 1.6 percentage points in renewables. It also introduces an indicative target of 5 % of newly installed renewable energy capacity from innovative technologies by 2030 for Member States.*
Commission Implementing Regulation (EU) 2020/1294 of 15 September 2020 on the Union renewable energy financing mechanism	*Legislative act*	*The mechanism supports renewable energy deployment across the Union. To this end, the Mechanism shall fulfil the following two functions:* *a) provide support for new renewable energy projects in the Union with the aim of covering a gap in the indicative Union trajectory pursuant to Article 33 (1) of Regulation (EU) 2018/1999 (the 'gap filling function');* *b) contribute to the enabling framework pursuant to Article 33(2) of Regulation (EU) 2018/1999 thereby supporting renewable energy deployment across the Union irrespective of a gap to the indicative Union trajectory (the 'enabling function').*
Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU	*Legislative act*	*This Directive establishes common rules for the generation, transmission, distribution, energy storage and supply of electricity, together with consumer protection provisions, with a view to creating truly integrated competitive, consumer-centred, flexible, fair and transparent electricity markets in the Union. Using the advantages of an integrated market, this Directive aims to ensure affordable, transparent energy prices and costs for consumers, a high degree of security of supply and a smooth transition towards a sustainable low-carbon energy system. It lays down key rules relating to the organisation and functioning of the Union electricity sector, in particular rules on consumer empowerment and protection, on open access to the integrated market, on third-party access to transmission and distribution infrastructure, unbundling requirements, and rules on the independence of regulatory authorities in the Member States. This Directive also defines the modalities of cooperation between Member States, regulatory authorities and transmission system operators with a view to establishing*

		a fully interconnected internal electricity market that improves the integration of renewable electricity, free competition and security of supply.
Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (recast)	*Legislative act*	*This Directive establishes a common framework of measures to promote energy efficiency in the Union in order to ensure the achievement of the Union's energy efficiency targets and allows for the further improvement of energy* *efficiency. The aim of that common framework is to contribute to the implementation of Regulation (EU) 2021/1119 of the European Parliament and of the Council and to the Union's security of energy supply by reducing its dependence on energy imports, including fossil fuels.* *This Directive lays down rules designed to implement energy efficiency as a priority across all sectors, remove barriers in the energy market and overcome market failures that impede efficiency in the supply, transmission, storage and use of energy. It also provides for the establishment of indicative national energy efficiency contributions for 2030. Contribute to the implementation of the energy efficiency first principle and thus to making the Union inclusive, fair and prosperous society s modern competitive economy effective using resources.*
Directive (EU) 2024/1275 of the European Parliament and of the Council of 8 May 2024 on the energy performance of buildings (recast)	*Legislative act*	*The Directive promotes the improvement of the energy performance of buildings and the reduction of greenhouse gas emissions from buildings in order to achieve a zero-emission building stock by 2050, taking into account outdoor climatic conditions, local conditions, indoor environmental quality requirements and cost-effectiveness. The Directive will strengthen Europe's energy independence, in line with the REPowerEU plan, by reducing and phasing out fossil fuels in building heating, the deployment of solar devices and the deployment of sustainable mobility infrastructure. From 1 January 2025, no financial incentives shall be provided for the installation of stand-alone fossil fuel boilers. The level of construction of zero-emission buildings for all new buildings will be required as of 1.1.2030 and for public body buildings from 1.1.2028.*

Regulation (EU) 2017/1369 of the European Parliament and of the Council of 4 July 2017 setting a framework for energy labelling and repealing Directive 2010/30/EU	*Legislative act*	*This Regulation lays down a framework that applies to energy-related products ('products') placed on the market or put into service. It provides for the labelling of those products and the provision of standard product information regarding energy efficiency, the consumption of energy and of other resources by products during use and supplementary information concerning products, thereby enabling customers to choose more efficient products in order to reduce their energy consumption.* *The A to G classification is intended to increase transparency and clarity for customers.*
Directive (EU) 2024/1788 of the European Parliament and of the Council of 13 June 2024 on common rules for the internal markets in renewable gas, natural gas and hydrogen, amending Directive (EU) 2023/1791 and repealing Directive 2009/73/EC (recast)	*Legislative act*	*The **recast Gas Markets Directive** aims at decarbonising the EU energy sector, boosting the production and integration of renewable gases and hydrogen.* *The measures referred **to in the Directive** are designed to ensure supplies energy disturbed geopolitical tensions, in particular Russia's war against Ukraine, and to address climate change. It includes provisions on transparency, consumer rights and support for people at risk of energy poverty.*
Regulation (EU) 2024/1789 of the European Parliament and of the Council of 13 June 2024 on the internal markets for renewable gas, natural gas and hydrogen, amending Regulations (EU) No 1227/2011, (EU) 2017/1938, (EU) 2019/942 and (EU) 2022/869 and Decision (EU) 2017/684 and repealing Regulation (EC) No 715/2009 (recast)	*Legislative act*	*The **recast Gas Markets Regulation** aims to decarbonise the EU energy sector, boosting the production and integration of renewable gases and hydrogen.* ***The new regulation** will strengthen fair price-setting mechanisms and stable energy supplies and allow Member States to restrict gas imports from Russia and Belarus. The regulation will introduce a common gas purchasing system to avoid competition between Member States and a pilot project to strengthen the EU hydrogen market for five years.* *The Regulation also aims at increasing investments in hydrogen infrastructure, especially in coal regions, and supports the transition to sustainable energy sources such as biomethane and low-carbon hydrogen.*

Regulation (EU) 2017/1938 of the European Parliament and of the Council of 25 October 2017 concerning measures to safeguard the security of gas supply and repealing Regulation (EU) No 994/2010	*Legislative act*	*This Regulation lays down provisions aimed at safeguarding the security of gas supply by ensuring the proper and uninterrupted functioning of the internal market in natural gas ('gas'), by allowing exceptional measures to be implemented in a situation where the market is no longer able to provide the required gas supply, including solidarity measures as a last resort, and by ensuring accurate demarcation a Division obligations natural gas undertakings, Member States and the Union in relation to preventive action and response to specific interruptions supplies gas. Hereby Regulation SA also introduces transparent mechanisms related to SA, in a spirit of solidarity, coordination of emergency planning national at regional and Union level, as well as responses to those situations*
Council Regulation (EU) 2022/2576 of 19 December 2022 enhancing solidarity through better coordination of gas purchases, reliable price benchmarks and exchanges of gas across borders	*Legislative act*	*This Regulation lays down temporary rules on the accelerated establishment of a service enabling demand aggregation and the joint purchase of gas by undertakings established in the Union; secondary capacity booking and transparency platforms for LNG facilities and for gas storage facilities; and congestion management in gas transmission networks.* *This Regulation establishes temporary mechanisms to protect citizens and the economy from excessively high prices through temporary an intra-day volatility management mechanism for excessive price movements and an ad hoc LNG benchmark to be developed by the European Union Agency for the Cooperation of Energy Regulators (ACER).* *This Regulation lays down temporary measures in the event of a gas emergency to achieve a fair distribution of gas across borders, secure gas supply for most critical customers and ensure the application of cross-border solidarity measures.*
Regulation (EU) 2021/1060 of the European Parliament and of the Council of 24 June 2021 laying down common provisions on the European Regional Development Fund, the European Social Fund Plus, the Cohesion Fund, the Fund for	*Legislative act*	*This Regulation lays down:* *— Financial rules for:* *European Regional Development Fund, European Social Fund Plus, Cohesion Fund, Just Transition Fund, European Maritime, Fisheries and Aquaculture Fund, Asylum, Migration and*

just Transition and the European Maritime, Fisheries and Aquaculture Fund and financial rules for those Funds as well as for the Asylum, Migration and Integration Fund, the Internal Security Fund and the Instrument for Financial Support for Border Management and Visa Policy		*integration, the Internal Security Fund and the Instrument for Financial Support for Border Management and Visa Policy.* *— Common provisions applicable to the ERDF; ESF+, Cohesion Fund, JTF and EMFAF.* *Aim is further develop coordinated a harmonised implementation of Union funds implemented under shared management.*
Regulation (EU) 2021/1056 of the European Parliament and of the Council of 24 June 2021 establishing the Just Transition Fund	*Legislative act*	*This Regulation establishes the JTF to provide support to the population, economy and environment of territories facing serious socio-economic. challenges resulting from the process the transition towards the Union's 2030 targets for energy and climate and a climate-neutral economy of the Union by 2050.*
Commission Regulation (EU) No 651/2014 of 17 June 2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty	*Legislative act*	*This regulation, known as the General Block Exemption Regulation (GBER), aims to allow EU governments to provide higher amounts of public funds to a wider range of companies without having to seek prior authorisation from the European Commission.*

Policy context at national level:

a) Energy policy of the Slovak Republic

The energy policy of the Slovak Republic was adopted by Slovak Government Resolution No 548/2014. The Energy Policy of the Slovak Republic (EP SR) is a strategic document that defines the primary objectives and priorities of the energy sector for the period up to 2035, with a view to 2050. The EP SR is part of the national economic strategy of the Slovak Republic, since ensuring sustainable economic growth is conditional on a reliable supply of affordable energy. The objective of the EP SR is to ensure the sustainability of the Slovak energy sector in order to contribute to the sustainable growth of the national economy and its competitiveness. The priorities are to ensure the security, reliability and stability of energy supply, the efficient use of energy at optimal cost, the affordability of different types of energy, and the protection of the climate and the environment. The EP SR is updated every 5 years through the Integrated National Energy and Climate Plan (NECP) or through an update of this plan.

b) National Reform Programme (NRP)

The National Reform Programme of the Slovak Republic (NRP) describes the reform efforts of the Slovak Government in key structural areas. It aims to provide a comprehensive overview of the measures implemented and planned by Slovakia in response to the specific recommendations of the Council of the EU to Slovakia. At the same time, the NRPs also serve as a tool for communicating the implementation of the Sustainable Development Goals and the European Pillar of Social Rights.

c) Slovakia's vision and strategy for 2030 – Slovakia's long-term sustainable development strategy – Slovakia 2030

From its content, the draft Slovakia 2030 document is based on four key principles:

- sustainability, i.e. the balance between available resources and their use;
- the priority of quality of life over economic growth;
- synergy-based efficiency; and
- integration of policies and their instruments.

Through cross-cutting cooperation, the material seeks to mobilise public administrations in harmonising cross-sectoral policies and implementing European programmes. It is therefore essential to translate its content into documents for the 2021-2027 EU programming period. The material is approved by Government Resolution 41/2021.

d) Strategy for adaptation of the Slovak Republic to climate change

The update was adopted by Resolution No 478/2018 of the Government of the Slovak Republic. The main objective of the updated National Adaptation Strategy is to improve Slovakia's preparedness to face the adverse impacts of climate change, to provide the widest possible information on current adaptation processes in Slovakia and to establish an institutional framework and coordination mechanism to ensure effective implementation of adaptation measures at all levels and in all areas, as well as to raise overall awareness of this issue. By Resolution No 478/2018, the Slovak Government assigned task B.3. The Ministry of the Environment of the Slovak Republic shall submit for discussion by the Government by 31. 12. 2025 update of the national adaptation strategy taking into account the latest scientific knowledge on climate change.

A technical support instrument (TSI) project for the preparation of a new national adaptation strategy is currently underway, which will be drawn up on the basis of the latest scientific knowledge and will be submitted for discussion by the Slovak Government by the end of 2025. The project also includes a comprehensive risk and vulnerability assessment in Slovakia, using the current best available tools to support adaptation: climate-ADAPT, guidance prepared by the European Commission, European Climate Risk Assessment (EUCRA), IPCC AR6 reports and national expertise.

e) Environmental policy strategy of the Slovak Republic "Greener Slovakia"

The Strategy for the Environment Policy of the Slovak Republic until 2030 (Envirostratégia 2030), approved by the Slovak Government in February 2019 by Resolution No 87/2019, defines a vision for 2030 taking into account possible, likely and desired future developments, identifies the underlying systemic problems, sets targets for 2030, proposes framework measures to improve the current situation, and also includes baseline result indicators to verify the results achieved. The core vision of the 2030 Envirostratégie is to achieve a better quality of the environment and a sustainable circular economy based on the consistent protection of environmental compartments, using the least non-renewable natural resources and hazardous substances, leading to improvements in the health of the population.

Several studies have been carried out in the context of the preparation of this strategy, stakeholders have been consulted and the general public has also had the opportunity to influence the content of the strategy.

f) Slovakia's low-carbon development strategy for 2030, looking ahead to 2050 (NUS SR)

The Nus SR was approved by Government Resolution No 104/2020 on 5 March 2020. The Nus SR is a cross-cutting document across all sectors of the economy and identifies all measures, including additional measures, that will lead to the achievement of climate neutrality in Slovakia by 2050. This ambitious target was formally defined only in the last stage of the strategy's preparation (after the end of modelling of possible emission scenarios) and other less ambitious scenarios for reducing emissions (and increasing sinks) are therefore analysed in detail: the WEM scenario and the WAM scenario. However, as pointed out in the strategy itself, these are unlikely to lead Slovakia to climate neutrality without additional efforts. Possible additional measures are proposed at the end of each sectoral chapter, marked as NEUTRAL, and should be modelled in subsequent updates of the strategy.

g) European Emissions Trading System (EU ETS)

The EU ETS was established by Directive 2003/87/EC and has undergone several revisions to strengthen implementation during each trading period.

As of January 2021, the Emissions Trading System entered its 4th phase, running until 31 December 2030. The emission cap shall be reduced by a linear factor of 2.2 % starting in 2021. The Modernisation Fund is an entirely new element of the trading system.

In order to achieve the essential elements set out in the Fit for 55 package, Directive (EU) 2023/959 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union and Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme was approved. The Directives adapt the EU Emissions Trading System (EU ETS) to the overall ambition of reducing emissions by 2030 in the sectors covered by the EU ETS to 62 % compared to 2005 levels. The scope of the EU ETS includes shipping emissions and establishes a new separate emissions trading system for buildings, road transport and other sectors (especially small industry).

- Auction

Auctioning is the way allowances are distributed. Pre-auctioning started in 2012 with an auction of 120 million EUA, of which Slovakia's share amounted to 1.8 million EUA allowances. Auctions are held on a single auction platform, the European Energy Exchange (EEX) every Monday, Tuesday and Thursday (on Wednesday separately for Poland and on Friday separately for Germany). The revenue obtained from the auctioning of allowances (excluding the allowances transferred to the Modernisation Fund) is the income of the Environmental Fund.

Table 4: Proceeds of the Slovak Republic from the auction during the period 2012-2021

Period	2016	2015	2014	2013	2012
			EUR		
Order of the Slovak Republic (EUA)	64 991 430	84 312 060	57 590 625	61 702 620	12 193 290
Order of the Slovak Republic (EUAA)	55 815	197 300	44 590	—	—
Total SVK yield	65 047 245	84 509 360	57 635 215	61 702 620	12 193 290
Period	**2017**	**2018**	**2019**	**2020**	**2021**
			EUR		
Order of the Slovak Republic (EUA)	275 832 390	241 854 770	244 474 150	229 635 710	87 007 265

Order of the Slovak Republic (EUAA)	332 330	213 555	239 360	178 950	57 205
Total SVK yield	276 164 720	242 068 325	244 713 510	229 814 660	87 064 470

Source: MINISTRY OF THE ENVIRONMENT OF THE SLOVAK REPUBLIC

- MSF

The Market Stability Reserve (Market Stability Reserve) has been introduced as a long-term solution to tackle the existing surplus of allowances under the EU ETS. It is an automated mechanism that will reduce the volume of allowances in the auction if there is a significant surplus of allowances in the market. If the need for additional allowances arises, the MSR will be used to increase the volume of allowances in the auction. The MSR has been operational since 2019 and all temporarily withdrawn allowances will become part of this reserve. This will lead to a continuous increase in the carbon price in the EU ETS and a stable environment for investors for the next decade.

h) Effort Sharing Legislation

The legislative framework for Member States' effort sharing to reduce greenhouse gas emissions is divided over the period from 2013 to 2020 and from 2021 to 2030. The legislative basis for the first period is Decision No 406/2009/EC of the European Parliament and of the Council on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020 (the so-called Effort Sharing Decision – ESD). The basis for the second period is Regulation 2018/842 of the European Parliament and of the Council 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 (the so-called Effort Sharing Regulation – ESR). The relevant legislation sets annual targets for Member States' greenhouse gas emissions, which are legally binding and cover only greenhouse gas emissions not included in the scope of the EU ETS, i.e. small energy and industry outside the EU ETS, transport (except aviation), buildings, agriculture (excluding LULUCF) and waste. Each Member State must define and implement national policies and measures to reduce greenhouse gas emissions in these sectors. These include promoting public transport, energy performance standards for buildings, more efficient farming practices, conversion of animal and plant waste into biogas, and measures in waste management. The emission limit values for the Slovak Republic are + 13 % by 2020 compared to 2005 levels. The Slovak Republic has achieved the national target set by the ECJ for 2020 through its policies and measures. The target set for 2030 is set at – 22.7 % under the revised ESR.

Table 5: Compliance under the ESD

Year	2013	2014	2015	2016	2017
AEA units	24 023 495	24 383 530	24 743 565	25 103 599	25 041 595
Verified emissions	21 080 248	19 782 144	20 084 623	19 758 694	22 063 225
Year	**2018**	**2019**	**2020**		
AEA units	25 344 020	25 646 446	25 948 871		
Verified emissions	21 065 066	20 087 964	18 877 704		

Source: MINISTRY OF THE ENVIRONMENT OF THE SLOVAK REPUBLIC

Table 6: Progress made towards the JO targets under the Effort Sharing Decision (ESD)

2020 ESD target (% vs. 2005)	+ 13.0 %
2015 ESD emissions (% vs 2005)	—13.2 %
2020 ESD emissions (% vs 2005)	—18.4 %

Source: Ministry of the Environment of the Slovak Republic, 2005 = 23137,11 GgCO2e

Road transport and heating in residential buildings are among the largest contributors of GHG emissions in the ESD sectors. Transport currently contributes 19.1 % to total greenhouse gas emissions (eq. Co_2) and its share of total emissions since 1990 has been on an increasing trend. Therefore, effective policies and measures to reduce emissions from road transport in the Slovak Republic need to be continuously addressed and implemented.

Table 7: Assessment of greenhouse gas emissions under ETS and ESD in 2020

Category	Unit	Total GHG emissions	ETS emissions	ESD emissions	ETS/ESD ratio in %
GHG emissions	eq. CO_2 Gg	37 002,71	18 170,00	18 887,70	49/51

Source: MINISTRY OF THE ENVIRONMENT OF THE SLOVAK REPUBLIC, SHMÚ

j) Policy on the use of biofuels

The underlying frameworks for the use of biofuels are Directive 2018/2001 of the European Parliament and of the Council on the promotion of the use of energy from renewable sources, as amended by Directive 2023/2413 of 18 October 2023.

The body responsible for implementing the Directive is the Ministry of the Economy of the Slovak Republic. The Ministry of the Environment is responsible for compliance with the sustainability criteria for biofuels and bioliquids, for calculations for determining the impact of biofuels and bioliquids on greenhouse gas emissions and for calculating the life-cycle greenhouse gas emissions of fossil fuels pursuant to Article 7a of Directive 2009/30/EC and Council Directive (EU) 2015/652 of 20 April 2015 establishing calculation methodologies and reporting requirements pursuant to Directive 98/70/EC of the European Parliament and of the Council relating to the quality of petrol and diesel fuels.

k) Policy on the use of hydrogen

In June 2021, the Slovak Government took note of the National Hydrogen Strategy, which aims to increase the competitiveness of the Slovak economy while contributing to a carbon-neutral society in line with the Paris Climate Agreement. Through the strategy, the State aims to create a framework for the use of hydrogen throughout its chain. It will cover its production, transport, but also distribution and storage, including all necessary safety features and components. In June 2023, the Slovak Government approved an Action Plan on measures for the successful implementation of the National Hydrogen Strategy until 2026, which already specifically addresses issues of legislative setting, subsidising hydrogen technologies as well as supporting start-ups. Funding of around EUR 60 million is foreseen for the 10 actions in the Action Plan and potential resources are also identified for each action.

l) Taxation of energy products and electricity

The most significant tax in relation to the generation of tax revenue is the tax on mineral oils. Revenues from excise duties on electricity, coal and natural gas are relatively low. The Slovak Republic generates relatively low income from environmental taxes and the implicit tax rate on energy is low. Low revenues from excise duties on electricity, coal and natural gas mainly result from a higher number of optional exemptions.The largest share of total energy use and CO_2 emissions in the Slovak Republic is accounted for by heating and energy use in industrial processes. As a result, a more harmonised tax regime in these areas would increase tax revenues and provide incentives to reduce $CO2_{emissions}$. This could be achieved by increasing taxes on all fuels used for heating and production to the standard rate per unit of energy for natural gas. Consumption taxes payable on a unit basis could also be indexed for inflation in order to avoid a decline in environmental tax revenue in real terms over time. The elimination of the tax differential between petrol and diesel could also be considered.

m) National emission ceilings (NES)

The original National Emission Ceilings Directive 2001/81/EC was replaced as of 1 July 2018 by the revised NEC Directive 2016/2284. Its main objective is to reduce the adverse health impacts of air pollution, including by more than half the number of premature deaths per year from air pollution. This revised Directive includes national emission reduction commitments for each Member State for the period up to 2030 (with intermediate targets set for 2025) for five specific pollutants: No_x, SO_2, NMVOC, NH_3, $PM_{2,5}$. The NEC Directive is transposed into national legislation through the Air Act.

National Emission Reduction Programme:

Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC sets emission reduction targets for sulphur oxides, nitrogen oxides, non-methane volatile organic compounds, ammonia and $PM_{2.5}$ dust particles by 2030. Government Resolution No 103/2020 of 5 March 2020 approved the National Emission Reduction Programme, which proposes policies and measures to achieve the above-mentioned national commitments in two stages, between 2020 and 2029 and beyond 2030. The national emission reduction programme shall contribute to the achievement of air quality objectives under Directive 2008/50/EC as well as to ensuring consistency with plans and programmes set out in other relevant policy areas, including climate, energy, agriculture, industry and transport. It will also support the shift of investment into clean and efficient technologies.

The Slovak Republic's adaptation strategy to the adverse effects of climate change, valued in the Commission's opinion, also defines measures that can contribute to improving air quality, in particular measures relating to the preservation of biodiversity and the enhancement of ecosystem services, which relate, inter alia, to the maintenance of good air quality. These measures have not yet been quantified in terms of air protection.

n) Upper Nitra Coal Regioń Transformation

On 3 July 2019, the Slovak Government adopted Resolution No 336/2019 on the Action Plan for the

Transformation of Upper Nitra Coal Region.

In the context of transforming the Upper Nitra region and maintaining continuity of heat supply in that region, it is appropriate to use existing heat and power generation infrastructure in line with the Upper Nitra Transformation Action Plan, taking into account the minimum environmental impact and price competitiveness and long-term sustainable growth of the region.

o) Long-term strategy for the renovation of the building stock

The long-term strategy for the renovation of the building stock is a strategic document prepared on the basis of Section 4c of Act No 555/2005 on the energy performance of buildings and amending certain acts and in accordance with Regulation (EU) 2018/1999, which was approved by the Government on 20 January 2021. This strategy sets indicative milestones for reducing CO2 emissions in the buildings sector compared to 1990, with the aim of achieving a decarbonised building stock by 2050. It contains policies, measures and financial instruments to achieve the milestones and we consider it an essential document for reducing emissions in the building stock.

p) Territorial Just Transition Plan

The Territorial Just Transition Plan (TJTP) is an initial strategy for the JTF, which has been prepared in a participatory way with the strong involvement of regions and socio-economic partners. The just transition plan is annexed to the Slovakia Programme, frames the transition process in Slovakia and defines the eligible regions from the JTF. It also takes into account the key challenges and needs of regions eligible under the JTF and defines concrete measures and activities to address the negative impacts of the transition.

111. Key issues of cross-border relevance

The Slovak Republic is highly dependent on imports of primary energy sources. With regard to Slovakia's location in Central Europe, the importance of diversifying transport routes is increasing.

After problems with the supply of natural gas in 2009, reverse gas flow facilities from the Czech Republic and Austria were operational. Following the launch of the commercial operation of the gas interconnector between Poland and Slovakia in November 2022, there is a interconnection at transmission system level with all neighbouring states. In the electricity sector, the interconnection with Hungary and the building of smart connectivity with Czechia (ACON) are being strengthened. The Danube InGrid (Danube Intelligent Grid) project within the Slovak Republic and Hungary integrates renewable energy sources into the distribution grid through the use of smart technologies.

The national objectives and targets for the provision of primary energy sources and the diversification of transport routes are set out in more detail in Article 2.3. Dimension: energy security

IV. Administrative structure of implementing national energy and climate policies

The Ministry of the Economy is responsible for the energy sector, and the Ministry of the Environment is primarily responsible for the air protection and climate change sector.

The Ministry of Economy is the coordinator of the Energy Efficiency Agenda, focusing primarily on energy savings in all sectors of the national economy, and has an inter-ministerial working group to this end, with the participation of all relevant central government authorities.

On the basis of an application, the Ministry of the Economy issues a certificate for the energy installation on the compliance of the investment project with energy policy.

The Ministry of the Environment of the Slovak Republic (MŽP SR) is responsible for drawing up national environmental policy and for developing national climate policy. The Ministry of the Environment proposes measures to achieve the climate objectives.

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

i. Involvement of the national parliament

The regular preliminary opinions of the Slovak Republic on the various draft European regulations and directives in the field of energy and climate are sent to Parliament on an ongoing basis after their preparation by the competent departmental ministry and after a public consultation.

ii. Involving local and regional authorities

Local and regional authorities shall be able to intervene in the drafting of strategy papers in accordance with the procedures set out in section 1.3 (iii).

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

In accordance with the rules governing the preparation of documents for discussion by the Government of the Slovak Republic, the preparation also involves consultation with all departments and entities concerned, as well as with the public. As part of a standardised process on the materials submitted for discussion by the Government, there is an intra-ministerial consultation, followed by an inter-ministerial consultation procedure (IPC). The material is published in the MPK via the publicly available Slov-Lex web portal, the operation of which is ensured by the Ministry of Justice of the Slovak Republic. The Portal is able to consult the proposed documents and the electronic form allows comments on the submitted material not only by representatives of state and public authorities, but also by natural or legal persons from the public. After the specified publication period (for materials of a legislative nature 15 working days, for materials of a non-legislative nature 10 working days), the submitter of the material must evaluate the comments made and incorporate them as necessary. If the material submitted relates to an activity for which a government advisory body has been established, it must be assessed in that advisory body before being submitted for discussion by the government. The accepted comments of the advisory body of the Government shall be incorporated into the material by the petitioner; any non-acceptance of comments shall be justified.

Under the legislation in force, the approval of strategic materials is also subject to the assessment process under Act No 24/2006 on environmental impact assessment and amending certain acts. Where a strategic environmental assessment is needed, the material shall be submitted for discussion by the government only after a public discussion of the strategy paper and the report on the evaluation of the strategy paper and the establishment of a final opinion on the assessment of the strategy paper. The documents referred to in Chapter 1.2.ii. were discussed by the Slovak Government in this procedure.

Organisations involved in the production, transmission and supply of electricity, petroleum products, distribution companies, heating companies and employers' associations were contacted to prepare the update of the NECPs.

iv. Consultation of other Member States

Other Member States were consulted at regional cooperation level with Czechia, Hungary, Poland and Austria.

v. Iterative process with the Commission

On 18.12.2023, the EC published a Communication on the evaluation of the draft National Energy and Climate Plans. The evaluation highlighted Slovakia as an example of good practices on the electricity interconnectivity target, the development of smart grids and work on the definition of energy poverty. The EC also positively assessed progress in diversifying nuclear fuel supply. The EC recommended to Slovakia to increase the share of RES to 35 % and to increase energy efficiency ambition.

The EC recommendations have been analysed by the relevant departments and based on their recommendations, the assumptions for the modelling of the WAM scenario have been modified. The intention was to be as close as possible to the recommended objectives. Given the constraints imposed by technical and economic factors and time-based considerations, it has become impossible to achieve them in 2030 while maintaining industrial production. Based on the results of repeated modelling, the proposed target for the share of RES in final consumption is 25 % (i.e. an increase of 2 % compared to the 2023 draft NECPs, or 6.2 % compared to the original NECPs).

The contribution under the new Energy Efficiency Directive (EU) 2023/1791 and amending Regulation (EU) 2023/955 is included to the extent allowed by the Compact-PRIMES energy system model (+ 2.6 % PES, -1.8 % FEC). Details of policies and measures referred to in section 3.

1.4. Regional cooperation in preparing the plan

i. Elements falling under joint or coordinated planning with others Member States

An online joint meeting of experts from V4 countries (Czechia, Hungary, Poland and Slovakia) and a bilateral meeting with experts from Austria took place in April 2024, where the aspects of the preparation of the draft update of the national energy and climate plans in each country, as well as their underlying objectives, measures and policies in the framework of renewables, climate protection, energy efficiency, the internal market and security of energy supply, were consulted.

At the same time, MS were informed about the continuation of the process of updating the national plans, as well as their positions on the EC recommendations on prepared draft updates of the NECPs in each Member State. In addition to representatives of national ministries, representatives of the analytical units (for the SR IEP and IHA) also attended the meeting and presented the analytical work (analytical tools – models, inputs and outputs) applied in the preparation of the national NECPs.

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

As the draft plan is based on previously approved materials that have been consulted in the preparation process, it reflects the requirements and positions of the countries concerned.

2. NATIONALLY SET OBJECTIVES AND TARGETS

2.1. Dimension: decarbonisation

2.1.1. Greenhouse gas emissions and removals

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

Binding targets for greenhouse gas emissions at EU level

- reduce greenhouse gas emissions by 55 % by 2030 compared to 1990;
- achieving climate neutrality in 2050.

Binding target for Slovakia under Regulation (EU) 2018/842

- reduce greenhouse gas emissions by 22.7 % in 2005 scrapping.

Greenhouse gas emissions from the non-EU ETS sectors are covered by the Effort Sharing Regulation (ESR). The ESR covers emissions from all sectors outside the EU ETS, except emissions from international maritime transport, domestic and international aviation (which has been included in the EU ETS since 1 January 2012) and emissions and removals from land use, land use change and forestry (LULUCF). This includes a wide range of small sources of pollution across a wide range of sectors: transport (cars and trucks), buildings (mainly related to heating), services, small industrial installations, fugitive emissions from the energy sector, fluorogas emissions from installations and other sources, land management and waste. These sources account for around 55 % of the EU's total greenhouse gas emissions.4

The ESR target has been divided into national targets, which have to be achieved by Member States individually. Under the Effort Sharing Regulation, national emission targets for 2030 are set as a percentage change compared to 2005. For the Slovak Republic, this is a 22.7 % reduction by 2030 compared to 2005. The maximum amount of greenhouse gas emissions for the non-EU ETS sectors for each year from 2021 to 2030 is expressed in terms of the amount of annual emission allocations (AEAs) established for each Member State in that year.

Member State's commitments and national targets for net greenhouse gas removals pursuant to Article 4(1) and (2) of Regulation (EU) 2018/841

Regulation (EU) 2023/839 of the European Parliament and of the Council of 19 April 2023 amending Regulation (EU) 2018/841 as regards the scope, simplifying the reporting and compliance rules, and setting out the targets of the Member States for 2030, and Regulation (EU) 2018/1999, as regards improving monitoring, reporting, tracking of progress and review, provides for the Slovak Republic to comply with the so-called 'No debit' rule in 2025 in the land use, land-use change and forestry sector according to the accounting practices set out in that Regulation, and to achieve in 2030 a quantity of net removals higher by 504 000 tonnes of CO2 equivalent compared to the average of net removals in 2016-2018 in that emission inventory. Where necessary, so-called flexibilities to assist Member States in achieving the target can be counted towards the target.

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

4 European Commission. Commission Staff Working Document – Accompanying the document: Report from the Commission to the European Parliament and the Council on evaluating the implementation of Decision No 406/2009/EC pursuant to its Article 14 (SWD(2016) 251 final) 2016 https://ec.europa.eu/transparency/regdoc/rep/10102/2016/EN/10102-2016-251-EN-F1-1-ANNEX-1.PDF

and adaptation goals, if available

In the area of greenhouse gas emission reductions, Regulation 2021/1119, which establishes the framework for achieving climate neutrality, sets an EU-wide target of at least a 55 % reduction in greenhouse gas emissions by 2030 compared to 1990 and climate neutrality by 2050. In the sectors covered by the Emissions Trading System (EU ETS), under Directive 2003/87/EC as amended (Directive 2023/959), emissions should be reduced by 62 % compared to 2005 in sectors outside the EU ETS under the revised Regulation (EU) 2018/842 as amended (as amended by No 2023/857) by 40 % and 22.7 % at Slovak level.

Slovakia's objective is to achieve emission reductions in line with the obligations under the Fit for 55 package and to contribute to achieving EU climate neutrality by 2050. The modelled scenario shows the feasibility of meeting these targets, but when setting ambitious policies and measures. Total emissions will fall by 64.3 % in 2030 compared to 1990, outside the EU ETS sectors (ESR) by 31.5 % compared to 2005. The most significant contribution to the total emission reductions modelled under the WAM scenario is the electrification of the kilns in the pot iron. Without this investment, the overall reduction in emissions will be significantly lower. The introduction of the Emissions Trading System (ETS2) from 2027 onwards in the buildings and transport sector (ETS2) with an estimated price in 2030 of around EUR 59.2 per tonne of carbon is still essential.

In the Paris Agreement, the Slovak Republic, together with other parties, has committed itself to the objective of holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, which would significantly reduce the risks and impacts of climate change. The Paris Agreement was further specified in the Katowice Climate Package, which contains detailed rules and guidelines for the implementation of the Paris Agreement.

The European Union has implemented its commitment under the Paris Agreement into a legal commitment in Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law') (OJ L 243/1, 9. 7. 2021), (the 'European Climate Law'). The aim of this Regulation is to adopt the objective of a climate-neutral society by 2050, to set a trajectory for achieving it, to prepare adaptation plans, to put in place control mechanisms such as regular assessment of EU progress, to regularly assess national measures and to enable public participation. Article 2 of the Regulation stipulates that Member States are required to take the necessary measures to achieve the above objective and Article 4 states that Member States will be responsible for progressing and increasing capacity, building resilience and reducing vulnerability to the climate crisis, while at the same time preparing and implementing strategies and plans for the mitigation and adaptation process that will enable the collective achievement of the objective of a climate-neutral EU.

On the basis of the above, a long-term climate target is set for the Slovak Republic, which is to achieve the climate neutrality of the Slovak Republic by 2050.

The first more comprehensive document providing basic strategic guidance for Slovakia's adaptation to climate change and providing examples of proactive adaptation measures is the 2014 Strategy for Adaptation of the Slovak Republic to the Adverse Impacts of Climate Change (NAS). 2018 saw the process of updating the National Adaptation Strategy in the light of the latest climate change science. The updated Strategy for Adaptation of the Slovak Republic to Climate Change was approved on 17 October 2018 by

Slovak Government Resolution No 478/2018. The strategy assesses the current state of adaptation and planned activities in critical areas and sectors, defines a general vision for adaptation of selected areas and sectors, a set of adaptation measures and a framework for their implementation. It examines the impacts of climate change and proposes options for adaptation action in a number of sectors. It proposes priority actions, an institutional framework for coordination and implementation of adaptation activities, as well as a proposal for monitoring and evaluation, and identifies potential sources of funding.

The main objective of the updated National Adaptation Strategy is to improve Slovakia's preparedness to face the adverse impacts of climate change, to provide the widest possible information on current adaptation processes in Slovakia, and to establish an institutional framework and coordination mechanism to ensure effective implementation of adaptation measures at all levels and in all areas, as well as to raise overall awareness of this issue.

Adaptation measures were prioritised in the document 'Action Plan for the Implementation of the Slovak Adaptation Strategy', approved by the Government by Resolution No 476 of 31 August 2021.

Circular economy

Circular economy measures, such as optimising resource use, optimising product use and increasing the number of material cycles, can also lead to energy savings (indirectly) and thus reduce emissions.

The circular economy affects all aspects of resource use, from product design, resource extraction and production to distribution, use and disposal. The following sectors have the highest GHG emission reduction potential in terms of OH:

- Materials (mainly plastics, but also metals and cement)
- Agriculture and food production (reduction of nutrient losses and recycling)
- Construction (replacement of materials, modular design, smart shredders, space sharing, improvement of lifespan)
- Waste sector
- Car transport.

Measure 3.1. The economic policy strategy for 2030 requires 'Adoption of a document for the implementation of the circular economy of the Slovak Republic, followed by its implementation, with a view to developing a green economy, based on mutually supportive aspects of economic, environmental and energy policy, promoting innovation and reducing the energy, material and emission intensity of the Slovak economy'.

2.1.2. Renewable energy

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

The European Union's binding target for the share of energy from renewable sources in gross final consumption of energy is at least **42.5 % in 2030.** For the purpose of achieving that binding target, Member States' contributions for 2030 to that target from 2021 onwards shall be consistent with the indicative trajectory for that contribution. The indicative trajectory shall reach the reference point at least:

a) 18 % by 2022;

b) 43 % by 2025;

c) 65 % by 2027

of the overall increase in the share of energy from renewable sources between that Member State's binding national target for 2020 and its contribution to the 2030 target.

The Slovak Republic proposes a target of 25 % for 2030. This represents an increase of 5.8 percentage points compared to the target set in the current plan of 19.2 %. The binding target for 2020 was 14 %. The indicative trajectory for Slovakia starts at 17.4 % and is increasing, thus meeting the baseline requirement.

As required by Article 4(2) of the Regulation, for the 25 % target, the reference points in the indicative trajectory for 2022, 2025 and 2027 are set at 16.0 %, 18.8 % and 21.2 %.

ii. Estimated trajectories for renewable energy shares in each sectors for final energy consumption from 2025 to 2030 in the electricity, heating and cooling and transport sectors

Table 8: Estimated RES trajectories

	2025	**2026**	**2027**	**2028**	**2029**	**2030**
RES – Heating and Cooling (%)	24,4	25,2	26,0	30,2	32,8	33,7
RES – Electricity generation (%)	22,9	23,8	24,4	24,7	25,1	26,3
RES – Transport including multiplication (%)	10,4	11,7	13,5	16,0	20,8	29,0*
Total RES share (%)	**20.3 %**	**21.0 %**	**21.5 %**	**23.2 %**	**24.4 %**	**25.0 %**

Source: MINISTRY OF THE ECONOMY

* the transport RES target defined in RED III is expressed in energy value; we consider it unlikely to reach 29 % (MS can alternatively set an emission target of 14.5 % or an energy target of 29 %).

iii. *Estimated trajectories per renewable energy technology*

the resources that the Member State plans to use to achieve the overall and sector-specific trajectories from 2025 to 2030, including the expected total gross final energy consumption per technology and sector in Mtoe and the total planned installed capacity divided by new capacity and repowering) per technology and sector in MW;

Table 9: Sector-specific contribution of renewable energy to final energy consumption (ktoe)

	2025	2026	2027	2028	2029	2030
(A) Expected gross final consumption of RES for heating and cooling	1 526	1 539	1 554	1 559	1 569	1 600
(B) Expected gross final consumption of electricity from RES	619	662	695	730	767	822
(C) Expected final consumption of energy from RES in transport	254	271	291	319	378	422
(D) Expected total renewable energy consumption *	**2 388**	**2 458**	**2 524**	**2 586**	**2 683**	**2 795**

* expected total renewable consumption takes into account electricity produced from RES only once, i.e. electricity used for heating and cooling, transport or renewable hydrogen is not included.

Source: MINISTRY OF THE ECONOMY, IEP

Table 10: Estimate of the total expected contribution (installed capacity, gross electricity produced) of each renewable energy technology in Slovakia for electricity generation in the period 2025-2030

	2025		2026		2027		2028		2029		2030	
	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh
Pumped-storage hydropower plants (PVE)	916	450	916	450	916	450	916	450	916	500	916	500
Hydroelectric plants	1 626	4 465	1 626	4 465	1 640	4505	1 650	4 533	1 660	4 561	1 660	4 560
&1 MW	38	110	38	110	42	122	43	125	45	131	45	130
1 MW – 10 MW	57	160	57	160	67	188	76	213	84	235	84	235
> 10 MW	1 531	4 195	1 531	4 195	1 531	4 195	1 531	4 195	1 531	4 195	1 531	4 195
Geothermal energy	0	0	0	0	0	0	0	0	4	29	4	30
Solar energy – *PV*	1 200	1 260	1 300	1 365	1 400	1 470	1 500	1 575	1 600	1 680	1 700	1 810
Wind energy – onshore	20	40	200	400	300	600	420	840	530	1 060	750	1 500
Biomass:*solid*	200	1 100	200	1 100	200	1 100	200	1 100	200	1 100	200	1 100
biogas/biomethane	90	540	100	600	110	660	120	720	130	750	150	800
TOGETHER (excluding SEE)	**3 136**	**7 305**	**3 426**	**7 830**	**3 650**	**8 235**	**3 890**	**8 668**	**4 124**	**9 080**	**4 464**	**9 600**

Source: MINISTRY OF THE ECONOMY

Table 11: Estimate of the total expected contribution (final energy consumption) of each renewable technology in Slovakia in heating and cooling over the period 2025-2030 (ktoe)

	2025	2026	2027	2028	2029	2030
Deep geothermal energy	7	7	13	13	17	40
Solar energy	13	14	16	18	21	23
Biomass:						
Solid	1 180	1 160	1 138	1 114	1 088	1 063
Biogenic waste fraction	134	144	150	153	156	159
biogas/biomethane	61	63	65	67	69	70
Renewable energy from heat pumps:						
air-to-air	112	128	143	159	179	198
ground-water	8	9	12	14	16	17
water-water	11	14	17	21	23	29
TOGETHER	**1 526**	**1 539**	**1 554**	**1 559**	**1 569**	**1 600**

Source: MINISTRY OF THE ECONOMY, IEP

Table 12: Estimate of the total expected contribution of individual renewable technologies in Slovakia in the transport sector (ktoe)

	2025	2026	2027	2028	2029	2030
First-generation biofuels (including Annex IX.B biofuels)	229,6	231,3	230,9	230,4	229,6	228,6
Advanced biofuels according to Annex IX.A	13,2	24,1	40,4	61,9	107,5	128,0
Hydrogen from renewable energy sources (including RFNBO)	0,0	0,0	0,0	0,3	1,9	8,3
Electricity from renewable sources	11,5	13,7	16,5	21,4	28,6	37,5
of which road	2,2	4,2	6,9	11,3	18,0	26,7
of which rail transport	9,3	9,5	9,6	10,1	10,6	10,9
RCF	0,0	0,5	1,0	2,0	4,6	9,0
bioCNG/BioLNG	0,3	1,4	2,3	3,2	6,0	10,0
Together	**254,5**	**271,0**	**291,1**	**319,2**	**378,1**	**421,5**

Source: MINISTRY OF THE ECONOMY

In order to facilitate the promotion of energy from renewable sources in the heating and cooling sector, the amended RES Directive provides5 in Article 23 that each Member State shall increase the share of renewable energy in the heating and cooling sector by at least 0.8 % as an annual average calculated for the period 2021 to 2025 and by at least 1.1 % as an annual average calculated for the period 2026 to 2030,

5Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652 starting from the share of renewable energy in the heating and cooling sector in 2020, expressed in terms of national share of gross final consumption of energy and calculated in accordance with the methodology set out in Article 7.

Table 13: Estimate of the total expected contribution of individual renewable technologies in Slovakia in the heat and cooling sector

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
RES for heat generation (ktoe)	1147	1325	1224	1443	1474	1526	1539	1554	1559	1569	1600
Estimate of heat demand for heating and cooling (ktoe)	5 903	6 788	6 145	7 029	6 652	6 213	6 103	5 991	5 190	4 787	4 684
Share of RES in heating	19.4 %	19.5 %	19.9 %	20.5 %	22.2 %	24.6 %	25.2 %	25.9 %	30.0 %	32.8 %	34.2 %
Annual increase		0.1 %	0.4 %	0.6 %	1.6 %	2.4 %	0.7 %	0.7 %	4.1 %	2.7 %	1.4 %
Average over 5 years		**1.0 %**					**1.9 %**				

Source: Eurostat, IEP, MH SR (2020-2022 reality Eurostat, 2025-2030 WAM IEP scenario)

iv. ***Estimated*** *trajectories for bioenergy demand broken down between heat, electricity and transport*

and biomass supply trajectories by feedstock and origin (when distinguishing domestic production and imports). For forest biomass, an assessment of its source and impact on the LULUCF sink

Woody biomass is a renewable heat source that accounts for a significant share of renewable energy production. Compliance with sustainable economy practices in the extraction of wood is a prerequisite.

The main sources of fuel woody biomass are forest lands, long-term unmanaged agricultural parcels planted with forest wood and wood processing residues in the woodworking, furniture and cellulose-paper industries.

According to the Summary Information on the Status of Forests (SISL), in 2022 the area of forest land in Slovakia amounted to 2.7 million ha, of which arable land (forest stands) reached 1.5.5 million ha. The forest cover calculated from the area of forest land is 41.3 % of Slovakia’s total area. 6

As a result of the gradual change in the age structure of forest stands in the Slovak Republic, according to SISL data, the trend of long-term increase in the total volume of timber stocks ended in 2022. After a phase-down period, the annual increase in wood stocks reached 482.8 million m^3 in 2022, which was 4.5 million m^3 less than in 2021. For the first time, there has also been a decrease of 1.4 million m^3 in the stock of hardwood. The decline in coniferous wood stock, which was 3.1 million m^3 & lower, has continued for about 10 years. The ratio of the stock of coniferous and hardwood in Slovakia was 39.7 % to 60.3 %. The average wood stock per hectare has also been reduced to 248 m^3 gross bark-free. For coniferous woods

there were 277 m^3 and 232 m^3 respectively. Stocks increased again in 2023 compared to 2022. While the increase has not reached the level of 2021, the decline in stocks is not so significant for the time being.

Timber harvesting in 2022 was 7.68 million m^3, which was just 0.046 million m^3 higher than last year.

6 Green Report 2023, Report on Forestry in the Slovak Republic 2022. https://www.mpsr.sk/zelena-sprava-2023/123--- 19005/

48.3 % of coniferous and 51.7 % of hardwood were harvested. Of this volume of logging, 2.75 million m^3 (35.8 %) were extracted to remove the effects of disturbances in forests.

Over the last 15-20 years, forests in Slovakia, including to a large extent the effects of climate change, have been exposed to unprecedented frequency and intensity of disturbances in forests. The positive finding in 2021 and 2022 was the lowest volumes of incidental (salamic) mining since 2005 (2.91 million m^3 and 2.75 million m^3). Of the harvested volume of coniferous wood, 65.7 % and 8 % of hardwood. This was the lowest share of incidental (salamic) logging since 2002.

The biggest damage was caused by bark and wood-infectious insects, which were mainly damaged by coniferous forests of 1.85$^{\text{million m 3}}$ woods and winds (0.51 million m^3 wood).

The total volume of current domestic consumption in Slovakia (deliveries + imports – exports) in 2022 amounted to 8 388.4 thousand m 3$^($ Table 14).

Table 14: Production, import, export and consumption of raw wood in Slovakia in 2022 (1 000 m 3$^)$

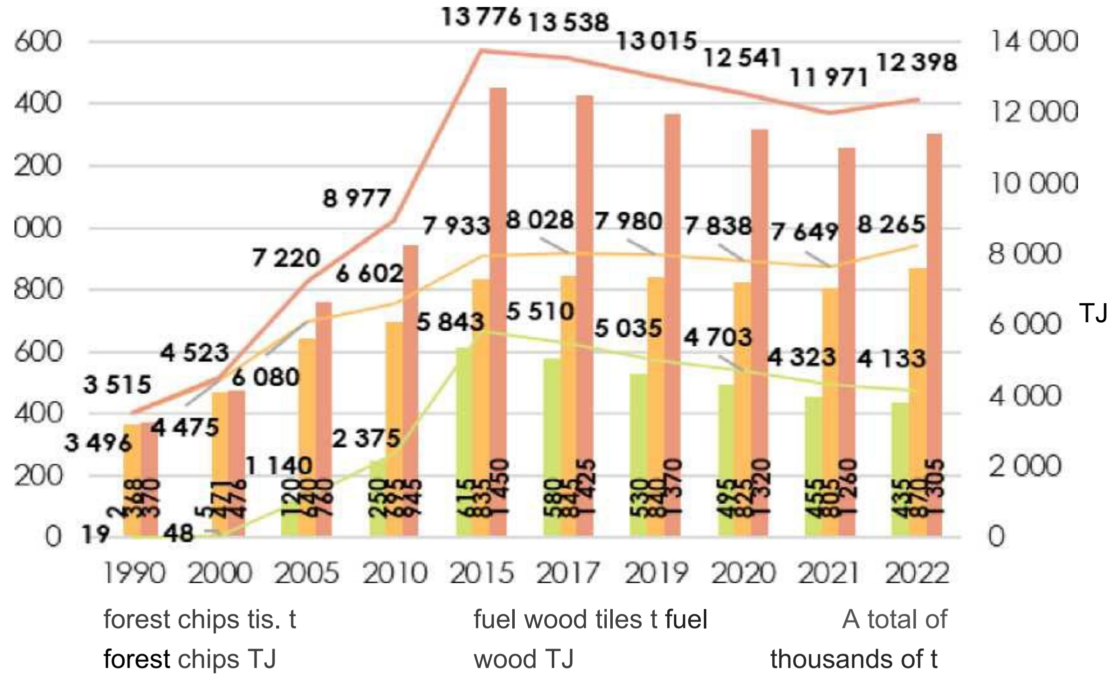
Assortment	Production	Imports	Export	Consumptio
Coniferous cuttings (I. to III. (KT)	2 559,4	1 130,0	512,0	3 177,4
Coniferous cuttings (IV and	765,5	705,0	766,0	704,5
Deciduous cutters (I. to III. (KT)	1 570,2	870,0	479,0	1 961,2
Deciduous cutters (IV and V.KT)	1 931,7	53,0	107,0	1 877,7
Fuel wood (VI. (KT)	608,6	83,0	24,0	667,6
Together	7 435,4	2 841,0	1 888,0	8 388,4

Source: NLC

Use of wood for energy purposes

In 2022, the total supply of fuel woody biomass was 1.3 million tonnes and increased by 45 thousand tonnes compared to 2021. Their reduction trend ended around 2015 when fuel woody biomass supply was the highest (1.45 million tonnes).

Figure 1: Evolution of the amount of dendromas for energy use and energy



Source: NLC, 1991-2023

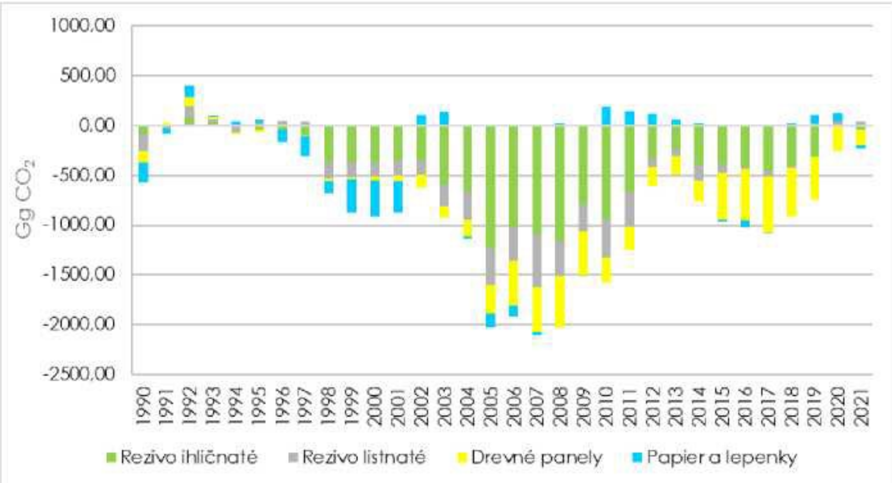
Forest carbonstocks in live biomass, non-column and forest land amounted to 507.1 million tonnes in 2022 (1.82 million tonnes lower compared to 2021). The reduction in carbon in living above-ground and underground biomass is due to a decrease in the wood supply in 2022 in forests in Slovakia. The largest amount of carbon is bound in soils (27.5 million t) and above-ground tree biomass (164.2 million t) (see Figure 2). Carbon stocks in forests have so far increased (similar to wood stocks) over a long period of time. The current trend in the development of the age composition of forests will lead to a decline in the carbon stock bound in the different balancing categories, in parallel with the decline in wood supply in forests. Older forests with the highest accumulated amount of carbon per hectare are particularly important for the stored carbon stock. The storage of new carbon from the atmosphere through increment is best ensured by trees and stands with rapid growth, i.e. younger stands and plantations. The evolution of the carbon stock and sink in individual stands significantly influences the way forests are managed (cooked, undergrowth, selective, without intervention). Unmanaged forests (primary forests) are constant in terms of long-term carbon balance, i.e. they accumulate just as much carbon as they release through natural processes of dying and decomposition. There is no carbon category in harvested wood products.

Figure 2: Evolution of the carbon stock in Slovakia's forests

Source: NLC, Summary information on the state of forests in Slovakia, 1991-2023; NLC Zvolen

In 2021, the resulting balance of CO2 weightbound in timber products, expressed by the difference between CO2 weights and CO_2 'emissions', was almost 195 thousand tonnes and increased by 163 thousand tonnes of CO_2 compared to 2020 (Figure 3).

Figure 3: Resulting mass balance of CO2 "captures" and "emissions" (thousand tonnes) in the core timber product categories in 2021



Source: Forestry studies 69/2019 (updated 2021).

Figure 4 presents7 the forecasted potential for wood harvesting volumes at 5-year intervals combined, for coniferous and deciduous wood. The above figures show that total logging will gradually decrease from almost 8.3 million m^3 in 2025 to 7.4 million m^3 in 2050, i.e. by 10.6 %. The potential for extracting coniferous wood from less than 4.2 million m^3 in 2025 will also decrease to 3.0$^{\text{million m 3}}$ in 2050, i.e. 27.1 %. The potential for hardwood harvesting will increase from 4.1 million m^3 to over 4.4 million m^3 around

7Study by the Ministry of Agriculture and Rural Development and the NLC: Business Sustainability Analysis in Primary Processing hardwood and coniferous wood in relation to the potential for wood supply following the new zoning of Slovak national parks with a view to 2050

2040-2045, before decreasing to less than 4.4 million m^3 in 2050. In 2025, the ratio of harvesting of coniferous and hardwood will be 50.2: 49.8 and turn 41 by 2050: 59.

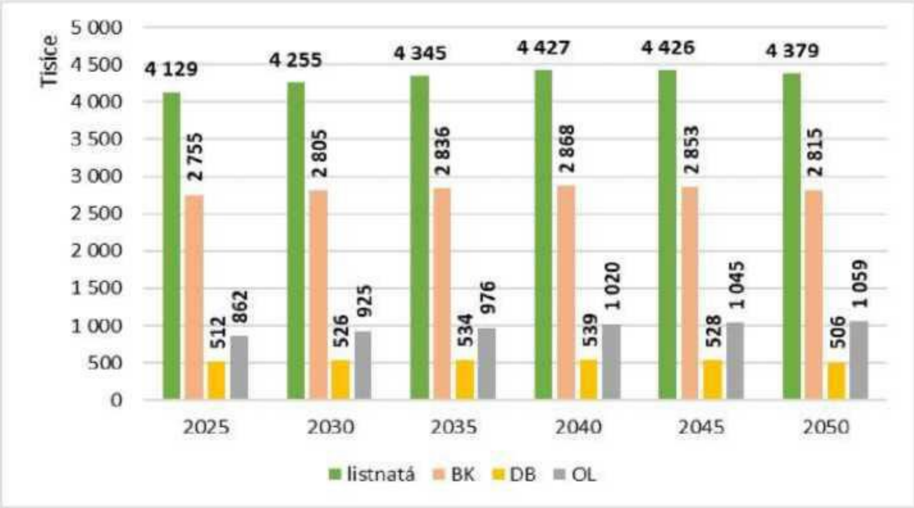
Figure 4: Total forecast of timber harvesting and by tree group (1 000 m 3)

Source: NLC

Graphs 5 and 6 below show forecasts for the harvesting of coniferous and hardwood. Among the coniferous woods, spruce is the largest. The decrease in the extraction of coniferous wood is mainly due to a decrease in spruce logging by 32.3 % by 2050. The extraction of other coniferous woods will decrease only slightly by 4.6 % over the period of 25 years. It is reduced by 18.9 % for eating, 5.7 % for pine and increased by 54.6 % for spruce.

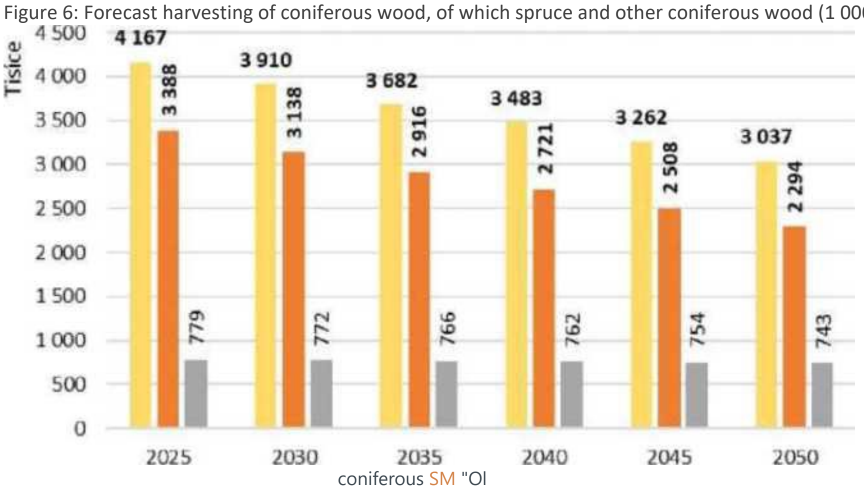
The trend in the overall extraction potential of deciduous plants is determined by the two main deciduous plants (beak and oak), the potential for which will increase until 2040-2045, after which it starts to decline. For other hardwood, their extraction will increase from 0.86 million m^3 to 1.06$^{\text{million m 3}}$ in 2050, i.e. 22.9 %. In particular, the continuous increase in potential mining up to 2050 will show valuable maple leaves (by 71.4 %), ash (by 40 %) and castle trees by 29.8 %.

Figure 5: Forecast harvesting of hardwood, of which beech, oak and other hardwood (1 000 m 3)



Source: NLC

Figure 6: Forecast harvesting of coniferous wood, of which spruce and other coniferous wood (1 000 m 3)



Source: NLC

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

The indicative target for innovative renewable energy technology, in line with the updated energy policy objective and the requirement of the Renewables Directive, is at least 5 % of the new installed renewable capacity by 2030. For more information on the measure, see chapter 3.1.2.

2.2. Dimension: energy efficiency

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

1. ***the indicative national energy efficiency contribution to achieving the Union's energy efficiency targets of at least 32.5 % in 2030 as referred to in Article 1(1) and Article 3(5) of Directive 2012/27/EU, based on either primary or final energy consumption, primary or final energy savings,***

or energy intensity.

Based on the Energy Efficiency Directive 2023/1791, Article 4(1), EU Member States are to collectively ensure a reduction in energy consumption of at least 11.7 % in 2030 compared to the projections of the 2020 EU Reference Scenario, so that the Union's final energy consumption does not exceed 763 Mtoe while primary energy consumption does not exceed 992.5 Mtoe. Building on these targets, each Member State is required to set an indicative national energy efficiency contribution at national level, while making efforts to contribute to the achievement of these targets.

In July 2021, the European Commission issued8a document setting out, for each Member State, including the Slovak Republic, the proposed level of contributions for both final and primary energy consumption. **Slovakia's contribution for 2030 was set at 8590 ktoe for final energy consumption and 13940 ktoe for primary energy consumption, both of which** the Directive allows for a derogation of 2.5 %. **Both contributions were calculated in accordance with Annex 1 to Directive 2023/1791 on energy efficiency and therefore do not take into account all the impacts referred to in Article 4(3) of that Directive. These have been taken into account in the development of scenarios for the evolution of final and primary energy consumption (WEM, WAM) through the CPS model9.**

In the WEM scenario, final energy consumption is expected to increase to 10740 ktoe and primary energy consumption to 18038 ktoe in 2030.

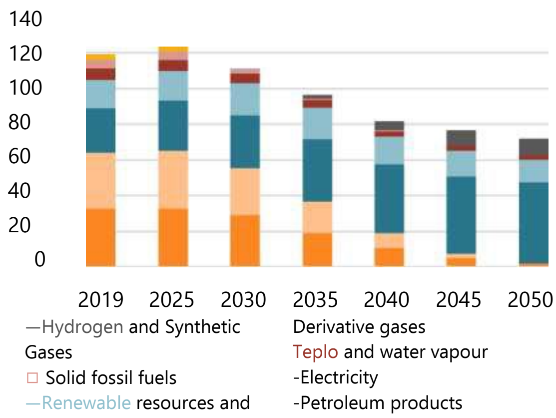
In an ambitious scenario (WAM scenario), final energy consumption is expected to decrease to 9628 ktoe and primary energy consumption to 16419 ktoe in 2030. Solid fossil fuel consumptionis expected to decrease by 57 % compared to 2019. The sharp decrease in the consumption of natural gas (-15 %) and oil (-11 %) will be accompanied by an increase in electricity consumption (+ 19 %). All sectors of final energy consumption except transport show a decrease between -2 % and -11 %. Energy consumption in transport will increase by 2 %. Emissions in the ETS sector will decrease by around 46 % compared to 2019 and by around 20 % in the ESR sector.

In the WAM scenario, the number of electric cars will reach around 192 thousand in 2030, which corresponds to additional investments made by final consumers (households and businesses) in their purchase in volume compared to the WEM scenario. EUR 3.1 billion. A precondition for meeting the ambition of the WAM scenario is also the implementation of key decarbonisation investments in the energy-intensive industry, with a special focus on the electrification of the iron and steel sector. Additional investment costs

8 European Commission, Directorate-General for Climate Action, Directorate-General for Energy, Directorate-General for Mobility and Transport, De Vita, A., Capros, P., Paroussos, L.et al., EU reference scenario 2020 – Energy, transport and GHG emissions: Trends to 2050, Publications Office, 2021, https://data.europa.eu/doi/10.2833/35750

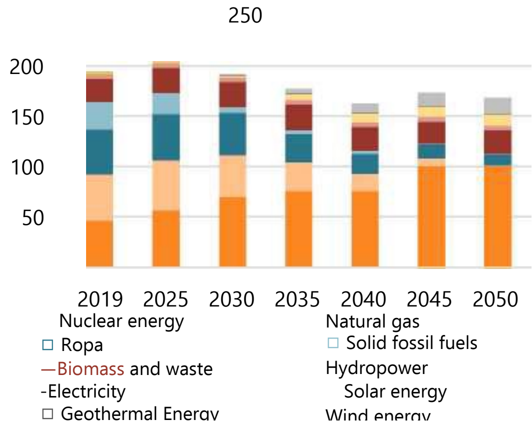
9Annex 3 Description of the methodologies for setting the level of targets of Directive 2023/1791 on energy efficiency the industry sector is estimated at around EUR 2 billion by 2030. Currently, the situation regarding the implementation of key decarbonisation investments by 2030 is unclear. At the same time, there is currently no indication by industry of projects that would fully replace the contribution of these investments to reducing emissions and energy consumption. In the household sector, renovation in both family and multi-apartment buildings is foreseen. By 2030, the recovery will require around EUR 5.8 billion, with partial public funding to be expected for its implementation. An optimal level of renovation is also foreseen for public sector buildings, which will increase the need for additional energy savings10 on top of the energy savings estimated by 2030 by around 200 GWh.

Figure 7: Final energy consumption (WAM, in TWh)



Source: IEP under CPS

Figure 8: Primary energy consumption (WAM, in TWh)



Source: IEP under CPS

The Slovak Republic is unique among the EU Member States in terms of its contribution to building a green economy at European level. The scenario was based on the fact that four out of five car manufacturing plants active in Slovakia expressed their ambition to produce pure electric cars by 2030. Heat pump production capacity in plants operating in Slovakia is 660 thousand units per year, which can cover demand from a significant part not only within the EU. There is also a long-established establishment in Slovakia of insulating materials, building materials, electronics and other products, which have an indispensable place in the transition to the green economy. As a consequence, a slight increase in consumption by 2030 can be expected in these sectors, or, due to increased demand, a slight increase in consumption. A significant drop in consumption will ensure investment in energy-intensive industries. However, investments in the iron and steel sector will be crucial to reach the WAM scenario.

Any further ambition to reduce energy intensity beyond the WAM scenario would be linked to a change in the structure of the Slovak industry, which would negatively affect in particular energy-intensive businesses. In addition to increasing dependencies on the supply of commodities, which would be produced to a limited extent or at all by reducing the production of energy-intensive industries, there would also be a decline in exports. However, the strongest sign of such a change would be the sharp decline in employment, which would have a very negative impact on the just transition process.
Support to industry by at least 2030 will be given the highest priority among the other sectors of final energy consumption, also taking into account the need to reduce energy consumption in other end-use sectors. The development and economic growth of industrial enterprises will ensure the sustainability

10Including the estimated savings achieved through the Slovakia Programme and the Recovery and Resilience Plan or growth of jobs, making households feel more financial security and not fearing to invest in measures aimed at renovating their homes with a longer payback period.

2. the cumulative amount of end-use energy savings to be achieved over the period from 2021 to 2030 pursuant to Article 7(1)(b) on the energy savings obligation in Directive 2012/27/EU;

The cumulative amount of end-use energy savings to be achieved over the period from 2021 to 2030 pursuant to Article 8(1), point (b), of Directive 2023/1791 on energy efficiency is set according to the Eurostat FEC2020-2030 methodology **at 80 230.39 GWh (** 6899 ktoe). The calculation procedure is set out in Annex 3. Alternatively, following the obligation in question, the Eurostat F_CE methodology also sets a target: 71375.4 GWh. This will apply to the deduction only if the benefits achieved by measures in the iron and steel sector are not taken into account.

The required amount of cumulated end-use energy savings for people affected by energy poverty, vulnerable customers, people in low-income households and, where applicable, people living in social housing, pursuant to Article 8(3) of the Energy Efficiency Directive 2023/1791 is set at 1744.57 GWh. The calculation procedure is set out in Annex 3.

3. the indicative milestones of the long-term strategy for the renovation of the national stock of residential and non-residential buildings, both public and private, the roadmap with domestically established measurable progress indicators, an evidence-based estimate of expected energy savings and wider benefits, and the contributions to the Union's energy efficiency targets pursuant to Directive 2012/27/EU in accordance with Article 2a of Directive 2010/31/EU;

The long-term strategy for the renovation of the building stock is a strategic document prepared on the basis of Section 4c of Act No 555/2005 on the energy performance of buildings and amending certain acts and in accordance with Regulation (EU) 2018/1999, which was approved by the Government on 20 January 2021. The strategy includes a roadmap with measurable progress indicators in Chapter 3, setting indicative milestones for the building sector in chapter 3.3 and a summary of policies and measures aimed at improving the energy performance of buildings in chapter 4.6 is compiled to achieve them. The strategy also provides an estimate of the investment intensity of building renovation after 2020.

An estimate of the expected energy savings that qualify for counting towards compliance with the obligation under Article 6 and 8 of the Energy Efficiency Directive 2023/1791 is provided for each measure in Annex 2. However, the amount of savings that cannot be counted towards these targets is higher. It concerns in particular Article 4. In addition to energy savings from the renovation of single-family houses, which are not recorded in the SIEA Energy Efficiency Monitoring System, natural gas savings achieved by replacing old gas boilers with new condensation boilers contribute to it. All measures that are not monitored by the SIEA Energy Efficiency Monitoring Scheme for failure to meet the conditions for counting towards compliance with the obligation under Article 8 of the Directive will also contribute to the achievement of the target under Article 4 of the Directive. These are primarily measures that consumers (households, tertiary sector) will implement, regardless of the policies or support mechanisms of the state. The list of measures whose contributions will count towards compliance with the obligation under Articles 6 and 8 of the Directive until 2030 is set out in Annex 2.

4. the total floor area to be renovated or equivalent annual energy savings to be achieved from 2021 to 2030 under Article 5 of Directive 2012/27/EU on the exemplary role of public bodies' buildings;

Article 5(1) of Directive 2023/1791 on energy efficiency obliges Member States to ensure that the total final energy consumption of all public bodies combined is reduced by at least 1.9 % each year compared to 2021. Following this obligation, a methodology was drawn up by the Ministry of the Economy in order to establish both the baseline and the target value for Article 5. The methodology for the indicative and binding part of the target is included in Annex 3. **The resulting value of the energy consumption of all public bodies in local territorial units with a population of over 50000 is set at 1 147.5 GWh for 2021. An indicative target for final energy consumption in the public sector to be achieved by 31. 12. 2026**, as required by Article 5(1) of the EED (1.9 % year-on-year reduction in the energy consumption of those public bodies), **is set at 1 042.55 GWh.** No other data are available for target setting in locations above 5000 inhabitants. The 2030 target for all public entities is provisionally set at 3 046 GWh.

The projected annual energy savings to achieve at least equivalent energy savings in buildings covered by Article 6(1) by 31 December 2030 shall amount to 13.69 GWhfor the Slovak Republic. In addition to this objective, the Integrated National Energy and Climate Progress Reports submitted to the European Commission pursuant to Article 17 of Regulation 2018/1999 on the Governance of the Energy Union will also include information on the amount of energy savings achieved by the renovation of public buildings, regardless of the level of the energy class to which the renovation has been carried out (deduction from the basis for calculating the target for Article 6 of Directive 2023/1791 on energy efficiency, i.e. 104.28 GWh/year).

A significant increase in the basis for calculating the final target, combined with an ambitious estimate of the share of public sector buildings renewable to the nearly zero energy class, will result in **a significant need to increase the pace of renovation of public buildings to the A0 energy class**[11]. This will also significantly increase the amount of costs needed to finance renovations. The assessment of whether a public building can be renovated to A0 class is to be made on the basis of cost-effectiveness. Only those buildings that meet the cost-efficiency conditions shall count towards the resulting target. Energy efficiency action plans, evaluating energy efficiency measures, as well as setting up new measures to meet energy savings targets, were the main implementation tools up to 2020. This task is transferred to the NECPs and biennial progress reports in the energy sector after 2020.

ii. Indicative milestones for 2030, 2040 and 2050, measurable progress indicators for at national level and an evidence-based estimate of the expected savings and other benefits and their contribution to the achievement of the Union's energy efficiency targets as included in the implementation plans set out in the long-term renovation strategies for the national stock of residential and non-residential buildings, public and private, in accordance with Article 2a of Directive 2010/31/EU

The text on the chapter is part of the long-term strategy for the renovation of the building stock in the Slovak Republic.

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

In heating and cooling, the main objective is to ensure more efficient primary energy consumption, both in the district heating system and in individual heating and cooling. At the same time, more efficient use of waste heat in both the energy and manufacturing industry is a high priority. For details see the Comprehensive Assessment of the potential for efficient heating and cooling in the Slovak

11level of construction of nearly zero-energy buildings

Republic.

In the transport sector, the list of main strategy papers is as follows:

- Action plan for the development of electromobility in the Slovak Republic[12]
- Long-term plan for addressing the challenges of road transport and smart mobility 2021-2030
- Strategic Transport Development Plan for the Slovak Republic until 2030
- National strategy for the development of cycling and cycling in the Slovak Republic
- Concept for the development of intermodal transport in the Slovak Republic by 2030
- Smart and Sustainable Mobility Strategy of Slovakia.

2.3. Dimension: energy security

Electricity
The objectives in the area of security of electricity supply will be achieved through:

• ensuring sufficient resources for electricity generation and sufficient stocks
nuclear fuel – resource adequacy will ensure self-sufficiency in the production of electricity and an adequate pro-export balance of the Slovak electricity system, in Slovakia we expect to achieve it by 2030, in particular by increasing the production of electricity from nuclear energy and renewable energy sources;

• ensuring the flexibility of the electricity system by ensuring that ancillary services are sufficient; (frequency and non-frequency support services);

• ensuring a high level of preparedness for prevention and resolution
electricity supply in accordance with Slovakia's plan for risk preparedness in the electricity sector drawn up pursuant to Articles 11 and 12 of Regulation (EU) of 5 June 2019 on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC.

On the basis of the transmission system operator's (SEPS) documentation, the Slovak Republic will evaluate the fulfilment of the reliability standard in the form of an indicative parameter for evaluating the level of security of electricity supply in Slovakia (at least in the form of a target duration of non-supply, the so-called LOLERS) as part of the resource adequacy assessment at national level.

Petroleum
In the field of oil, the Slovak Republic focuses on:

- strengthening alternative routes of oil supply through the Adria pipeline (after its expansion);
- the possibilities for further exploitation of the Druzhba pipeline;
- possibilities for processing other types of crude oil in the Slovnaft refinery;
- reducing the consumption of crude oil and petroleum products, in particular in the transport sector;
- supporting the development of alternative fuels infrastructure, namely charging points for electric cars as well as refuelling points for hydrogen, as well as the development of cycling routes and other tools to reduce the consumption of oil products in transport.

Gas
In the context of energy security in the field of gas supply, Slovakia has the following objectives:

12 https://www.slov-lex.sk/legislativne-procesy/-/SK/LP/2024/56

- continuing steps to ensure greater diversification of gas transmission routes and sources;
- increasing preparedness to deal with gas supply crises;
- creating conditions for access to gas infrastructure for low-carbon and renewable gases;
- supporting the development of sustainable biomethane production and consumption.

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

Currently, the obligations and responsibilities for ensuring the security of energy supply in the Slovak Republic, including limited or interrupted supplies and the resolution of electricity emergencies or gas crisis situations, are laid down in Act No 251/2012 (Energy Act and amending certain acts).

Electricity

The main state authority for electricity security policy for preventing and dealing with electricity emergencies is the Slovak Ministry of Economy. In accordance with Section 88 of the Energy Act, the Ministry of Health ensures monitoring of compliance with the security of electricity supply, determines the application of measures to ensure security of electricity supply where the security and reliability of the electricity system are at risk. Elements within the meaning of Article 4(c) to ensure the baseline level of security of electricity supply are necessary to ensure sufficient resources for electricity generation (source adequacy, see Chapter). 2.4.iv National objectives in ensuring the adequacy of the electricity system as well as the flexibility of the energy system). Elements within the meaning of Article 4(c) related to system flexibility by ensuring that ancillary services are sufficient (see Chapter. 2.3.iv National objectives with regard to increasing the flexibility of the national energy system).

The current legislation on security of electricity supply is based on the ‘Clean Energy for all Europeans’ package and in particular the Regulation (EU) of 5 June 2019 on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC. Regulation (EU) 2019/941 imposes obligations on the competent authority to draw up a risk-preparedness plan setting out procedures for security of electricity supply and ensuring uninterrupted electricity supply for end-users, and which is consulted with stakeholders to ensure a common approach to crisis prevention and management and updated regularly.

National procedures for the prevention and management of emergencies are included in the Energy Act 2012 (Energy Act No 251/2012) and in Decree No 416/2012 of the Ministry of the Economy of the Slovak Republic laying down the details of the procedure for the state of electricity emergency and the gas crisis situation. Decree of the Ministry of the Economy of the Slovak Republic No 80/2019 amending Decree No 416/2012 as of 1 April 2019 reflects, inter alia, the requirements of Commission Regulation (EU) 2017/2196 of 24 November 2017 establishing a network code on emergency and restoration in the electricity sector.

Annex 5 ‘Policy on Emergency and Restoration’ of the SAFA (Synchronous Area Framework Agreement for Regional Group Continental Europe) Treaty sets out the reference rules for system operation by the national SEPS transmission system operator in emergencies and large-scale system failure recovery processes or ‘black-out’.

Petroleum

Oil deliveries to and transit through Slovakia are relatively reliable and relatively fluent, in line with the volumes agreed in the contracts concluded between Slovak and Russian companies, despite the ongoing war conflict on the territory of Ukraine and the resulting sanctions of the European Parliament and the Council. The supply of crude oil has so far been provided in accordance with the Agreement between the Government of the Slovak Republic and the Government of the Russian Federation on cooperation in the long-term supply of crude oil from the Russian Federation to the Slovak Republic and the transit of Russian oil through the territory of the Slovak Republic, which entered into force on 1 January 2015 and expires on 31 December 2029.

Slovakia has a strategic geographical location and a relatively large transport capacity on the Družba pipeline to meet the needs of Slovakia, the Czech Republic and, in part, the Republic of Hungary. As regards the transport of oil from the sea coasts to the territory of Slovakia and ensuring the diversification of such transport, Slovakia's position in terms of access to such pipelines with sufficient capacity is not ideal.

Nevertheless, Slovnaft, a.s., as a dominant Slovak oil importer, as well as a producer and distributor of petroleum products in the Central European region, is making every effort to gradually replace Russian oil with alternative oil from other parts of the world. This requires access to sufficient transport capacity of the Adria pipeline, in addition to investments in technologies in the Bratislava refinery, which will ensure flexibility in the processing of different types of terrain.

Gas

Following the beginning of the conflict between Ukraine and the Russian Federation, it became clear that there was a need to ensure further gas supply possibilities from other producers.

Several possibilities for pipeline gas imports are available, but LNG supplies are also becoming significant in the context of the significant development of the necessary regasification infrastructure in maritime states.

Another factor for diversification is the fact that the transit contract between Ukraine and Russia was in force only until the end of 2024, and it is difficult to predict whether it will be renewed.

From a technical point of view, Slovakia is ready to supply gas from other producers thanks to the implemented projects that have linked our transmission network to the transmission networks of all neighbouring countries. This means that gas imports can be technically secured from all directions.

At the same time, since the beginning of the war in Ukraine, much has changed in terms of our unilateral dependence, especially in the area of natural gas imports. The transport of Russian natural gas by the Ukrainian pipeline system was stopped in January 2025 and the possibilities for Slovakia to resume natural gas supplies on this route are not yet predictable. Ensuring a sufficient supply of natural gas for future periods is therefore a challenge for the EU as a whole.

The Slovak Gas Industry, a.s. (SPP), with a market share of around 60 %, is actively discussing other possible sources of supply and contributing to the aggregation of demand in the EU according to the relevant European legislation. Various forms of possible participation in different LNG projects (FSRUs) in the EU are currently being considered and would further contribute to security of supply.

The CAP has signed Memoranda of Understanding with a number of companies from Italy, Poland and Germany that could ensure access to LNG terminal regasification capacities and possible gas supply to Slovakia. The above steps have been taken to ensure that Slovakia's energy independence is strengthened. In parallel, negotiations are also ongoing with LNG producers from the US, Qatar, Asia and Africa.

The CAP has signed new diversification contracts with the largest international natural gas suppliers for 2023 and 2024. By concluding these diversification contracts, SPP is now able to cover around 70 % of its customers' consumption from non-Russian sources.

Reducing import dependency can be achieved in a cost-effective manner and, in a relatively short period of time, also by using biomethane, the potential of which is estimated at around 8 % of current natural gas consumption. At the same time, gas companies are implementing projects that explore the technical possibilities for the use of blending hydrogen with natural gas.

As regards bilateral agreements concerning technical, legal and financial arrangements between Member States for the purpose of applying the solidarity mechanism, Slovakia has consulted the Czech Republic, Hungary and Austria.

The solidarity mechanism currently applies Articles 26-28 of Council Regulation (EU) 2022/2576 of 19 December 2022 to enhance solidarity through better coordination of gas purchases, reliable price benchmarks and exchanges of gas across borders, the effectiveness of which was extended until 31 December 2024 by Council Regulation (EU) 2023/2919 of 21 December 2023 amending Regulation (EU) 2022/2576 as regards the extension of its period of application.

ii. National objectives with regard to increasing: diversification of energy sources and supply from third countries

countries; for the purpose of increasing the resilience of regional and national energy systems

Electricity

In order to diversify the nuclear supply chain in order to ensure the flexibility and long-term supply of nuclear materials, fuel, spare parts and services to VVER-440 units, new nuclear units under construction and planned units, as well as the long-term management of nuclear waste, it is appropriate to provide long-term political support for the future of nuclear energy at both national and European Union level. Such actions will encourage the interest of financial institutions in long-term investment, as well as of manufacturing companies themselves that have previously supplied nuclear materials, fuels, spare parts and services for VVER-440 units, or new nuclear units, so that they are more active and can rebuild strong supply chains at European level. The declared clear interest on the part of the State and the European Union will increase the attractiveness of the whole nuclear segment in the long term, as well as the interest of studying in relevant fields of study, which is crucial for nuclear energy.

Only some spare parts from alternative suppliers are available on the market, such as several firms in Slovakia, the Czech Republic. Most spare parts are from the Russian Federation. SE, a.s. currently only uses spare parts and maintenance services from suppliers from the Russian Federation, which are critical for the safe operation of their nuclear facilities. Expanding cooperation with VVER440 operators in Eastern and Central Europe is one of the means of potentially diversifying dependencies related to spare parts and subsystems, structures and maintenance service components.

Petroleum

The Družba oil pipeline in Šahach connects the Adria pipeline, which starts at the Croatian port of Omišalj and ends in Slovakia at the Tupá pumping station. The Adria pipeline is bidirectional in this section. However, in the near future, it is envisaged to use this interconnection mainly in the HU-SK direction for the supply of alternative oil blends as a partial substitute for the supply of crude oil from the Russian Federation. The maximum transport capacity of this part of the Adria pipeline is approximately 5.2 million tonnes per year. In Hungary, the Croatian border – Százhalombatta – has a transport capacity of approximately 11.0 million tonnes per year on the route, while the pipeline itself is estimated at around 14 million tonnes per year. The reduction in the transport capacity of the Adria pipeline is due to restrictions on the territory of Croatia. The reported available transport capacity of the Adria pipeline is sufficient to fully supply the MOL refinery in Hungary and to cover Slovakia's domestic consumption.

The surrounding countries in the region are not self-sufficient in oil fuel production. As a member of the MOL group, Slovnaft, a.s., is the only export refinery in the region and assumes responsibility for ensuring security of supply. The operator of the Croatian oil pipeline system JANAF closed 11. 4. 2024 with the MOL Group, short-term contracts for the transport of 2.2 million tonnes of oil from the Croatian seaport on the island of KRK, as well as contracts for the storage of 79 385 m 3^{oil} at the Omišalj terminal and 70 000 m 3 at^{the} Sisak terminal until 31. 12. 2024. These contracts were signed despite the fact that due to the unresolved Croatian-Hungarian political issues arising from the privatisation of the Croatian petrochemical company INA, the charges for the transport of oil through Croatian territory are multiple times higher than in the surrounding countries.

Exports are important for Slovnaft, a.s., because it does not confine its production to the Slovak market alone. Slovnaft, a.s. is a key exporter to Czechia, accounting for 20 % of the missing diesel on the Czech market. On the basis of the extension of the exemption for imports of Russian oil products into Czechia, the refinery may export these products to CZ until 5. 12. 2024. When the derogation expires, Slovnaft a.s. will be forced to import alternative oil from other countries around the world via the Adria pipeline from Croatia.

Gas

Slovakia is an important transit country for natural gas in the directions East-West, West-East and North-South.

Steps are being taken, both on the part of the State and on the part of the gas companies, in order to secure gas supplies, so that the Slovak Republic will be better prepared for possible gas supply problems. These measures aim at transporting gas supplies from other directions/states, including securing auxiliary gas supplies through reverse flows from the Czech Republic and Austria. In particular, the medium and long-term measures aim at strengthening the interconnections of transmission networks providing possibilities for the diversification of gas supplies and the construction or expansion of gas storage facilities in Slovakia in the appropriate geological structures currently available.

Slovakia supported interconnection projects with Poland, Hungary, as well as reverse flow projects from the Czech Republic and Austria (which were carried out only on the territory of those Member States but with a direct impact on the possibility of using reverse gas flows in Slovakia). It also supported a technical adjustment project to enable reverse flow in the Slovak transmission network operated by eustream, a.s. and NAFTA a.s., which will allow for an increase in the volume of gas supplies from the storage to the transmission network in times of crisis.

Under the Slovakia-Hungary Interconnection Project, after the successful completion of construction and testing operations, the pipeline was brought into standard commercial operation on 1 July 2015. After the entry into commercial operation of the Slovakia-Poland interconnection in November 2022, the Slovak transmission network is connected to all neighbouring transmission networks and is ready to import gas from all directions.

Increase of fixed transmission capacity at Veľké Zlievce interconnection point:
Due to expected changes in natural gas flows within Europe, an investment project was launched to increase the fixed transmission capacity at the Greater Zlievce interconnection point. The increase in transmission capacity at this interconnection point occurred on 1 February 2024.

The implementation of the project will contribute to:

- further effective diversification of natural gas sources (through connection to the project RO-HU), which will also increase the intensity of competition in the internal energy market;
- creating a platform for a competitive, liquid internal gas market enabling market entry of new players;
- enhancing the security of natural gas supply in the Central and Eastern Europe region;
- new opportunities for price arbitrage in Central European gas hubs;
- ensuring more effective crisis response mechanisms on a reciprocal basis cooperation and, in particular, using existing mechanisms (transmission networks).

Increasing the reverse flow of natural gas in the direction of Ukraine:

Since the construction of the pipeline connection and the gas metering station at the compressor station site at Veľké Kapušanoch in 2014, Eustream is ready to ensure, through the exit point Budince, a flow of natural gas in the direction of Ukraine of 14.6 billion m^3year (of which 9.9 billion m^3/year is fixed transmission capacity and the remainder interruptible transmission capacity).

In the context of a possible increase in gas transmission in the SK-UA direction, Eustream completed the preparatory and engineering activities of the project 'Reverse flow of natural gas in the direction of Ukraine'. Currently, given the ongoing conflict in Ukraine, coupled with a decline in demand for capacity, there is no presumption of interest in this project. For the above reasons, the project is temporarily suspended.

III. Where appropriate, national objectives with a view to reducing dependence on energy imports from third countries to increase the resilience of regional and national energy systems

Petroleum

Due to diversification, the affordability of crude oil and the utilisation of refinery capacity in Slovakia, as well as the existing robust infrastructure of the Družba pipeline in the territory of Slovakia, negotiations are ongoing with the Ukrainian side to ensure the further use of the Druzhba pipeline to transport crude oil other than crude oil supplied from the Russian Federation. As part of the REPowerEU plan, Slovakia is diversifying the supply of crude oil through the Družba oil pipeline and upgrading the refinery on its territory to also process alternative sources. Significant progress includes modernisation of the Adria pipeline and increased capacity for oil imports from countries such as Kazakhstan, Iraq and Azerbaijan. The significant investments made by the refinery in our territory in modernisation enabled about 30 % of the oil supply to be diversified.13

Before the outbreak of the war in Ukraine, Slovnaft, a.s. processed almost one hundred percent of Russian oil. In the meantime, the refinery has tested up to a sixth of new jets (from Kurdistan, Caspian, Azerbajjan, Libya, Oman and USA) which flowed to Slovakia from the Croatian port of Omišalj via the Adria pipeline.

Due to the need to meet the logistical, technological needs of the oil carrier on the territory of Slovakia and possible changes in the storage of emergency oil stocks, including their renewal, Transpetrol is preparing the construction of new large-scale oil storage facilities on the sites of the Tupá and Bučany pumping stations. These bunkers will significantly contribute to increasing the flexibility of oil transport logistics, as there is a high probability of transporting different oil blends as a substitute for the Russian

13State of play in June 2024

export mix. For this project, TRANSPETROL a.s. will seek different ways of co-financing through different funds (e.g. EU funds).

Diversification of natural gas routes and sources

Solidarity Ring

The objective of the project is to provide an import route for gas supplies from Azerbaijan with an estimated volume of 5-20 billion m 3/year when the transmission network is modified[as] a minimum. The implementation of the project would connect the existing key infrastructure in Slovakia, connected to the Western gas hubs, with the gas infrastructure in Hungary, Romania, Bulgaria, Türkiye and gas sources in the Caspian area. This solution would help in an efficient way to enhance the diversification of gas transmission routes and sources in Central and South-Eastern Europe regions, which are heavily dependent on Russian gas supplies and sensitive to their potential outage. The implementation of the project would significantly strengthen the EU's efforts to diversify gas routes and sources in this area and would also be one of the tools for fulfilling the Memorandum of Understanding on a Strategic Partnership on Energy signed on 18 July 2022 between the European Commission and Azerbaijan to increase gas imports to Europe. The project is at an early stage of preparation. In time, Ring's solidarity is a quicker solution for ensuring security of gas supply, especially for the Central European region, compared to the Eastring project, as it is about using already existing infrastructure and not implementing a new line.

A Memorandum of Understanding was signed in Sofia on 25 April 2023 to promote cooperation between natural gas transmission system operators from Bulgaria (Bulgartransgaz EAD), Romania (Transgaz S.A.), Hungary (FGSZ Ltd.), Slovakia (eustream, a.s.) and Azerbaijani energy company SOCAR. The Memorandum concerns their joint initiative, supported by the European Commission, "Solidarity Ring", which aims to increase the security of natural gas supply for the EU and in particular for the Central and South-Eastern Europe region. The Solidarity Ring project foresees the use of modernised transmission systems of Bulgaria, Romania, Hungary and Slovakia, which will allow additional natural gas supplies from Azerbaijan.

Energy transition of the transport system, in particular for hydrogen

As part of the long-term development of the transmission network, eustream sees the potential for further greening of energy, including a strategy for the use of hydrogen in the European Union, the use of biomethane, the reduction of methane emissions and carbon capture and storage. These technologies can potentially represent not only an important decarbonisation contribution, but also an opportunity to further exploit gas infrastructure and new investments. Moreover, the implementation of development projects with an environmental focus will be a necessary step towards meeting the environmental objectives of the European Union. For this reason, Eustream is planning to implement a number of projects for the energy transition of the transmission network in the coming years, which can be summarised in the following categories:

- Reduction methane emissions
- Increase energy efficiency transport networks
- Transport natural gas with an admixture hydrogen
- Transport pure hydrogen

Transport of natural gas with hydrogen admixture

Eustream pays significant attention to the European strategy for the use, production and transport of hydrogen. Within the company, an analysis of the possibilities for future hydrogen transport in the transport network is ongoing. Initial analyses focused on the maximum permissible hydrogen admixture content in natural gas, so that hydrogen can be safely transported with already installed technologies. The results of the ongoing analyses have identified measures and projects that will ensure the readiness of infrastructure to transport a blend of hydrogen with natural gas as required by the EU legislation currently under preparation. The above measures are and will continue to focus in particular on commercial, measuring, security and safety devices. The analyses will be gradually complemented with new information from which it will be possible to change the hydrogen blending strategy in natural gas in order to efficiently and safely increase the content of transported hydrogen in natural gas in future periods. The implementation of projects classified in this category will allow the transport of permissible concentrations of hydrogen blended into natural gas within the gas transmission network of the Slovak Republic. The transport of natural gas with hydrogen admixture will reduce the negative environmental impact of fossil fuels and meet the European Union's energy and environmental objectives.

Transport of low-carbon hydrogen

In September 2021, Eustream, EP Infrastructure, NAFTA and RWE Supply & Trading signed a Memorandum of Practice on exploring the possibility of developing state-of-the-art low-carbon hydrogen production facilities in eastern Slovakia. RWE Supply & Trading intends to source and import produced hydrogen into Germany and other key RWE markets in Western Europe. Hydrogen should be transported to Germany via the modified Eustream pipeline. Carbon dioxide captured in hydrogen production could be stored in depleted natural gas deposits in Slovakia or in neighbouring countries of Central and Eastern Europe, including Ukraine. Partners want to contribute to accelerating the start-up of the hydrogen economy and make a significant contribution to Europe's decarbonisation objectives. In 2024, the project was suspended.

Project H2I – T

In order to achieve the objectives of the European Union and to have a significant impact on economic growth, sustainability or EU-wide value creation in the transformation of the economy leading to the reduction of greenhouse gas emissions, Eustream has engaged in the process of obtaining IPCEI status for research into the impact of hydrogen on the transmission network components used to transport natural gas, through the construction of a testing polygon, including laboratory and practical research.

If the European Commission considers the proposed H2I-T project to be sufficiently innovative, Eustream may have access to sources of co-financing from the Slovak State budget for this project.

Repurposing one line to hydrogen – Slovak Hydrogen Backbone

Eustream has become part of several hydrogen initiatives in the central Europe area and the company's transmission system should form an integral part of the European Hydrogen Backbone, which will transport significant volumes of hydrogen that will flow across all border interconnection points of the transmission network. The EU's energy transition and the development of electro-mobility will require large amounts of energy to be imported from outside the EU. Such sites are foreseen to include North Africa, Ukraine, the Balkans and the potential Middle East. Two projects for the construction of new compressor stations powered by compressors will provide a potential increase in hydrogen transport capacities. The transformation will entail significant investment costs, mainly for the replacement, retrofit of unsuitable system components and the construction of new hydrogen-related compressor stations. Slovak Hydrogen Backbone, in the process of selection and processing of Important Projects of Common Interest (IPCEI), also known as the H2I-TR project, was included in the 3 rd IPCEI list of hydrogen technologies projects approved by the European Commission on 15 February 2024. By repurposing one of the existing gas lines connecting Ukraine to the east with the Austrian and Czech transmission networks in the west with planned operations in 2030, the H2I-TR project was included among 33 projects from 7 countries on the IPCEI list to support hydrogen infrastructure and increase the supply of renewable hydrogen.

Hydrogen projects at distribution network level

The largest gas distribution system operator SPP – Distribution, a.s. is ready to upgrade existing as well as build new hydrogen-ready infrastructure, i.e. to ensure the transformation of existing natural gas infrastructure into hydrogen. Slovakia's demand for gaseous fuel energy is higher than that for electricity, therefore there is considerable potential for a large amount of hydrogen need. Significant volumes will need to be imported from abroad via the international hydrogen backbone corridor.

The projects aim to build hydrogen infrastructure from hydrogen backbone to Slovakia's largest industrial customers and large Slovak cities, enabling the gradual transformation of the distribution network from natural gas to hydrogen.

Figure 1: Hydrogen projects CAP-distribution a.s. (hydrogens)

Source: CAP – Distribution, a.s.

❶ H2 – Seeds:
New high-pressure pipeline DN350 PN40 using the existing Methane Pipeline DN300 PN25 route currently planned to be reconstructed (originally built in the 1950s). The length of the main route shall be 150 km and the length of connection pipes shall be at least 50 km.

❷ H2 – Záhorie-Bratislava-Duslo-Ivánka pri Nitre:
Repurposing of 67 km of high-pressure pipeline DN700/DN500 Láb – New Dedinka-Slovnaft – connection of the Slovnaft refinery and other large gas customers – the potential emergence of the Bratislava Hydrogen Valley.

New high-pressure pipeline DN700/DN500 PN40 using the current route of the existing methane pipeline DN500 PN40 with a length of 84 km:

Consumer	Industrial sector	Length of H2 gas pipeline DN500-700 PN40 (from H2-backbone line) in km

Duslo Šaľa	Fertilisers	16
Slovnaft MOL Group Bratislava	An oil refinery	68 (possible extension of the pipeline from Duslo Šaľa to New Village) – Broadcasting of Bratislava by H2-backbone pipelines in 2 directions

❸ H2 – Košice-Prešov:
The new high-pressure gas pipeline DN500 PN40, using the current route of the existing methane gas pipeline DN500 PN40 to U.S. Steel Košice, s.r.o., further to Košice with a length of 32 km and subsequently using the existing (currently reconstructed) methane pipeline DN500 PN40 to Prešov. Potential emergence of the Košice region hydrogen valley.

Domestic gas extraction

There is domestic gas extraction in Slovakia. It accounts for up to 2 % of total gas consumption. In the long term, it is foreseeable that the extraction of natural gas from current sources will continue, with a decreasing trend. This trend may only change if new deposits are discovered, though the volumes extracted will depend on the scope, nature and location of those new deposits. The economic difficulty of extracting such deposits will also be a non-negligible factor. NAFTA a.s. carries out a number of exploration wells in different parts of the country. Despite today's low gas extraction, there is considerable potential in Slovakia, so it is efficient to take measures to support gas extraction. The potential for extraction is up to 10 % of Slovakia's annual consumption.

Underground gas storage facilities

Slovakia has a number of suitable geological structures that are used or can be used as underground storage facilities for natural gas.

We see underground storage as the most important tool for ensuring the security of gas supply and thus the resilience of energy systems. In Slovakia, two companies operate underground storage facilities – NAFTA a.s., Bratislava and POZAGAS a.s., Malacky. The total storage capacity in the Slovak Republic is 37 137 GWh (data of operators on 1 May 2023) (i.e. 3.5 billion m 3)' with a maximum daily fixed production capacity of almost 490 GWh (over 46 million m 3)and a maximum daily fixed injection capacity of more than 410 GWh (38 million m 3).

The Dolní Bojanovice (on the territory of the Czech Republic) underground storage, operated by SPP Storage s.r.o., Prague, with a capacity of 6 944 GWh (0.65 billion m 3), is also used for Slovakia's needs, with a maximum daily extraction capacity of about 95 GWh (8.8 million m 3). This storage facility is connected to the Slovak gas network and is independent of the interconnection technologies used by NAFTA a.s. and POZAGAS a.s., at the same time, it has a high degree of flexibility and it is possible to change the gas injection regime to the production mode and vice versa in a relatively short period of time.

Projects to convert other suitable geological structures into underground gas storage facilities or other energy-related uses, such as NAFTA a.s., are also at different stages of development:

a) H2I S&D project (HENRI)

NAFTA a.s. successfully participated in an IPCEI (Important Projects of Common European Interest) status in hydrogen technologies. The project was notified by the European Commission on 17 June 2022. The aim of the project is to identify a suitable storage facility for hydrogen in a mixture with natural gas, possibly in pure form, and to identify the maximum possible concentration at which it could be stored in a porous type of deposit. The first phase of the project is dedicated to finding suitable deposits for the storage of hydrogen blended with natural gas. In the second phase of the project, a pilot test technology will be developed, whereby hydrogen will be produced by electrolysis of water and then in a clean form or defined concentration (output from the first phase of the project) blended with natural gas and stored in the deposit. The unique data generated by the project will allow a comprehensive picture of how hydrogen or its mixture can be stored in specific rock structures. This project was also included in the TYNDP 2024.

b) Retrofitting UGS Lab

This is a project by NAFTA a.s. which aims to enable the storage of natural gas in a blend with hydrogen of 5 % H2 on the existing PZZP Láb Complexex storage facility. The project includes an assessment of the complete infrastructure in terms of suitability for gas storage with 5 % hydrogen, identification of components for replacement and materials leading to safe and reliable operation of the storage facility for the mixture by 2030 at the latest. This project was also included in the TYNDP 2024.

c) UGS Veľké Kapušany

This is a project for the construction by NAFTA a.s. of a new underground energy storage system Veľké Kapušany in eastern Slovakia, in the geological structure of Ptrukša (technical parameters envisaged: working volume of 3 122 GWh, extraction and injection capacity 34.44 GWh/day) in Great Corušan. The storage facility should store a mixture of natural gas with hydrogen of at least 20 % hydrogen. The project is located directly near the Ukrainian-Slovak entry/exit point Veľké Kapušany and at the centre of the NSI East gas corridor and the HI EAST hydrogen corridor.

Storage of a mixture with a higher concentration of hydrogen or possibly pure hydrogen will only be possible based on positive results from the HENRI Project. The project will thus support the priority energy and hydrogen corridor of the European Union (Corridor E-EAST and SOUTH EAST) in line with Repower EU and European Hydrogen Backbone and the revised Regulation on guidelines for trans-European energy infrastructure. It is strategic to locate the project on the eastern border of the European Union, in close proximity to one of the natural gas gateways and in the future of hydrogen or other renewable gases to the EU. There is currently no storage capacity in this area of Slovakia. The construction of an underground reservoir with direct connection to the Veľké Kapušany compressor station will strengthen the position of the Veľké Kapušany power hub. In addition, the project considers the possibility of energy storage in the form of a blend of natural gas and hydrogen. Hydrogen storage in a blend with natural gas has the potential to increase the development of the use of renewable energy sources, as such a storage facility eliminates the disadvantages of these energy sources (volatility of the amount of energy obtained from renewable sources) and allows for the long-term storage of renewable energy sources.

IV. National objectives with regard to increasing the flexibility of national energy system, in particular through the deployment of indigenous renewable energy sources, demand response and energy storage

Electricity

The main objective of the Slovak Republic in the area of energy security with a view to increasing the flexibility (flexibility) of the national energy system is to ensure that support services are sufficient in view of the expected evolution of the Slovak electricity production and consumption balance, including the expected increase in RES production by 2030.

The Slovak Republic will also evaluate the need for flexibility and set an indicative national target for non-fossil flexibility under Articles 19e and 19f of Regulation (EU) of the European Parliament and of the Council amending Regulation (EU) 2019/943 of the European Parliament and of the Council on the internal market for electricity adopted as part of the reform of the electricity market design in 2024 (Cap. 2.4.3.i National objectives relating to other aspects of the internal market, such as increasing the flexibility of the system).

In the context of increasing the **flexibility of the energy system**, it is necessary **to ensure sufficient flexibility of the electricity** market for market participants, primarily those with variable power generation resources. The basis for this flexibility is trading as close as possible to the physical supply time of electricity, as variable generation cannot be accurately planned over a longer time horizon. Attention will therefore be paid to the development of trading opportunities and their rules, in particular through intraday and balancing markets. This was completed on 1. 10. 2022, when Slovakia joined the international XBID platform, which allows trading electricity on day D. This connection allows trading for 15 min or 1 hour of trading derivatives, which proves to be highly liquid for the needs of electricity traders from Slovakia's Regulatory Area.

In connection with increasing the flexibility of the electricity system, Slovakia's intention was to create, in accordance with the overriding European legislation, conditions for the provision of ancillary services enabling the **aggregation** of demand facilities, energy storage facilities, facilities for converting electricity into another form of energy (Power-to-X) and power-generating facilities for the purpose of offering balancing services, on the basis of clearly defined rules. In addition to the above, the task was to establish rules and appropriate conditions allowing demand facility owners, third parties and owners of electricity generation facilities from conventional and renewable energy sources, as well as owners of energy storage units, to become balancing service providers.

These objectives have been met through the ES SR Transmission System Operator (SEPS), which is responsible for maintaining a balanced power balance. Since the beginning of 2023, as part of the harmonisation of types and requirements for ancillary services, the provision of PSPs with a regulatory capacity of 1 MW or more has been allowed to participate as an aggregation within the control unit for installations with a regulatory contribution of 0.01 MW or more. From a technology perspective, it is possible to provide flexibility on all types (production, offtake, storage) and their combinations. In the same vein, the provision of SSPs from a decommissioned state or operational status is allowed, which has increased the possibilities and opportunities for all market participants. The objective was to ensure full and equal access for all technologies and providers, including renewables, to balancing markets.

The PS operator shall dimension the need for ancillary services in line with the requirements of COMMISSION REGULATION (EU) 2017/1485 (SO GL) and COMMISSION REGULATION (EU) 2017/2195 (EB GL). Slovakia's difficulty in providing flexibility in electricity generation is the low installed capacity of power plants, which can respond flexibly to current grid requirements. Together with the increasing share of volatile renewables in electricity generation, there are growing requirements to secure volumes of some types of ancillary services. The PS operator will take into account the tools for assessing flexibility needs and dimension the need for flexibility and ancillary services in accordance with the ENTSO-E methodology approved under Regulation (EU) 2024/1747. In these months, there are also difficulties in activating a high PpS volume due to the occurrence of positive or negative balance sheet incidents. Any rapid uncoordinated expansion of the connection of photovoltaic and wind power plants will be linked to increased demand for ancillary services and, for its further development, it will be necessary to ensure the operation of resources with adequate regulatory capabilities or to link the operation of photovoltaic and wind power plants to the operation of energy storage and/or power-to-X facilities in order to eliminate unpredictability of supply to the grid.

The challenge for increasing national ambition for solar and wind power generation is their variable generation and the existing electricity generation structure, where 61 % of electricity is generated from nuclear power. For 2030, the share of RES in electricity consumption was set at 26.3 %. Variable sources with high fluctuations of electricity generation have a significant impact on ensuring sufficient ancillary services.

Flexibility in the electricity system can be achieved in several ways:

- the construction of new flexible production resources and the modernisation of existing resources;

  providing flexibility
- interaction with other energy vectors (power to X, heat)
- limiting the production of RES
- transforming biogas stations with continuous electricity production into production biomethane with flexibility for the electricity sector
- development of electricity storage sites (batteries, FBOs)
- increasing the capacity of transmission and distribution lines;
- offering demand flexibility from customers (industry, aggregation)

For Slovakia, there is neither a reference study setting out the flexibility needs at different time horizons (daily, weekly, monthly) nor a reference study setting out optimal flexibility contributions from different sources. Partly, but based on studies carried out for the whole of the EU. A study by the Joint Research Centre 'Flexibility requirements and the role of storage in future European power systems' estimates a high increase in the flexibility needs of the Slovak electricity system. At the same time, the study shows that by 2030 the Slovak pumped hydroelectric power plants (PVE) should be sufficient for flexibility needs to be used more intensively, in line with ENTSOE and SEPS simulations.

The increased use of Slovak EGPs means that, in order to further develop flexibility in the Slovak electricity system, it is appropriate to consider the modernisation of the existing TE and TE. An increase in installed capacity, an increase in overall efficiency, a regulatory scope or an operational maximum also increases the overall amount of flexibility that can be provided by the EGD.

Another source of new flexibility could be to resolve sedimentation in water reservoirs, which could significantly increase their stock volume and thus the volume of electricity stored.

The economically efficient development of the flexibility of the electricity system could provide for the addition of heat storage to existing DHCs.

An important element in providing flexibility to the electricity transmission system is the operation of the Montenegrin Váh PES. The Montenegrin Váh was designed 50 years ago for a different type of operation than will be needed after 2030 with a high share of RES. In view of its ending lifespan in 2032, it is desirable to upgrade it to allow it to continue operating with significantly improved parameters, following the example of the modernisation of similar RES built in the 1970s and 1980s. Such modernisation has the potential to effectively address future flexibility and CSR needs.

The planned SE Integrator project, which focuses on the ambitious modernisation of the Montenegrin

VAH, is therefore key in this regard.

SE Integrator project

SE Integrator is a unique hybridisation project consisting of the upgrade of a pumped hydropower plant ('PVE') of Black Váh with an installed capacity of 735 MW and the construction of a battery storage facility with an installed capacity of up to 80 MW. The project promoter is Slovenské elektrárne, a.s. (SE,a.s.). The project is expected to be implemented by 2030.

The SE Integrator is part of ENTSO-E of the 2022 Ten-Year Network Development Plan ('TYNDP 2022') and was included in the 6th European Union PCI list in November 2023.

The modernisation under the SE Integrator will extend the operating life of the Black Váh PES for at least 25 years and, together with the integration of the battery storage site, will allow, in the context of an increasing share of RES, to ensure in an efficient manner the needs for flexibility and ancillary services for the Slovak electricity system. The SE Integration project will provide flexibility in the form of ancillary services (FCR, aFRR, mFRR, voltage control, black start service), which are crucial in the context of the impact of increasing the share of RES, decarbonising the energy-intensive industry and shutting down fossil power plants, which are currently the largest provider of these services.

The SE Integration project will combine state-of-the-art PVE technology for two out of six ternary pumping units with the construction of a battery storage site. This unique hybridisation and coordinated operation will create synergies between the two technologies – a huge energy reserve in the upper reservoir (up to 4 GWh) with a rapid reaction time of the battery. It is this synergy that will provide flexibility in the form of support services (FCR, aFRR, mFRR, voltage control, black start service), thus enabling the integration of large amounts of renewable energy sources. The projected implementation of the project is set for 2030.

Under the Slovak Recovery and Resilience Plan, Component 1 (POO SR K1 – Renewable Energy Sources and Energy Infrastructure) includes investments in new sources of electricity generation from RES, modernisation of existing hydropower plants and biogas stations, transformation of biogas stations into biomethane stations, as well as **support for installations increasing the flexibility of the Slovak electricity system** (battery storage sites, hydrogen electrolysis plants and modernisation of pumped-storage hydropower plants). The structure of the POO K1 consists of a set of reforms and investments. In total, these are investments of more than EUR 202 million for the construction of:

- 120 MW of new RES resources (C1, Investment 1),
- 83 MW of modernised RES installations (C1, Investment 2) and
- 52 MW of installations increasing system flexibility (C1, Investment 3).

The development and modernisation of the electricity grid, and the consequent investments in distribution grids, are key to further integrating RES and achieving the green transition objectives. The investment aimed at further developing and modernising the electricity transmission system, followed by investments within the different regional distribution networks, aims to increase the technical capacities for further RES integration and accelerate it. Here, as part of the new REPowerEU chapter of the Slovak recovery and resilience plan, reform 1 and investment 1 aim to ensure the technical capacities of the electricity system for connecting RES, which are essential to achieve carbon neutrality by 2050. The total allocation for the investment amounts to EUR 133 million, corresponding to approximately 36 % of the allocation of the grant part of REPowerEU. In addition to the further development of RES, including increased energy security and diversification, measures in this area will ultimately contribute to reducing Slovakia's dependence on Russian fossil fuel imports and meeting the targets for a 55 % decrease in EU greenhouse gas emissions by 2030 and achieving EU carbon neutrality by 2050.

In July 2022, Slovakia transposed into law the requirements stemming from the ‘Clean Energy for All Europeans’ package in the field of electricity market design, including provisions on aggregation and the provision of flexibility (recast EP and Council Directive (EU) 2019/944 and related provisions of Regulation (EU) 2019/943 of the European Parliament and of the Council on the internal market for electricity), by amending the Energy Act (Act No 256/2022) and by amending secondary legislation (in particular through Decree No 207/2023; laying down rules for the functioning of the internal market in electricity and Decree No 246/2023 establishing price regulation in the electricity sector and adjustments to tertiary legislation (Technical conditions for access and grid connection and system operation rules for transmission and distribution system operators and OKTE short-term electricity market operator operating rules), which, together with the implementation of the new model for the provision and exchange of data in the electricity market (Energy Data Centre – EDC), should enable the effective functioning of new active elements and activities on the electricity market, which support increasing flexibility in Slovakia’s electricity system.

The new electricity market design provides for new activities and actors in the electricity market, including aggregation and the provision of flexibility, in particular in relation to the integration of RES. Several of these new activities cannot be efficiently implemented and operated without centrally adjusting data flows (RES sharing, storage, energy communities, active customers). Investment 1 of the Slovak Recovery and Resilience Plan (REPowerEU Plan chapter) responds to this need in its last part by supporting the creation of an Energy Data Centre (“EDC”), which aims to streamline and accelerate the access of new entrants to the electricity market. The launch took place in several stages. From 1. 7. 2023 allowed the registration of new market participants. Full EDC functionality was achieved 1. 7. 2024, when new methods of calculation of sharing and the introduction of aggregation into aggregation blocks were launched. As a result of this functionality, sets of one or more selected demand and handover points can sell flexibility on organised electricity markets or ancillary services market, or to minimise imbalance. The aggregation unit is managed by an aggregator through a management terminal as a whole.

Gas

There is a need to create a suitable environment for the flexibility of storage operators and for energy storage. The benefits of underground storage in Slovakia and the district heating system should be fully exploited.

Slovakia has underground gas storage facilities which are located in the south-western part of the country and play an important role in balancing the imbalance in gas supply and offtakes, as well as in the case of peak offtakes. Gas storage facilities can be considered as the most important tool for the security of gas supply. Currently, their operators also provide natural gas storage services to a number of foreign gas companies.

Sector coupling

The development of energy storage will ensure the integration of variable RES into the grid. Such a system makes it possible to store locally produced energy and, depending on the need to consume it, to consume it. The integration of local energy storage in storage appliances, energy storage facilities and electric vehicles or in the gas distribution network with their storage capacities is therefore an important element of the smart grid. In addition to energy storage, local consumption management concepts are being developed, based on good mapping and analysis of grid ratios, so that electricity at the generation site does not have to be transformed to a higher voltage level and then back to a lower voltage level at the remote point of consumption. Ensuring a flexible, low-carbon and sustainable electricity generation resource base structure requires first and foremost to maintain and support existing hydro-pumped capacity and operation, for example through appropriate upgrades, while improving the storage volume of existing reservoirs that are currently loaded with sedimentation. Another option, taking into account the needs of the source base of all V4 countries, needs to reassess the possible increase in storage capacity through the construction of a new pumped hydropower plant.

Heating

In the heat sector, efficient CZT systems with the supply of heat from RES, waste heat from industrial processes for the economic cost of using RES, in particular locally available biomass/biomethane and waste, including support for multi-fuel systems, as well as heat pumps which, as a form of RES, allow significant cost savings for heat production will be supported. The transition from coal to natural gas will continue to be supported, taking into account that investments in heat production facilities from natural gas must contribute to achieving the Union's 2030 climate target and climate neutrality by 2050 in accordance with Section 4.30 of Annex 1 to Commission Delegated Regulation (EU) 2021/2139 supplementing Regulation (EU) 2020/852 of the European Parliament and of the Council by establishing the technical screening criteria for determining the conditions under which an economic activity qualifies as contributing substantially to climate change mitigation or climate change adaptation and for determining whether that economic activity causes no significant harm to any of the other environmental objectives. As part of the identification and elimination of regulatory distortions leading to resource adequacy issues, options for incentivising the flexible operation of heating plants for regulatory purposes, for example by paying aid for available capacity (in MW) rather than electricity generation (in MWh), will be assessed. Preference will be given to CZT with CHP over fossil fuel power generation without the use of heat. Their operation is necessary so that they can be used as much as possible in the provision of balancing electricity. It is necessary to use heat plant infrastructure and the location of existing high-efficiency cogeneration plants for the integration of RES in the form of electricity and heat production from biogas and biomethane (which originates mainly from waste from crop and livestock production, from the biodegradable fraction of municipal waste, biodegradable kitchen and restaurant waste and waste from waste water treatment plants), for the energy recovery of municipal waste in the circular economy and energy efficient RES installations, meeting sustainability criteria.

2.4. Dimension: internal energy market

Objective in the field of the internal electricity market:

- keep electricity interconnectivity above 50 % for 2030

The objectives in relation to this dimension are:

- ensuring further integration and interconnection of electricity markets, including delivering forward-looking
objectives and targets for building an EU single electricity market in line with directly applicable European legislation
- increasing the flexibility of Slovakia's electricity system with regard to internal market aspects.

Gas market

In relation to the internal gas market, the Slovak Republic:

- ensure the integration of low-carbon and renewable gases (including biomethane) into the system
in accordance with the provisions of the gas package
- promote maximising the domestic potential of natural gas production
- support the continuation of diversification and efforts of other Member States affecting transport
gas into Slovakia or the region of Central and Eastern Europe

2.4.1. Electricity interconnectivity

1. *I. The level of electricity interconnectivity that the Member State aims for in 2030 having regard to the 2030 electricity interconnection target of at least 15 %, a strategy setting the level from 2021 onwards in close cooperation with the Member States concerned, taking into account the 10 % interconnection indicator by 2020 and sorted by urgency;*

Slovakia is currently meeting the 15 % interconnection level target by 2030, set as a share of the net import transmission capacity in the total installed capacity of the power-generating facilities of the Member State. The level of connectivity is growing by building new cross-border interconnections, but is decreasing with the construction of new generation capacities. Slovakia's current connectivity has long been above 50 % connectivity and is not expected to fall below 15 % even in the case of large-scale connection of new RES.

Slovakia also complies with the indicative indicators for the 2030 interconnection target of the Member States of the European Union, according to the Commission report14 of November 2017, according to which the nominal transmission capacity, i.e. the thermal capacity of a Member State's cross-border interconnections, should be at least 30 % of the maximum grid load in the import direction, 30 % of the installed capacity of renewable energy sources in the export direction, and the average annual marginal price differential of trading zones should not exceed EUR 2/MWh.

In the first two criteria, Slovakia will meet the required level of connectivity in the period up to 2030. In case all planned European interconnected grid reinforcement projects are implemented by 2030, the average annual marginal price difference should be less than EUR 2/MWh for neighbouring CZ, HU and UA trading zones, between EUR 5 and EUR 10/MWh for the PL trading zone, and greater than EUR

14European Commission, Directorate-General for Climate Action, Directorate-General for Energy, Directorate-General for Mobility and Transport, De Vita, A., Capros, P., Paroussos, L.et al., EU reference scenario 2020 – Energy, transport and GHG emissions: Trends

10/MWh for the AT trade zone15.

The average annual marginal price in trading areas represents the amount of variable costs and thus depends on the variable costs of the source mix of the Member State. The difference in prices in neighbouring areas indicates a degree of market distortion by limiting transmission. In case there is sufficient capacity on all profiles, the average annual marginal price difference should not be greater than EUR 2/MWh.

2.4.2. Energy transmission infrastructure

i. Key projects covering electricity and gas transmission infrastructure; and where appropriate, modernisation projects necessary to achieve the objectives and objectives in the five dimensions of the Energy Union Strategy

Electricity transmission infrastructure

In the area of electricity transmission infrastructure, the Slovak PS operator (SEPS) in cooperation with the Czech postal operator (ČEPS) is continuing to prepare the planned connection of 1x400 kV Ladce (SK) – Otrokovice (CZ). This project has been included in the list of Projects of Common Interest (PCI). This is an interconnection that would replace the gradually shutdown 220 kV transmission system (PS) on both sides of the SK/CZ border. This profile reinforcement also includes the planned increase of the transfer capability of the V404 Varín (SK) – Nošovice (CZ) line as part of the upcoming renewal on the SEPS side.

SEPS implements an investment measure to remove a bottleneck inside the PS SR on lines 400 kV Veľký Ďur – Levice (V490 and V491), which causes a failure to comply with the SEPS obligation under Article 16(8) of Regulation (EU) 2019/943 of the European Parliament and of the Council on the internal market for electricity to have at least 70 % of the capacity of each PBS line available for electricity transmission. The (investment) solution was chosen to include V492 Veľký Ďur – Horná Ždana do R400kV at Levice's electrical station (ESt) and the V490 Veľký Ďur-Levice interconnector and V449 Veľký Ďur-St. Game. SR/HU (Göd), including modifications of secondary equipment in related ESt SEPS.

Slovakia is connected to Ukraine by a simple 400 kV from ESt Veľké Kapušany (SK) to ESt Mukačevo (UA). Also on the basis of a joint discussion between the governments of the Slovak Republic and Ukraine on 11 April 2024, the project to strengthen the Mukačevo (UA) – Veľké Kapušany (SK) electricity interconnection, to be commissioned at the latest in 2028, became a priority strategic project for cross-border energy infrastructure of European importance. Both SEPS and Ukrenergo operators confirmed this intention by concluding a cooperation agreement. This project is applying for PMI (Project of Mutual Interest) status under the TEN-E Regulation and is included in the Union Ten-Year Network Development Plan 2024 ('TYNDP 2024').

The decarbonisation of steel production in the east of Slovakia and the development of the strategic territory of Valalika (VOLVO car) and other strategic territories in the same node area of the Slovak electricity system will increase and change the nature of the load in this part of Slovakia, and therefore strengthening transmission and distribution capacities with an appropriate structure of electricity generation and storage facilities will be crucial to ensure security of supply and reliable operation of the grids.

Gas transmission infrastructure

In the area of gas transmission infrastructure, several projects have been built (including the Slovak-

15 https://eepublicdownloads.blob.core.windows.net/public-cdn-container/tyndp-documents/TYNDP2020/Foropinion/TYNDP2020_Main_Report.pdf

Hungarian interconnection and the Slovak-Polish interconnection). The transmission network of Eustream a.s. is connected to all the transmission networks of neighbouring States, while ensuring the possibility of reverse flow on those connections.

Different options for using existing transmission infrastructures to secure gas supplies from other sources are currently being assessed. Eustream and other detectors are exploring the possibilities of gas imports from Azerbaijan.

Central European Hydrogen Koridor

The initiative brought together gas transmission system operators from Ukraine (Gas TSO of Ukraine), Slovakia (Eustream), Czech Republic (NET4GAS) and Germany (OGE).

A large gas corridor connecting Ukraine to European demand areas passes through Slovakia and the Czech Republic. At the same time, the Slovak, Czech and German pipelines can be adapted for the transport of hydrogen. Germany is expected to be an important area of hydrogen demand within Europe. In order to meet this expected demand, large quantities of hydrogen imports will be necessary.

It is the new Central European Hydrogen 'motorway' that can be created by adapting the existing transmission network together with targeted investments in new pipelines and compressor stations. This will make it possible to transport hydrogen over long distances and at an affordable price.

Project partners have already started exploring the technical feasibility of establishing a Central European Hydrogen Corridor for the transport of renewable hydrogen from Ukraine to Germany in quantities of up to 144 GWh per day, equivalent to 1.3 million tonnes of hydrogen per year from 2030.

The H2EU + Store initiative, based on a partnership of Eustream, RAG Austria, Eco-Optima, Bayerngas, bayernets, OGE, Gas Connect Austria, NAFTA, MND and partners from Ukraine, targets the entire value chain (from production, transport and storage, including consumers) of the future hydrogen market to import green hydrogen from countries with potentially high green hydrogen production (such as from Ukraine) to Austria and Germany using storage capacities to cover seasonal demand.

The SunsHyne Corridor initiative is supported by 5 leading EU transmission system operators – SNAM, Trans Austria Gasleitung, Eustream, NET4GAS and OGE. The initiative aims to transport green hydrogen from future production areas in North Africa via Italy, Austria, Slovakia and the Czech Republic to areas with expected high demand in Germany and beyond.

The EASTGATE-H2V initiative, in which Eustream participates, is an initiative of the Košice Self-Governing Region for the production, transport and use of hydrogen on the territory of Slovakia.

The SEEHyC initiative, supported by the transmission system operators OGE, NET4GAS, Eustream and FGSZ, is in the pipeline. It aims to implement a hydrogen corridor from production areas to consumption areas in cooperation with Transgaz Romania, DESFA and Bulgartransgaz transmission system operators.

ii. Where applicable, major projects planned in the field of infrastructure other than projects of common interest16

Electricity

The development of the PS SR and the associated need to plan individual investment measures reflect the requirements of both existing and potential new users of the PSR, taking into account the potential development of the Slovak electricity sector in the light of the Slovak strategic documents available, as

16In accordance with Regulation (EU) No 347/2013 of the European Parliament and of the Council of 17 April 2013 on guidelines for trans-European energy infrastructure and repealing Decision No 1364/2006/EC and amending Regulations (EC) No 713/2009, (EC) No 714/2009 and (EC) No 715/2009 (OJ L 115, 25.4.2013, p. 39).

well as the requirements for changing existing PBS infrastructure in order to achieve the projected lives of the facilities and to assess their current state of affairs as non-compliant. The need to extend the PS SR may also be based on the input of PBS users.

Slovakia’s investment needs for the transition to the green economy also include investments in increasing the ability of the electricity system to connect RES installations, including increasing grid flexibility for solar (FVE) and wind (VTE) power plants. The development of the electricity grid needs to be stepped up to increase energy security and promote RES-based electrification. Otherwise, security of electricity supply as well as a reduction in the quality of system operation may be compromised, which may ultimately have a major negative impact on Slovakia’s economy and industry. From the point of view of PBS, the aim is to create conditions that do not go hand in hand with a deterioration in the demand of DSO users to supply electricity. In order to ensure Slovakia’s energy security and resilience, it is crucial to have robust PS with sufficient regulatory performance and adequate DS.

SEPS invests in the conversion of its ESt into remote management with no service. This significantly modernises, digitalises and adapts the ESt to new operational, security and reliability requirements, but also to high energy transmission efficiency requirements. Energy efficiency is essential for long-term sustainability. There will be increased demands on the transmission system in response to the expected challenges of RES integration into the grid. SEPS priorities include investment plans that will ensure:

• replacement of the necessary parts of 220 kV of the transmission system, phased out of operation, 400 kV installations;

• the transition of electrical stations from local and remote control to remote control, including comprehensive upgrading;

• strengthening the PS infrastructure for fulfilling Slovakia’s obligations and commitments under national and international legislation (e.g. NECP targets, FitFor55, REPowerEU);

• adequate capacity for system users, in particular for DS operators (e.g. replacement of transformers 400 kV/110 kV for DS supply to machines with higher installed capacity or projects for the construction of new transformations 400 kV/110 kV for DS supply);

• sufficient capacity of Slovakia’s cross-border profiles for international electricity transmission.

Gas

In the gas sector, in the context of strengthening the internal gas market, a number of measures are expected to be implemented with the aim of:

a) enable and facilitate a liquid and competitive internal gas market environment;

b) enable and strengthen the diversification of routes and sources, thereby increasing the security of natural gas supply through increased flexibility of the gas system;

c) contribute to improving sustainable development in Europe, given that natural gas plays an important role in the European Union’s energy mix in the short and medium term, particularly with regard to economic development and environmental protection,

d) increase preparedness to deal with gas supply crises;

e) create conditions for access to gas infrastructure for low-carbon and renewable gases

As regards interconnection with neighbouring states at transmission system level, there is a connection with each neighbouring country once the Slovakia-Poland interconnection becomes operational. These interconnections make it possible to transport gas from different producers and from different directions.

In June 2024, Regulation (EU) 2024/1789 of the European Parliament and of the Council on the internal markets for renewable gas, natural gas and hydrogen and Directive (EU) 2024/1788 of the European

Parliament and of the Council on common rules for the internal markets in renewable gas, natural gas and hydrogen were adopted. In addition to addressing changed gas issues, both legal acts also deal with the area of low-carbon and renewable gases, which should become part of the gas sector in the context of their access to the grid and blending with natural gas. They are also essential documents to create an internal market for hydrogen. These documents were officially published in July 2024.17

2.4.3. Market integration

I. National objectives relating to other aspects of the internal energy market, such as: increasing system flexibility, in particular in relation to the promotion of competitively determined electricity prices in accordance with relevant sectoral legislation, market integration and coupling, aimed at increasing tradable capacity of existing interconnections, smart grids, aggregation, demand response, storage, distributed generation, dispatching, redispatching and curtailment mechanisms, real-time price signals including a timetable for achieving the objectives

Electricity market

In the field of the internal market in electricity, in line with Slovakia's energy policy priorities set out in Chapter 1.1, the aim is to:

- **increasing the integration of renewable electricity** (RES-E) into the electricity grid and into electricity markets (see cap. 2.1.2 Renewable energy; cap. 2.4.3.ii National objectives regarding non-discriminatory participation of renewable energy in all energy markets; and a cap. 2.4.3.iii. National objectives with regard to ensuring consumer participation in the energy system and the benefits of self-generation)

- ensuring further integration and interconnection of electricity markets, including delivering forward-looking
objectives and targets for building the EU's single electricity market in line with directly applicable European legislation (see Chapter. 2.4.3.i National objectives for integration and market coupling and increasing tradable interconnection capacity).

- **increasing flexibility in Slovakia's electricity system** in view of the expected increase in electricity generation
RES by 2030 (see chapter. 2.3.iv National objectives with regard to increasing the flexibility of the national energy system; and a cap. 2.4.3.i National objectives relating to other aspects of the internal market, such as increasing system flexibility)

- ensuring the resource adequacy of Slovakia's electricity system at national level;
ensuring self-sufficiency in electricity production and an adequate EC SR pro-export balance (see chapter. 2.4.iv National objectives in ensuring the adequacy of the electricity system).

Increasing the flexibility of the energy system (in particular in relation to the promotion of competitively determined electricity prices, real-time price signals)

Slovakia does not have a specific objective for increasing the flexibility of Slovakia's electricity system for greater integration of RES. The measures will take into account the evaluation of flexibility needs following agreed legislation and the expected increase in electricity generation from RES.

In 2022, Slovakia transposed into Slovak law the requirements stemming from the **'Clean Energy for All**

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see Table 3 for17 more details.

Europeans' package in the field of internal electricity, including in particular the recast of Directive (EU) 2019/944 of the European Parliament and of the Council and the recast of Regulation (EU) 2019/943 of the European Parliament and of the Council on the internal market for electricity, including provisions on aggregation and the provision of flexibility.

At the same time, the requirements of Directive (EU) 2019/944 on electricity in the area of **dynamic electricity price contracts** (Dynamic Price Contract – Article 11) have been transposed into Slovak law. The new Section 17c of Act No 251/2012 on energy, as amended by Act No 256/2022, which transposed the Electricity Directive, regulates the rules for the negotiation of contracts for the (joint) supply of electricity with a dynamic price or other method of determining or calculating the electricity price derived from changes in electricity prices on organised electricity markets.

The regulatory**policy for the 6th regulatory period from 1.1.2023 to 31.12.2027 adopted on 29 March 2023 by the Regulatory** Authority for Network Industries ('ÚRSO' or 'the Regulatory Office') foresees the development of new innovative supply products supported by **dynamic tariffs** and new types of distribution tariffs to stimulate the use of new technologies or to support the provision of storage and flexibility services to other electricity market participants. One of the conditions for the development of current and emerging trends (aggregation, flexibility) is dynamic prices in addition to the implementation of IMS. A new element of regulatory policy will be a **more dynamic pricing** of reserved capacity and distribution. In the 6th regulatory period, the regulatory authority will support the management of distribution grid loads, either by using **flexibility** or by developing the **concept of dynamic pricing** (including dynamic pricing of reserved capacity), with a view to making more efficient use of existing grid capacity, reducing system imbalance over time and supporting the needs of new electricity market entrants.

In line with the above, the objectives set out in Slovakia's regulatory policy must also be reflected in the regulatory framework in the relevant legislative documents, which will enable the objectives of European and national legislation to be met, to ensure the safety of the operation of the electricity system and the efficient functioning of the internal market in electricity.
The upcoming legislative documents on the regulatory framework need to include appropriate and incentive conditions for the implementation of new regulated activities such as flexibility aggregation, electricity sharing, the provision of frequency and non-frequency ancillary services, including at distribution system level, so that barriers to meeting objectives such as increasing the flexibility of the electricity system in terms of system operation security and flexibility for the functioning of the internal electricity market can be effectively removed.

The Slovak Republic has transposed and implemented the provisions of the 2019 Clean Energy Package on electricity market design (EMD, in particular Directive (EU) 2019/944 and Regulation (EU) 2019/943) on demand response, distributed resources and electricity storage.

The Slovak Republic started preparing the takeover and implementation of the 2024 package on Electricity Market Design Reform (EMDR), the main objectives of which are to strengthen the stability and predictability of electricity prices, promote flexibility in the electricity system and thus accelerate the development of RES and further improve consumer status and protection. Implementation will cover, inter alia, the introduction of a legislative and regulatory framework to support long-term instruments and markets through Power Purchase Agreements (PPAs) and through bidirectional Contracts for Difference (CfDs), as well as a framework aimed at promoting flexibility in the electricity system and accelerating the development of RES to achieve the Union's decarbonisation objectives.

The need for flexibility and the setting of an indicative target for non-fossil flexibility will be based on the Report on the assessment of system flexibility needs according to the methodology referred to in Article 19e and 19f of Regulation (EU) 2024/1747.

As part of the transposition of the provisions of the new Article 20a of Directive (EU) 2018/2001, as revised by Directive (EU) 2023/2413 on renewable energy (RED3), Slovakia will also address the issues of facilitating the integration of electricity from renewable sources into the energy system.

Participation in the **project for the cross-border exchange of balancing electricity in the Grid Control Cooperation (e-GCC) in early 2012 contributed to the improvement of the safety of the operation of the ES SR and in particular to the reduction of the need for the activation of regulatory power in** RV and the number of TRV activations. The e-GCC was discontinued in 2020 due to its participation in the International Grid Control Cooperation (IGCC) common system. Participation in the IGCC also confirmed the expected lower number of TRV/mFRR activations relative to previous years, as well as reduced volumes of RE from domestic power generating installations providing the SRV/aFRR support service.

In 2024, Slovakia joined **international balancing energy exchange platforms** (PICASSO and MARI) through SEPS to ensure the improvement of the competitive environment in the PSP market and the activation of balancing electricity at the lowest possible price. This will provide more opportunities for flexibility and balancing electricity provision also for flexibility providers from Slovakia. Once connected to platforms, balancing electricity will be priced from pay-as-bid to marginal pricing. At the same time, there will be a deregulation of balancing electricity prices, which will provide an incentive for new CSS providers to enter the market.

Slovakia, through SEPS, became an observer in the FCR cooperation project, which uses the "Regelleistung" platform for cross-border sharing of PpS FCR balancing capacity. Joining the platform will ensure SEPS access to a liquid market for the purchase of FCR from abroad.

Market integration and coupling

Electricity market

The national objectives of the Slovak Republic with regard to the establishment of **a single electricity market** within the EU are primarily determined by directly applicable European legislation (i.e. relevant market-based network codes and regulations).

Forward-looking objectives and targets with regard to market integration are mainly conditional on Commission Regulation (EU) 2015/1222 establishing a guideline on capacity allocation and congestion management (CACM Regulation), complemented by Regulation (EU) 2019/943 of the European Parliament and of the Council on the internal market for electricity and Commission Regulation (EU) 2017/2195 of 23 November 2017 establishing a guideline on electricity balancing (the EBGL Regulation).

In the time frames of the **day-ahead and intraday markets**, this is primarily a matter of full integration of the Slovak Republic in a single solution, based on the principles of implicit allocation of cross-zonal capacities, the Single Day Ahead Coupling (SDAC) and single intraday coupling, based on the principle of continuous allocation of cross-zonal capacities, the so-called Single Intraday Coupling (SIDC).

For the timeframe of the day-ahead electricity market, the project for the timely implementation of the merger of Slovakia, Czech Republic, Hungary and Romania (4M MC) with the connected region of Western Europe MRC (DE-AT-PL-4MMC) on a transitional basis based on the Net Transmission Capacity (NTC) method was launched at the end of 2018/2019[18]. This day-ahead market integration project was successfully launched in June 2021. At the same time, all project stakeholders, including the Slovak parties and the national regulatory authority, confirmed the commitment to implement a targeted European solution and methodologies stemming from legally binding EU legislation on the principle of coordinated capacity calculation, the Core CCR, within the region. The Core Flow-based Day Ahead

18http://www.urso.gov.sk/?q=node/598

Market Coupling project was successfully launched on 8 June 2022.

The basis for a targeted solution for intraday electricity market integration would be the XBID project, where integration is implemented through a comprehensive accession process, to which the Slovak Republic also belongs. Slovak stakeholders became fully part of the XBID project (currently replaced by SIDC) in early 2020, the operational connection of the bidding zone of the Slovak Republic to the XBID project was successfully implemented through a Local Implementation Project 17 ('LIP17') in November 2022.

With regard to **balancing markets**, it is assumed that in the course of 2024 the Slovak Republic will become an integral part of the single centralised European platforms for the provision of power balance services. The Slovak Republic's involvement in these platforms, which stems from the European legislation currently in force, responds to the need for increased flexibility in managing the interconnected electricity system, increasing the liquidity of the balancing market and transparent pricing of power balance services.

On the basis of the appropriate conditions laid down by the relevant legislation, it is possible to foresee an increase in the liquidity of European platforms through the promotion of new technologies and entities providing power balance services.

In the area of wholesale market integration and **increasing the tradable capacity** of the Slovak Republic and Slovak parties, they will work in coordination with other Member States and stakeholders in the CORE region in implementing the principles of capacity allocation and congestion management under Regulation (EU) 2019/943 of the European Parliament and of the Council on the internal market for electricity (Article 16).

The implementation of **two new cross-border interconnections between Slovakia and Hungary included in the Projects of Common Interest List (PCI Chapter 2.4.2) has made an important contribution to the integration of wholesale electricity markets in terms of reducing the price differential between** market areas (Chapter 2.4.1 for interconnectivity indicators). The new Slovak-Hungarian interconnectors 2x400 kV Veľký Ďur (SK) – Gönyű (HU) – Gabčíkovo (SK) and 1x400 kV Rimavská Sobota (SK) – Sajóivánka (HU) were successfully put into commercial operation on 5 April 2021, leading to an increase in the tradable electricity capacity on the SK-HU profile.

The PSO operator (SEPS) plans and implements the national investment plans of the PSO operator in order to comply with the obligation under Regulation (EU) 2019/943 of the European Parliament and of the Council on the internal market for electricity, Article 16, paragraph 8, to have at least 70 % of the capacity of each PS line available for electricity transmission (Chapter 2.4.2 point i.).

By increasing the transmission capacity available to the SK-HU profile in April 2021, it contributed to removing bottlenecks in Slovakia's transmission system from the point of view of system permeability, and closed the 'stop-state' for connecting new resources to the ES SR and increasing the installed capacity of existing resources in the ES SR. Also from a broader regional perspective, this bottleneck was an obstacle to renewable energy flows from north to south of Europe.

With a view to meeting the objectives of the relevant national and European legislation on the efficient functioning of the electricity market and the security of operation of the electricity system, it is necessary to identify further bottlenecks in Slovakia's transmission system in a timely manner and to propose measures to address them. In this context, the V490 direct connection project for the V449 cross-border line to Hungary is at an advanced stage of preparation (point 2.4.2 Energy transmission infrastructure).

Smart grids

The main objectives for the development of **smart metering systems** (IMS) and **smart grids** (IS) are summarised in the Slovak Energy Policy, 2014 (section 3.5.10). Smart metering systems are an essential building block of smart grids. One of the conditions for developing current and emerging trends (aggregation, flexibility, dynamic prices) is the deployment of smart metering systems (IMS). The implementation of the IMS is a key element for the development of smart grids.

Slovakia is in the initial construction phase of basic smart grid infrastructure in the scope of the selective roll-out of smart metering systems as required by EU legislation (Articles 19-21 and Annex II to Directive 2019/944) and Slovak transposition legislation within the meaning of Act No 251/2012 on energy and Ministry of Health Decree No 358/2013 on the implementation of the IMS (see point (iii) of this chapter). An efficient tool for the functioning and use of smart grids is a fibre network as a communication layer in the distribution of electricity. This layer of communication helps to meet the obligations of system operators with regard to secure and reliable network operation, increases automation and distribution quality by reducing the extent and duration of faults and is also an essential basis for achieving the already defined objectives of increasing flexibility, dynamic pricing and demand response models (demand-response).

In the area of **smart grid** development (IS), Slovakia focuses on the implementation of projects of common interest (PCI) in the smart grid priority area under Regulation (EU) No 347/2013 of the European Parliament and of the Council, as amended by Regulation (EU) 2022/869 of the European Parliament and of the Council on guidelines for trans-European energy infrastructure (TEN-E Regulation).

An important contribution to the development of **smart grids** with a view to the future development of distributed and renewable energy sources is the implementation of the cross-border **smart grid of the ACON project** between Slovakia and the Czech Republic, which is included in the list of Projects of Common Interest and has received Union support from the Connecting Europe Facility (CEF Energy). The project will increase the efficiency and security of the distribution grid and the preparedness for the integration of distributed renewable resources, in particular in the common border areas of Czechia and Slovakia. At the same time, a joint Slovak-Hungarian **smart-grid project Danube InGrid** is being prepared and is also included in the list of Projects of Common Interest.

Smart grid ACON project

The main objective of the cross-border smart grid of the ACON (Again COnnected Networks) project between Slovakia and the Czech Republic is to strengthen the integration of the Czech and Slovak electricity markets and to efficiently standardise the behaviour and activities of electricity system users so as to create an economically viable, sustainable electricity system with low losses and high quality and security of supply.

In 2023, Slovakia's two cross-border projects in the area of smart grids ACON (and Danube InGrid) were re-introduced on the 1st list of Projects of Common Interest (PCI) under the revised TEN-E Regulation (overall the 6th list of PCIs under Regulation (EU) 1316/2013 repealed and replaced by Regulation (EU) 2021/1153). The project promoter on the Slovak side is Západoslovenská distribučná, a.s. (ZSD) and, on the Czech Republic side, EG.D, a.s. The expected implementation date is until 2027.

The project will not only upgrade the already existing infrastructure but also build a new one. Examples include a new electricity station in Borskie Saint Jure or a digitisation of over 200 kilometres of 22 kV lines. The benefits of the ACON project should include a significant improvement in the performance parameters of the distribution network, in particular maintenance induced failures and outages, as well as the reduction of losses arising from the transmission of electricity.

The ACON project is implemented in the border areas of Western Slovakia, but the benefits from the project will have an impact not only on the territory of the whole of Slovakia but also on the surrounding countries. The implementation of smart elements will provide adequate capacity for all distribution system users and allow for better monitoring. Easier identification of potential failures will reduce the time needed to correct them. This will provide the customer with a more stable distribution system with a minimum of outage and a high quality of supply.

Work on the ACON project will involve a number of activities, namely: new cross-border 22 kV interconnection between Holič and Hodon; new electric traction system and upgrade of existing phosphate plants; cabling; and installation of IT devices and smart solutions.

The possibility to co-finance the development of the distribution system from EU resources represents an opportunity to make a significant contribution to the digitalisation of the Slovak distribution system and to offer new technological solutions to system users. The total value of the supported ACON project is EUR 182 million, with European co-financing amounting to EUR 91.2 million, i.e. 50 % of the value of the project and the cost of each of the project partners being 50 %.

Smart grid Danube InGrid

The regional distribution system operator ZSD initiated another similar project, this time in cooperation with a Hungarian company from the E.ON group and the national transmission system operators SEPS and MAVIR.

The main objective of Danube InGrid (Danube Intelligent Grid) is to integrate renewables more widely into the distribution grid through the use of smart technologies at transmission and distribution level, including their smart management.

While the PCI ACON is mainly implemented in the territory of Trenčín and Trnava, the Danube InGrid PCI should cover mainly the Nitra region and part of the Trnava region, the second phase of the project will also affect the Košice region.

The purpose of the Danube InGrid PCI is to strengthen the interaction and integration between the Slovak and Hungarian electricity markets. The project implements smart technologies at the internal level of system operators as well as at cross-border level for the development of modern energy infrastructure. It will effectively integrate the behaviour and actions of all market participants connected to the electricity system, in particular consumers, prosumers and producers, in order to integrate large amounts of electricity from renewable sources and/or distributed energy sources. The Danube InGrid project is a number of smart elements deployment areas that are essential for achieving the project's final objectives. These are smart elements focusing on security of operation, their implementation in electricity stations (sensors, IT devices, applications) to upgrade the network due to RES integration, e-mobility, smart metering, communication devices.

In order to better distinguish the activities of the project, the Danube InGrid project is divided into the first and second waves due to territorial and temporal differences. The first wave of the project – Action No 10.7-008-SKHU-W-M-20 ('the Action') is currently being implemented, for which the European Commission has been awarded a grant for a smart grid project from the Connecting Europe Facility (CEF) of EUR 102 million. The promoters of the action are Západoslovenská distribučná, a.s., Észak-dunántúli Áramhálózti Zrt. and Slovenská Electricityá Transmission Systema, a.s., supported by MAVIR. The project activities implement the construction of the new ESt Vajnora with transformation 400/110 kV, including the modernisation and extension of the ESt Podunajské Biskupice and ESt Stupava, leading to a more robust grid in the Bratislava area, with greater capacity, which is essential for the increased integration of renewable energy sources (RES) and to cover the increased electricity demand in this area of Slovakia.

The second wave of the Danube InGrid (Danube InGrid 2.0) PCI project concerns activities in eastern Slovakia and north-eastern Hungary and focuses on the deployment of smart grid elements, related to smart substations design, data exchange, data flow and smart metering, and to manage interactions between TSOs and DSOs for the safe and efficient operation of future energy systems. The second wave of Danube InGrid aims to improve cross-border cooperation at TSO and DSO level in coordinating the management of the electricity grid, with a focus on smart data collections and data sharing to enable the connection of more renewable energy producers to the electricity grid, with an emphasis on ensuring high quality and security of supply for energy customers in the region of Eastern Slovakia, North-East and Central Hungary. The promoters of the second wave of the project are Východoslovenská distribučná, a.s., Slovenskáelektrá Transová sústava, a.s. Elmű Hálózti Kft. and MVM Émász Áramhálózti Kft.

The main objective of the project is to develop a smart electricity grid in the Central and Eastern Europe region with the aim of integrating more RES into the distribution system while maintaining high quality and security of electricity supply to consumers. The project will create greater capacity for the development and connection of distributed electricity generation and appropriate conditions for the possible connection of new distribution system users in the region. The project will support the connection of a number of new renewable electricity producers, improve the quality and security of electricity supply, extend grid connection for all users and reduce negative environmental impacts.

Aggregation, demand response, storage, distributed generation, dispatching, redispatching and curtailment mechanisms

In July 2022, Slovakia transposed into Slovak law the requirements of the 'Clean Energy for All Europeans' package on **new electricity market design**, including provisions on aggregation, demand response, storage, distributed generation (recast EP and Council Directive (EU) 2019/944) and rules and mechanisms for dispatching, redispatching and curtailing generation resources and demand response (pursuant to directly applicable Regulation (EU) 2019/943 of the European Parliament and of the Council on the internal market for electricity).

The reform of the electricity market, which is also a completed reform of the Slovak recovery and resilience plan, facilitates new activities and access to the electricity market for operators (energy generating communities, aggregator, self-consumer, electricity storage) and increases the overall flexibility of the electricity system and the possibility of connecting new renewable sources to the Slovak system.

New **market entrants** include active customer, energy community, electricity storage facility operator and aggregator. In addition to the rights and obligations of these new market entrants, the way in which they enter the market is also proposed, while maintaining the current concept of authorisation or notification certificate for energy activities.

Several of these new activities cannot be efficiently implemented and operated **without centrally adjusting data flows** (RES sharing, storage, energy communities, active customers). The REPowerEU investment responds to this need by supporting the creation of an Energy Data Centre (EDC).

Gas market

In addition to supporting the implementation of infrastructure projects, the national objectives of the Slovak Republic in the area of building a single gas market will focus on promoting the proper and timely implementation of other network codes in the field of gas transmission. On the basis of the applicable network codes, the transmission system operator sells transmission capacity at cross-border transmission points through all existing platforms (PRISMA, RDF, GSA). Looking ahead to 2030, it will be necessary to focus on the internal gas market package, which, in addition to the integration of gas markets, should significantly strengthen sustainability.

The consumption of natural gas in the Slovak Republic in 2017-2022 was around 5 billion m^3. More than 98 % of domestic gas consumption is imported. In 2022 and 2023, a decrease in consumption was observed, mainly related to commodity prices and commercial company decisions due to adverse price developments. An emergency regulation – a Council Regulation to ensure gas demand reduction – was also agreed at EU level.

In particular, changes in the gas market can be seen in the context of the forthcoming transposition of the Gas Directive into national legislation and the establishment of basic rules for the hydrogen market.

II. Where applicable, national objectives relating to non-discriminatory participation in energy from renewables, demand-side response and storage, through aggregation, in all energy markets, including a timeline for achieving the objectives

Slovakia has adopted a basic legal framework allowing the non-discriminatory participation of energy from renewable sources, demand response and energy storage, including **through aggregation**, in all energy markets within the meaning of EU legislation, the "Clean Energy for all Europeans" package in the field of the internal market for electricity under the recast Directive (EU) 2019/944 and the recast Regulation (EU) 2019/943 on the internal market for electricity (see previous point i.a. of this chapter – Aggregation, demand response, storage, distributed generation).

Act No 256/2022 of 22 June 2022 amending Act No 251/2012 on energy and amending certain acts, as amended, and amending certain acts, regulates the following new market entrants and new active elements and activities in the electricity (and gas) market:

- Energy Community and Renewable Energy Community
- Aggregator
- Active customer
- Electricity storage/Electricity storage facility operator
- Flexibility/Provision flexibility

The transposing amendment to the Energy Act (Act No 256/2022) introduces a number of new or amends existing provisions (in particular in relation to new entrants to the electricity market) that directly or indirectly improve grid connection and access possibilities, including installations for the production of electricity from renewable energy sources (RES) and electricity storage facilities.

Support for RES, including in the area of access and connection of RES, is governed by Act No 309/2012 on the promotion of renewable energy sources and high-efficiency cogeneration and amending certain acts, as amended.

Slovakia is currently in the process of adopting secondary and tertiary legislation (in particular the amendment of the Decree on the rules for the operation of the electricity market, the Decree on price regulation in the electricity sector, the technical conditions for access to and connection to the grid and rules on system operation of transmission and distribution system operators) and the implementation of a new model for the provision and exchange of data on the electricity market (through the Energy Data Centre (EDC) project), which aims to streamline and accelerate the access of new entrants to the electricity market.

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

The intentions and design of national legislation with regard to **ensuring the participation of consumers in the energy system and the benefits of self-generation of electricity and new technologies, including smart meters, stem from the transposition of Directive (EU) 2019/944 of the European Parliament and of the Council into Slovak law, in particular the provisions relating to the active participation of consumers in the market in Chapter III (Dynamic Price Agreement – Article 11, Active customers – Article 15, Citizens Energy** Communities – Article 16, Demand Management through aggregation – Articles 13 and 17 and smart meters – Articles 19 to 21 and Annex II) and other related EU legislation, the "Clean Energy for all Europeans" package, in particular of Directive (EU) 2018/2001 of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (ii/24.13. 2023).

Slovakia has implemented legislation promoting self-generation by introducing a **'local source'**. The concept of a local source was introduced since the beginning of 2019 in Act No 309/2009 on the promotion of renewable energy sources. The production of electricity from these sources more significantly meets the objective of developing RES in electricity generation. In March 2022, the local source provisions were amended. The aim of this amendment was immediately to promote the large-scale but controlled development of local renewable energy sources installed by final electricity customers up to the maximum reserved capacity of their demand points and to use them primarily for self-consumption purposes.

Slovakia has fully transposed the provisions of Directive 2009/72/EC of the European Parliament and of the Council (Annex I, point 2) in the field of **smart metering systems** (**IMS)**. On the basis of an economic evaluation carried out in 2012, Slovakia decided to proceed with the selective roll-out of smart electricity metering systems for demand points with annual consumption above 4 MWh, which represented around 23 % of all expected demand points in 2020, representing approximately 53 % of total annual consumption (around 3.2 TWh) at low voltage (NN). The timetable for the deployment of IMS for 2013 and 2020 was extended until the end of 2021 due to COVID-19 restrictions. The economic evaluation resulted in a negative net present value (NPV) of large-scale (national) deployment. By the target date of 31 December 2021, 431 had been installed 433 smart electricity meters under Regional Distribution System Operators (DSOs) out of the final planned number of 414388 smart meters (an additional few thousand smart meters were installed by local DSOs).

On the basis of approved legislation in line with Commission Recommendation 2012/148/EU, an economic assessment of the long-term costs and benefits of the roll-out of smart metering systems (CBA IMS) was carried out in 2023 with a negative result for further expansion of IMS deployment beyond the current Decree 358/2013 Coll. The legislation allows, in addition to the mandatory selective deployment of IMS by distribution system operators, the possibility of voluntarily installing IMS at the request of the final customer against the related costs as required by Directive 2019/944.

IV. National objectives for ensuring both electricity system adequacy and flexibility the energy system with regard to the production of electricity from renewable sources, including a timetable for the achievement of the objectives;

The objectives and objectives of the Slovak Republic in ensuring the **adequacy of the electricity system** are defined by the **Energy Policy of the Slovak Republic** (see point 1.2.ii).

An adequate and balanced **resource mix, both in terms of sufficient generation capacity (quantity) but also in terms of generation technology (quality) of electricity, is an important prerequisite for ensuring the adequacy** of the electricity system or ensuring secure and reliable system operation of each Member State. **Slovakia's intention is to create the conditions for ensuring the adequacy of the electricity system in meeting climate and energy objectives and respecting the conditions of the European single market**.

By 2030, the grid export balance is expected to be around 20 % of projected electricity consumption, assuming[19] the entry into operation of Mochovce's 4th nuclear power plant. In this scenario of development, Slovakia will not have any difficulty in covering the expected loads.

Under the Regulation of the Parliament and of the Council on the internal market for electricity, each Member State, when applying a capacity mechanism,[20] must have a **reliability standard** in place that indicates in a transparent manner the required level of security of electricity supply. For the purposes of setting the reliability standard, NRAs should estimate the Value of Lost Load (VoLL) in EUR/MWh on **the** basis of a single ENTSO-E methodology approved by ACER. The Reliability Standard (RS) should be expressed in terms of the Lost of Load Expectation (LOLERS) in h/year and, where appropriate, the Expected Energy Not Served (EENSRS) in MWh/year, which should be taken into account, inter alia, in the resource adequacy assessment.

Under the European legislation currently in force (Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity), the 10-year European Network Development Plan (TYNDP ENTSO-E) also includes an adequacy assessment based on a probabilistic approach. The European resource adequacy assessment (ERAA) shall be carried out in an annual cycle based on input from ENTSO-E Member States' transmission system operators, focusing on sensitivities of the impact of sudden changes in fluctuated RES production, climatic conditions, market conditions (commodity prices and emissions) etc.

The probabilistic processing of the pan-European adequacy outlook[21] also includes indicatively calculated reliability indicators, predicted Energy Not Served (EENS) in MWh/year and Loss of Load Expectation (LOLE) in h/year. Non-zero values beyond the reliability standard indicate in the results a problem with the adequacy of the Member State's system.

Slovakia does not yet have a reliability standard (VoLL, EENS, LOLE) and there is currently no capacity mechanism in place to ensure resource adequacy. In order to establish these parameters, it is necessary to take into account the socio-economic and economic interest of energy self-sufficiency, i.e. the price of energy not supplied on the basis of the projected resource mix in line with climate and energy objectives, as well as the technical limits of national and pan-European grid interconnections. According to the expected development of the network and in the event of the introduction of a capacity mechanism in Slovakia, the Ministry of the Economy, in cooperation with the operator of the PS, will set a reliability standard in Slovakia's conditions, in accordance with the applicable European and national legislation.

When setting a national reliability of supply standard (following the application of the capacity mechanism) in accordance with current European legislation, Slovakia may in the future set or update strategic objectives for ensuring the adequacy of the electricity system and the flexibility of Slovakia's energy system with regard to production from RES in accordance with climate and energy objectives or ensuring sufficient import capacity of the system (in which case the risk of underperformance in the surrounding systems must be taken into account as well as the interest in ensuring an adequate level of security of supply in its own territory).

The measures to ensure the adequacy of the electricity system in terms of increasing PpS availability by the PS operator over the last years have been directed towards searching for reserves that can be activated by adjusting the PpS rules (allowing aggregation, enabling the provision of FCR from battery systems, lowering the minimum value for TRV3MIN± service providers). The modification of the rules is perceived by the PB operator from a number of perspectives. One of these is the economically efficient provision of PSP volumes targeted by the "Strategy for ensuring a sufficient volume of support services" for the year in question. The strategy shall include recommendations to minimise the risks associated with ensuring the necessary volume of balancing capacity. Among the measures, risk sharing by procuring the availability of PSPs in the context of multi-day tenders (annual and monthly tenders)

19https://www.economy.gov.sk/uploads/files/C3BT8Jnt.pdf?csrt=5290539972842755229
20 https://eur-lex.europa.eu/resource.html?uri=cellar:d7108c4c-b7b8-11e6-9e3c-01aa75ed71a1.0001.02/DOC_1&format=PDF
21https://www.entsoe.eu/outlooks/eraa/2021/eraa-downloads/

is supplemented by daily purchases of PSPs. The result is to ensure a high level of system security and reliability, while achieving economic benefits. The revision of the Strategy is carried out with a frequency of one year.

Another aspect is the introduction of important changes stemming from European legislation, namely Regulation (EU) 2019/943 of the European Parliament and of the Council on the internal market for electricity, in the framework of harmonising the rules for organising day-ahead selection procedures for the procurement of ancillary services.

Since 1 January 2022, SEPS has proceeded to adjust the parameters of balancing electricity products and the availability of PSPs, as well as to harmonise the nomenclature of RDP products on FCR, SRV+/SRV- to aFRR+/aFRR- and TRV+/TRV- to mFRR+/mFRR-. The amendment was applied on the basis of the requirements of Commission Regulation (EU) 2017/2195 establishing a guideline on electricity balancing ('EBL Regulation') and the resulting implementation frameworks for the implementation of the European platforms for the exchange of frequency restoration reserves and replacement reserves. The specific changes are set out in the 'Proposal for the use of specific products for balancing energy and availability' published on SEPS'.

Product standardisation is linked to the preparation of SEPS to connect to platforms for the exchange of frequency restoration reserves:

- 5 November 2024 – PICASSO (reserve exchange aFRR)
- 3 December 2024 – MARI (mFRR exchange)

As regards increasing flexibility in the procurement and provision of FCR-type PpSs, SEPS is an observer to access the Regelleistung platform (exchange of FCR within the Regional Group Continental Europe).

Another important step that should contribute to establishing a competitive environment in the SGP market is also the planned entry of central flexibility resources into the market for SGP, so-called aggregators. The issue of aggregation is addressed by the PIAF project (Pilot of Flexibility aggregation for support services), which has as its main objective:

test the concept of aggregation of flexibility of decentralised installations for the provision of ancillary services to the transmission system operator, identify legislative barriers to the development of this concept, propose possible adjustments to energy legislation.

Attention in the field of support services in development years after joining international platforms will increasingly be focused on **resource base flexibility**, in particular in the context of meeting the decarbonisation targets resulting from F55 and REpowerEU. These objectives include, inter alia, the connection of electricity sources in the form of photovoltaic and wind power sources with variable operation dependent on climatic conditions, which, in the case of higher installed capacities, may cause divergences between Slovakia's planned and actual balances, which will need to be regulated.

Until new generation nuclear sources (new nuclear source in Jaslovské Bohunice and SMR) are included in the energy system, CCG will play an important role in providing:

a) flexibility of the electricity system (rapid start-up capability);
b) security of supply (in times without wind and sun);
c) secure system operation (floating sources ensuring sufficient inertia).

This is also, for example, the expected significant demand side electrification, with an impact on the negative mFRR-, currently mainly provided by hydropower plants, including pumped storage.

One major planned project aimed at increasing the provision of support services to pumped storage is the SE Integrator project, which has been included on the EU list of PCIs (see Chapter. 2.3.iv National objectives with regard to increasing the flexibility of the national energy system).

For this reason, it is necessary to continue to develop the necessary measures, whether at technical (removal of technical barriers) or legislative level, in order to create a competitive environment on the PSP market, with the need to preserve existing ones, but in particular to apply new flexible technologies not only on the generation but also on the demand side, such as LER systems (e.g. battery systems) and technologies enabling demand-side management.

Prior to the possible introduction of capacity mechanisms, regulatory distortions and market failures need to be identified. The elimination of such regulatory distortions and market failures is considered to be the first level of measures targeting resource adequacy issues and only subsequently, if such measures are not sufficient, can a Member State proceed with the introduction of capacity mechanisms (Article 20(2) and (3) of Regulation (EU) 2019/943 of the European Parliament and of the Council on the internal market for electricity).

In line with the Commission Recommendation under point 468(a) of the Guidelines on State aid for climate, environmental protection and energy 2022, the Slovak Republic will review existing aid schemes incentivising the generation of electricity from flexible generation sources so that these generation resources can be efficiently used in the ancillary services market. The review will also be carried out to avoid providing incentives at a time when this would mean limiting the use of renewable energy sources with zero air pollution (paragraph 126 in conjunction with point 392 CEEAG).

v. Where appropriate, national objectives for the protection of energy consumers and improvement

competitiveness of the retail part of the energy sector

In July 2022, Slovakia transposed into Slovak law the requirements arising from the ‘Clean Energy for All Europeans’ package in the field of the internal market in electricity, including **provisions relating to consumer protection** (Articles 4, 10, 11, 12, 14, 18 and Annex I of the recast EP and Council Directive (EU) 2019/944) and provisions relating to the application of state interventions in price setting for supply in the retail electricity market (Article 5 of the recast EP and Council Directive (EU) 2019/944).

The amendment to Act No 250/2012 on regulation in network industries by Act No 85/2022 of 22 March 2022 and the amendment of Act No 251/2012 on energy by Act No 256/2022 of 22 June 2022 amended inter alia:

- price regulation of retail electricity (and gas) prices;
- the area of consumer protection for electricity (and gas).

The amendments to consumer protection legislation by the Energy Act No 251/2012 by Act No 256/2022 of 22 June 2022 also relate to the new regulation in the area of retail price regulation for the supply of electricity and gas (which was the subject of a separate amendment to Act No 250/2022 on regulation in network industries by Act No 85/2022), with an emphasis on the freedom of choice of supplier/aggregator, the right to switch supplier/aggregator and the rules on fees associated with it, rights in the event of collective switching, the legal establishment of a tool for comparing suppliers’ offers, rules on content and formal requirements for billing and billing information, the right to out-of-court contracts, and rules for out-of-court settlement of disputes.

Changes in retail price regulation in the electricity (and gas) market responded to the sharp price increase in wholesale electricity/gas markets at the end of 2021 and early 2022, while the initial proposal for a new regulation and the deregulation plan under Article 5 of the Electricity Directive, which required the phasing out of regulated prices in the electricity supply market, had to be reviewed and adjusted in early 2022. A so-called partial price deregulation model in the electricity (and gas) supply market has been designed, allowing for the coexistence of regulated and unregulated (market) prices/products (applicable from 1 January 2023) with equal access to electricity and gas supply.

Act No 143/2024 amending Act No 250/2012 on regulation in network industries strengthened the position of the ÚRSO, including the area of State supervision.

2.4.4. Energy poverty

I. where applicable, national energy poverty objectives and timetable achieving the objectives

The conclusions adopted by the European Commission in its Commission Recommendation (C) 2023/4080 of 20 October 2023 on energy poverty ('EC Recommendation on energy poverty') state: "Energy poverty is a multidimensional phenomenon. In many cases, there are three main causes behind this situation, linked to high energy expenditure compared to household budgets, low income levels and low energy performance of buildings and appliances."

Energy poverty goes well beyond the energy sector and inter-ministerial cooperation is essential to tackle it effectively. The European Union has required Member States to take measures to protect final customers and, in particular, to ensure that there are sufficient safeguards to protect vulnerable customers.

In this context, each Member State is to develop the concept of protecting customers who can be considered at risk of energy poverty.

There is a close causal link between energy and income poverty. Energy poverty is often a consequence of and part of income poverty, since in Slovakia the availability of the necessary amount of energy and water is primarily a question of the financial situation of households and not of physical scarcity of energy and water. Over 99 % of households are connected to electricity, more than 66 % use natural gas, while both media are also used for heating and producing hot water.

More than one third of households heat their dwellings by heating from district heating systems. A more significant proportion of households cut across wood and solid fuels. In the order of 90 % of households are connected to public water systems, two thirds of them have access to public sewerage.

Figure 9: Residential heating

Source: SOBD

Figure 10: Residential heating fuel 2021

Source: SOBD

In particular, when addressing energy poverty as a whole-of-society phenomenon, the following are considered key policies: social policy, labour market policy, fiscal policies and policies aimed at improving the energy efficiency of residential buildings. However, individual income plays an important role both in the definition of energy poverty and in addressing energy poverty and reducing the number of energy and water consumers at risk of energy poverty. Standard setting also plays an important role, for example when it comes to household consumption thresholds.

The Slovak Republic's national energy poverty objectives can be divided into three basic steps:

- Establishing an official definition of energy poverty
- Identification of households at risk of energy poverty by definition
- Setting up adequate policies and targeted measures to reduce the number of energy poor households.

Definition of energy poverty

In order to effectively apply solutions to energy poverty, energy poverty needs to be properly defined, appropriate indicators need to be set up to monitor and evaluate it, and tools to mitigate it should be chosen.

The definition of energy poverty is also provided in Directive (EU) 2023/1791 of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (the 'EED'):

'energy poverty' means a household's lack of access to essential energy services, providing basic levels and decent standards of life and health, including adequate heating, hot water, cooling, lighting and power for appliances, in the relevant national context, existing national social policy and other relevant national policies, due to a combination of factors such as at least unaffordability, insufficient disposable income, high energy expenditure and low energy efficiency of dwellings.

The national definition of energy poverty should take into account the EED definition and adapt it to its own criteria based on the individual national context.

The Slovak Republic has so far a proposal for a national definition of energy poverty which reflects the national context and takes full account of the definition from the Energy Efficiency Directive. This proposal is part of the 'Blueprint for the protection of customers qualifying for energy poverty22' ('the Concept'), drawn up by ÚRSO and discussed and adopted by the Slovak Government at the end of 2022. This draft definition was subsequently clarified in the conclusions of the ÚRSO's whole-of-government working group.

Identification of households at risk of energy poverty by definition

The Slovak Republic does not yet have officially established data on the number of households at risk of energy poverty. The draft definition is based on a study by the Slovak Academy of Sciences (SAV) on energy poverty in the Slovak Republic ('the23 study') and is based on the relationship of household income and expenditure, which, according to the SAV study, constitutes a 'gold standard in housing analyses and policies' as well as the basic principles defined in the Energy Efficiency Directive. The proposed definition includes, as a point of reference, an already existing element of social policy, i.e. a living wage, which at the same time converts it into the number of household members. At the same time, the use of the above-mentioned primary parameters (revenue and expenditure) is crucial in view of the fact that, in particular, Slovakia is among the countries with the highest share of energy expenditure in disposable income within Europe24. In Slovakia, this situation is not due to primary energy prices, since these are lower in comparison between EU countries, due to the price regulation applied to the supply of electricity and gas to household customers and the application of price regulation to the consumption of heat from district heating systems. In this way, the national context of the Slovak Republic is taken into account when setting the proposed definition. From the results of this study, the estimated number of households at risk of energy poverty is around 8 %.

In June 2024, the SAV published the publication 'Energy Poverty 2024'25, which follows an in-depth study from 2023 and presents additional outputs of SAV's knowledge on energy poverty.

As indicated in the introductory part of the publication, the main changes compared to the previous 2023 study are the following:

- Update based on the latest data and knowledge on energy poverty.

22https://rokovania.gov.sk/RVL/Material/27993/2

23In-depth study of energy poverty, Foresight Institute, Social Sciences and Psychological Sciences Centre, SAV. June 2023, p. 5.

24 Energy Poverty 2024, Foresight Institute, Social Sciences and Psychological Sciences Centre, SAV. June 2024. Available online: https://www.prog.sav.sk/wp-content/uploads/Energeticka-chudoba_2024.pdf

25Energy Poverty 2024, Foresight Institute, Social Sciences and Psychological Sciences Centre, SAV. June 2024. Available online: https://www.prog.sav.sk/wp-content/uploads/Energeticka-chudoba_2024.pdf

• Slight change in the definition of energy poverty – the median household income calculated on the basis of EU SILC is used, e.g. when determining the poverty threshold.

• Introduction of the concept of energy-vulnerable household – one at risk of energy poverty due to circumstances – tendency towards low incomes, high energy expenditure, low energy efficiency of the dwelling.

• Analysis of the credit system for electricity consumption.

National programmes and strategies affecting energy poor households

The Slovak Republic has adopted national programmes and strategies which are also secondary in the area of energy poverty problems, even though they do not directly define the criteria for assessing the risk of energy poverty for the time being, nor do they contain targeted tools specifically applied to a category of households that would meet such a definition.

In particular,

- The 2023 National Reform Programme of the Slovak Republic (NRP), which describes the reform efforts of the Government of the Slovak Republic (SR) in key structural areas. It aims to provide a comprehensive overview of the measures implemented and planned by Slovakia to respond to specific EU Council recommendations to Slovakia, regardless of whether they are implemented through EU cohesion policy, from resources of the Slovak Recovery and Resilience Plan or from state budget resources. At the same time, the NRPs also serve as a tool to communicate the implementation of the 2030 Agenda for Sustainable Development and the European Pillar of Social Rights.
- Employment strategy papers up to 2030 as 'Strategic priorities for the development of employment in the Slovak Republic with an outlook to 2030', 'National plan for strengthening the Youth Guarantee in the Slovak Republic with a view to 2030', 'Action plan to further strengthen the integration of the long-term unemployed into the labour market in Slovakia with a view to 2030'.
- Whole-of-government papers which, with the contribution of social partners, municipalities and civil society, have identified mechanisms to promote employment development.
- A national framework strategy for promoting social inclusion and combating poverty – a document that systematises and develops approaches to tackling poverty and social exclusion under a coherent framework, both in relation to the objectives stemming from the Europe 2020 strategy and in relation to the European Pillar of Social Rights.
- Long-term strategy for the renovation of the building stock
- Networking and development of public employment services.

The ÚRSO concept aims to define a draft methodology for the definition of energy poverty, including a proposal for qualification criteria, but also to define a proposal for a recommended framework for possible measures to protect and reduce the number of energy consumers (electricity, gas, water and heat) who are at risk of energy poverty and to propose instruments to protect these household energy customers from energy poverty in the Slovak Republic.

In March 2023, ÚRSO set up a super-ministerial group consisting of relevant central government bodies, including social and family, finance, economics, and environment departments. The Prognostic Institute of the Slovak Academy of Sciences was also invited to participate in the group, which has long been working on the issue of energy poverty in the Slovak Republic and has a database of information that is complementary to the work of the trans-ministerial working group.

The conclusions of this inter-ministerial working group, which were presented to the Government of the Slovak Republic in September 2023, also include proposals for specific policies and measures to reduce the number of energy poor households. These suggestions are described in Article 3.4.4 of this document.

Furthermore, in its conclusions, the over-industry working group recommends that the Slovak Government:

- decide on a state administration responsible for energy poverty issues;
- subsequently, entrust the responsibility for the subject matter with the umbrella of the sub-ministerial working group and prepare a legislative proposal containing a definition of energy poverty, possibly elaborating on the content of the recommended text and taking the proposal thus modified into account when drawing up the proposal for a legislative definition of energy poverty.

In addition, the PWG recommends that the following open questions and other topics arising from the work of the Working Party so far be included in the public consultation:

- The element of economy has proved necessary. In the future, consideration should be given to fine-tuning the definition to take into account and promote the economic behaviour of households. Taking into account, in the future, adequate energy standards and the adequate size of the dwelling, assistance from the State will be provided to those households that have been proven to be in energy poverty rather than by their own guilt or misalignment of their living standards.
- For the purposes of assessing the household's risk of energy poverty, it is essential to set a target group. The definition under Section 115 of Act No 40/1964 of the Civil Code is now universal: the household 'shall consist of natural persons who live together permanently and jointly cover the cost of their own needs' and the household of an individual. Another reason for taking into account the definition of household under the Civil Code is that the contribution to housing costs is not always related to family ties arising, for example, from mutual maintenance obligations of members of the household. However, attention should be drawn to the issue and legislative context of the current definition of a household end-user against the identification of the end-user of energy. Attention should also be drawn to the possible inconsistency between the definition of a household in accordance with the Civil Code and the definition for the purposes of Act No 601/2003 on the minimum subsistence figure.
- In the future, normal heating and hot water requirements (by building category, number of people in the household, etc.) will also need to be taken into account.
- The assets of the assessed person should also be taken into account in the future, which will require their evaluation, which is also preceded by the availability of data for the evaluation.
- The definition will require a distinction for the future between the household in rent (it has no possibility to influence the renovation of the building) and the household of the building owner.
- Property ownership will also need to be addressed in the future, as they often prevent targeted support in practice.
- The EU SILC 2023 includes questions for managing households focusing on energy efficiency assessments. On the basis of their evaluation, it will be possible to evaluate the energy efficiency of household managers, also following the setting of certain standards, as well as to evaluate their further incorporation into the EU SILC survey (Statistical Survey on Household Income and Living Conditions) for the years to come, but this also requires additional financial envelopes.

The integrated national energy and climate plan is an important policy framework that directly affects the future design and implementation of the Slovak Social Climate Plan, to be submitted by the Slovak Republic to the European Commission by 30 June 2025. The measures in the Slovak Social Climate Plan will be designed in line with the reforms and commitments set out in the NECPs, while respecting the objectives of the Social Climate Fund and its primary focus on vulnerable groups at risk of energy poverty.

Slovakia's Social Climate Plan may also include structural and reform measures complementing related legislative or regulatory measures proposed in the NECPs.

While the NECPs provide a general policy framework, commitments and an overview of planned measures and investments to address the five dimensions of the Energy Union, the Slovak Social Climate Fund will provide funding to support the green transition and the related social impacts on vulnerable groups.

Proposals in the NECPs may be extended through the Slovak Social Climate Plan within the framework of its proposed measures and commitments resulting from changes or additions to energy and climate policies.

The Social Climate Plan will be obliged to respect the DNSH principle as a criterion for resource use and will be oriented towards renewable energy technologies as an option for energy production and supply. The Social Climate Fund will target vulnerable groups to increase energy efficiency by reducing consumption and increasing energy efficiency.

2.5. Dimension: research, innovation and competitiveness

In the context of the EU's energy system and the gradual increase in the share of renewables, research on increasing power flexibility is needed on the national objectives and objectives of R & I funding in the field of the Energy Union, which requires the involvement of Slovak organisations in the development of new types of equipment, with emphasis on the core and potential of hydrogen.

The objective of R & D is to ensure sustainable energy in Slovakia in accordance with the document "Research and Innovation Strategy for Smart Specialisation of the Slovak Republic". Research and development in this area will focus on new and renewable, environmentally friendly energy sources, the rationalisation of energy consumption in all sectors of the economy and energy distribution.

Horizon Europe has a budget of EUR 95.5 billion for the period 2021-2027. From the total budget, EUR 15.1 billion is allocated to Climate, Energy and Mobility and EUR 8.9 billion is allocated to Food, Bioeconomy, Natural Resources, Agriculture and Environment. Research and innovation exploiting synergies in the areas of climate, energy and mobility addresses the sustainability of our way of life from an environmental and economic perspective. The main objectives of the Climate, Energy and Mobility cluster are the fight against climate change, the improvement of the competitiveness of the energy and transport industries and the quality of services provided by these sectors to companies.

In Slovakia, there is potential to use the knowledge and acquired domestic expertise in the field of big data (BIG DATA) in the processing, analysis, prediction and visualisation of large volumes of data in real time, as well as the use of AI based on historical data extraction, to support further decisions such as environmental protection, climate, etc. By using these methods, already tested prediction models can be improved, modern technologies and developed algorithms for distributed and parallel data processing can be used. This allows, inter alia, the processing of analyses of different internal and external factors (e.g. weather effects) to predict the evolution of relationships within the chosen ecosystem or energy system, including the visualisation of large-scale data and virtualisation of different situations.

The EURATOM (European Atomic Energy Community) Treaty was created to establish the European Atomic Energy Community, which, inter alia, helps to coordinate Member States' research programmes in the field of peaceful uses of nuclear energy. It is currently one of the frameworks for sharing knowledge, infrastructures and financing of nuclear energy. It ensures security of supply of nuclear energy through a centralised monitoring system. Euratom is a supplementary research and training programme for nuclear research and training under the European Framework Programme Horizon Europe. The Euratom Programme was approved by Regulation (Euratom) 2021/765 of the Council of 10 May 2021 establishing the Research and Training Programme of the European Atomic Energy Community for the period 2021-2025 complementing Horizon Europe. The main objectives of the programme are to

- Improving and promoting the safety of nuclear energy and radiation protection, spent fuel and radioactive waste management and decommissioning of installations
- Maintaining and developing capacity and knowledge in the field of nuclear energy within the European Community.
- Supporting the development of nuclear fusion as potential future energy
- Supporting EU and national policies.

The Euratom Programme is divided into two main pillars, namely:

- Nuclear fusion (Fusion)
- Nuclear fission

Activities and calls for projects are implemented under the Strategic Agenda 2021-2025 (with a budget of EUR 1 382 billion) and the current work programme for 2023-2025.

The creation of new European research and innovation partnerships should also be part of the programme.

I. National objectives and objectives for funding public and, where available, private research and innovation in the field of the Energy Union, including, where appropriate, a timetable for achieving the objectives

In the context of the EU energy system and the gradual increase in the share of renewables, research is required in increasing the power flexibility of currently operating nuclear installations, research into the possibilities of using spent nuclear fuel, safe disposal of spent nuclear fuel and analysis of advanced types of nuclear fuel. It is essential to involve Slovak organisations in the development of new types of nuclear installations with hydrogen production potential. The implementation of smart grids, i.e. efficient consumption management systems and energy supply in the changing conditions of operation of the energy system, together with the integration of RES in distribution networks and the involvement of active customers, help to achieve this strategic objective in line with European energy policy and Slovakia's strategic objectives in the EU.

R & D objectives

Ensuring sustainable energy in Slovakia is a priority for energy R & D.

The objectives of R & D in the field of energy are in line with the document 'Research and Innovation Strategy for Smart Specialisation of the Slovak Republic 2021-2027' (SK RIS3 2021+).

R & D in this area will focus on new and renewable, environmentally friendly energy sources, the rationalisation of energy consumption in all sectors of the economy and energy distribution, such as:

- exploration of indigenous deposits of energy raw materials, geothermal energy and their efficient use;
- development of renewable electricity and heat technologies (water, sun, wind, biomass and geothermal energy);
- development of energy storage and conversion technologies (POWER to X) to sector coupling;
- development of new types of smart materials, materials for conversion, transport and storage energy;
- research in nuclear energy with a focus on safety and spent fuel disposal;
- research on fourth generation reactors and fusion issues (Slovak participation in ITER and DEMO global projects);
- development of new energy transmission systems (power cables without electrical diffusion and magnetic fields);
- developing technologies to increase energy efficiency and reduce energy difficulty.

One of the key objectives of the strategy is that vocational training responds to the needs of the economy and produces more workforce with the skills needed to address scientific and economic challenges. It is therefore proposed to adopt a specific set of measures targeting human resources across this ecosystem. In nuclear energy, the implementation of the project for a new nuclear resource and small modular reactors will require strong engineering support and expertise for their construction, licensing or supervision. It would therefore be appropriate, through cooperation with Slovak and foreign universities and in close coordination with the business sector, to create the conditions for increasing the number of professional capacities, e.g. through the scholarship scheme of the Ministry of Education, Research, Development and Youth of the Slovak Republic (hereinafter 'the Ministry of Education, Research, Development and Youth of the Slovak Republic') – 'Študu at home, Slovakia will reward you':

ii. Where available, national 2050 objectives to support clean energy technologies and, where appropriate, national objectives including long-term targets (by 2050) for the deployment of low-carbon technologies, including the decarbonisation of energy and carbon intensive industries and, where appropriate, related carbon transport and storage infrastructure;

The promotion of clean technologies by 2050 is in the process of being processed.

iii. Where applicable, national objectives with regard to competitiveness

Slovakia's recovery and resilience plan sets out a coherent package of reforms and investments that are implemented until 2026 and are supported by the Recovery and Resilience Facility. The implementation of the REPowerEU education chapter supports the energy transition, also called energy system transformation.

REFORM 6: SKILLS FOR THE GREEN TRANSITION
Promoting better preparedness of secondary vocational schools for green skills education. The objective of the reform is to update current education and training programmes to reflect current labour market needs for green skills. The reform will contribute to the gradual adaptation of secondary school level curricula into practice. With the investment, we will create the material, organisational and other conditions for education and practical teaching in the 13 schools concerned and develop the necessary educational materials. The reform consists of three parts.

FIRST PART: Adaptation of existing secondary vocational education programmes, we ensure the adaptation of curricula for vocational secondary schools that focus on the development of green skills needed in sectors with the highest growth potential, in particular: renewable energy sources and electro-mobility. The updated curriculum will be consistent with the ESCO (European Classification of Occupations, Skills and Competences) Green Skills Classification.

SECOND SESSION: The creation of new professional development training programmes for teaching staff will bring about a change in the qualification standards for the preparatory training of teachers in secondary vocational schools, as well as an update of the teacher training programmes themselves. The newly created education for teachers and other teaching staff in secondary vocational schools will focus on developing pedagogical skills in the areas of: renewable energy sources and electro-mobility. The update of the Teachers' Programme will reflect the ESCO (European Classification of Occupations, Skills and Competences) green skills classification.

THIRD PART: The creation of accredited modular adult education programmes focusing on green skills provides for the development of adult learning programmes to acquire or expand skills and/or qualifications for occupations where there is a shortage of skilled workers or for sectors undergoing major transformation (such as heavy industry, automotive). Adult learning programmes will focus on skills in the areas of: renewable energy sources and electro-mobility. The training programmes shall be developed in close cooperation with relevant experts.

INVESTMENT 7: SCHOOL EQUIPMENT AND TRAINING
The objective of the investment is to adapt and provide schools with adequate equipment for theoretical and practical teaching. In thirteen secondary vocational schools, there will be material and technical equipment, as well as the necessary building adaptations of the premises for the implementation of dedicated training programmes for both renewable energy and electro-mobility.

The second part of the investment is aimed at providing training for teaching and professional staff on the basis of an updated training programme for teachers to be developed under Reform 6. Training will be provided in schools to specialise in the training of renewable and electro-mobility subjects.

The main objective of introducing new technologies in teaching is to implement in the teaching process modern progressive methods and technologies in building energy equipment that will make the teaching process itself more attractive and broaden pupils' practical skills. Renewable energy professionals will be trained by a hydrogen thermal system, a heat pump with complex diagnostics for teaching these systems, photovoltaics with excess energy storage in a battery storage site that will be part of the classroom equipment. Their use will be instrumental in preparing pupils to cope with future challenging tasks in installing, maintaining and repairing the distribution of technical building equipment, including wiring, as well as in diagnosing and remedying malfunctions in buildings' energy installations and their accessories. These training systems will be so unique in their specification and focus that they will only be used in the training programme for energy technicians in buildings.

By providing training in green skills, key aspects of the energy transition will be ensured:

- Skilled environment to increase the share of renewables – investments
in renewable energy technologies, in line with the available energy mix, they are key to reduce dependence on fossil fuels.

- Reducing energy intensity – developing green skills to improve energy
the efficiency of buildings, appliances and industrial processes, which are essential to reduce overall energy consumption.

- Developing smart energy systems – educating green skills in the field
smart and smart element deployments.

- Promoting electro-mobility: education on the transition to electric cars and moving away from
petrol and diesel vehicles are an important aspect of reducing transport emissions.

- Policy-making and regulation: regions and municipalities play a key role in supporting
energy transition through low-carbon strategies that promote renewable energy sources, investments in energy efficiency, education in clean technologies. At the same time, the technical equipment for teaching is the backbone of regional support for innovation, science and research.

3. POLICIES AND MEASURES

3.1. Dimension: decarbonisation

3.1.1. Greenhouse gas emissions; and removal

1. *Policies and measures to achieve the objective set out in Regulation **(EU)** 2018/842, how indicates, in point 2.1.1, and policies and measures to comply with Regulation **(EU) 2018/841, covering all** key emitting sectors and sectors where removals are to be stepped up, with a view to a long-term vision and the objective of becoming a low-emission economy and achieving a balance between emissions and removals in line with the Paris Agreement;*

This chapter provides information on the most important greenhouse gas emission reduction policies and measures with a baseline year 2019. It describes both existing and planned measures.

Table 15: Cross-sectoral policies and measures

Policies and measures	**scenario**	**Gas/Category**	**measure**

European system emissions trading (EU) ETS) established Directive 2003/87/EC in the text all amendments and transposed by the Trade Act 414/2012 with emission quotas and on the amendment of and supplements certain Acts	WEM/WAM	CO_2, CH_4, N_2O, HFC, PFC and SF_6/Regulatory measure	An essential tool for cost-effective reduction; emissions greenhouse gases in industry, energy and aviation, the EU is the ETS. The EU ETS is a market-based instrument based on the principle of capping and trading, with continuously reduced annual ceiling volume permitted emissions. Within this limit, scheme participants may purchase and sell emission allowances through an auction system, as appropriate. The EU ETS is economic and regulatory action s high by having a positive impact on reducing greenhouse gas emissions and in the fuel mix, it stimulates the use of biomass and drives technological innovation. At the same time, the EU ETS is extended to the maritime sector and a new emissions trading system is introduced for buildings, road transport and other sectors to achieve an emission reduction of 42 % by 2030 in compared to 2005, so-called EU ETS 2.
Legislation common effort established v Regulations European of the Parliament and of the Council (EU) 2018/842	WEM/WAM	CO_2, CH_4, N_2O and perfluorocarbons	The Effort Sharing Decision sets annual emission limits for Member States' greenhouse gas emissions in the period 2013-2020, which are legally binding and only cover greenhouse gas emissions that are not

annual greenhouse emission reductions gases Member States from 2021 to 2030, by which SA contributes on measures in the area of climate focused the meeting Paris commitmentsagreements and prepared climate by law;		(PFC)/Regulatory measure	part of the scope of the EU ETS, i.e. small energy and industry outside the EU ETS, transport (excluding aviation); buildings; agriculture and wastes. Each Member State must define and implement national policies and measures to reduce emissions in these sectors, such as: supporting public transport; energy performance standards for buildings, and biogas, measures in agricultural waste management.
Policy v areas use of biofuels	WEM/WAM	CO_2, CH_4 and N_2O/Regulatory measure	It lays down the regulatory framework for increased use of biofuels in transport through Act No 309/2009.
Longterm vision for EU rural areas – Towards K stronger, more connected, resilient a thriving rural areas by 2040			The document addresses a stronger focus on mitigation changes climate, a thisalso through manufacturing energy Z renewables is an opportunity for rural areas fight against efficiency poverty, as long as ecosystem services are properly valued and business models within rural communities retain their value.
Taxation of energy products and electricity	WEM/WAM	CO_2, CH_4 and N_2O/Regulatory measure	Most important v context s creating tax revenue is tax Z mineral oils. Low income from excise duties on electricity, coal and natural gas result mainly from a higher number of optional exemptions

National emission ceilings as set out in Directive 2001/81/EC o national emission ceilings and revised Directive 2016/2284 transposed by Act No. 146/2023 Z.z. o air protection and change a additions certain laws and decrees linked to that Act and supplemented Act No 190/2023 Coll. o fees for pollution of air	WEM/WAM	air pollutants: NOx, SO_2, NMVOC, NH_3, $PM_{2,5}$ a CH_4/Regulatory measure	Its main objective is to reduce the adverse health impacts of air pollution, including by more than half the number of premature deaths per year from air pollution.
National program reductions emissions as a follow-up the Directive 2016/2284	WEM/WAM	air pollutants: NOx, SO_2, NMVOC, NH_3, $PM_{2.5}$/Regulatory measure	It contains policies and measures to achieve the national commitments in two stages between 2020 and 2029 and beyond 2030. The national emission reduction programme contributes to the achievement of air quality objectives under Directive 2008/50/EC as well as to ensuring consistency with plans and programmes set out in other relevant areas policies including climate, energy, agriculture, industry and transport. It will also support the shift of investment into clean and efficient technologies.

a) **Sectoral industrial policies and measures** – In addition to the legislative instruments on greenhouse gas emission allowance trading, Act No 146/2023 on air protection and amending certain acts, which serves to control and control sources of air pollution by introducing emission limits for pollutant discharges, plays an important role. This Act is supplemented by Act No 190/2023 on charges for air pollution, which serves as an economic tool for reducing emissions.

The main measure leading to emission reductions in industry is to move away from solid fossil fuels and petroleum products through the electrification of production. In terms of overall emissions, the electrification of generation should also be linked to an increase in the share of low-emission electricity sources. For this reason, there is a potential for emission reductions in particular in the steel industry by 2030. Given the financial difficulty of electrification, the expected changes in other industrial sectors are smaller in this timeframe, as there is only a shift to less net-intensive fuels such as natural gas and waste-based solid alternative fuels (especially in cement production). The use of biomass is increasing in part, but its potential is limited.

Table 16: List of main industrial measures in the WAM scenario by 2030

Policies and measures	Gas/Category
Transforming the production processes in a basket steel plant towards low-carbon alternatives	Co_2,/economic measure
Reducing the use of solid fossil fuels and petroleum products	Co_2/Economic
Increase the use of solid alternative fuels in cement production	Co_2/Economic
Increased share of cogeneration in steam production for industry	Co_2/Economic
Reducing the share of free emission allowances from 30 % to 0 % in 2030	Co_2/Economic

Table 17: List of additional measures applied in the post-2030 WAM scenario

Policies and measures	Gas/Category
Projected strong increase in emission allowance prices (ETS)	Co_2,/economic measure
Application of direct reduction of iron ore in steelworks since 2045 (as a substitute for a third blast furnace not previously electrified)	Co_2/Regulatory, Economic
Gradual replacement of natural gas with hydrogen in those activities for which electrification is not possible (and affordable)	Co_2/Economic
Application of higher energy standards in relation to the use of *best available techniques*	Co_2/Economic

b) Sectoral transport policies and measures

Table 18: List of measures in the WEM 2030 scenario

Policies and measures	Gas/Category
CO2 emission standardsfor new passenger cars – 95 g/km by 2024, additional 15 % reduction in 2025-2029, 37.5 % reduction from 2030 (EU Regulation 2019/631)	Co_2,CH_4, N_2O/Regulatory
CO2 emission standardsfor new light commercial vehicles – 147 g/km by 2024, additional 15 % reduction in 2025-2 029.31 % reduction from 2030 (EU Regulation 2019/631)	Co_2,CH_4, N_2O/Regulatory
CO2 emission standardsfor new heavy-duty vehicles – from 2025 a 15 % reduction compared to 2021, a 30 % reduction from 2030 onwards (EU Regulation 2019/1242)	Co_2,CH_4, N_2O/Regulatory

Table 19: List of measures in the WAM scenario by 2030

Policies and measures	Gas/Category
Introduction of the Emissions Trading System for the transport sector (ETS2) as of 2027, with an estimated price for 2030 of around EUR 59.226 per tonne	Co_2,CH_4, N_2O/Regulatory and economic
CO2 emission standards for new passenger cars – 55 % reduction from 2030 (EU Regulation 2023/851)	Co_2,CH_4, N_2O/Regulatory
CO2 emission standards for new light commercial vehicles – 50 % reduction from 2030 (EU Regulation 2023/851)	Co_2,CH_4, N_2O/Regulatory and economic
CO2 emission standards for new heavy-duty vehicles – 45 % reduction from 2030 (proposal for EU regulation 2023/0042)	Co_2,CH_4, N_2O/Regulatory and economic
CO2 emission standards for urban buses – 100 % reduction from 2030 (proposal for EU regulation 2023/0042)	Co_2,CH_4, N_2O/Regulatory and economic
CO2 emission standards for suburban buses – 45 % reduction from 2030 (proposal for EU regulation 2023/0042	Co_2,CH_4, N_2O/Regulatory and economic
Subsidies to support the purchase of emission-free vehicles on the basis of an action in the E-mobility Action Plan Financial measure for the purchase of emission-free and low-emission vehicles under the E-mobility Development Action Plan	Co 2/Economic
Increasing the share of sustainable fuels (biofuels and renewable gases) in transport	Co_2/Regulatoryand economic
Promoting the transition to zero- and low-emission vehicles corresponding to legislative adjustments (such as tax disadvantages for legal persons) and improving the availability of charging options for battery electric vehicles (based on the E-mobility Development Action Plan)	Co_2/Regulatoryand economic
Uptake of advanced biofuels and synthetic fuels in aviation (based on EU Regulation 2023/2405)	Co_2/Regulatoryand economic
Moderate shift of activity from individual to public road transport, based on the application of measures from the Sustainable and Smart Transport Strategy, in parallel with investments in infrastructure and modernisation of rail and bus transport (Recovery and Resilience Plan, Slovakia Programme)	Co_2,CH_4, N_2O/Regulatory and economic

The following measures are also applied in the WAM scenario:

- gradual increase in the range of vehicles combined and their higher annual range resulting from the expected development of technology and infrastructure investments
- introduction of direct support for the purchase of vehicles in 2025 of EUR 81.6 million[27] over 5 years)
- support for the transition to a new type of vehicle resulting from the application of measures in the E-

26This corresponds to EUR 45 at the 2020 price level, corresponding to the MSR mechanism
27All reported prices are at 2023 price level for Slovakia

mobility Action Plan (e.g. by reducing the behavioural effect of shorter driving ranges due to increased availability of charging)

Table 20: List of measures in the post-2030 WAM scenario

Policies and measures	**Gas/Category**
Increasing price of emission allowances in the transport sector (ETS2)	Co_2,/economic measure
Application of CO2 emission standardsfor new passenger cars and new light commercial vehicles (EU Regulation 2023/851)	Co_2/Regulatoryand economic
Application of CO2 emission standardsfor new heavy-duty vehicles and buses (EU Regulation 2023/0042)	Co_2/Regulatoryand economic
Continued increase in the share of biofuels and renewable gases (especially advanced) in transport	Co_2/Regulatoryand economic
Entry of hydrogen electric vehicles in passenger car categories between 2030 and 2035	Co_2/Economic
The grant of a subsidy for the purchase of an emission-free vehicle upon delivery of a vehicle over 15 years of age. Adaptation of emission performance standards to achieve zero-emission vehicles or combustion-powered vehicles using exclusively emission-free	Co_2/Regulatoryand economic
Increased application of bio- and synthetic emission-free fuels to a fuel blend in aviation (based on Regulation (EU) 2023/2405)	Co_2/Regulatoryand economic
Additional transfer of activity from individual to public road transport	Co_2/Economic

c) Sectoral agricultural policies and measures

The agricultural sector accounts for about 7.3 % of total greenhouse gas emissions produced in Slovakia. In 2022, according to the SHMI, GHG emissions from agriculture decreased marginally by 4.9 % year-on-year. The evolution of greenhouse gas emissions from agriculture has been decreasing since 1990 and has changed only marginally since 2005 using the WEM scenario with a slight downward trend.[28]

28Green report, 2023

The agricultural sector also contributes to the emission reduction target through strategy papers. The CAP Strategic Plan 2021-2027 includes, among other objectives, the intervention that will contribute to the reduction of emissions. Afforestation and grassland is an important factor in reducing greenhouse gas emissions.

For example, the following interventions will contribute to:

Reducing greenhouse gas and ammonia emissions	**Action type**
Investments on farms to reduce greenhouse gas and ammonia emissions	WAM
Animal welfare – Growing	WAM
Afforestation of agricultural land	WAM
Protection and maintenance of woodland in afforested agricultural land	WAM
Organic farming	WAM
Sectoral interventions in the dairy and pigmeat sectors	WAM
Investments in tangible and intangible assets, research and experimental and innovative production methods, and other	WAM
Promoting practices to increase carbon sequestration	
Establishment of an agroforestry system	WAM
Protection and maintenance of plants under the established agroforestry	WAM
Establishment of linear vegetation elements	WAM
Protection and maintenance of plants within the established lineside vegetation element	WAM
Afforestation of agricultural land	WAM
Protection and maintenance of woodland in afforested agricultural land	WAM
Organic farming	WAM
Grassing of arable land	WAM
Whole farm eco-scheme	WAM
Sectoral intervention Soil protection in the fruit and vegetables sector	WAM

Measures to reduce emissions from livestock production

The measures listed below have a high potential to contribute to the decarbonisation of agriculture. These measures have a significant reduction potential for greenhouse gas emissions and their successful implementation depends mainly on farmers' support and motivation.

Table 21: Application potential of the selected measures in WEM and WAM scenarios (%)

Category	**Name of action**	**WEM**	**WAM**
HD – Milk	Improving longevity of cattle	0	80
HD – Milk	Addition of amino acids as additives to the feed ration	25	50
HD – Meat	Replacement of carbohydrates in the feed ration with unsaturated fats	65	65
Poultry	Daily faeces removal	8	80
Pigs, cattle, poultry	Anaerobic manure digestion for biogas production	80	80
Land	Precision farming techniques	0	48

From an agricultural point of view, the priority in meeting emissions targets will be to put emphasis on sound land management, on maintaining sustainable agriculture and rural areas in Slovakia. It follows that reducing emissions from livestock production is not desirable by reducing animal stocks, but by measures in the management of animal by-products and improved manure management (BAT). Food security for the population, food self-sufficiency and healthy food is a priority for agriculture.

Those measures make a significant contribution to reducing emissions in the agricultural sector, and their implementation does not require a reduction in livestock, but rather an optimisation of processes and technologies. In the case of adequate support or financial incentives, farmers can greatly contribute to the decarbonisation of livestock production and to meeting the environmental objectives of the Slovak Republic.

Scenario setting

WEM**Scenario (from English With Existing Measures) is** a reference scenario taken from the 2023 Greenhouse Gas Emission Projections Report (GHGE) prepared in cooperation with the National Forestry Centre (NLC) and the National Agricultural Centre (NPPC). It includes measures implemented in 2020 at the latest**. The underlying assumptions**of the scenario are as follows:

1. the maximum application potential of many of the listed measures is significantly limited or zero, i.e. some measures are not used
2. the implementation potential of the measures is achieved in 2050 with the measures consulted with the NLC and NPPC, the conversion of land-use species is expected to be double in the net beneficial direction, the other measures significantly reduced the implementation potential.

WAM**Scenario *(from English With Additional Measures)* is a**decarbonisation scenario showing potential emission reductions through measures selected on the basis of gradually increasing their affordability. The underlying assumptions of the scenario are as follows:

3. the maximum application potential of the measures is not limited, every year all measures that can be applied and affordable (i.e. not earlier than five years before the year of full availability) are used.
4. the projected carbon price is increasing on the basis of the European Commission's assumptions for the WAM scenario – hence the year of full availability will take place earlier than in the WEM scenario, i.e. the advent of individual measures is accelerated compared to the WEM scenario.

Example of a selection of measures in the model

The following three measures are included in the list of measures for dairy cattle:

1. Addition of nitrates as an additive to the feed ration at a price of EUR 20.75 per tonne of emissions saved, an application potential of 30 %, a reduction potential of 12 % and a year of full availability 2030
2. Addition of 3-nitrooxypropanol as an additive to the feed ration at EUR 123,15 per tonne of emissions saved, application potential of 90 %, reduction potential of 20 % and full availability year 2025
3. Adding concentrate to the feed ration at a price of EUR 150,33 per tonne of emissions saved, application potential of 70 %, reduction potential of 10 % and full availability year 2032 Based on the projected carbon price, the full availability year for Measure 2 will be postponed to 2031 in the WAM scenario and to 2033 for Measure 3.

For this reason, measure 1 is activated for the first time in 2026. Subsequently, measure 2 is activated for the first time in 2027. Since the use of different additives in the ration is excluded, only one of these measures can be activated. As the reduction potential of measure 2 is higher, measure 1 will be deactivated.

Subsequently, measure 3 is activated for the first time in 2029. As it is also a measure aimed at reducing emissions from enteric fermentation, which may have overlaps with measure 2, the overall reduction potential of this pair of measures is reduced by 20 %.

The resulting effects are shown in Tables 22 and 23.

Table 22: Application potential of the selected measures in the WAM scenario by year (%)

	2025	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**
1	—	6	—	—	—	—	—	—	—
2	—	—	18	36	54	72	90	90	90
3	—	—	—	—	14	28	42	56	70

Table 23: Applied reduction potential of the selected measures in the WAM scenario by year (%)

	2025	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**
1	—	0,72	—	—	—	—	—	—	—
2	—	—	3,6	7,2	10,8	14,4	18	18	18
3	—	—	—	—	1,4	2,8	4,2	5,6	7
Overall	—	0,72	3,6	7,2	*11,92*	*16,64*	*21,36*	*22,48*	*23,6*

** in italics, the numbers for which the reduction potential for combinations of measures has been exploited are*

d) Sectoral policies and measures in the land use, land use change and forestry sector (LULUCF)

A broader list of measures has been designed on the basis of available literature and expert estimation. It included measures in each of the UNFCCC land-use categories (forests, arable land, permanent grassland, settlements, wetlands, other landscapes, wood products).

Those measures for which reduction potential and prices could be identified so that they can be used in Slovakia and have sufficient potential for increasing removals were then selected from the list. Therefore, there are no measures in the final list in the categories of dwelling and other country.

In parallel to the selection of measures, the National Forest Centre (for measures in the forest landscape category and forests related measures of other categories) and the Ministry of Agriculture and Rural Development were consulted. On the basis of these consultations, the basic parameters of the measures were adapted to reflect the Slovak conditions as much as possible.

Basic parameters of the measures

Each of the measures is characterised by the following parameters on which the calculations relevant for implementation are based:

- unit reduction potential – average annual amount of emissions captured per ha (or other unit) obtained from the implementation of the measure
- annual unit cost – annual costs of implementation of the measure, also including possible economic losses, unless they are replaced by a subsidy scheme
- one-off unit costs – one-off costs for the implementation of the measure are determined similarly to the annual unit cost
- implementation potential – size of area (ha) or number of other units on which the measure can be implemented
- number of years of implementation of the measure – time during which the effect of the measure lasts
- These are used for the calculation of other important parameters:
- annual proportion of lump sum unit costs = lump sum unit cost/number of years of duration of the measure

- price per tonne of emissions saved = (annual unit cost + annual proportion of lump sum unit costs)/unit reduction potential
- overall reduction potential = implementation potential 29 unit reduction potential

Underlying assumptions

Due to the lack of available data, the average values of the individual parameters were taken into account. This means that although, for example, the reduction potential of a measure may vary during the implementation period, the same (average) value is used for the entire implementation period.

Scenario setting

WEM**Scenario *(from English With Existing Measures)* is a**reference scenario taken from the 2023 GHG Emission Projections Report (GHG) prepared by the National Forestry Centre. It includes measures implemented in 2020 at the latest.

WAM_A**Scenario *(from English. With Additional Measures)* is a**decarbonisation baseline using modelling measures, assuming a gradual implementation of individual measures. The WEM scenario, to which the effect of the additional measures is calculated, is used as a basis. The underlying assumptions of the scenario are as follows:

- implementation of measures in 2025 and 2030 is in line with plans Common agricultural policy and National Forestry Plan in cases where the measures are listed in these documents;
- the underlying trend of the uptake of measures is linear, moderately slowed down by 2030 and slightly accelerated in 2050

The WAM_B scenario is a modification of the WAM_A scenario to which the only additional measure has been added, namely the modification of timber harvesting based on historical values. This measure, including its parameters, is taken from the Emissions Projections Report 2023 (Emission Projection Report) and corresponds to a reduction in mining by 5-8 %, modelled as follows:

- the total normal increment, plantation area and harvested wood volume have been taken over from the source
- the coefficient determining the share of CO_2 in m^3 of wood was taken as constant for harvesting on the basis of the growth tables presented in the source
- the coefficient determining the share of CO_2 in m^3 wood for wood increments was calculated for each year separately on the basis of the projection of removals provided in the data annex to that source (based on recalculation of emissions and removals, using information on total normal increment and harvesting)

29 the measures will only start in the year when they become affordable (i.e. the price for the tonne of emissions saved in that year is lower than the projected carbon price corresponding to the EC ETS allowance price in the WAM scenario)

- the implementation potential of the measures is achieved in 2050 with the measures consulted with the National Forestry Centre, double conversion in net beneficial direction is foreseen for land species conversions, other measures significantly reduced implementation potential

- data on the measure can be found in the Realizovana_tozba calculation sheet

The WAM_ambiciosyn scenario is an ambitious scenario that achieves the European LULUCF target, i.e. an increase of 504 kt of sinks in 2030 compared to the average of 2016-2018. As a result of this setting, assumptions are also significantly changed:

- the roll-out of measures is accelerated by 2030, i.e. the uptake of measures in 2030 is higher than in other scenarios
- increase of used implementation potential for selected measures (for agricultural measures or conversions)
- similar to the WAM_B scenario, the measure "Harvesting based on historical values" has been added, the implementation of which in 2030 is linked to the achievement of a regulatory target corresponding to a reduction in mining of around 10.5 %, with reductions in the range of 6 to 10.5 in recent years. % (data can be found in the calculation sheet Realizovana_tazba_ambiciozna)
- in the scenario, measures are applied regardless of the carbon price

All the above prices were recalculated to the level of EUR'2015 prices in order to maintain their comparability between measures.

e) Sectoral policies and measures in waste management

In general, the more waste we produce, the more we have to discard. Some waste disposal operations release both pollutant and greenhouse gas emissions into the air. Waste recycling is one of the methods of reducing the impact of waste disposal on the air and climate. However, there are also more environmentally friendly ways of managing waste.

The waste management sector shall consist of the following categories:

- 5.A Storage of solid wastes
- 5.B Biological treatment of solid wastes
- 5.C Waste incineration incineration plants and uncontrolled incineration
- 5.D Waste water treatment

Landfills and, to a lesser extent, incineration are the most common methods of disposal. When landfill waste is decomposed, non-methane volatile organic matter (NMVOC) and methane are released into the atmosphere, particulate matter (PM) emissions are released when waste is handled.

Incineration is the least used waste management method in the Slovak Republic. This energy has not been used frequently in the past and waste has only been disposed of. Modern facilities for the energy use of waste (WEEE) currently use waste as a fuel to produce energy, heat and waste. In this case, combustion emissions are included in the energy sector. Waste incineration contributes minimally to the amount of dioxins and furans (PCDD/PCDF) that are discharged into the atmosphere. The incineration of waste also generates high amounts of heavy metal emissions. Modern waste incineration plants (WICPs) effectively capture these substances.

Waste recycling is not the only sustainable way to recover waste. Composting of any organic waste, such as food and garden waste, is also one of them. Organic waste decomposes over a few weeks into a mulch that can be used as a fertiliser for soil. Many households practice small-scale composting and large-scale composting systems are also being developed, collecting organic waste from parks and civic amenities. Similar types of organic waste can also be treated in biogas plants. Unlike composting, waste decomposes anaerobically (without air access) and generates biogas that can be further incinerated, thus generating energy that can be further used for heating. Biogas stations are important terminals for the recovery of separated biodegradable household or restaurant waste that can significantly help reduce the share of biodegradable waste in mixed municipal waste from today's 50 % to 25 % by 2025 under the Waste Management Plan. Separated biodegradable catering waste is a suitable raw material for the production of biomethane. Biogas stations are cost-effective Category 2 and 3 animal by-products terminals. Directing this type of waste to biogas plants will increase the real production of biomethane in installations and contribute to further objectives in increasing renewable energy and reducing greenhouse gas emissions in Slovakia.

Digestate, as a product of biogas plants, is the residual part of the decomposed mass of input substrates. It is a stable organic matter rich in different nutrients, depending on the starting materials used. Digestate is an excellent example of the circular economy. Its use reduces the need for the production and use of industrial mineral fertilisers. Half of the phosphorus and nitrogen used each year on agricultural land comes from non-renewable sources to the EU and fossil fuels are used to produce them. These nutrients are ingested by plants, plants harvested and consumed by livestock or humans subsequently end up as waste. If we do not recover them from biowaste, a high percentage of these valuable nutrients will end unused in landfills or waste water treatment plants. This does not return to the natural cycle of nutrients contained in the digestate and applied back to the soil.

Support for biogas plants and composting plants must take into account their added value and strike a balance for the efficient use of biodegradable waste. An important basis mapping the potential of biogas and biomethane is the project 'Developing and supporting the production of sustainable biomethane, organic fertilisers and the circular economy', whose activity is also the creation of a comprehensive map of production potential for biogas and biomethane production. The project is implemented by the National Agricultural and Food Centre.

Waste water management also generates leakages of pollutants and greenhouse gases (CH4 and N2O). In general, emissions of POPs as well as NMVOC, CO and NH3 occur in waste water treatment plants, but in most cases are negligible amounts.

Table 24: List of policies and measures in the waste sector

Policies and measures	**scenario**	**Gas/Category**	**measure**

Act No 79/2015 on waste and amending certain acts v text later[29]	WEM, WAM	CO_2,CH_4, N_2O/Regulatory and economic valid from 2015	This law places emphasis on the sorting of packaging and recyclable materials. The separate funding scheme is also amended harvesting from national A Recycling Fund for the Organisation of Responsibility manufactur ers. Disposal of waste is permitted only in authorised controlled landfills. This law prohibits disposal garden waste, biologically degradable waste landfilling and incineration, and requires segregated collection of catering waste. The law tracks especially reduction quantity waste, which SA dispose of landfilling, treatment and prevention inception waste, minimising the negative impacts of waste generation and management on the environment and human health, introducing and applying extended producer and importer responsibility in a

[29] https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2015/79/20220630

Programme on waste management Of the Slovak Republic for 2021-2025[30]	WEM, WAM	Co_2,CH_4, N_2O/Regulatory and economic valid from 2021	Head aim waste the economies of the Slovak Republic for the period 2021 — 2025 is diversion waste from their disposal by landfill, in particular for municipal wastes, increasing recycling together with improvement of sorted harvesting a introducing a increasing reuse. includes several key objectives on climate change mitigation: Increase peace sorted harvesting municipal waste by 2025 to 60 % and rates of preparation for re-establishment use a recycling municipal waste to 55 %; reduce the proportion of biodegradable municipal waste in mixed municipal waste to 25 % by 2025, diversion of landfilling of municipal waste to 10 % by 2035. In the area of textile collection, the main objective is the establishment of a functional textile system in the Waste Act with effect from 1. 1. 2025.

(F) Sectoral policies and measures in the household sector

Main measures modelled in the WAM scenario for the household sector:

- introduction of the Emissions Trading System for Buildings and Transport (ETS2) as of 2027, with an estimated price for 2030 of approximately EUR 59.2 per tonne[81]
- introducing higher energy efficiency requirements for new constructions and renovated buildings corresponding to the application of stricter standards and the introduction of energy classes to support investments in improving the thermal performance of buildings
  - promoting more efficient technologies in heating and heating of water (e.g. thermal pumps and solar water heaters) associated with the reduction of solid fuels
  - promoting investment in new technologies such as energy management systems

(g) Sectoral policies and measures in the services sector

Greenhouse gas emissions in the services sector result from the combustion of fossil fuels for the purpose of heating and heating water. Therefore, in particular in the medium term, there is a strong link between decarbonisation and improving the energy efficiency of buildings.

In particular, an important measure in this area is the introduction of the Emissions Trading Scheme (ETS2), which can financially incentivise the transition to less carbon-intensive technologies.

In particular, the Energy Efficiency Directive (2023/1791), which requires a 11.7 % reduction in energy consumption in the EU by 2030 and the Energy Performance of Buildings Directive (2024/1275), is a key European legislation for improving energy efficiency. The impacts of these standards are incorporated in the WAM

30https://www.minzp.sk/files/sekcia-enviromentalneho-hodnotenia-riadenia/odpady-a-obaly/registre-a- Lists/poh_sr_2021_2025_vestnik.pdf scenario.

In particular, the following measures are modelled in the WAM scenario by 2030:

- introduction of the Emissions Trading System for Buildings (ETS2) as of 2027;
with a projected price for 2030 of approximately EUR 59.20 per tonne
- introduction of higher targets for insulation rates of buildings
- reducing the share of solid fossil fuels
- promoting investments in renewable energy sources (heat pumps, solar water heating); and
more efficient heating boilers
- introducing higher energy efficiency requirements for new and renovated buildings
through objectives in this area

ii. Where relevant, regional cooperation in this area

Under Regulation (EU) 2018/842 of the European Parliament and of the Council, which obliges Member States to reduce greenhouse gas emissions, the Slovak Republic may apply flexibilities by lending, transferring and transferring emission allocations to other Member States in the event of a surplus of emission allocations.

iii. Where appropriate and without prejudice to the applicability of the State rules assistance, financial measures, including Union support and the use of Union funds in this field at national level

Sources of financing of financial measures:

- Environmental Fund
- Modernisation Fund
- Programme Slovakia
- Recovery and Resilience Plan
- Social climate fund

- Environmental Fund

A financial instrument financed by proceeds from the sale of emission allowances by auction. Pursuant to the amendment to Act No 414/2012 on emission allowance trading and amending certain acts, as amended, the revenue obtained from the auctioning of emission allowances is revenue of the Environmental Fund and may also be used as expenditure in future years for climate purposes in accordance with the EU Emissions Trading Scheme Directive. On a proposal from the Minister for the Environment, the Government of the Slovak Republic approves the reallocation of funds from the proceeds to finance eligible purposes by means of a resolution for every three subsequent calendar years. According to the text of the amendment to Act No 414/212, 50 % of the revenue is intended for measures under the Environmental Fund (MŽP SR) and 50 % of the resources can be made available by the Environmental Fund to the accounts of the relevant departments (MH SR, MARD SR and Ministry of Agriculture and Ministry of the Slovak Republic) to finance climate measures under the Emissions Trading Directive (Article 10(3)).

The purpose of this use of proceeds is to be able to respond more flexibly to the needs of the Slovak Republic in terms of meeting climate objectives, a more transparent way of reallocating these funds than to meet the text of the Directive on the rate of use of revenues from trading for climate purposes. The proceeds obtained from the auctioning of allowances, which are revenue from the Environmental Fund, may be used to finance the proposed measures and may be distributed under Section 18(7) and (8) of the Act on trading No 414/2012 on emissions trading.

The funding may also be used for projects in the power generation sector with the promotion of efficient and sustainable district heating, high-efficiency electricity and heat production and the development of renewable energy sources. The objective will be to support projects by operators of district heating and cooling systems aimed at switching to efficient district heating and cooling by constructing new or upgrading existing heat generation plants and cogeneration plants using renewable energy sources.

State aid scheme – Indirect cost compensation

To cover indirect CO2 costs, EU Member States may grant State aid to certain electricity-intensive industries as compensation for indirect CO_2 costs, i.e. costs resulting from increased electricity prices because electricity producers pass on the cost of purchasing emission allowances to customers. Indirect CO2 cost compensations at EU level are regulated by the State Aid Guidelines in the context of the Union Emissions Trading System (EU ETS). For the period 2021-2030, new (revised) guidelines were adopted on 21 September 2020.

The current calls funded by the Environmental Fund are published at https://envirofond.sk/

- Modernisation Fund

The Modernisation Fund supports investments in generation and use of electricity from renewable sources, energy efficiency, energy storage, modernisation of energy networks, including district heating, pipelines and grids, and just transition in carbon-dependent regions.

Heating aid scheme

The State aid scheme from the Modernisation Fund to support investments to modernise energy systems, including energy storage, and improve energy efficiency, as amended by Appendix 1, was updated in 2024. The annual budget of this scheme is 150 million euro per year. The indicative amount of expenditure planned under this scheme for the period 2021-2030 is EUR 1 billion. The scheme aims at improving energy efficiency, modernising energy systems, including district heating or cooling (CZT) distributions, as well as repowering fossil-based heat distribution facilities for small-scale CZT grids for energy storage and smart solutions for heat distribution, increasing the share of electricity and heat produced by high-efficiency cogeneration (CHP), including switching from separate heat production to high-efficiency cogeneration and replacing solid fossil fuel power generation with natural gas (‘heat scheme’).

Text of the scheme:
https://obchodnyvestnik.justice.gov.sk/ObchodnyVestnik/Formular/FormularDetailHtml.aspx?IdFor mular=4104415&CSRT=3243472261462518942

State aid scheme to support investments in the production of heating and/or cooling from renewable energy sources, the production of renewable hydrogen and the promotion of high-efficiency cogeneration (as amended by Appendix 1)

The scheme has been in force since 8 August 2024. The estimated budget of the scheme for renewable energy generation for the period 2024-2026 is EUR 350 million. The estimated annual budget for the implementation of this scheme is EUR 117 million. The call is planned for the first quarter of 2025. The text of the RES scheme is available at: https://obchodnyvestnik.justice.gov.sk/ObchodnyVestnik/Formular/FormularDetailHtml.aspx?IdFor mular=4151545&CSRT=13299953491492304058

State aid scheme for the decarbonisation of industry

On 10. 10. Two State aid schemes for the decarbonisation of industry have been approved by the European Commission and the European Investment Bank. The schemes will be financed by the Recovery and Resilience Plan K4 (RRP) and the Modernisation Fund (MoF).

The scheme aims to contribute to the reduction of greenhouse gas emissions by supporting projects to decarbonise industry that will lead to primary energy savings, reduce final energy consumption and introduce the use of advanced environmental technologies in industrial production, thereby directly supporting the achievement of national, European and global climate targets under the Paris Agreement. The schemes aim to contribute to the reduction of greenhouse gas emissions by supporting projects to decarbonise industry under the greenhouse gas emissions trading system (EU ETS). The scheme for the decarbonisation of industry from the Modernisation Fund foresees a total amount of aid of EUR 750 million for the period 2022-2030.

The text of the industrial decarbonisation schemes is available at:

1. POO – Component 4
Https://obchodnyvestnik.justice.gov.sk/ObchodnyVestnik/Formular/FormularDetailHtml.aspx?IdFor mular=3550367&CSRT=2384708614519771708
2. Modernisation Fund
https://obchodnyvestnik.justice.gov.sk/ObchodnyVestnik/Formular/FormularDetailHtml.aspx?IdFor mular=3550458&CSRT=5070622561081576384

Increasing the energy efficiency of public buildings, the so-called "Big L" (Modernisation Fund)

This call was launched at the end of 2024 and will be open for a minimum of 2 months. The amount of the subsidy per project is between EUR 500000 and EUR 5000000, with 5 % co-financing and 95 % of the eligible costs. The call will largely replicate the already existing call L for improving the energy performance of buildings financed by the Environmemtal Fund. The main difference is the source of funding and the focus also on larger projects.

Supporting new RES resources, modernising the existing ones and increasing the flexibility of the electricity grid

Within the framework of the Modernisation Fund, Slovakia plans to support new sources of RES by 2030 and to modernise existing sources of RES with an output of around 400 MW, and also supports increasing the flexibility of the electricity system by supporting electricity storage. The objective of the measure is to support faster implementation of RES investments and to directly contribute to achieving the post-2030 climate change targets. The total size of the investment project amounts to approximately EUR 400 million.

The investment support under this investment project will be directed towards:

- support for the installation of new renewable electricity installations – out of the overall objective of increasing electricity generation from renewable energy sources, the support scheme will support new energy sources with a capacity of at least 400 MW that will be supported by this measure and connected to the electricity grid;

- the modernisation of existing generating capacity for electricity from renewable energy sources, in particular by supporting the modernisation of hydropower plants with an installed capacity of less than 10 MW;
- investments in increasing the flexibility of the electricity system (electricity storage facilities, solutions to increase the regulatory capacity of hydropower plants and hydrogen-based solutions in industry and transport). Installations increasing the flexibility of the electricity system will be supported under the support scheme.

In addition to new sources of electricity generation from RES, further support is also foreseen for the modernisation of existing hydropower plants and biogas plants, the transformation of biogas plants into biomethane stations, as well as support for facilities increasing the flexibility of Slovakia's electricity system and the modernisation of pumped-storage hydropower plants.
The Modernisation Fund also finances measures in other dimensions of the plan; a more detailed description is given of the policies and measures that can be financed from the Modernisation Fund in the relevant part of this document.

Multiannual Financial Framework 2021-2027

Table 25 provides an overview of the EU funds specifically allocated to Slovakia for the 2021-2027 period. These funds are also supplemented by other EU funding programmes available to all Member States.

Table 25: Key EU funds allocated to Slovakia (current prices), 2021-2027

Instrument	Country allocation (million euros)
Cohesion policy	**Total: 12 817,1**
ERDF	7 305,6
CF	2 472,8
ESF+	2 356,3
ETC (ERDF)	223,3
Just Transition Fund	**459,0**
EAFRD/Rural Development under CAP Strategic Plans 2023-2027	**1 295,4**
European Maritime, Fisheries and Aquaculture Fund (EMFAF)	**15,2**
Recovery and Resilience Facility 2021-2026	**6328,6 (grants)**

- Programme Slovakia

Based on the approved Partnership Agreement and Commission Implementing Decision of 18.7.2022, approving the Partnership Agreement with the Slovak Republic, the provisional climate contribution target for Slovakia is set at 31 % of its total ERDF allocation and 43 % of its total Cohesion Fund allocation.

Most (EUR 4.2 billion) was allocated to policy objective 2 'Greener low-carbon Europe', followed by policy objective 4 'A more social and inclusive Europe' (EUR 3.25 billion) and policy objective 3 'A more connected Europe by enhancing mobility' (EUR 2 billion). The draft covers all relevant environmental sectors mainly under PO 2, which includes 3 policy priorities: energy efficiency and decarbonisation; environment and sustainable urban mobility.

For policy objective 2 'Greener low-carbon Europe', the objective is to support the achievement of the national energy and climate targets set out in the integrated national energy and climate plan as well as the more ambitious objectives under the 'Fit for 55' package. This includes improving energy efficiency in enterprises and improving the energy performance of buildings (public buildings and multi-apartment buildings), as buildings together with industry have the highest potential for energy savings. Where relevant and feasible, restoration will include the installation of RES and the application of elements to protect biodiversity and green infrastructure to support climate change adaptation. The development of sustainable regional and local energy and the application of the energy efficiency first principle are an important prerequisite for achieving the energy targets.

Support for energy efficiency and reduction of greenhouse gas emissions awaits the following results:

- contribution to reducing primary energy consumption by around 230 GWh and to meeting the energy efficiency targets in the NECPs and contributing to reducing greenhouse gas emissions by around 50 600 tonnes to meet the targets set in Slovakia's low-carbon strategy for 2030;
- establishing a network of energy centres and strengthening the energy management of municipalities in order to optimise energy needs and consumption, including awareness raising on energy efficiency;
- reducing energy intensity in enterprises, preferably SMEs, by implementing energy efficiency measures in the areas of consumption: buildings, technology and transport;
- the expansion of a highly energy efficient building stock by 2030 and its progressive decarbonisation;
- reducing final energy consumption in buildings by applying the energy efficiency first principle, thereby contributing to the reduction of greenhouse gas emissions;
- improving the thermal characteristics of buildings, leading to improved conditions for a healthy indoor climate, higher levels of well-being and comfort and improving the health of users.

For renewable energy support in line with Directive (EU) 2018/2001 and its revision 2023/2413 of 18 October 2023, including the sustainability criteria set out therein, the expected results are:

- total contribution to increasing the share of RES in Slovakia by around 300 MW;
- higher uptake of RES by businesses and households;
- reducing the use of fossil fuels by increasing the share of RES in heating and cooling systems, including the use of biomethane and renewable hydrogen;
- increasing the share of RES in individual heating and cooling;
- increasing the use of RES in the environment of energy communities and active customers;
- creating conditions for the use of geothermal energy for energy purposes;
- accelerating the transition to a cost-effective, sustainable and secure energy supply system, reducing greenhouse gas emissions by around 105 000 tonnes/year and improving air quality.

Table 26: Support for RES under the Slovakia Programme (SIEA)

Focus on RES support	Possible involvement of enterprises from the heat sector	Indicative allocation (EUR million) (EU resources)	Indicative power (MW)	Notes

Promoting the use of RES in enterprises based on active electricity customers, RES self-consumers and renewable energy communities	yes	EUR 95062529	96	Measure 2.2.1 Use of RES Eligible applicants: businesses, self-consumers and communities

Focus on RES support	Possible involvement of enterprises from the heat sector	Indicative allocation (EUR million) (EU resources)	Indicative power (MW)	Notes
Promoting the use of RES in small and medium-sized enterprises	No	EUR 55930017	62	Measure 2.2.1 National project (SIEA) Green Business Beneficiary: SIEA (as a government organisation, SIEA provides contributions in the form of a voucher for SMEs)
Promoting the use of RES in enterprises (without sector constraint), in the public sector, in communities	yes	EUR 24132512	19	Measure 2.2.1 Demand-driven challenge Business enterprise sector
Promoting the use of RES in enterprises	yes	EUR 15000000	15	Measure 2.2.1 Financial instruments
Promoting the use of RES in energy supply systems	yes	EUR 138573808	94	Measure 2.2.2 Use of RES Eligible applicants: public sector, including ITIs (ITI, UMR), business sector
Promoting the use of RES in energy supply systems	No	EUR 10000000	10	Measure 2.2.2 Demand-driven challenge Public sector
Promoting the use of RES in energy supply systems	yes	EUR 113522597	62	Measure 2.2.2 Demand-driven challenge Business enterprise sector
Promoting the use of RES in energy supply systems	No	EUR 14363713	22	Measure 2.2.2 Demand-driven challenge ITI, UMR

Focus on RES support	Possible involvement of enterprises from the heat sector	Indicative allocation (EUR million) (EU resources)	Indicative power (MW)	Notes
Feasibility study for the use of energy from production sources in Slovakia	No	687 498	0	Measure 2.2.2 National project (SIEA) Beneficiary of the Ministry of the Economy
Support for household use of RESs	No	EUR 142605649	217	Measure 2.2.3 Use of RES National project (SIEA) Eligible applicants: households/households affected by energy poverty
Support for household use of RESs	No	EUR 116056048	169	Measure 2.2.3 National project (SIEA) Green Households Beneficiary: SIEA (as a government organisation, SIEA provides allowances in the form of household vouchers)
Support for household use of RESs	No	EUR 26549601	48	Measure 2.2.3 National project (SIEA) Green Solidarity Beneficiary: SIEA (as a government organisation, SIEA provides allowances in the form of household vouchers)
Support for the prospection and exploration of geothermal energy sources with a view to making them available for energy purposes	yes	EUR 13096436	0	Measure 2.2.4 Demand-driven challenge Eligible applicants: business enterprise sector
Together		**EUR 389338422**	**407**	

Further description of Measure 2.2.3 **National project "Green Households"** and need for top-up allocation

- The Green Households National Project, administered by the Slovak Innovation and Energy Agency, aims to promote the use of renewable energy sources in households. The increase in the share of heat from RES in the district supply system is ensured by the condition that, in a multi-apartment building connected to a district heating system, the installation of the installation supported by the Green Households project cannot result in a breach of the conditions for ending heat consumption.
- The national project Green Households (after 2023) is a follow-up to the first three successful national Green Households projects funded by the Quality of Environment Operational Programme between 2015 and 2023. Thanks to the support, almost 60000 renewable energy installations have so far been installed in Slovak households. Households used EUR 124.5 million of vouchers when purchasing equipment. The total installed capacity of the supported facilities exceeded 460 MW.
- EUR 142.6 million is allocated to household vouchers for the installation of heat pumps, photovoltaic panels, solar collectors, biomass boilers and wind turbines. The project aims to increase the share of domestic RES use and reduce greenhouse gas emissions from 2023 to 2029.
- It is a successful project with rapid take-up and therefore requires an increase in the allocation.
- Given the fact that heat pumps make the largest contribution to achieving the RES target in households, priority needs to be given to support for heat pumps.

The following results are expected for the development of smart energy systems, grids and storage outside the trans-European energy network (TEN-e):

- efficient use of resources and storage capacities connected to the system;
- greater integration of renewables into distribution grids, improved demand and supply planning at local level;
- reduction of losses in electricity distribution;
- introduction of standardised solutions for smart distribution grids and storage.

In the case of the promotion of a sustainable multimodal urban moblity, the following results are expected:

- increasing the accessibility and attractiveness of public passenger transport with a view to increasing the share of public passenger transport in the distribution of transport work and reducing the share of individual car transport;
- reducing negative environmental impacts in large agglomerations (reduction of noise loads, vibrations, dustiness and emissions of pollutants and greenhouse gases);
- improving the quality of services provided by public railway transport (MHD);
- improving transport infrastructure and creating the conditions for introducing complex changes in the organisation of public transport at headquarters;
- ensuring safe and quality cycle infrastructure, including its integration with public passenger transport;
- increased share of cycling and other non-motorised transport in the overall distribution of transport work.

- Just Transition Fund

Support shall also include resources from the Just Transition Fund, which aims to provide support to people, the economy and the environment in territories facing serious socio-economic challenges deriving from the transition process in pursuit of the Union’s 2030 targets for energy and climate and a climate-neutral economy of the Union by 2050. Support to exploration wells is also possible from an activity under the Just Transition Fund, for which a call is under preparation in early 2025.

The SIEA shall also implement measure 8.2.1. (Specific objective 8.1 Just Transition Fund) Promoting clean energy and circular economy (Upper Nitra region) and Promotion of clean energy (Košický and Banská Bystrica Region).

An amount of EUR 42328201 was allocated to these activities in 2024.

- Recovery and Resilience Facility

Slovakia's recovery and resilience plan responds to the urgent need to support a robust recovery and prepare the country for the future. The reforms and investments in the plan will help Slovakia become more sustainable, resilient and better prepared for the challenges and opportunities of the green and digital transitions. The plan then went through an update and adjustment of the overall allocation in 2022-2023, with the addition of a new green REPowerEU chapter to reduce dependence on Russian fossil fuels. To this end, the plan consists of six key policy areas (green economy, education, research and innovation, health and public administration, digitalisation and REPowerEU) with 19 components. EUR 6.4 billion in grants will be allocated to the measures. As regards the green economy, the plan reflects the climate commitment and represents significant contributions to the green transition and the ambitious target of reducing greenhouse gas emissions by 55 % by 2030 and to the overall objective of achieving EU carbon neutrality by 2050. The total support to the green economy component is EUR 2.103 billion and is followed by measures in the REPowerEU component for a total amount of EUR 403 million. The plan is to be implemented under a number of conditions to ensure the application of the 'do no significant harm' principle.

Key actions of the green economy, to which EUR 2.103 billion are allocated, are:

- EUR 207 million for renewables and energy infrastructure.
- EUR 620 million for building renovation.
- EUR 368 million to decarbonise industry for energy efficiency improvements and deployment innovative technologies.
- EUR 759 million in sustainable transport, for example to support the deployment of at least 3029 charging points for electric cars or hydrogen refuelling stations, upgrading of railways and 200 km of new cycling infrastructure. These investments will be further strengthened by comprehensive reforms establishing, for example, integrated public transport systems in six regions or policies for the promotion of alternative propulsions.
- EUR 149 million for climate change adaptation measures related to protection reform nature, water management and landscape planning to preserve biodiversity.
  The investment will result in 90 km renatured watercourses and the promotion of a more sustainable local economy.

Home Renovation Project

The 'Renovation of Houses' project is a long-term programme for the renovation of single-family houses financed through the Recovery Plan to contribute to the recovery of Slovakia's countryside, to protect against the adverse effects of climate change. The objective of this programme is to renovate at least 30000 single-family houses by June 2026. The investment targets owners of older single-family houses, makes it possible to finance traditional energy-saving measures (e.g. thermal insulation, window replacement, replacement of inefficient heat sources or installation of new installations using RES) and measures to support adaptation to climate change (e.g. green roofs). Under the Renovation of the House project, 4 calls were launched for the renovation of the family house and one extraordinary call aimed at the renovation of family houses following the hail in the districts of

Michalovce and Sobrance and the earthquakes in the Prešov region. AS OF 11. 7. 22313 applications were received, with 19318 applicants provisionally approved by the same deadline.

In accordance with Slovak Government Resolution No 231/2024 of 17. 4. 2024 the MŽP, in cooperation with the SAŽP, prepared the 'Renovation Dom Mini' scheme under the REPowerEU component of the Slovak Recovery and Resilience Plan, which focuses on the Banská Bystrický and Košice Self-Governing Regions due to high air pollution and long-term exceedances of PM10 limit values in their territory. One of the measures that will contribute to partly improving air quality as well as reducing the energy intensity of single-family houses in problematic areas is this scheme aimed at supporting the partial renovation of single-family houses for households at risk of energy poverty. The pilot call will support the partial renovation of at least 3060 single-family houses in the eligible municipalities in Banská Bystrica and Košice regions through REPowerEU. The non-repayable financial contribution provided for the partial renovation may also be partially paid before the renovation, with support for measures such as insulation of parts of building structures, replacement of windows and doors, replacement of heat source or installation of renewable energy sources, etc.

- Social Climate Fund (SKF)

The EU regulation establishing the Social Climate Fund is part of the Fit-for-55 package of legislative proposals. SKF is proposed for the period 2027-2032. It aims to mitigate impacts on vulnerable households and vulnerable transport users following the introduction of the emissions trading sub-scheme for buildings and road transport (ETS 2). Member States may use the allocation for investments in increasing the energy efficiency of buildings, decarbonising building heating and cooling systems, including the integration of renewable energy sources, as well as providing better access to zero- and low-emission mobility and transport, e.g. through the deployment of alternative propulsions (e.g. LPG, CNG, hydrogen, biofuels) or for direct financial support.

The allocation for Slovakia amounts to EUR 1.5 billion (to be filled from both the old and the new ETS+ETS2) for the period 2027-2032 (NB 2026 will be refinancing, official fund will become operational as of 2027). These EU resources will be increased by 25 % through mandatory national co-financing to be secured primarily from additional national revenues from emission allowances. The total amount of investment from the Fund for Slovakia will thus be EUR 1.875 billion. It is important for Slovakia to maintain the favourable allocation key for SK at 2.36 % (as opposed to the 0.9 % levy), thanks to the European redistribution of resources, to benefit Slovakia from the fund much more than it will out of its ETS revenues, to maintain the eligibility of technical assistance directly from the Fund at 2.5 % and that the annual amount of support will not change even if the total length of the fund has been reduced by one year compared to the EC proposal.

In addition to EU funds earmarked specifically for Slovakia in the 2021-2027 period, there are also funding programmes open to all Member States. These include LIFE (EUR 5.4 billion), Horizon Europe (EUR 95.5 billion), the Connecting Europe Facility (CEF) (EUR 33.7 billion) or funds to be mobilised under InvestEU. They will also support the green transition, including research and innovation activities for environmental protection (Horizon Europe), clean transport and energy (the CEF) or sustainable infrastructure (InvestEU).

3.1.2. Renewable energy

I. Policies and measures to achieve the national contribution to the binding target at level The Union for 2030 on renewable energy and trajectories as referred to in Article 4, point (a)(2), and, where applicable or available, the elements referred to in point 2.1.2, including sector-specific and *technology-specific measures;31*

Existing policies and measures

The RES policy and its underlying measures follow up on previous strategic documents approved by the Slovak Government (Energy Security Strategy (2008), National Renewable Energy Action Plan (2010) and Energy Policy of the Slovak Republic (2014)). These documents supported increasing the share of renewable energy sources in energy consumption and reducing the share of fossil fuels. These policies have thus made it possible to reduce the share of coal in the energy mix.

Table 27: Existing RES policies and measures

E.g. number	Name and reference of the measure	Type of action	Expected outcome	Targeted group and/or activity	Start date/end of action
1.	Mandatory blending of biocomponents into motor fuels	regulatory	Maintenance of up to 7 % of biofuels from food crops after 2020	fuel suppliers	2006
2.	Mandatory blending of sustainable fuels into CNG and LNG	regulatory	Maintenance of up to 7 % of gaseous biomass fuels from food crops after 2020	fuel suppliers	2023

When planning these measures,31 Member States shall take into account the end of life of existing installations and the potential for repowering.

3.	Mandatory blending of advanced biofuels with motor fuels	regulatory	Target 5.5 % of advanced biofuels in 2030	fuel suppliers	2019
4.	Mandatory blending of advanced sustainable fuels into CNG and LNG	regulatory	Target 5.5 % of advanced biofuels in 2030	fuel suppliers	2023
5.	Support for electricity generation through feed-in tariffs (up to 500 kW)	legislative, regulatory	New sources – electricity generation 0.5 TWh in 2020-2030	investors	2009-2030
6.	Support for electricity generation through the auction system	legislative, financial	Support for electricity generation 1.5 TWh v 2020-2030	investors	2019-2030
7.	Support for decentralised electricity generation	legislative, financial	New sources – electricity generation 0.5 TWh in 2020-2030	investors	2019 —►
8.	Promotion of use RES in the business sector	financial	Electricity and heat generation from RES	investors	2014 —►
9.	Support for household use of RESs	financial	Increasing the use of RES	household	2015 —►
10.	Support for the renovation of heat distribution pipes	financial	energy saving, promotion of district heating	investors	2014 —►

In some existing electricity generation measures, the estimated contributions from individual technologies in electricity generation from Chapter 2.1.2 have been included in the expected result.

Policies and proposed measures for achieving the national contribution

More RES policy

The principle set out in the Slovak Energy Policy, which, when projecting the use of RES, took into account the principle of cost minimisation in an integrated approach to the use of RES and the reduction of greenhouse gas emissions, remains valid for the next period. Maintaining this principle will lead to the setting of RES support ensuring the achievement of the objectives set in a cost-effective manner and avoiding significant negative effects on electricity prices. In order to achieve the RES targets, it is essential to use all available options, with one of the greatest potentials in developing waste recovery in biomethane production and the energy recovery of waste that cannot be recycled and would therefore end up in landfill. In particular, the energy potential of geothermal, solar, biomass and biomethane and the use of heat pumps will be exploited in CZT systems.

Key RES policies

1. support for small-scale power and heat generation installations in single-family and multi-apartment buildings and support for RES communities

A sustainable approach is to support the installation of small-scale power plants, where beneficiaries are incentivised to consume as much electricity as possible and minimise supply to the grid. This approach will address their energy self-sufficiency and reduce the impact of variable RES in the electricity grid. Support for small-scale resources will continue to support the installation of heat generators using RES. Heat pumps make the largest contribution to achieving the RES target in households. The reduction of local emissions will not only be achieved by promoting proven technologies, but it is also appropriate to promote new fuel cell technologies with reduced carbon footprint for the use of natural gas or zero carbon footprint for the use of biomethane or renewable hydrogen.

2. development of the use of Generation II biofuels

The priority for RES in the transport sector is the development of biofuels with high greenhouse gas savings. These are advanced biofuels (a term defined in the RES Promotion Act, possibly also referred to as 2nd generation biofuels) from feedstocks listed in Annex IX, Part A, and biofuels from feedstocks according to Annex IX, Part B, to the RES Directive. At the same time, taking into account the existing biofuel production capacity from food and feed crops, this policy will maintain as much as possible the share of these biofuels that counts towards meeting the transport targets. Slovakia will examine the possibilities of increasing the maximum possible share of biofuels from feedstocks according to Annex IX.B of the RES Directive.

3. continued support for electricity generation from RES

Support for electricity generation from RES will continue mainly through investment aid. Operating aid will remain for smaller installations as set after the support reform effective in early 2019. This is a pre-fixed feed-in tariff support scheme (FIT support scheme) covering new generators with an installed capacity of up to 500 kW or, in the case of electricity generation in high-efficiency cogeneration, up to 1 MW. Equipment with an installed capacity of up to 250 kW has the possibility in the FIT system to support electricity buy-in and take responsibility for imbalance. This form of support to installations of up to 250 kW will be provided until 2033, when the activity of the buyer carrying out those activities will also cease. Existing aid to electricity generation complies with Commission Regulation No 651/2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty.

The Ministry of the Economy has the possibility for installations with higher installed capacity to issue an auction to obtain operating support (support with surcharges). Given the sufficient amount of funds allocated, investment aid is favoured.

4. continuation of the support mechanism for increasing the share of RES in the heating sector and in CZT systems, including through RES production in high-efficiency cogeneration and waste heat

Slovakia considers heating and cooling to be a key sector in meeting the 2030 RES target. There are two options to decarbonise the supply of heat in buildings through the use of environmentally friendly and highly efficient primary energy-saving equipment and technologies:

- at the level of each building separately, or

- at the level of existing district heating and cooling systems supplying multiple buildings at the same time.

All analyses comparing the two alternatives prefer the other one. Given the lower costs, CZT systems allow for the efficient integration of local RES (RES according to site specifics) and waste heat from both the industrial and terrestrial sectors, both in terms of cost and operational efficiency of the installations.

The existing CZT infrastructure is the ideal basis for building the city's smart energy system and is well placed to play the role of integrator of the different RES solutions on its territory. Already today, CZT systems play an important role in maintaining favourable air quality in cities, as these systems can deliver green heat meeting the highest legal standards and emission limit values. Individual heat sources are virtually uncontrollable from the point of view of emissions and may not meet such high standards and therefore pose a greater risk to the population in terms of air pollution.

Local and regional authorities are currently facing significant changes linked to efforts to ensure sustainable growth based on a low carbon economy. They are therefore looking for smart or smart solutions.

CZT infrastructure requires large-scale investments to upgrade to allow for the gradual integration of new smart solutions. For future Smart Cities, CZT systems will be indispensable. The deployment of these modern smart solutions is leading to building the so-called 4th generation CZT, creating an efficient and smart system in cities. Such a system is able to link production and consumption flexibly, to store energy in times of surplus, to integrate different forms of energy generated in the city, including renewables, to use waste heat from industrial processes or tertiary (e.g. data centers or hospitals) or waste heat from nuclear power plants that are otherwise leaking into the atmosphere. It is more acceptable for citizens to have a minimum of chimneys in the city, which are under constant control and not hundreds to thousands of uncontrolled chimneys.

CZT systems use cogeneration, use renewable energy sources, use emission-reducing technologies, build energy storage, etc. CZT is already not only heat generation, but also combined heat and power (CHP), which consumes approximately 20 % less fuel than separate production of the same amount of electricity or heat. CZT allows the provision of ancillary services in electricity grids and the storage of energy in the form of heat.

In existing buildings (classical panel houses), the cooling supply from CZT systems is so far a matter of future development. But in new buildings, this solution is starting to be successfully implemented. Absorption cold production projects are successfully implemented in Bratislava and for industrial customers in Žilina and Levice and are in preparation.

In developed countries, CZT systems are considered the most efficient and environmentally friendly way of producing heat and as a tool for decarbonising energy. Emerging new energy trends bring new challenges and opportunities to heat. Slovakia has all the preconditions for building and developing the 4th generation CZT systems. CZT systems are suitable for the integration of RES in the form of biomethane.

In addition to increasing the use of RES, the objective of heating and cooling policy is to actively contribute to the concept of smart cities, thus contributing to creating quality conditions for citizens' lives in cities, using and developing energy thermal infrastructure to ensure energy savings, healthier air, recycling and energy use of waste. CZT systems respond to current global challenges and challenges of modern, fast-moving cities, where clean air is a key indicator of quality of life.

5. support for biomethane production

By 2030, it is realistic to obtain over 200 million m^3/year biomethane based on existing measures. With further measures, the ambition is to increase production to 300 million m^3 biomethane.

Without biomethane, it will not be possible to meet the transport sub-target, either as a share of RES or as emission reductions. Biomethane will also be crucial for meeting the targets in heat generation, industry and buildings.

Biomethane can now be efficiently obtained from:

- conversion from biogas to biomethane
- recovery of energy-targeted crops
- recovery of waste from the biodegradable fraction of municipal waste (BLW); catering and restaurant waste
- recovery of waste from crop and livestock production for the production of biomethane

Table 28: Different types of waste in relation to biomethane

Type of waste	Annual production in tonnes	Amount of biomethane	Quantity of ktoe
Livestock excrements	10.1 million tonnes*	155 million m^3 – 205 million m^3 (methane content in biogas 55 %)	141-187
Biodegradable fraction of municipal waste (BRKO)	1 million tonnes (50 % of total KO*)	65 million m^3	60
Biodegradable fraction of catering and restaurant waste (one, canteens, hotels, school canteens, etc.)	0.35 million tonnes	42 million m^3	38
	Energy potential of the farmer/Waste component (breeding and FYT 40 % of the declared volume (1100 ktoe)*	biomass kernel = 115.2 PJ straw barrel)	(2750 ktoe)

* SIEA – National Road Map for the development of biomethane production and use in Slovakia'

Both biogas and biomethane stations reduce the impact of greenhouse gases on the atmosphere by using inputs such as biodegradable waste (BRO) and biodegradable catering waste (BRO) in their operations. Landfilling of these substances releases CO2, methane and other gases that reduce air quality. Based on the logic of the waste hierarchy, it is more advantageous to recover waste than to store it. Therefore, promoting separate waste collection is an important step, which in the future should account for a significant share of input materials to biogas stations.

Biogas as well as biomethane stations also use manure and slurry and unfeeded animal production residues as inputs. Freely stored manure discharges into the air methane and odours that impair air quality. Slurry can deteriorate the quality of both surface water and groundwater if it is not properly stored. In this regard, it is crucial to support the construction, expansion or transformation of farm stations to cover manure and slurry storage capacities on livestock farms.

Biogas plant transformation projects and the construction of new biomethane stations will be supported to support biomethane production.

6. promoting renewable and low-carbon hydrogen and the building of RES for its production

The policy on the promotion of hydrogen in Slovakia will be based on the National Hydrogen Strategy (UV No 356/2021) and its Action Plan (UV No 307/2023), as well as any future updates of these documents. Based on the existing use of hydrogen, it can be assumed that 200 kilotonnes of hydrogen per year will be consumed in Slovakia by 2030. This consumption of currently fossil-based hydrogen will be gradually replaced by renewable and low-carbon hydrogen according to agreed European legislation. Hydrogen policy aims to cover as much as possible the need to replace hydrogen from indigenous sources, in particular through the construction of electrolysers and other low-emission hydrogen production pathways. Given the energy demands related to hydrogen production and its expected consumption in Slovakia, it is necessary to consider covering part of the consumption by importing hydrogen from abroad.

The promotion of renewable and low-carbon hydrogen includes the development of new RES for electrolysers in line with the principle of additionality as described in the European RED II and its possible future revisions.

In May 2024, as part of the approved Slovak Recovery and Resilience Plan, the Ministry of the Economy launched a call for support to increase the flexibility of electricity systems for greater integration of RES **– construction of facilities for the production of hydrogen by electrolysis using RES** and for its storage. A total of EUR 13.56 million is allocated to the call, with a maximum of EUR 4 million available per project. Projects aiming at the construction of a new hydrogen production facility by electrolysis exclusively using RES with an installed capacity equal to or greater than 0.05 MW may receive financial support. It may also include a facility for the storage of hydrogen produced exclusively in that facility.

7. support for exploration wells for geothermal energy

The Slovak Republic wishes to create the conditions for eliminating the geological and investment risk of investors (e.g. through appropriate support from European fund programmes) and to remove legislative barriers to the development of the use of geothermal energy for energy purposes, linked in particular to an excessively long permitting process. In particular, aligning the specificities of the authorisation of geothermal wells with the conditions of calls for grant funding through European sources is essential for the use of resources from EU funds.

It is appropriate to set up financial incentives to support the investment and operating costs of geothermal wells.

The shortening of deadlines in permitting processes for renewable sources is part of European legislation (RED III Directives). The responsibility for transposing the RED III Directive is the Ministry of the Economy. In the context of RED III, the Ministry of the Environment acts as a joint authority in those areas that affect environmental impact assessment processes in the context of Act No 24/2006 on environmental impact assessment, as amended.

Under the Slovakia Programme, EUR 13096436 is allocated under Measure 2.2.4 “Support for the prospection and exploration of geothermal resources”.

Due to the war in Ukraine and the unstable fuel supply from the Russian Federation, energy security and price stability can now be considered a major benefit of geothermal energy use. Its use will reduce Slovakia’s dependence on imports of primary heat sources, in particular natural gas, whose combustion can be replaced by this renewable energy source.

Given the energy geothermal potential of the Slovak territory, the temperature of geothermal waters and the low-carbon electricity mix, the priority is to promote geothermal energy for the production of heat and the supply of this heat to CZT systems.

8. promoting innovative technologies

Innovative technologies for renewable electricity include, in particular, the combination of variable power generation and its storage or production of renewable gas from these variable sources and appear to be prospective:

1. Innovative technologies for electricity storage

In the coming years, solar electricity generation will increasingly generate intervals with low or negative day-ahead electricity prices, while on the same day in the early morning or evening hours prices will be much higher. Therefore, support for the construction of solar power plants will be aimed at the joint construction of these installations with electricity storage.

2. Innovative technologies for the production of renewable gas (hydrogen)

Production of renewable gas through electrolysis will ensure the use of higher installed capacity of variable resources. Due to the efficient operation of the electrolyser, hydroelectricity is an appropriate complement for variable electricity sources.

In the case of heat generation, innovative technologies mainly involve building a smart energy system for the city through district heating (see more in measure 4). Looking ahead

1. heat pumps integrated into intelligent energy management systems using locally produced electricity or waste heat (e.g. also from a nuclear power plant)

2. heat storage, including the use of electricity at times of low or negative prices.

Financial support allocated to renewable energy sources will prioritise innovative technologies in order to achieve the target of at least 5 % of installed capacity.

Proposed legislative, regulatory and technical measures in the field of electricity

In order to implement measures aimed at increasing the share of RES in the electricity sector, the following legislative, regulatory and technical measures will need to be adopted.

The transposition of newly adopted EU legislation under the Fit for 55 package, together with the modifying Directive (EU) 2023/2413 on the promotion of the use of renewable energy sources (RED III), to fully adopt elements of the new electricity market design within the meaning of Directive (EU) 2019/944, which will create an environment for the development of new players in the electricity market, will be a prerequisite for the full promotion of the use of RES in the electricity sector.

The immediate condition for the development of RES in the electricity sector is the reinforcement of the basic technical infrastructure, including the transmission and distribution networks, in order to increase the capacity available to RES operators interested in connecting to the grid for business purposes. In addition, it will be necessary to mitigate the impact of the operation of intermittent RES, the production of which may vary depending on externalities, by integrating elements of flexibility.

The following measures take into consideration the implementation of other elements of modern energy embedded in EU legislation, including self-consumers and energy communities producing renewable electricity. They also take into consideration EU-wide measures for faster installation of RES technologies, in particular with regard to permitting processes linked to the environmental impact of projects and shortening deadlines, the non-transparent length of which may slow down the faster integration of RES into Slovakia's national energy mix.

Table 29: Overview of measures for electricity

Name of action	Type of measure/Short description of the measure	Expected outcome	Target Group	Start and end dates of the measure
1. Modernisation and digitalisation of the electricity grid	technical/strengthening the Slovak electricity system and its preparation for greater integration of renewables	increasing connection capacity and speeding up the connection process	System operators	2024 —

Name of action	Type of measure/Short description of the measure	Expected outcome	Target Group	Start and end dates of the measure
2. Support for new flexibility elements	technical/Legislative development and integration of flexibility elements into the electricity market to limit negative impacts of variable RES on the electricity system, legislative and regulatory framework for the provision of flexibility	ensuring the stability and security of the electricity system and the functioning of the electricity market	System Operators/ÚRSOs	2024 —
3. Definition of acceleration zones for RES development	legislative/determination of zones suitable for priority construction of RES technologies	acceleration of permitting processes	Energy producers	2025 — 2026
4. Simplification and shortening of permitting processes	legislative/ensure shorter deadlines linked to the administrative processing of applications for the construction of RES and the environmental impact assessment	faster construction of RES installations	Energy producers	2025
Application of the principle of overriding public interest to the construction of energy infrastructure	legislative/application of significant investment status for investments in energy infrastructure related to RES integration	faster construction of RES installations	System operators/Energy generators	2025

Proposed legislative, regulatory and technical measures in the field of heating and cooling:

Legislative and regulatory measures will be needed to implement measures aimed at increasing the share of RES in the heating and cooling sector. They will cover regulatory measures in addition to the transposition of Directive (EU) 2023/2413. The aim will also be to introduce incentive mechanisms for operators of district heating and cooling systems aimed at increasing the share of RES in the fuel mix (e.g. a more favourable calculation of reasonable profit for operators using RES in the fuel mix, regardless of the other economically eligible costs and the amount of the maximum heat price – URSO).

The conditions of the post-2022 regulatory periods in the field of thermal energy will take into account the obligation to increase the share of RES in district heating systems. They shall also take into account the connection of self-consumers and create the conditions for their effective integration into district heating systems on the basis of commercial mutual benefit and respecting the technical capabilities of the CZT systems. At the same time, incentivising instruments for supporting RES will be designed in such a way that there is no inefficient, contradictory use of public finance instruments.

Table 30: Overview of heating and cooling measures

Name of action	Type of measure/brief description of the measure	Expected outcome	Target Group	Start and end dates of the measure
1. Supporting self-consumers of heat	legislative/ enabling the installation of RES heat generation plants for the own use of RES self-consumers for self-consumption, RES storage in connection to district heating and cooling systems (with the possibility of selling over-production to the CZT system)	Integration of-decoupled heat generators in the CZT system	CZT and customers	2025
Right to disconnect self-consumption of heat eel from RES	legislative/ right of a self-consumer of heat from RES connected to CZT systems to install a RES heat generator if the CZT system does not fulfil the condition of efficient district heating	Installation of own equipment the heat generation from RES	self-consumer or RES heat-producing community	2026
(3) Use of waste and waste heat and energy compliance and use of waste heat in CZT systems	regulatory/ favouring the construction of biomethane production facilities (coming mainly from crop and livestock waste, the biodegradable fraction of municipal waste, biodegradable kitchen and restaurant waste and waste treatment plants) and promoting the use of waste heat from industrial processes, tertiary, waste water and energy processes in CZT systems	reducing fossil fuel consumption	waste recovery sector, nuclear power plants, industry	2025
Support for district heating systems	regulatory/ Enabling investment support for the installation of RES for CZT equipment and systems with technical prerequisites for the installation of RES	reducing fossil fuel consumption and pollutant emissions	CZT	2025

Measures in the transport sector

Table 31: Measures in the transport sector

Name of action	Type of measure/brief description of the measure	Expected outcome	Target Group	Start and end dates of the measure
1. Increasing the minimum share of sustainable fuels for fuel suppliers	regulatory/ in line with the indicative trajectory to reach 29 % RES in transport in 2030	Achieving the RES target in transport	fuel suppliers	2025-2030
2. Increasing the contribution of advanced biofuels and biogas	regulatory/ increase in the share of advanced biofuels and biogas referred to in Part A of Annex IX as a share of final energy consumption in transport	Achieving the RES target in transport	fuel suppliers	2025-2030
3. Examination of the possibility of increasing the limit for biofuels from feedstocks from RED Annex IX.B	regulatory/ increase of the 1.7 % cap for biofuels produced from feedstocks listed in Annex IX, Part B of the Renewables Directive, determined as a share of final energy consumption in transport	Achieving the RES target in transport	fuel suppliers	2025-2030
4. Increasing the share of RES in transport	analysis of the contribution of available new fuel technologies (biofuels, synthetic fuels, bioCNG, bioLNG) to meet the transport RES targets	Achieving the RES target in transport	fuel suppliers biofuel suppliers MINISTRY OF THE ECONOMY MINISTRY OF THE	2024

Name of action	Type of measure/brief description of the measure	Expected outcome	Target Group	Start and end dates of the measure
5. Building hydrogen infrastructure in transport	in line with Regulation (EU) 2023/1804 of the European Parliament and of the Council on the deployment of alternative fuels infrastructure, and repealing Directive 2014/94/EU (AFIR), ensure the construction of recharging infrastructure for electric cars and hydrogen refuelling infrastructure along TEN-T corridors and defined urban nodes	Achieving the RES target in transport		2024
6. Analysis of the introduction of B10 diesel	regulatory/ develop an analysis for options to introduce B10 fuel by 2030	An assessment of the compatibility of the fleet in Slovakia with B10 fuel and an evaluation of the possibility to extend the fuel supply to the general public to include B10 diesel. Due to the fact that not all vehicles will be compatible with B10 fuel in 2030, it is necessary to maintain a B7 protection grade of 7 % FAME (fatty acid methyl esters)	fuel suppliers	2025
7. Operating support for the development of low-emission public passenger transport	financial/ exemption from excise duty for all 100 % advanced sustainable fuel produced from waste raw materials for use in public passenger transport (MHD, suburban and regional transport, rail transport)	Increasing the share of RES in transport	biofuel suppliers, MHD, suburban bus, rail passenger transport	2025
8. Developing sustainable public transport	explore the possibility of using resources from the Slovakia Programme for the purchase of buses running on 100 % sustainable fuel	Increasing the share of RES in transport (promoting the market for fuels with higher biofuel content)	biofuel suppliers, MHD, suburban bus transport	2025-2027

Name of action	Type of measure/brief description of the measure	Expected outcome	Target Group	Start and end dates of the measure
9. Introduction of the possibility to trade surplus RES in transport	regulatory/ Legislative adjustment of the introduction of a credit system for the purchase and sale of RES in transport, for all renewable fuels, including electricity, hydrogen and biomethane	Increasing the share of RES in transport	fuel suppliers, renewable fuel suppliers, including equatorial, hydrogen and biomethane	2025
10. Support for the development of low-emission freight transport	financial/ exploring the possibility of reducing registration fees for the purchase and transcription of 100 % sustainable fuel vehicles of categories N1 to N3. Reduction of the annual tax rate for category N1 to N3 lorries (or tractors) to 100 % sustainable fuel.	Increasing the share of RES in transport (increase in fuel consumption of 100 % sustainable fuels)	biofuel suppliers, transporters	2025

Measures in the biomethane and hydrogen sector

In line with the approved National Hydrogen Strategy Action Plan and based on EU requirements, the legislative and regulatory environment for hydrogen in Slovakia will need to be adapted to support the development of hydrogen use in industry, transport and energy and the implementation of relevant technologies. This will include preparing new or amending existing legislation, in particular in the field of individual permitting processes for hydrogen technologies (e.g. EIA, IPPC, territorial procedure, construction procedure, etc.) with a view to proposing legislative measures that significantly simplify permitting processes for hydrogen technologies. It will also be necessary to adopt European standards on an ongoing basis in the Slovak Technical Standards (STN) system and, if necessary, on the basis of the identification and input of stakeholders, to ensure the development of the original STN.

Promoting biomethane (and adequate support also for renewable and low-emission gases) will ensure their uptake in industry, transport and energy. The production of biomethane will benefit from simplification and acceleration of the permit-granting process.

Table 32: Measures in the biomethane and hydrogen sector

Name of action	Type of measure/brief description of the measure	Expected outcome	Target Group	Starting date of the action
(1) Establishment of guarantees of origin for biomethane	legislative/ guarantees of origin for biomethane for the development of a market for biomethane tradable in the EU, including its recognition under the EU ETS	biomethane guarantee market	biomethane producers	2022
(2) Supporting the transition from biogas to biomethane	regulatory/ promoting the transition from biogas to biomethane for transport or high-efficiency combined electricity and heat generation	production of 110 million m^3 (90 ktoe) biomethane	biomethane producers	2022
Support for the recovery of waste from crop and livestock production	regulatory/ promoting the recovery of waste from crop and livestock production for the production of biomethane	production 60 million m^3 (50 ktoe) biomethane	biomethane producers	2022
Support for the recovery of waste from the biodegradable fraction of municipal (BRKO), industrial kitchen and restaurant waste	regulatory/ promotion of waste recovery	production 30 million m^3 (25 ktoe) biomethane landfilling of less than 10 % of municipal waste generated	processors of BRKO,industrial, kitchen and-restaurant waste	2022
(5) support for the production of renewable or low-carbon hydrogen *	support for the production of hydrogen to be used in transport, industry or high-efficiency cogeneration	100 % coverage of the consumption of hydrogen refuelling stations and partial replacement of fossil-based hydrogen	hydrogen producers	2022
(6) promoting the recovery of animal by-products of cat. 2 and 3	regulatory/ support for the recovery of animal waste for biomethane production	Support for biogas/biomethan e production	producers of animal waste	2025
(7) incentives to participate in flexibility of higher generation generation	regulatory/ facilitating the provision of flexibility services for electricity from biogas		biogas electricity producers	2025

8. promoting the use of digestate in agriculture	regulatory		producers of digestate	2025
Support for the buy-in of biomethane	regulatory or financial/facilitate biomethane sales		biomethane producers	2025

*low-carbon hydrogen for this measure is hydrogen whose carbon footprint is 70 % lower (e.g. with carbon sink or CO_2) compared to hydrogen production in the natural gas reforming process

ii. Where relevant, specific measures for regional cooperation as well as for on a voluntary basis, estimated overproduction of energy from renewable sources that can be transferred to other Member States to achieve the national contribution and trajectories referred to in point 2.1.2

No use is made of the voluntary statistical transfer of RES to another Member State. Slovakia will primarily seek to contribute to the European objective set out in Chapter 2.1.2. This contribution is intended to be met. If Slovakia exceeds its objective, it will consider using a statistical transfer.

iii. Specific measures to provide financial support, including, where appropriate, support from Union resources and the use of Union funds to promote the production and use of energy from renewable sources in the electricity, heating and cooling and transport sectors

Financial support for the achievement of renewable energy targets shall be divided into operating and investment support.

- Operating support

Operating support is currently provided by Act No 309/2009 on the promotion of renewable energy sources and high-efficiency cogeneration and amending certain acts, as amended, which allows support for installations of producers of electricity from renewable energy sources and high-efficiency cogeneration by means of tendering procedures and auctions (Section 5c) or by means of a surcharge for electricity producers' installations with an installed capacity of up to 1 MW (Section 3(4)) and for selected installations with an installed capacity of up to 125 MW (Section 3c). The aid scheme was approved by Commission Decision SA.54318 (2020/NN) of 4.3.2021 and is valid until 31.12.2025

1. Operating support for the production of heat from RES

Operating support for RES is linked to electricity production, with the heat sector only having access to it for combined heat and power technologies and promoting biomass and biogas technologies. In order to achieve the 2030 RES targets, operational support will also need to be considered to allow separate operational support for the production of heat from RES for the construction of new plants for the production of heat from biomass, biogas, biomethane, deep geothermal and solar energy and energy used in heat pumps. The aid will be limited to the construction of installations whose operators build a new district heating and cooling system (with a preference for air quality sites) or which have an approved transition plan to efficient district heating (Article 24(2) of Directive (EU) 2018/2001) and which fulfil the conditions for efficient district heating on the basis of the installation of the supported installation. The financing of this form of operating support will be ensured in cooperation with the MoE.

2. Operating support for the production of electricity in cogeneration plants using RES technology with an installed capacity of up to 1 MW

Act No 309/2009 on the promotion of renewable energy sources and high-efficiency cogeneration and amending certain acts, as amended, currently allows support for the production of electricity in new combined heat and power plants (regardless of the use of RES) for installations with an installed capacity of up to 1 MW_e, of which at least 60 % of the heat produced is used to supply heat by district heating, and primary energy savings are at least 10 %.

In order to increase the incentive for investors in RES electricity and heat generation technologies, this form of support will need to be modified to cover new cogeneration plants installed together with RES heat generation plants. Support should be provided in the form of a guaranteed price.

3. Operating support for electricity generation in modernised combined heat and power plants using RES technology

Act No 309/2009 Coll. on the promotion of renewable energy sources and high-efficiency cogeneration currently allows support for electricity generation in modernised cogeneration plants (regardless of the use of RES) with an installed capacity of up to 125 MW_e, provided that the achieved overall efficiency of cogeneration is at least 80 % for combined cycle combustion turbines and condensation steam turbines with steam extraction and 75 % for other cogeneration plants, at least 60 % of the heat produced in the cogeneration plant is supplied by centralised heat supply and at least 60 % of the total heat supply by district heating is supplied to the public. Support for electricity generation is provided through a guaranteed feed-in tariff.

In order to increase the incentive for investors in RES electricity and heat generation technologies, it would be necessary to modify this form of support so that, under the current conditions, the support only applies to cogeneration plants that will be upgraded, as long as the upgrade includes the installation of a heat generator from RES, or the CZT operator concludes a long-term contract for the supply of biomethane.

4. Operating support for the maintenance of cogeneration of electricity and heat from biomass

Operating support will be granted to cogeneration plants using biomass in order to compensate for the differences between the operating costs of the power plant and the market price for electricity and heat. Support shall be provided by means of a feed-in tariff for a period of three years, with the possibility of extending the duration of the support in the event that differences have not been settled after the expiry of the previous support period. Operating support for cogeneration of electricity and heat from biomass will only be granted in air quality management areas if this is in line with stricter technological requirements.

5. Operating support for new cogeneration installations using renewable energy sources with installed capacity above 1 MW

The existing support scheme for electricity generation in cogeneration plants using renewable energy sources through transparent tendering procedures (auctions) will continue to be maintained, with an increased focus on supporting such plants that will place the bulk of the thermal output in district heating and cooling systems. If support is to be given to an installation from renewable energy sources that technologically enables the use of useful heat, the heat output will have to be located in district heating and cooling systems.

6. Operational support for biomethane production

In order to kick-start investments in biomethane production, the introduction of cost-effective operating support will be explored. The support scheme should ensure that generators recoup their investments and that obligated parties can meet their greenhouse gas emission reduction targets, the share of RES and the share of advanced sustainable biofuels through biomethane.

- Investment support

In particular, investment support will be provided through:

- Environmental Fund
- Modernisation Fund
- Programme Slovakia
- Recovery and Resilience Plan

A broader description of these instruments and allocation to support the use of RES is given in section 3.1.1 iii.

Investment support for the use of RES will focus in particular on:

- the use of RES in district heating and cooling systems, including increasing the efficiency of heat production and distribution in district heating system circuits;
- support for RES installations to ensure lower electricity prices and renewable gas for industry (including through PPAs);
- energy distribution and storage facilities (including smart management systems) to increase the efficiency of existing facilities and the installation of new RES facilities (business, public and households)
- geothermal energy use, including exploration wells;
- support for transport infrastructure aimed at charging electric cars and refilling hydrogen to vehicles, as well as electrification of public passenger transport (electrification of railway lines, construction of new tram and trolleybus lines instead of bus);
- solutions to ensure flexibility needs and ancillary services for the electricity system;
- construction of renewable hydrogen production facilities using RES and biomethane.

Overlapping of investment and operating support

In order to reduce operating support, the possibility of combining investment and operating support shall be ensured in such a way as to ensure the condition of proportionality from the point of view of State aid and to respect the requirements for deducting any investment aid from the total amount of investment in the calculation of the average cost of energy production (LCOE).

Other measures having a similar effect to investment and operating support

In order to implement measures aimed at increasing the share of RES in the heating and cooling sector, fiscal measures may also be introduced, e.g. a reduced VAT rate on heat from district heating and cooling using RES.

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

The Slovak Republic shall assess once every five years, no later than the end of 2025, the efficiency of its support schemes for electricity from renewable sources and their significant distributional impacts on different consumer groups and investments The results of this assessment will be taken into account in the indicative long-term planning guiding the decisions on support and proposals for new support. This assessment will be included in progress reports in accordance with Regulation (EU) 2018/1999.

v. Specific measures to establish one or more contact points; streamlining administrative procedures, providing information and training, and promoting power purchase agreements

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

The Slovak Innovation and Energy Agency (SIEA) is the contact point for streamlining administrative procedures.

SIEA provides expertise in RES awareness. The training of installers of RES installations is provided by accredited training, which gives the installer a certificate. At the end of the training, the installer shall have the skills required to install the relevant equipment and systems in order to meet the consumer's performance and reliability needs, to perform quality work and to comply with all relevant regulations. The training course ends with an examination on the basis of which a certificate is issued free of charge by the Ministry of the Economy. The certificate shall be valid for 5 years and shall be automatically renewed once for a period of 5 years if the holder of the certificate attends up-to-date training.

In preparing this plan, the existing unjustified barriers and the potential for self-consumption of renewable energy have been assessed. The result of the assessment is that there are no regulatory or other legislative barriers for such self-consumers. The only real barrier for more than half of the household is the financial difficulty of installing the equipment. The cost of installing the equipment as an additional or substitute heat source in relation to the return on investment generates a low degree of interest in these sources. The situation changes in the case of an installation subsidy. An example is the Green Households programme, which supports equipment to match the payback period of the investment. Interest in installing equipment has increased several times. Therefore, for the period beyond 2024, it is proposed to continue household subsidies in the existing Green Households programme. Support for the development of energy self-consumption and renewable energy communities is ensured by a financial grant in particular in measure 2.2.1 of the Slovakia Programme.

vi. Assessment of the need to build new infrastructure for district heating and cooling using renewable sources

In order to implement measures aimed at increasing the share of RES in the heating and cooling sector and in order to improve air quality in locations with increased emission loads (notably due to emissions of fine dust particles), the construction of new district heating and cooling systems based on renewable heat generation plants (in particular deep geothermal energy, biomass, biogas, biomethane, solar energy and energy used in air-to-air, ground-to-water, water-to-water heat pumps), possibly in combination with high-efficiency cogeneration plants, appears necessary. In the event of insufficient interest of heat and cooling market participants to build a new district heating and cooling system under market conditions, the competent authority shall tender for new district heating and cooling capacities with the possibility of participating in one of the above-mentioned investment or operating support schemes.

The challenge is also to build cooling generation and supply infrastructure using new or existing district heating infrastructure, absorption cooling technology as well as heat pumps. Projects implementing such infrastructure may participate in investment and operating support programmes, provided that they use renewable energy sources, possibly in combination with high-efficiency cogeneration technology.

vii. Where appropriate, specific measures aimed at promoting the use of energy biomass, in particular new biomass sources, taking into account:

The Ministry of Agriculture and Rural Development, as the department responsible, is responsible for the development of the bioeconomy at national level in the field of agriculture in Slovakia. In this context, it started in 2022 with the preparation of the concept material of the Circular Bioeconomy Road Map: https://www.mpsr.sk/strategie-analyzy-a-prierezove-cinnosti/biohospodarstvo/1-242-1659

The bioeconomy is part of the 'green economy' to promote the sustainable use of natural resources. The circular bioeconomy should promote efficiency in the use of these resources, increase efficiency in the use of biomass, apply circularity principles (waste as a raw material) and promote cascading solutions for the use of biological resources in various manufacturing sectors.

The Circular Bioeconomy Roadmap addresses the following chapters: Circular bioeconomy, renewable energy sources – biomass and biowaste, biogas and biomethane, organic fertilisers, urban wastewater treatment of small municipalities and plants, carbon farming, sustainable insulation systems, construction and packaging materials, technological (artificial sinks and recycling of CO_2 at source, with subsequent energy and raw material uses.

3.1.3. Other elements of the dimension

i. Where relevant, national policies and measures related to the sector under the EU ETS; and assessment of the additionality aspect and impacts on the EU ETS

The effects of the mitigation measures were not specified in the update of the NECPs.

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

On 17 October 2018, Slovak Government Resolution No 478/2018 approved the updated Strategy for Adaptation of the Slovak Republic to Climate Change. The main objective of the updated adaptation strategy is to increase the resilience and preparedness of the Slovak Republic to face the adverse impacts of climate change and to establish an institutional framework and coordination mechanism to ensure effective implementation of adaptation measures at all levels and in all areas.

The achievement of the main objective of adaptation should contribute to the achievement of the milestones of: ensuring the active development of national adaptation policy, implementing adaptation measures and monitoring their effectiveness, strengthening the translation of the objectives and recommendations of the adaptation strategy in multi-level governance and promoting entrepreneurship, raising public awareness of climate change issues, promoting synergies between adaptation and mitigation measures and using an ecosystem-based approach in the implementation of adaptation measures, and supporting the translation of the objectives and recommendations of the 2030 Agenda for Sustainable Development, the UN Framework Convention on Climate Change and the Paris Agreement.

The strategy seeks to link scenarios and possible impacts of climate change to proposals for appropriate adaptation measures in the broadest possible range of areas and sectors. In terms of adaptation to the adverse impacts of climate change, key areas and sectors are considered to be: rock and geology, soil environment, natural environment and biodiversity, water regime in the landscape and water management, settlement environment, population health, agriculture, forestry, transport, tourism, industry, energy and other business areas, and risk management.

The ‘action plan for the implementation of the Slovak Strategy for Adaptation to Climate Change’ (‘NAP’ or ‘Action Plan’) aims to increase Slovakia’s preparedness for the adverse impacts of climate change through the implementation of cross-cutting and specific adaptation measures and tasks. At the same time, the institutional framework and coordination mechanism will be supported to ensure effective implementation of adaptation measures at all levels and in all areas, as well as to raise overall awareness of the issue.

The structure of the NAPs is based on the definition of a headline target, which is based on the implementation of strategic priorities. To achieve the objective, 5 cross-cutting actions are identified to improve the implementation framework, support science and research on adaptation to climate change, establish an efficient crisis management and response system for extreme events such as floods and fires, support green infrastructure, as well as promote education and awareness. 18 tasks follow up on these actions. The core of the NAP is 7 specific areas: water protection, management and use, sustainable agriculture, adapted forest management, natural environment and biodiversity, health and healthy population, settlement environment and technical, economic and social measures. Each of these 7 areas has a specific objective, each of which has defined its basic principles and specific measures defining tasks in a given segment. A total of 45 specific actions were identified and in their 169 tasks for the period of validity of the NAPs until 2027. These measures and their follow-up tasks are based on the Strategy for Adaptation of the Slovak Republic to Climate Change – Update. The action plan was approved by Resolution No 476 of the Slovak Government of 31 August 2021.

On 23 June 2021, the Slovak Government, by Resolution No 356/2021, took note of the document ‘National Hydrogen Strategy – Preparing for the Future’, which defines the strategic role of the State in the use of hydrogen technologies in Slovakia and the conditions for deploying hydrogen technologies in line with the long-term strategic objective of developing Slovakia1,2 by 2030 and 2050 respectively. The National Hydrogen Strategy is further elaborated in the form of an Action Plan of Measures for the Successful Implementation of the National Hydrogen Strategy by 2026, which was approved by the Slovak Government on 12 June 2023. Following the evaluation of the implementation of the Action Plan between 2023 and 2026, an update of the Action Plan will be prepared, with implementation from 2027 to 2030.

The National Hydrogen Strategy defines targets for the use of hydrogen in different areas of Slovakia’s economy in such a way as to contribute to Slovakia’s energy transition and decarbonisation objectives. Measures to meet these objectives, as defined in the Action Plan, will pave the way for investments in the economically sustainable value chain of renewable and low-carbon hydrogen, i.e. its production, transport and distribution, storage as well as use in particular in industry, energy and transport, especially in cases where direct electrification will not be possible or cost-effective. Together with them, conditions will be created for the areas of R & D, international cooperation and marketing.

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

The Slovak Ministry of the Economy has drawn up a ‘Draft Action Plan for the development of electromobility in the Slovak Republic’, which follows on from the conclusions and recommendations of the GEAR 2030 High Level Group of 18 October 2017, as well as the Commission’s strategic document ‘Europe on the Move’ and the clean mobility packages adopted. The Action Plan contains 15 measures that have the characteristics of direct support for the use of low-emission vehicles and the possibility of a financial mechanism to support the development of charging infrastructure, as well as the nature of incentive support. In support of the development of electro-mobility, the Slovak Government, at its meeting of 29 February 2024, adopted a number of resolutions on the sustainability of car production in Slovakia, in the context of the transition to the production of electric cars and on selected problems in the development of electro-mobility.

In July 2019, the Ministry of the Economy launched the first ever call for the construction of AC charging stations for municipalities and municipalities (a planned volume of EUR 500 000). At the end of 2019, the Ministry of the Economy launched a call for the purchase of battery and plug-in hybrid electric vehicles (EUR 5 million).

Support by the Ministry of the Economy is implemented on the basis of Section 2(h) – Construction of alternative fuels infrastructure and letter (i) – use of new alternatively fuelled vehicles of Act No 71/2013 on the granting of subsidies under the competence of the Ministry of Economy of the Slovak Republic.

Support for environmental aspects and decarbonisation is also included in the annual business plans and strategic orientations of many companies under the Ministry of Transport, which, in addition to reducing energy consumption in the organisation and efficient use of buildings, also aim to gradually renovate the vehicle fleet and seek to comply diligently with all the requirements imposed by the transposed European Union legislation. As these technologies are more costly, they are significantly more difficult to procure for some companies. In addition, problems related to compliance with the adopted Act No 343/2015 on public procurement and amending certain acts were also registered in relation to maintaining the percentage of clean vehicles based on the provisions of Act No 2014/2021 on the promotion of clean road transport vehicles and amending certain acts for above-threshold contracts. These problems relate in particular to the consequent disadvantages in the competitive environment (increase in the price of services) as well as the narrower supply of electric vehicles on the market and the current state of the recharging infrastructure.

In line with Regulation (EU) 2023/1804 of the European Parliament and of the Council on the deployment of alternative fuels infrastructure, and repealing Directive 2014/94/EU (AFIR), a network of recharging points for electric cars and hydrogen refuelling stations along TEN-T corridors and at designated urban nodes needs to be considered by 2030.

iv. Where appropriate, national policies, timetables and measures planned for phasing out energy subsidies, especially for fossil fuels

Slovakia supported the use of fossil fuels at an average of EUR 307.8 million per year (2011 to 2021 inclusive32), of which 54.5 % were direct support and 40.2 % tax reductions. This form of aid followed a steady trend over the period under review. Indirect support amounted to 5.3 %, a fluctuating trend reflecting the dependence of the amount of subsidies on energy and commodity prices on the market and the regulatory decrees of the Slovak institutions. In terms of the type of fossil source, the State supported the most coal (52.5 %) and natural gas (32.2 %) in the period under review.

The share of fossil fuel subsidies in Slovakia's total GDP was on average 0.36 % per year (after leaving the extreme in 2021 due to increased support for natural gas through regulated prices for vulnerable customers on average 0.31 % per year). By omitting negative subsidy values (in the case of indirect subsidies), the share of fossil fuel subsidies increases by an average of 0.07 p.p. per year. Direct subsidies and tax expenditure accounted for 1.70 % of government expenditure. A fluctuating trend was observed in that period. This trend was due, for example, to one-off aid (refunds for gas) or legislative change (e.g. support to businesses at reduced or individual TPS and

322 Measuring fossil fuel subsidies in the context of the sustainable development goals, available at: FossilFuel.pdf (unep.org)

TSS rates).33

A significant component was subsidies for electricity generation from indigenous coal in relation to the general economic interest of maintaining stability of energy supply for the Upper Nitra region. In the context of the termination of the scheme 'State aid SA.52687 – Slovakia – Electricity production in Slovakia from indigenous coal', the Nováky thermal electricity plant ceased operations in December 2023.

Slovakia does not currently have a prioritisation for fossil fuel subsidies and builds on government regulations on the necessity to provide different types of support. In assessing the need for subsidies, consideration shall be given to the current economic, social and environmental priorities of the State.34

3.2. Dimension: energy efficiency

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, including planned measures and instruments (also of financial nature) to promote the energy performance of buildings, in particular as regards to the following:

I. Energy efficiency obligation schemes and alternative policy measures under articles 7a and 7b and Article 20(6) of Directive 2012/27/EU to be developed pursuant to Annex III to this Regulation

Slovakia will continue to ensure compliance with the obligation under Article 8 of Directive 2023/1791 on energy efficiency through policy measures. The most significant energy savings are expected in industry. The Modernisation Fund, the Recovery and Resilience Plan and the Slovakia Programme will be the dominant financial mechanisms to support energy efficiency gains. Private financing will play a key role in terms of overall costs, especially in the household sector. The final contribution of households to energy savings will thus be directly dependent on their financial capacities and investment priorities. The renovation of public sector buildings will continue at roughly the same pace as hitherto, but this will not be sufficient in view of the more ambitious targets in this area. The transport sector will contribute to reducing final energy consumption, in particular through the promotion of electro-mobility.

The industry sector should remain a clear priority in terms of promoting investment to reduce energy intensity, mainly due to the lowest measurement costs per unit of energy saved, with the highest share of total final energy consumption among all sectors of final consumption. In the household sector, it will be important to focus in particular on the renovation of single-family houses. The current financial mechanisms and support programmes do not reflect by far the required level of recovery. To reach this level, the pace of renovation needs to increase at least threefold. The focus on tackling energy poverty will be an absolute priority in this regard, but this will require a large amount of additional funding for support. The pace of renovation of multi-apartment buildings in Slovakia has long been high, but there has been a more pronounced downward trend in recent years, reflecting a significant share (more than 70 %) of partially or comprehensively renovated multi-apartment buildings. The focus will remain on the renovation of public buildings, but given the public sector's share of only around 4 % in final energy consumption and the high cost of energy saved, it will be the lowest priority in terms of promoting investment, alongside the industrial and household sectors. Nevertheless, it will be necessary to identify forms of support which Slovakia will ensure compliance with its obligations under Articles 5 and 6 of the Directive.

Industry

In Slovakia's efforts to comply with its obligation under Article 8 of Directive 2023/1791 on energy efficiency,

33Institute of Economic Analysis, How do we subsidise fossil fuels?2022, p. 3
34Institute of Economic Analysis, How do we subsidise fossil fuels?2022, p. 13

industry will have an indispensable place by 2030. Among all sectors of final consumption, it will contribute most significantly to the target. The largest amount of energy savings will be achieved by using funds from the Modernisation Fund and the Recovery and Resilience Plan Fund. In addition to the cost-effectiveness of the measures, it will also be of utmost importance that the supported investments are carried out at the planned scale and time, i.e. by the end of 2030 at the latest. Incentives and opportunities for businesses to make investments to reduce consumption beyond their normal investment will also play a key role.

In the context of the planned investments from the Recovery and Resilience Plan and the Modernisation Fund, a reduced contribution of energy savings from energy saving agreements is expected, as some of the enterprises with which the Ministry of the Economy has signed these agreements will implement part of their significant investments through the financial mechanisms mentioned above. The Ministry of Economic Affairs will therefore make efforts vis-à-vis industry, associations and associations to set up this model of cooperation in such a way as to encourage stakeholders to reduce their energy consumption in a positive way.

The iron and steel sector has the potential to contribute more than 40 % to the obligation under Article 8 of Directive 2023/1791 on energy efficiency. **Finding resources to finance investments and implement them by 2030 at the latest should also be one of the main priorities**. These are two investments with a total estimated cost of around EUR 2 billion. EUR. The decarbonisation of steel production by installing electric arc furnaces, together with the environmentally sustainable processing of liquid steel by thin strip casting, should result in a reduction in energy consumption of almost 13 TWh compared to 2019.

A significant part of the Modernisation Fund and the Recovery and Resilience Plan funds will go to the chemical, petrochemical and paper industries, as well as the cement and building materials industry. The most significant part of the savings will be achieved in the petrochemical industry, a set of technological measures to increase energy efficiency and CO2eqv savings per ethylene unit. Investments made in the cement and construction products sector will focus primarily on decarbonising cement production and also at decarbonising production as such (use of waste heat, change of operation of heat exchanger, etc.). The remaining energy savings will be achieved by decarbonising the lime kiln in the paper industry, by decarbonising production capacities in the glass industry and by introducing green ammonia production in the chemical industry.

For measures implemented on the basis of recommendations from energy audits and recommendations implemented thanks to energy management systems, energy savings are estimated to increase by around 10 % to 20 % compared to the previous period. Directive 2023/1791 on energy efficiency introduces a new obligation for companies with an average annual consumption of all their energy carriers higher than 85 TJ over the previous three years to implement an energy management system. The implementation of the energy management system has been voluntary for enterprises in the past. In addition, enterprises with an average annual energy consumption higher than 10 TJ over the previous three years that do not implement an energy management system will be subject to an energy audit. Both measures will result in an increase in the number of enterprises that were not obliged to implement them in the past, but will not be implemented under the new Energy Efficiency Directive. Given that a large proportion of these firms had implemented measures with a short payback period before this obligation was introduced, the overall percentage of the increase in savings is expected to be lower than the percentage of the increase in the number of enterprises subject to the obligation to carry out energy audits/energy management systems.

In addition to the energy savings achieved by the measure Improving energy efficiency in enterprises, the programme**Slovakia will also contribute with savings from the new Greens programme.** Compared to the previous programming period, support to enterprises has been extended from energy efficiency to renewables. Pursuant to Annex V of the Energy Efficiency Directive 2023/1791, energy savings from measures promoting small-scale renewable energy technologies on or in buildings, as well as measures promoting the deployment of solar thermal technologies, can also count towards the fulfilment of the obligation under Article 8. However, despite this, both measures are rather complementary in terms of contribution to the overall objective, as they are of the order of magnitude lower than those of the other measures. In order to increase the contribution, it is important to rethink the financing method, which currently represents grant support amounting to more than four fifths of the total eligible costs.

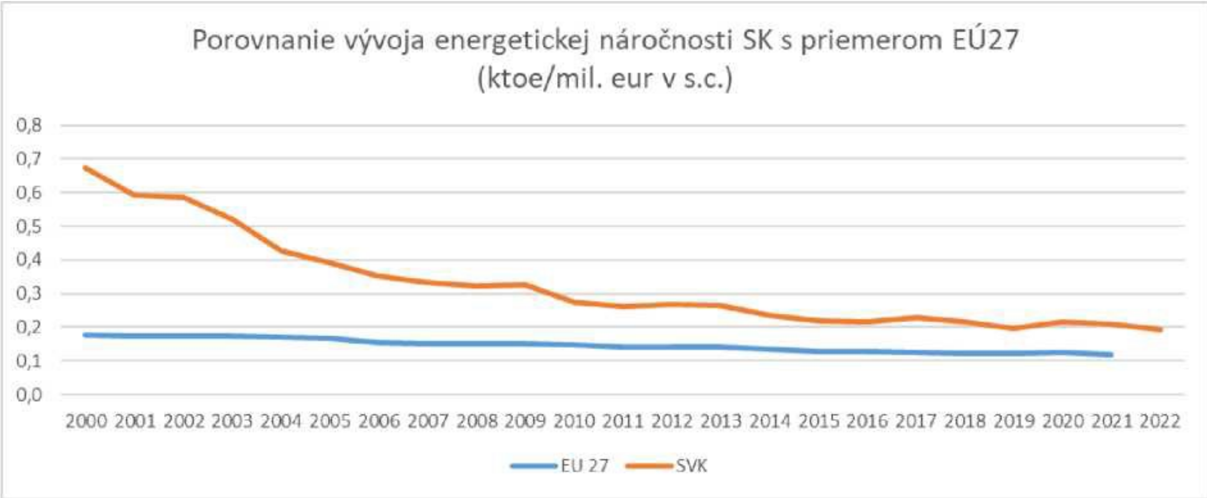
Guaranteed energy services offer**great potential for the future, the benefits of which will be particularly evident for more technically demanding solutions with longer payback periods, such as projects aiming at the efficient use of waste heat. Realising this potential will depend on the setting of the legislative framework, in particular as regards the flexibility to use the available financial mechanisms for co-financing.** It will also be important to set up the legislative framework in terms of form (types of contracts). A key element will be the involvement of the State in the form of awareness raising and effective links with other measures such as the Energy Savings Agreement (Finland). Businesses have a general interest in improving energy efficiency. This interest is mainly driven by economic efficiency and the environmental aspects of production. At the same time, however, it is limited by financial implications, in particular return on investment and debt constraints. In the past, a number of investment projects have been implemented to improve energy efficiency, mostly involving projects with a short-term financial return over a 2-3 year horizon. The stock of such investments is being depleted relatively quickly, as confirmed by the summary letters from the energy audits of large enterprises under the management of the Ministry of the Economy, as well as by the statements made by these companies. Companies also have energy efficiency projects in their investment pools with medium to long-term returns. However, the existing funding offer is not capable of providing undertakings with financial conditions for which the implementation of such projects would also have economic and financial justification for the undertakings in question. The underlying trend towards developing energy services, financing projects with medium- and long-term payback periods is the so-called off-debt financing model. This would allow the undertakings concerned to make their investments without increasing their financial liabilities and thus encumbering their financial balance sheet. Businesses would repay such investments as part of their operating costs. In this case, it is necessary to support companies providing guaranteed energy services that would carry out investment projects for large companies in order to reduce their energy consumption.

Creating an environment that maximises incentives for businesses to invest in reducing self-consumption will be a**prerequisite for increasing the pace of energy savings in industry.** Reducing the administrative burden and simplifying processes related to the use of public funds to promote energy efficiency will be at least as important as securing financing in this respect. A predictable energy policy that minimises sharp fluctuations and changes with a major impact on energy price developments will be crucial. It will be important to continuously raise awareness among businesses of existing and upcoming instruments to promote energy efficiency in industry by the state. The State shall endeavour to contribute to the shaping of an environment that promotes the exchange and sharing of information between businesses, sectors and associations with a view to reducing energy intensity. The data collection, verification and evaluation system will be modified to identify all available measures to assess them in terms of their benefits and feasibility.

Impact of measures on the development of final energy consumption by 2030

The evolution of final energy consumption in industry by 2030 will depend as a priority on the implementation of planned investments co-financed by the Recovery and Resilience Plan and the Modernisation Fund. If these investments are not achieved by 2030, industry can expect an increase in final energy consumption of between 1 % and 4 %. By contrast, the implementation of these investments is expected to decline by around 10 %. Battery production will also have an important impact on the future development of energy consumption in this sector. However, this impact can be offset by the more pronounced apologies of industrial enterprises to implement consumption reduction measures without the co-participation of public resources, or an increased level of implementation of measures of an operational nature. However, given the trend in energy intensity, the potential for energy savings from these measures is significantly limited (Graph 11). A negative phenomenon that may lead to a reduction in energy consumption is the shut-down of energy-intensive installations in particular as a result of the introduction of stricter environmental policies and the associated increase in costs and reduced competitiveness.

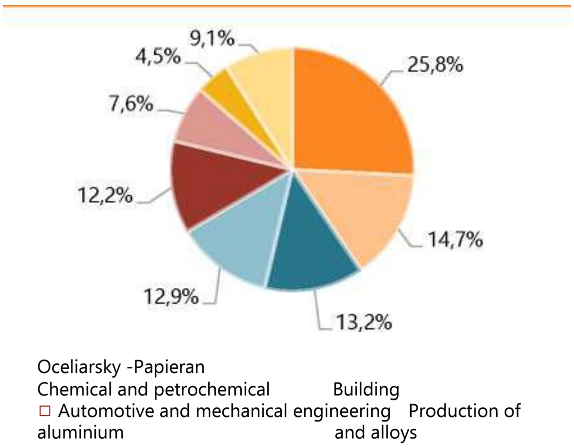
Figure 11: Comparison of developments in Slovakia's energy intensity with the EU average (value added in constant



Zdroj: MH SR, Eurostat

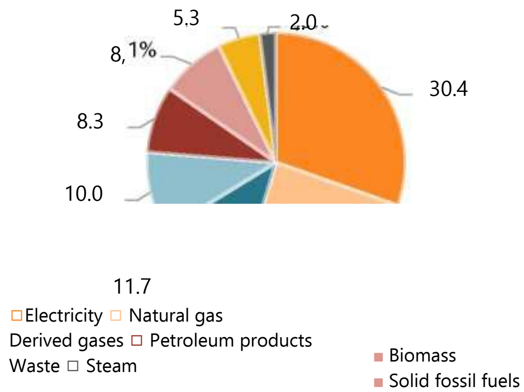
Industry's share of final energy consumption has long been between 32 % and 37 %. Of which the metallurgy, chemistry, petrochemicals and paper sector account for more than 50 % of the final energy consumption of the Slovak industry. The energy intensity of industry in 2019 was 0.19 ktoe per million euro of production. It was the second highest in V4. In terms of energy storage, electricity and natural gas are dominant in industry, accounting for more than half of final energy consumption. The share of fossil fuels, outside natural gas, is around 30 %. The rest is made up of renewable energy sources and heat.

Figure 12: Industry fuel consumption in 2019 by industry (in TWh)



Source: IEP according to Eurostat

Figure 13: Fuel consumption in industry in 2019 by energy carrier (in TWh)



Source: IEP according to Eurostat

Final energy consumption in the economy depends on the evolution of the economy (measured by value added) **and energy savings.** Energy savings at company level can be influenced by changes in production technology or technological processes, but also by changes in production themselves, which significantly influence the amount of activity (e.g. quantity of products produced or added value). This is maintained in the scenarios of the CPS (WEM/WAM) model, i.e. the production assumption is the same, only the production technologies and the fuels used change.

Table 33: Value added of industries between 2019 and 2030 (million EUR[35])

Industry sector	2019	2025	2030
Steel	1 081	1 389	1 371
Manufacture of aluminium and	340	427	440
Chemical and petrochemical	1 086	1 081	1 131
Building	1 147	1 169	1 272
Paper pulp	669	676	741
Foodstuff	1 390	1 692	1 860
Automotive and mechanical	13 238	15 357	17 836
Textile	1 107	920	891
Others	4 977	4 172	4 541

Source: GEM-E3 SK

Final energy consumption of fuels in industry will increase by 1.8 % by 2030 in the WEM scenario compared to 2019. This is mainly due to an increase in production in the automotive sector (in conjunction with the arrival of a new car) and a lower basic level in the steel industry (due to a partial downsizing of production in 2019). A slight reduction will occur mainly in the chemical and paper industry.

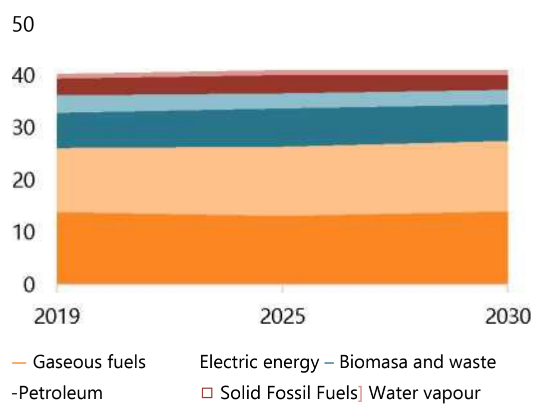
In the WAM scenario, final energy consumption will decrease by 9.5 % compared to 2019. A further reduction in energy consumption will continue beyond 2030, when the price of ETS allowances is expected to increase significantly and to apply stricter energy standards in relation to the use of *best available techniques*.

List of main industrial measures in the WAM scenario 2030:

- Maintaining a high level of production capacity of energy-intensive businesses (mainly the steel plant in Košice, the clay plant in Žiari nad Hronom, the production of ferro-alloys in Siroky)
- Replacement of two blast furnaces in a basket steel plant linked to the cessation of coke production
- Increase the use of solid alternative fuels in cement production
- Reducing the use of solid fossil fuels
- Increased share of cogeneration in steam production for industry linked to higher energy efficiency
- Unavailability of free emission allowances

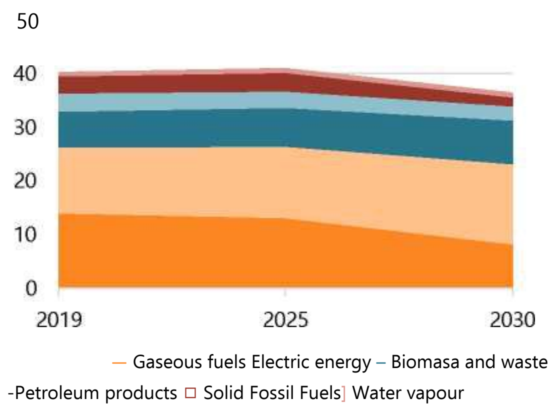
[35] Prices are quoted at the 2023 price level for Slovakia

Figure 14: Energy based fuel consumption in industry (WEM, in TWh)



Source: IEP under CPS

Figure 15: Energy based fuel consumption in industry (WAM, in TWh)



Source: IEP under CPS

Figure 16: Fuel consumption by industry (WEM, in TWh)

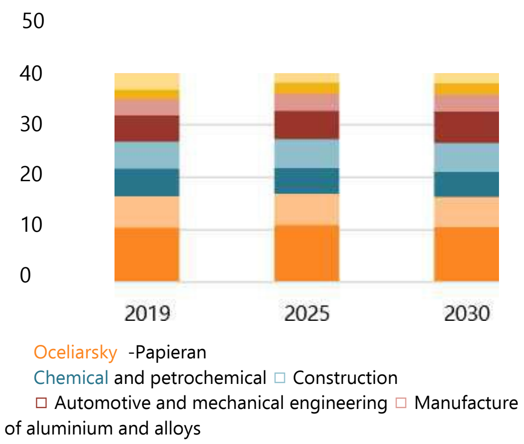
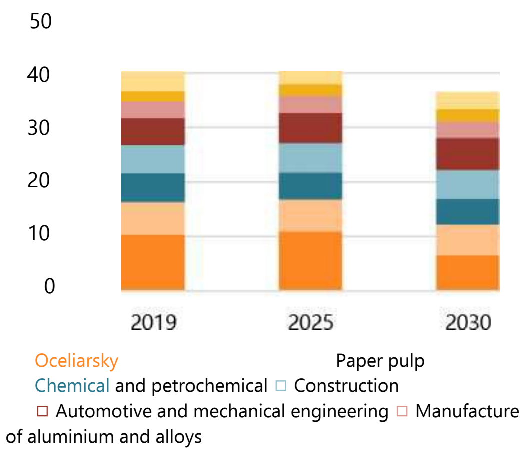


Figure 17: Fuel consumption by industry (WAM, in TWh)

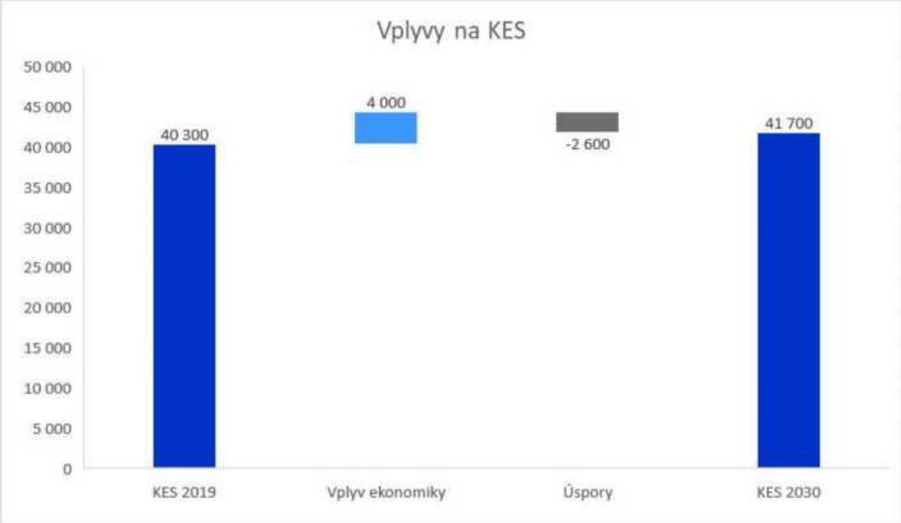


One of the determining impacts on investment in industry is the price of emission allowances (ETS). At least as important is the share of free allowances for selected sectors and entities. The price of allowances varies depending on the scenario in later years – the price rises faster in the WAM scenario. In the WEM scenario, the share of free emission allowances will decrease from 50 % to 25 % in 2030 (down to 0 % by 2040), free allowances are not provided in the WAM scenario.

In parallel to the CPS (WEM, WAM) scenarios, the bottom-up approach modelled 3 scenarios for the evolution of final energy consumption by the Institute of Economic Analysis, taking into account impacts at corporate/sectoral level. Similar to the CPS model, 2019 data were established as reference data.

Scenario 1 (baseline) assumes only a very modest increase, at around 3.5 %. The scenario assumes a natural decline in energy intensity and a baseline scenario for the growth of industrial activity (at the level of the trend of previous years). Production in energy-intensive businesses will decrease. Key planned investments aimed at decarbonising the iron and steel sector are not foreseen. Battery production capacity is estimated at 40 GWh per year. Investments by enterprises from their own resources in measures to reduce energy consumption will follow the trend of previous years, which means that even if companies will generate more energy savings than in scenario 1, the downward trend in achieving self-financed energy savings will continue.

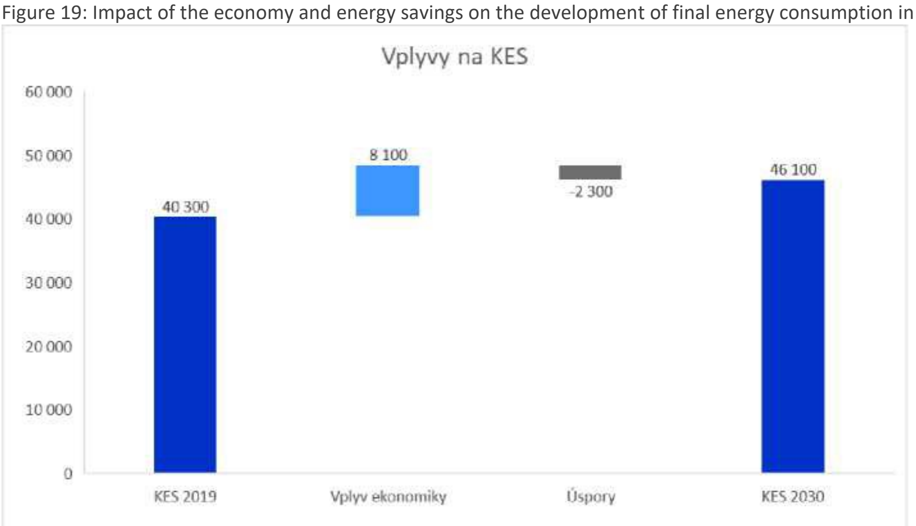
Figure 18: Impact of the economy and energy savings on the development of final energy consumption in industry by 2030, Scenario 1



Source: IHA

Scenario 2 (pesimistic) projects an increase of more than 14 % in final energy consumption in industry by 2030, compared to 2019. The scenario assumes both a natural evolution of energy intensity and, at the same time, an optimistic trend in gross value added, driven by faster output growth. Production in all energy-intensive businesses will take place in a standard mode without significant changes, in the sense of limiting production or decommissioning. Key planned investments aimed at decarbonising the iron and steel sector are not foreseen. On the contrary, battery production is envisaged, at an annual capacity of 60 GWh. Investment by enterprises from own resources in measures to reduce consumption is estimated only to a very limited extent or not.

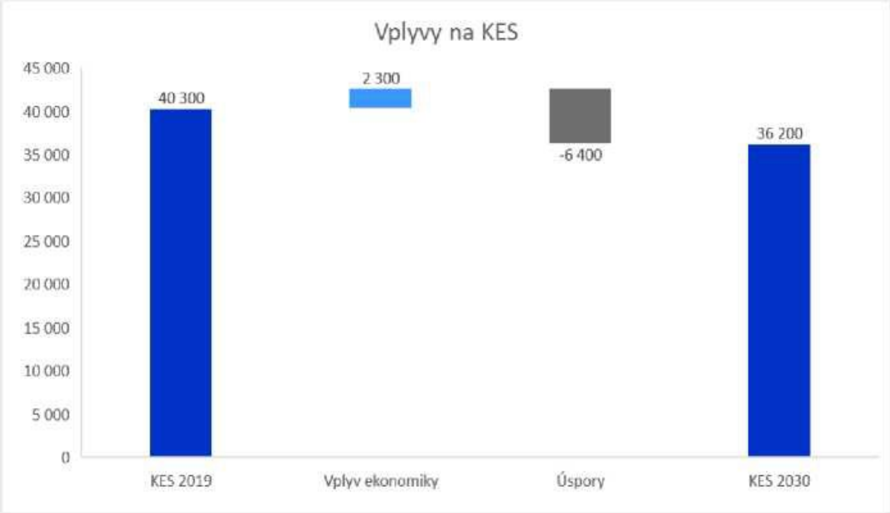
Figure 19: Impact of the economy and energy savings on the development of final energy consumption in industry by 2030, Scenario 2



Source: IHA

Scenario 3 (optimistic) projects final energy consumption in industry to decline by up to 10 %. This scenario assumes slower output growth and also a reduction in production in energy-intensive businesses. On the other hand, it envisages the completion of key planned investments aimed at decarbonising the iron and steel sector by 2030. Battery production capacity is estimated at only 20 GWh per year. Firms are expected to have increased interest in investing their own resources in measures to reduce energy consumption, which will make the pace of achieving energy savings with measures financed by own resources stable.

Figure 20: Impact of the economy and energy savings on the development of final energy consumption in industry by 2030, Scenario 3



Source: IHA

The estimated contribution of the energy efficiency improvement measures in industry to the obligation under Article 8 of the Energy Efficiency Directive 2023/1791 is set out in Annex 2.

Costs

In order to achieve energy efficiency savings and to reduce greenhouse gas emissions in industry, an additional investment of at least EUR 2.5 billion compared to the WEM scenario is needed[36] **in the WAM scenario over the period 2021-2030**. Most (approximately EUR 1.9 billion) is directed to the steel industry to replace blast furnaces for electric arc furnaces and the processing of liquid steel by casting into a thin strip. Another important sector is the construction industry, where additional investments, leading to higher uptake of solid alternative fuels combined with energy efficiency gains, amount to around EUR 260 million. The resources of the Modernisation Fund and the Recovery and Resilience Plan are planned to support these investments. These investments will reduce the annual cost of fuels, emission allowances and operation of installations by up to EUR 650 million in 2030, which means investments with a short payback period, but requiring a large initial investment.

Household

The situation of the household sector in terms of energy savings by 2030 will not change substantially compared to 2020 without additional public funding. The continuous decline in savings in both residential and family houses, which has taken place since the middle of the second decade, will be partly offset by existing and new financial mechanisms to support the renovation of housing buildings. Clearly, the main determinants of the pace of renovation will be the financial capacity of households and their investment priorities. Legislation, in particular the new Energy Performance of Buildings Directive, will also have a major impact on the development of savings. Supporting the renovation of single-family houses, with an emphasis on households in bad economic conditions, will be a high priority. For multi-apartment buildings, the objective is to activate residential owners to renovate the housing stock through State support instruments for the renovation of buildings with incentives. Support for the mobilisation of owners' own resources for the purpose of renovating a property has an

36At 2023 price level for Slovakia, excluding value added tax (VAT) effect only for a group of the population able to generate income savings**.**

Family houses

In Slovakia, 1081293 single-family *houses are built according to the 2021 Census of Population of Housing and* Houses, of which 66 % were constructed after 1960. The number of apartments in single-family houses accounts for more than half of the total number of apartments in Slovakia and is privately owned by their inhabitants. This fact is essential in the state's approach to incentivising its citizens to renovate their houses. According to data from the 2021 Census of Population of dwellings, around 69 % of single-family houses do not have a sealed envelope, 45 % do not have swapped windows and up to 70 % of single-family houses do not have an insulated roof. At least one of the above measures is implemented in 60 % of single-family houses.

Renovations until 2021 were almost exclusively financed by private owners, possibly in combination with the use of a building savings loan or a commercial bank loan. In orderto motivate owners of single-family houses, the State introduced support in the form of a State subsidy for the insulation of the family house to improve the energy efficiency of the family house in 2016[37]. It allows the owner to cover up to 40 % of the eligible and paid renovation costs, subject to compliance with the conditions for granting the allowance, but up to a maximum of EUR 8000 per family house and EUR 800 for project documentation. On the basis of practical experience, a revision of the contribution has been carried out, covering the increase in the amount of the contribution, the scope of the activities covered by the contribution, as well as the simplification of administrative requirements in order to make the support mechanism for owners more attractive.

The Recovery and Resilience Plan's 'Renove House' programme will be a**key support programme for the renovation of single-family houses by 2030.** The objective of the investment is to complete the renovation of at least 25164 single family houses, while achieving on average at least 30 % primary energy savings. The investment is targeted to the owners of older family houses. In addition to traditional energy savings measures such as thermal insulation, window replacement, the mechanism shall enable replacing inefficient heat and hot water sources with high efficiency installations or installing new renewable energy devices.

At its meeting of 17 April 2024, the Slovak Government approved the intention to prepare a call for renewals to Dom Mini under the REPowerEU component of the Slovak Recovery and Resilience Plan. It also instructed the Deputy Prime Minister and the Minister for the Environment, in cooperation with the Slovak Environment Agency (SAŽP), to prepare and launch a call for applications for the partial renovation of family houses entitled 'Obnovation of the House of Mini' under the REPowerEU component of the Slovak Recovery and Resilience Plan by 30 June 2024. The call was launched on 25. 6. 2024. The financial volume foreseen for this call is EUR 36 million. The proposed solution aims to improve air quality and reduce the energy intensity of single-family houses in the areas concerned, thereby contributing to shortening the time when the limit value for microparticles PM_{10} is exceeded while demonstrating that the Slovak Republic is actively addressing the problem. The proposed solutions will have a positive impact on air quality and energy performance and the resulting positive consequences for human health as well as the social aspect, due to the focus of the call on socially disadvantaged groups.

The current financial mechanisms to support the renovation of single-family houses will only partially contribute to achieving the required level of renovation pace. A further EUR 1.37 billion by 2030 will be needed to move closer to it. EUR 138 million from public funds. On average, 8991 single-family houses were renovated in 2016-2021, representing 1.2 % of the total fund of non-renovated single-

37Section 9c of Act No 555/2005 on the energy performance of buildings and amending certain acts, as amended
38Constant 2021 prices

family houses, representing around 0.8 % of the total single-family houses fund. In order to achieve the rate of renovation of 3 % of single-family houses per year of the total fund of non-renovated single-family houses, around 22570 single-family houses would need to be renovated annually,39which would require public co-financing of the renovation for around 13600 single-family houses per year. The estimated amount of costs refers only to those households that will have sufficient own resources to be40 able to finance the renovation of their property using public funds. Thus, only the category of households whose cash savings and income are sufficient to obtain a recovery loan is considered. In addition to the availability of the owner's financial resources, other factors such as the owner's motivation and willingness, the availability of capacities, etc. will have an impact on the pace of renovation of single-family houses.

The renovation of single-family households in a long-term adverse financial situation41 will be linked to the need for public co-financing at a rate close to 100 %. In case of priority support to this group of households, the estimated cost of public co-financing of the renovation of single-family houses by 2030 would increase at least twice as much in order to achieve the required level of renovation. At the same time, about 40 % of single-family households in this category would be renovated.

Multi-apartment buildings

The renovation of multi-apartment buildings has a long tradition in Slovakia. This is evidenced by a renovation rate of around 70 %, despite 88 % of multi-apartment buildings having been built after 1960. The most significant programme to support the renovation of multi-apartment buildings in Slovakia is the State Housing Development Fund, which will continue to play an important role in the renovation of multi-apartment buildings in the next period. The State Housing Development Fund provides a loan for the renovation of multi-apartment buildings up to 100 % of eligible expenditure. The interest rate is based on the type of purpose of the loan support and is up to 3 % (1-3 % from 1 January 2024). Where at least two of the types of renovation are carried out simultaneously on the construction site, the common interest rate shall be the lowest of the annual interest rates indicated for the types of renovation carried out. The repayment period of the loan is 25 years. The applicants for support are owners of apartments and non-residential premises in a multi-apartment building.

EU funds from the Slovakia Programme are also an important source of funding for renovation through the State Housing Development Fund. Projects whose energy saving measures achieve a minimum level of savings of 30 % of primary energy will be supported. Eligible activities will include, inter alia, improving the thermal-technical characteristics of the building structures of multi-apartment buildings (incubation of perimeter walls and roofs, replacement of windows), modernisation of heating systems, including plumbing and hydraulic control, installation of thermo-regulating valves, installation of measurement and management systems, upgrading of lighting, modernisation of lifts, elimination of system failures, installation of RES, green measures and debarrierisation measures. The funds will be managed through the beneficiary, which will be the State Housing Development Fund. The revolving nature will allow these funds to be reused in the future.

Stabilising the downward trend in energy savings achieved by the renovation of multi-apartment buildings will be one of the priorities until 2030. The cost of keeping the renovation pace at 3 % per year is estimated at EUR 0.5 billion. EUR 1 billion EUR 203042 of public funding. The rate of renovation of multi-apartment buildings of 3 % per year corresponds to approximately 207 GWh of energy savings in final energy consumption. In the period 2010-2015, the rate of renovation of apartments in multi-apartment buildings was 4.4 % per year. In the following period, up to 2021, it decreased to 3.2 % per

39based on SODB 2021 data processing, including unoccupied family houses
40Co-financing is under consideration as for the Renovation House programme
41Households unable to save any money or living on debt
42Constant 2023 prices. The value represents the total cost. The cost of insulation alone amounts to EUR 0.36 billion. EUR

year. In 2015, energy43 savings from the renovation of multi-apartment buildings of 274 GWh were monitored, compared to only 140 GWh in 2022. With the exception of 2016, this decrease was more – less continuous. If this trend continued, energy savings of between 95-100 GWh would have been estimated to be between 95-100 GWh in 2030, without State intervention.

Mobilising public resources to achieve additional energy savings of at least 593 GWh by 2030 will be essential to keep the renovation pace to 3 % per year. Motivating owners to carry out renovations and encouraging the mobilisation of their own resources are essential preconditions for maintaining the pace of renovation of apartments. Given the long-term renovation policies of multi-apartment buildings in Slovakia, the number of renovated housing units is naturally decreasing over time. The Slovak Republic is aware of this and has actively proceeded to set up new incentive elements in the financial instrument for recovery (within the framework of the SFR). As of 1 January 2024, incentives were introduced under the State Housing Development Fund in the form of a waiver of part of the loan of up to 30 % of the loan amount (indirect grant), subject to the fulfilment of conditions laid down by law, in particular primary energy savings and the realisation of a renewable energy source. Such grant support contributes to the further continuation of the renovation of unintegrated multi-apartment buildings.

Multi-apartment + family homes

The most important fund to support the renovation of multi-apartment and single-family houses in terms of volume of finance for this purpose will be the Social Climate Fund, which was created in response to the extension of the EU ETS to the household sector. The Fund should serve as a priority for the renovation of buildings for housing and should be dedicated exclusively to vulnerable households. The allocation for Slovakia is expected at EUR 1.5 billion. EUR. Beyond this amount, the State must provide at least 25 % of the resources through national co-financing. Up to 37.5 % of this allocation will be available for direct compensation of high energy costs, due to the extension of the ETS to the household and transport sectors, for vulnerable households and businesses. The remaining costs should be dedicated to increasing energy efficiency in buildings, decarbonising cooling and heating, integrating and storing renewable energy and improving access to zero- and low-emission mobility and transport. The duration of the mechanism is foreseen for the period 2026-2032.

The most significant contribution of savings among all housing renovation measures is expected from the measure related to the renovation of single-family and multi-apartment buildings, the renovation of which is linked to the issuance of an energy performance certificate. This is a legislative measure, based on Section 5 of Act 555/2005 on the energy performance of buildings and amending certain acts, as amended. Nearly 85 % of the energy savings monitored by the SIEA Energy Efficiency Monitoring System achieved by this measure are attributable to multi-apartment buildings, despite the fact that the energy savings achieved through the renovation of single-family houses significantly exceed the savings from the renovation of multi-apartment buildings. As a result, the bulk of these savings are not reported in relation to the fulfilment of the obligation under Article 8 of the Energy Efficiency Directive 2023/1791. The measure allows the counting of energy savings corresponding to the difference in energy consumption before and after the renovation of the building.

The risk of double counting of energy savings with other measures (e.g. SFRB) is thoroughly treated in the Energy Efficiency Monitoring System.

The energy savings achieved by constructing buildings for housing above the minimum requirements of the law will have a slightly decreasing trend by 2030. The main reason, despite the increasing

SIEA Energy Efficiency43 Monitoring System number of residential buildings built above A1 level44, is the introduction of zero-emission buildings.

Green households will play an important role in reducing grid energy consumption in households. Compared to the original programme, the new version will also support the purchase and installation of renewable energy sources for multi-apartment buildings, with around 16 % of the total allocation to support households in energy poverty. It is estimated that the programme will save at least 0.4 TWh of grid energy by 2030.

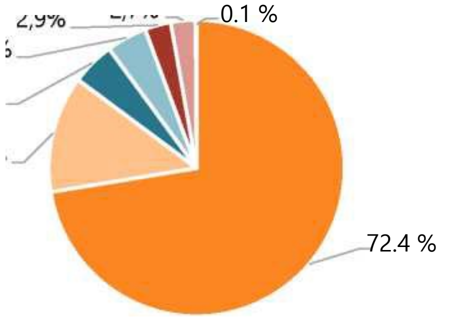
The replacement of old gas boilers with new condensing boilers has the overall potential to reduce household natural gas consumption by almost 1 TWh (3-4 % of household final energy consumption). The provision of financial incentives for the installation of stand-alone fossil fuel boilers is from 1. 1. 202545 prohibited. The most significant contribution to reducing fuel consumption (in particular natural gas consumption) in terms of household sources is the installation of heat pumps in insulated buildings with a potential of 250 GWh/year. The introduction of support for the purchase of new condensing gas boilers in the form of replacements at least for vulnerable households, in addition to energy savings in the order of tens of GWh, would in particular mitigate adverse social impacts. Under the Commission Communication on the phasing out of financial incentives for stand-alone fossil fuel boilers under the recast of the Energy Performance of Buildings Directive (C/2024/6206), it will be possible to support hybrid heating systems, such as a gas condensing boiler in combination with solar heating, from public sources.

Impact of measures on the development of final energy consumption by 2030

Final energy consumption of households reached around 30 TWh in 2019, representing around 26 % of the country's total consumption. Most of the energy consumed by households was used for heating (72.4 %) and water heating (12.8 %). Natural gas (13.1 TWh), followed by biomass (6.7 TWh), was the most frequently used fuel. Around 18 % of the energy used for heating and heating water came from central supply.

44Decree of the Ministry of Transport of the Slovak Republic 364/2012 implementing Act No 555/2005 on the energy performance of buildings and amending certain acts, as amended
energy Performance of Buildings45 Directive (C/2024/6206) (recast) of 18.10.2024

Figure 21a: Final energy consumption of households by use in 2019



- Heating Water heating -White Technique
- Cooking Illumination □ Montenegro technician
- Air conditioning

Source: IEP according to Eurostat

Figure 22a: Final energy consumption of households by fuels in 2019

1.1 %

—0.3 % 0.3 %

42.8 %

17.9 %

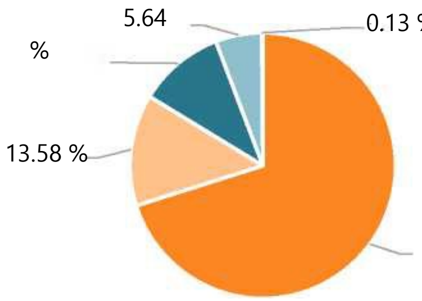
22.2 %

- Gaseous fuels
- Electricity
- Solid fuels
- Solar energy
- Biomass and waste
- Heat

Source: IEP according to Eurostat

Households' final energy consumption was around 31.2 TWh in 2022. The largest part of the energy was used for heating (70.1 %). Natural gas (42.4 %) and biomass (22.7 %) were the most used fuel. The share of electricity has increased compared to 2019. On the contrary, the share of heat from central supply decreased.

Figure 21b: Final energy consumption of households by uses in 2022 fuels in 2022



- Heating
- Electronics and lighting
- Air conditioning
- Water heating

Source: Eurostat

Figure 22b: Final energy consumption of households by

1.9 % 0.3 %

0.3 %

K- 42.4 %

19.4 %

70.12 %

22.7 %

- Natural gas
- Electricity
- Solid fossil fuels
- Solar energy
- Biomass and waste
- Heat

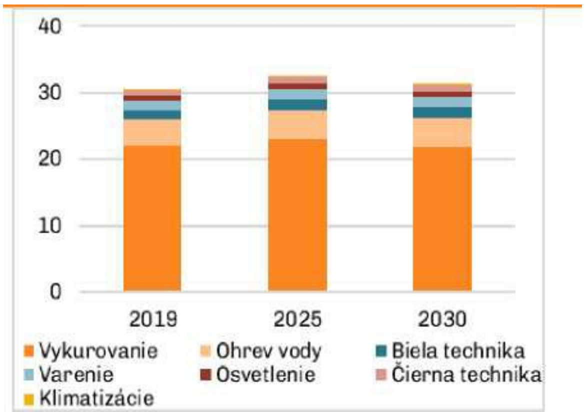
Source: Eurostat

The final energy consumption of single-family houses is about 85 % of total consumption households. However, the pace of renovation of multi-apartment buildings is significantly higher compared to single-family houses. In 2010 — 2015 has been re-established annually in Slovakia, approximately
% Of the total floor area of multi-apartment buildings, almost 4 times less (1.2 %) for single-family houses over the same period. After 2015, the pace of renovation both for multi-apartment and single-family houses decreased significantly. The downward trend, in addition to calculations from the 2021 SODB data, was confirmed by the results from the SIEA Energy Efficiency Monitoring System.

Heating will continue to be a**key area in efforts to reduce energy consumption in the household sector.** The improvement of the thermal performance of buildings and the shift to more efficient heating equipment will result in a significant reduction in heat demand. This objective is also supported by the requirements of Directive 2024/1275 on the energy performance of buildings (recast), which introduces an obligation to renovate an existing building to the level of new construction requirements, an obligation to install solar installations in buildings, as well as an obligation to set minimum energy performance standards for non-residential buildings and a requirement to reduce the average primary energy of the housing stock. As GDP grows, the use of electrical appliances is also expected to grow. Due to climate change, energy consumption for heating is also expected to decrease, but this will be offset by higher energy consumption for the operation of air conditioning units.

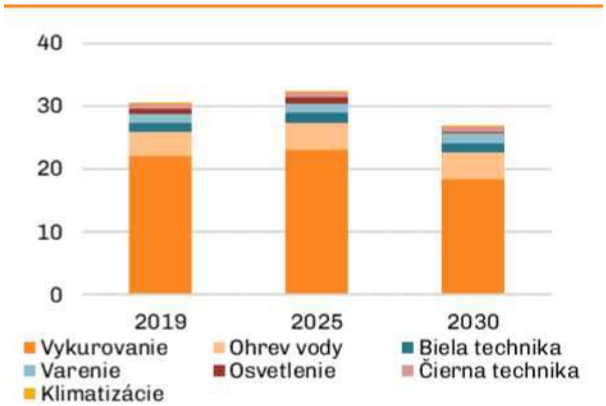
The final household energy consumption will increase by around 3.1 % by 2030 in the WEM scenario compared to 2019. This is mainly due to higher demand for water heating**46** and heating**47**. In the case of heating, however, it is offset by significant investments. There is also an increase in electricity consumption due to higher use of electrical appliances. **In the WAM scenario, final energy consumption is reduced by 11.4 % mainly due to significant savings in heating and lighting.**

Figure 23: Final energy consumption of households by use by 2030 (WEM, in TWh)



Source: IEP under

Figure 24: Household final energy consumption by 2030 (WAM, in TWh)



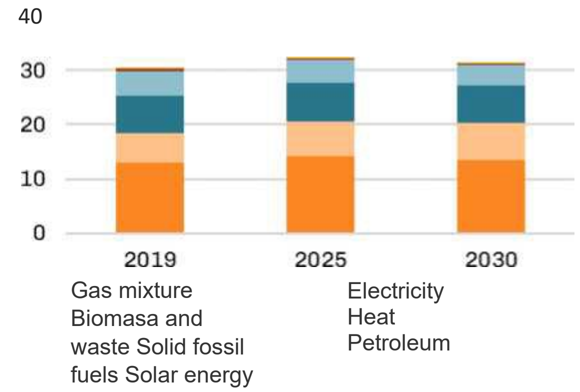
Source: IEP under

Both scenarios gradually replace part of the gas boilers with heat pumps, reducing natural gas consumption. In the WAM scenario, this trend is more pronounced and is complemented by a stronger shift to more efficient gas boilers. these are the most economically efficient option for households that cannot afford the high costs of switching to heat pumps.

In the WAM scenario, the energy consumption used for lighting is expected to decrease significantly due to a stronger introduction of LED bulbs. Overall, however, electricity consumption will grow, mainly due to electrification of heating and higher demand for electrical appliances.

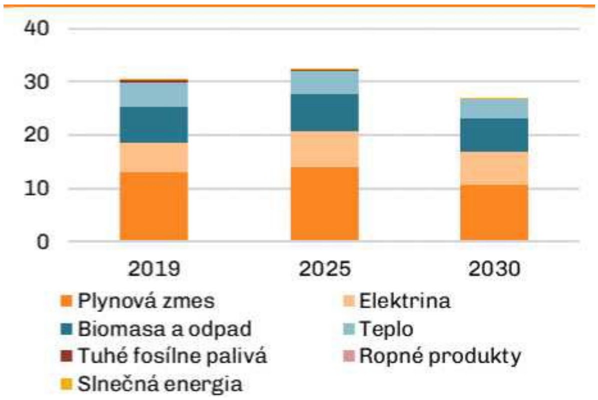
46Due to the rise in living standards
47This effect is also due to a low base level, as 2019 was one of the warmer

Figure 25: Final energy consumption of households by fuel (WEM, in TWh)



Source: IEP under CPS

Figure 26: Household final energy consumption by fuel (WAM, in TWh)



Source: IEP under

Beyond 2030, the WAM scenario continues to implement those measures more ambitiously (such as increased support for investments in more efficient installations or an increase in the price of emission allowances). Due to the increase in the price of emission allowances, the share of efficient technologies (in particular heat pumps and condensing gas boilers) will also increase in later years.

In the context of the forecast of household energy consumption by 2030, the Institute for Economic Analysis of the Ministry of the Economy, in addition to the WEM and WAM scenarios, has also produced 3 scenarios for the evolution of energy consumption: basic, pessimistic and optimistic. The baseline scenario corresponds to the WEM scenario (the baseline is slightly more ambitious) and the “Optimistic” scenario is the equivalent of the WAM scenario.

Scenario 1 – baseline. It is assumed that both the intensity of building construction and the insulation intensity of single-family houses are maintained as in 2017-2021. The pace of renovation of multi-apartment buildings will fall by a quarter relative to the 2017-2021 period due to the depletion of the potential. Furthermore, a baseline scenario is envisaged for the renewal of gas boilers for condensation, for the replacement of bulbs for more cost-efficient and for consumption behaviour (internal temperature and number of hours heated). The average heat demand for heating multi-apartment buildings after renovation will be 43 kWh/(m^{2}year) in all scenarios and 108 kWh/(m^{2}year) for single-family houses.

As a result of those assumptions, households’ final energy consumption will decrease by 3 % in 2030 compared to 2019.

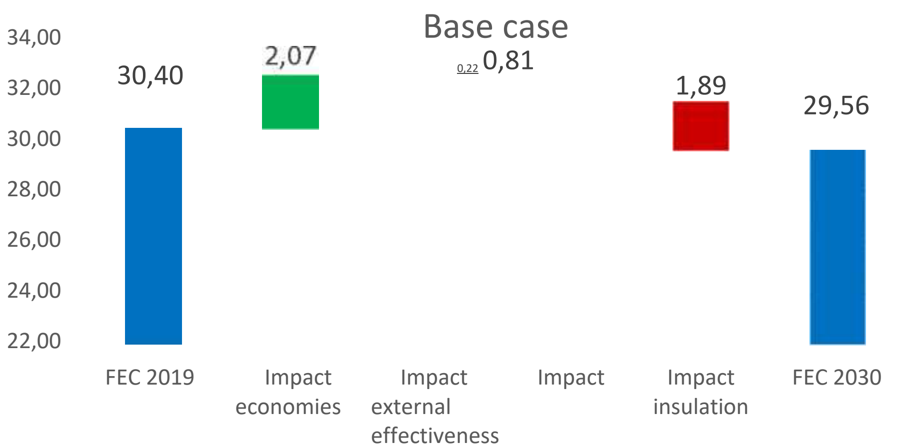
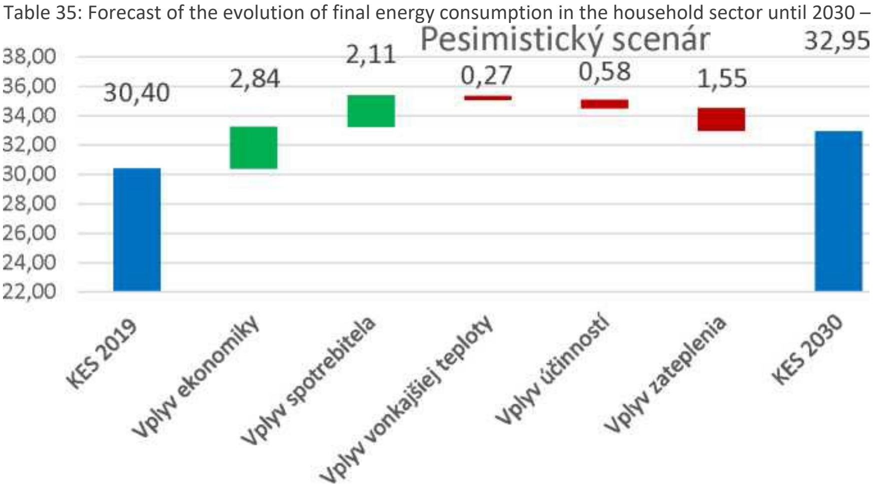


Table 34: Forecast of the evolution of final energy consumption in the household sector until 2030 – baseline
Source: IHA

Scenario 2 – pessimistic. Building construction intensity is projected to increase by 25 % compared to 2017-2021 average. On the contrary, the intensity of the renovation of single-family houses and multi-apartment buildings will decrease by 25 % and by 50 % relative to the 2017-2021 average. Furthermore, a baseline scenario for the renewal of gas boilers after condensation and a negative scenario of replacing bulbs for more efficient and consumer behaviour (internal temperature and number of heated hours) is envisaged.

Households' final energy consumption will increase by 8 % compared to 2019. The impact of insulation will be halved compared to the baseline scenario. Consumers will be most affected by the dramatic increase in consumption.

Table 35: Forecast of the evolution of final energy consumption in the household sector until 2030 – pessimistic scenario

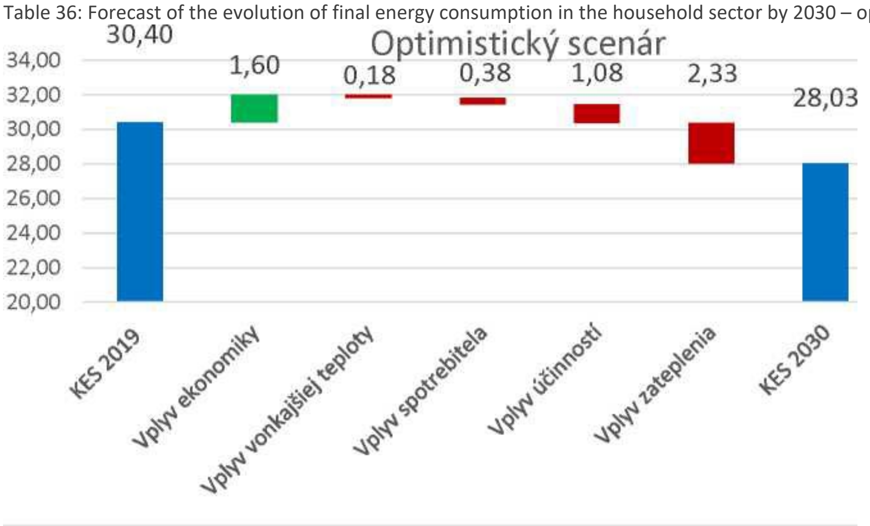


Source: IHA

Scenario 3 – optimistic. It projects a 25 % slowdown in building construction intensity compared to the 20172021 average. Conversely, the intensity of the renovation of single-family houses will increase by 25 % compared to the average 2017-2021 and the renovation intensity of multi-apartment buildings will be the same as in the reference period. Furthermore, an optimistic scenario is envisaged for the renewal of gas boilers for condensation, for the replacement of light bulbs for more cost-efficient and for consumer behaviour (internal temperature and number of hours heated).

In particular, due to the significant increase in the pace of renovation of single-family houses and the stabilisation of the downward trend in the renovation of multi-apartment buildings, final energy consumption in households will decrease by 8 % compared to 2019.

Table 36: Forecast of the evolution of final energy consumption in the household sector by 2030 – optimistic scenario



Zdroj: IHA

Costs

The amount of additional investment in the WAM scenario vs. the WEM scenario in the household sector is expected to amount to around EUR 5.8 billion over the period 2021-2030, most of which (EUR 5.4 billion) should be used to improve the thermal performance of buildings, the remainder for the replacement of heating, lighting and water heating equipment. Part of these investments are to be covered by the challenges of the Recovery and Resilience Plan, the Slovakia Programme and the Social Climate Fund. Investments in this sector have a short pay-back period – they should lead to a reduction in fuel costs of EUR 510 million per year. Further savings of around EUR 30 million per year will result in reduced entitlements to purchase allowances following the introduction of ETS2.

Impact of socio-economic aspects on the pace of renovation of buildings for housing

The impact of households' monetary savings on the pace of housing renovation of buildings will be crucial. On the basis of data from family accounts for 2020, the Economic Analysis Institute of the Slovak Ministry of the Economy estimates that the average Slovak household income in Slovakia was EUR 18639, of which less than one quarter of this amount was able to save households. More than EUR 10000 per year were able to save one quarter of households in Slovakia, but up to 27 % of Slovak households saved less than EUR 1000 per year or lived on debt.48

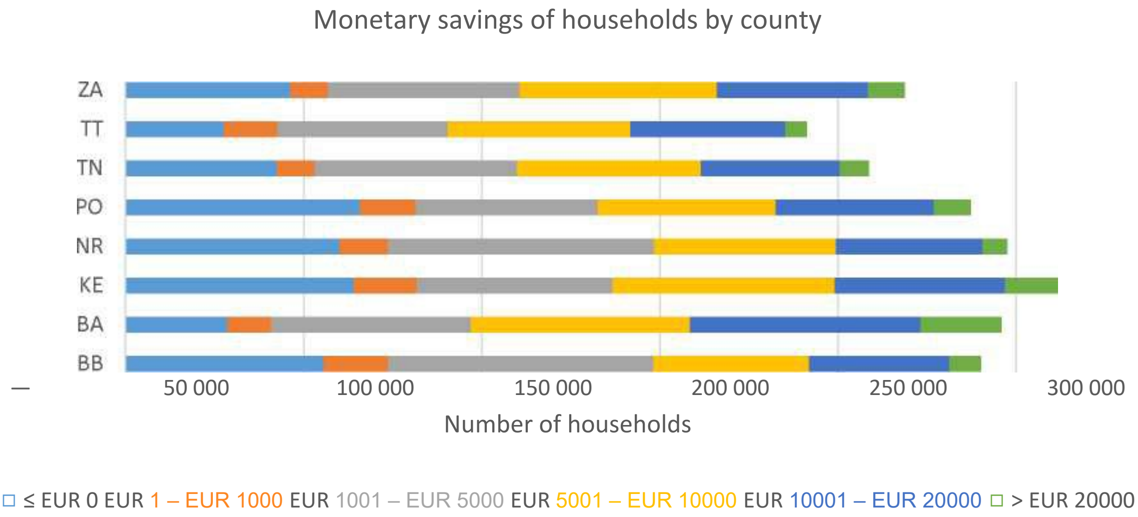
However, the pace of renovation of single-family houses could be gradually accelerated by applying appropriate incentives to households with monetary savings of between EUR 5000 and EUR 10000, accounting for around 23 % of the total number of Slovak households.49 One such incentive could be the provision of concessional loans for financing, depending on the rate of renovation, or support in line with the value-for-money principle, i.e. the amount necessary to incentivise the implementation of the measure.

Providing financing for the renovation of single-family households with annual monetary savings of between one thousand and EUR 5 thousand will be a challenging challenge given the need to involve the grant component. The number of these households is estimated to be more than 470 thousand, representing approximately 1⁄4 of the total number of households, but the exact number of single-family houses is unknown. Almost one third of these are households of the Banská Bystrica and Nitra regions. With a support facility such as the Recovery and Resilience Plan, supporting the recovery of 100 thousand family houses would require EUR 2 billion of public malpractice.

More than 390 thousand households in Slovakia (21 %) have either zero money savings or live on debt. Nearly 2/3 of these households are households of the Banská Bystrica, Prešov, Košice and Nitra regions. This group of households is not expected to have funds to co-finance renovation. Therefore, compensation for the cost of high energy prices from the Social Climate Fund can be considered as a short- and medium-term solution, as the socio-economic impact of the extension of the ETS will be compensated by the Social Climate Fund only for some households. However, this cannot be considered a systemic solution in the long term, as it will lead, inter alia, to a reduction in the number of single-family houses that could be renovated. In the light of the above, the **allocation of the Social Climate Fund to the Slovak Republic can be considered to be significantly under-sized**, since the socio-economic impact of the extension of the ETS will be compensated only for a small part of the households concerned. On the contrary, for most vulnerable households, the social and economic challenges related to the extension of the ETS will increase. In addition, many low-income households will fall into vulnerable households as a result of the introduction of ETS2.

48Data based on 2020 (newer not available) are very likely to be overestimated. First, in 2020, households reported disproportionately high rates of forced savings due to pandemic lockdowns, while the MF SR's macro-forecast showed a savings rate of 11.5 % in 2020, ranging between 5 and 6 % in 2022 and 2023. Secondly, household income and expenditure in family accounts may not reflect reality, as both are only made on a certain sample of households and, at the same time, data are not collected for the whole year, but are estimated on the basis of data collection at a shorter interval and then extrapolated to the whole year.
49ratio between households living in single-family and multi-apartment buildings not known

Figure 2: Annual monetary savings of households by county



Source: IHA based on the 2020 Family Accounts

With the introduction of emissions trading for heating in households after 2026, a significant increase in household heating and hot water expenditure can be assumed. This can to some extent incentivise owners to renovate their property, but only those with a sufficient financial buffer. The introduction of ETS2 will have significant negative social consequences for owners of non-renovated family houses with lower incomes.

The financial support instruments for the renovation of the housing stock from public sources (e.g. SFRB) reflect the current renovation situation and have new incentives for owners in place.

Restoration funding is set in a fair manner for all segments of the population. However, support for vulnerable households will need to be reinforced with measures aimed at renovating their homes, in particular from the Social Climate Plan, in order to prevent this population from falling into the social safety net of the state following the launch of the new issuance scheme.The transparent setting of conditions for the provision of support for the renovation of residential buildings in which socially disadvantaged households live will be particularly challenging, given that most of them also live in households outside this category.

Transport

Among all sectors of the national economy, transport is the sector with the fastest growing energy consumption. This trend will continue until at least 2030 thanks to strong inertia. The rate of growth in energy consumption will decrease in proportion to the gradual increase in electro-mobility to the detriment of internal combustion engine vehicles. Support for public passenger transport will also contribute to moderating growth, which is expected to reduce the use of passenger car transport. Building and developing rail and road infrastructure will also be an important part of consumption reduction measures.

Promoting electro-mobility will be a key action until 2030. Measures aimed at promoting rail and intermodal transport, public passenger transport and cycling will play at least an equally important role. Support for e-mobility will be characterised by massive support for infrastructure building primarily from the Recovery and Resilience Plan and complementary to the JTF in the context of supporting public passenger transport (possibility of procuring recharging and refuelling infrastructure). The amount of planned support from both sources amounts to EUR 62 million. As part of the promotion of vehicles with lower specific energy consumption and lower CO_2 emissions, the Ministry of Health prepared an action plan for the development of electromobility in the Slovak Republic, based on the

National Policy Framework for the Development of the Alternative Fuels Market (Government Resolution No 504/2016). The Action Plan presents a package of support measures to ensure that consumers see low-emission mobility as smooth, also taking into account the pace of deployment of the relevant infrastructure.

In the case of rail, support will mainly focus on the construction and modernisation of infrastructure. The focus will be on the implementation of reforms as a stepping stone for the further development of rail transport. From the RRP, namely component 3 – Sustainable transport, 2 reforms and two investments totalling EUR 638.7 million are planned to be implemented by 2026. One of the reforms aims at preparing investment projects – a prioritised investment plan for rail infrastructure projects. Another reform is the reform of public passenger transport. It envisages the creation of a National Transport Service Plan for public passenger transport, with an impact on optimising the ordering of public transport services, as well as the creation of an optimised rail passenger transport graphics, which was put into practice in Graphics 2022/23 on the basis of the Transport Service Plan for Rail Transport. An important part of the reform is the Public Passenger Transport Act, which creates the conditions for the harmonisation of tariff and transport conditions between rail, suburban bus and municipal public transport, in order to allow travel on a single ticket by all means of public passenger transport in the public interest. The aim is to improve the coordination and coherence of the different modes of transport operated in the public interest. In addition, the RRP will also support the purchase of clean rolling stock. Slovakia's programme will support the development of rail transport by building and upgrading railway lines and intermodal connections for a total amount of more than EUR 686 million. In addition to energy savings, these are intended to contribute to time savings and ensure an increased number of rail users. An important financial mechanism to support rail will be the Connecting Europe Facility 2021-2027 (CEF 2) with EUR 584.7 million to modernise and electrify cross-border rail connections between Member States and promote the use of alternative fuels and the construction of related infrastructure.

Support for intermodal transport should be implemented in accordance with the Concept for the Development of Intermodal Transport by 2030, approved by the Slovak Government in April 2022. A one-off support to intermodal transport through the Recovery and Resilience Plan Fund of EUR 16.1 million is planned to set up at least 1 intermodal transport line and buy 1000 new intermodal units. In addition, it is planned to introduce regular support for the acceleration of intermodal transport performance, to introduce regular support for individual wagon packages and to support the construction and upgrading of terminal infrastructure. The Slovakia Programme foresees EUR 30 million to support terminal infrastructure.

The construction and modernisation of infrastructure will also be a high priority in the public passenger transport segment. Construction and modernisation of railway MHD, renewal and upgrading of rolling stock of railway MHD and vehicles providing MHD and suburban transport (alternative fuel buses, including related refuelling and charging infrastructure) areplanned. Support is to be given to the construction and modernisation of public passenger transport infrastructure (transfer terminals, stops and parking areas, the introduction of public passenger transport preference measures), the construction and modernisation of technical bases for the management of MHD vehicles, the provision of tariff, information and dispatch systems, the construction and modernisation of supply infrastructure. These measures will result in 6 km of new tram lines, 15 km of new trolleybus lines, 12 km of reconstructed or upgraded tram lines, 79 km of reconstructed or upgraded trolleybus lines and an increase in the capacity of environmentally friendly public transport vehicles of 30581 passengers Introduction/upgrading of existing digitised systems should take place in 15 cities.

As part of cycling development, nearly 500 km of cycling infrastructure is planned to be built for almost EUR 190 million by 2030. The RRP will save the construction of 161.8 km of cycling infrastructure with EUR 85 million. Slovakia's programme has EUR 101 million to build 325 km of dedicated cycling infrastructure.

The digitalisation and automation of transport will be the basis for the development of intelligent transport systems in the road infrastructure environment, with an impact on reducing the number of vehicles on the roads in private passenger transport to the benefit of public passenger transport. In addition, smart vehicles will also make it possible to optimise traffic management, make better use of transport infrastructure capacity, increase transport safety and fluidity, with positive impacts on reducing the energy intensity of transport and reducing negative environmental impacts. In Slovakia, the National Coordinator for Smart Mobility, established at the Ministry of Transport of the Slovak Republic, coordinates activities related to this issue. Three strategic documents have been drawn up by the Ministry of Transport for this area: Slovakia's Smart and Sustainable Mobility Strategy, the Long-Term Plan for Addressing the Challenges in Road Transport and Smart Mobility 2021-2030 and the Action Plan on Addressing the Challenges in Road Transport and Smart Mobility 2021-2025. The legislative document dealing with the issue is Law 429/2022, which amends certain laws in the context of the development of automated vehicles.

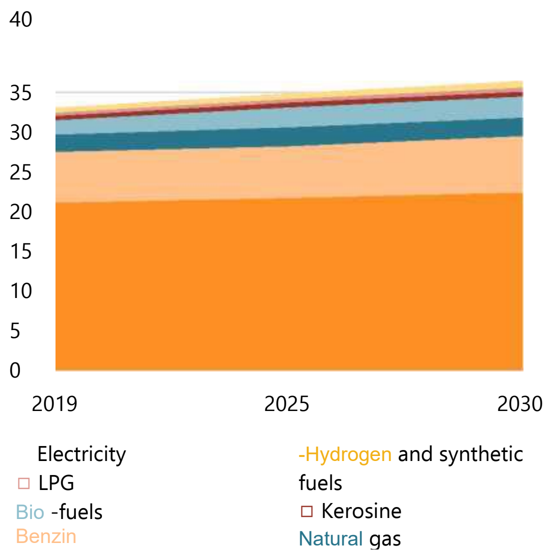
Impact of measures on the development of final energy consumption by 2030

The estimated increase in final energy consumption in transport by 2030 is between 2.6 % and 10.2 %. The development of electro-mobility, which is estimated to contribute around 90 % to the obligation under Article 8 of the Energy Efficiency Directive 2023/1791, will have a key impact on its development. The impact of other measures is less pronounced.

The estimated increase in final energy consumption in transport by 2030 is around 10.2 in the WEM scenario. %. This is mainly due to the increase in personal activity (number of both passenger-kilometres) and freight (tonne-kilometres) traffic, which depends on rising living standards. Higher activity also results in a higher number of vehicles. The development of e-mobility will be key to reducing final energy consumption.

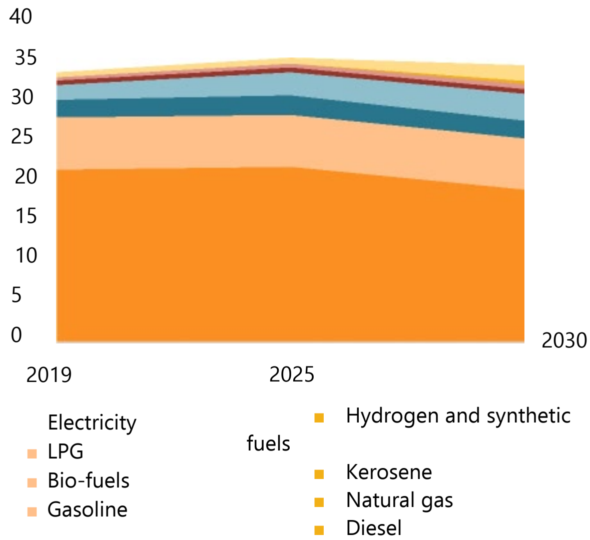
Key measures in the WAM scenario include strengthened emission standards that will, among other things, increase the number of battery electric vehicles. The introduction of the Buildings and Transport Allowance Trading Scheme (ETS2) from 2027 is also an important measure. The scenario also included the application of measures from the Action Plan for the Development of E-Mobility (APRE), which mainly aim at an initial increase in the number of vehicles which, based on experience from other countries, increase the willingness to switch to a vehicle with a different mode of use (so-called substitution elasticity). **As a result of the combination of measures and expected price developments, the number of battery electric passenger cars will increase to around 192 thousand units in the WAM scenario.** In addition, the number of battery-electric buses and commercial vehicles, as well as the number of plug-in hybrid vehicles, will be substantially increased. Given that the long-term cost of ownership of electric cars is already close to the total cost of ownership of internal combustion vehicles, an increase in their share in all scenarios can be expected.
However, the availability and charging times, range, as well as other aspects such as the residual priceof the end-of-life vehicle will be crucial for the actual development. Before 2030, the first phase of hydrogen electric heavy-duty vehicles is also considered in the WAM scenario.

Figure 27: Transport fuels by 2030 (in TWh, WEM scenario)



Source: IEP under CPS

Figure 28: Transport fuels by 2030 (in TWh, WAM scenario)



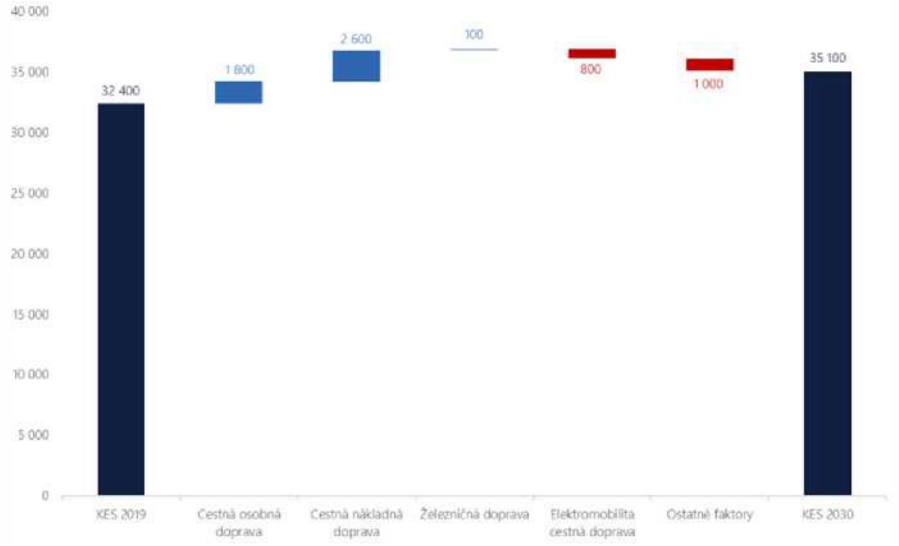
Source: IEP under CPS

Fuel demand for aviation will not change more fundamentally by 2030. In rail, despite the investments in the RRP, it will not lead to more fundamental changes in fuel consumption, as there will be a slight shift in activity from individual road to rail (in the WAM scenario), which will cover a slight increase in energy efficiency due to investments in electrification. The overall share of both sectors in final energy consumption will remain roughly maintained. A slight decrease can be expected in pipeline transport due to a reduction in natural gas consumption.

In parallel to the CPS scenarios (WEM, WAM), a bottom-up approach modelled 3 additional scenarios for the evolution of final energy consumption, taking into account different impacts. Similar to the CPS model, 2019 data were established as reference data.

Scenario 1 (baseline) projects **an** increase in the number of electric passenger cars, battery electric buses and battery electric trucks under the WEM scenario. It also foresees a minimum level of shifting goods from road to rail, not increasing the efficiency of internal combustion engines, as well as a slight increase in the use of rail passenger transport.

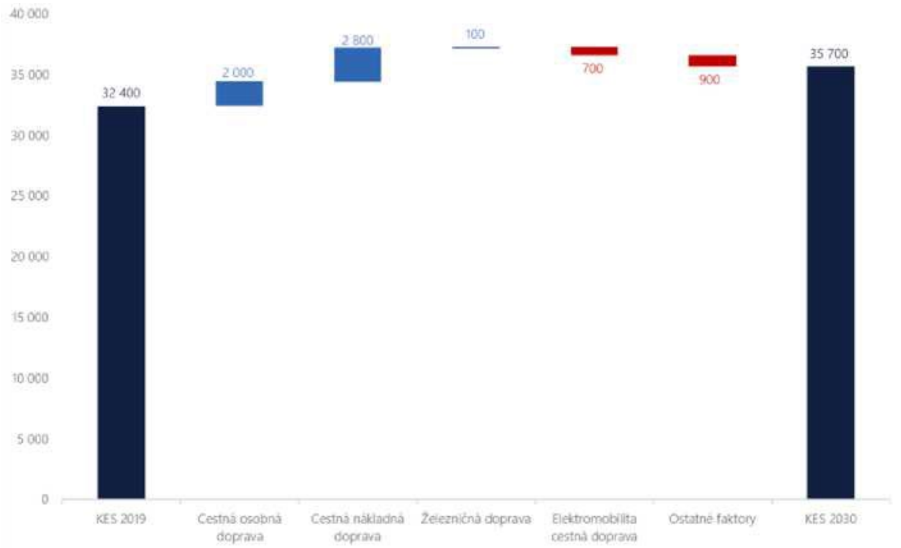
Figure 29: FEC baseline for transport in 2030 (GWh)[50]



Source: IHA Calculation

Scenario 2 (pessimistic) estimates a higher increase in the total number of motor vehicles and, at the same time, a lower increase in the number of electric cars, battery electric buses and battery electric trucks. The scenario does not foresee any additional shift of goods in freight transport from road to rail and also no increase in the efficiency of internal combustion engines. A slight increase in the use of rail passenger transport is foreseen.

Figure 30: FEC 2030 pessimistic scenario in the transport sector (GWh)

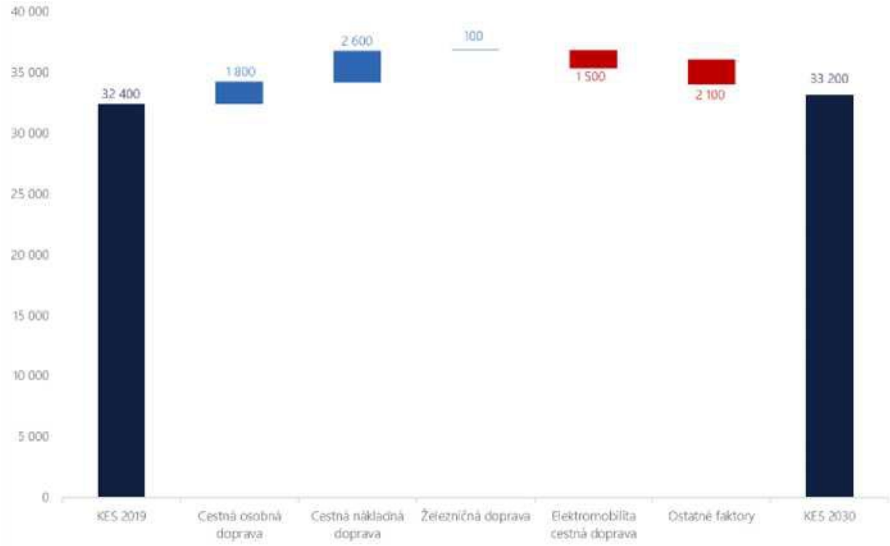


Source: IHA Calculation

[1] Other factors driving the decline of FEC include a return to average final energy consumption of pipeline transport, which was unusually high in 2019, driven by the highest volumes of gas transported since 2011 and a modal shift in freight transport.

Scenario 3 (optimistic) projects a significant increase in the number of electric passenger cars, battery electric buses and battery electric trucks following the adoption of additional measures of the E-mobility Action Plan, **a significant** additional shift of goods in freight transport from road to rail, as well as an increase in the efficiency of internal combustion engines according to adopted emission standards. At the same time, it foresees a slight increase in the use of passenger rail transport and the maintenance of low volumes of transit of natural gas through Slovakia in 2022. The scenario does not envisage restoring the volume of natural gas to the level of the last decade.

Figure 31: Optimistic FEC scenario in the transport sector in 2030 (GWh)



Source: IHA Calculation

The estimated contribution of energy efficiency improvement measures in transport to the obligation under Article 8 of Directive 2023/1791 on energy efficiency is set out in Annex 2.

Costs

Electrification is a key measure in the transport sector. Electric vehicles have a higher investment cost, so an additional EUR 6.6 billion need to be invested in new vehicles by 2030, with investments in passenger cars amounting to around EUR 3.1 billion, a further EUR 1.9 billion in the purchase of commercial vehicles. The remaining costs will be mainly for public road and rail transport. Investments will have a significant impact on reducing annual fuel costs (EUR 640 million) and, once ETS2 has been introduced, the cost of emission allowances (EUR 130 million). On the contrary, there will be an increase in other operating costs (EUR 60 million) due to the expected higher costs of servicing and repairing electric vehicles, which are due to temporarily lower availability of specialised service works. The costs of strengthening distribution grids and charging infrastructure have not been quantified.

Trade and services

In addition to the standard measures and financial mechanisms used for the renovation of public buildings in the past, the Recovery and Resilience Plan and REPowerEU will be one of the key sources of financing for the recovery by 2030. The renovation of public buildings will continue to be supported by EU funds through the Slovakia Programme. This support will mainly be based on grant-assisted co-financing, but an extended use of financial instruments is envisaged. The Envirofond and the Just Transition Fund are also foreseen. Improving the energy performance of non-residential private sector buildings in trade and services will be mainly financed by private sources.

A key support mechanism to support the renovation of commercial non-residential buildings in the trade and services sector will be the Slovakia Programme through Measure 2.1.1 'Improving energy efficiency in enterprises'. In addition to technological equipment and the purchase of means of transport, it will also be possible to support the improvement of the thermal protection of business buildings through co-financing. In particular, but not only, the ESS will play an important role in rebuilding outdoor lighting (parks, in-house sites, other).

Support from the Recovery and Resilience Plan will focus on improving the energy performance of historic and listed buildings. These are among the worst performing buildings. Improving the energy performance of these buildings requires a specific approach to renovation, given the need to preserve the historical and cultural value of the goods, and it is mostly possible to carry out renovations only to a limited extent. The objective of the investment is to improve the structural condition of historical and listed public buildings, while improving their energy performance, while also improving their public use and extending their lifetime.

The renovation of public buildings will also be supported through REPowerEU through a support programme entitled 'Improving the energy and efficiency of state buildings (Fast measures)'. The aim is to reduce energy consumption through rapidly feasible and procedurally low-intensity civil engineering or technological measures in public buildings. The primary target group is central government buildings. Measures that have a demonstrable impact on the reduction of energy consumption in the building will be financed. The investment will be implemented in the form of a non-repayable financial contribution through a direct invitation. The selection of specific project objectives will be based on eligibility criteria and energy-saving potential for the required amount.

The Slovakia Programme will support the renovation of public buildings applying the energy efficiency first principle. At least a medium level of renovation of the building will berequired, with the intensity of support taking into account primary energy savings. The quality of the indoor environment will also need to be respected by ensuring the required indoor air exchange or by other measures to improve the indoor environment. Expenditure on debarierisation measures and infrastructure for electro-mobility will be eligible. In order to make the operation of buildings more efficient and maximise the realisation of the energy savings potential, the deployment of energy management, monitoring of operational data, including technical support to the contractor for the sustainability of the project will also be supported. Support for the installation of RES facilities related to the renovation of the building will be financed from Measure 2.2.2.

Public buildings are planned to be renovated through the Just Transition Fund, with a projected saving of 10.3 GWh of primary energy. The allocation amounts to EUR 41.3 million, of which EUR 25.5 million are financial instruments and the remainder is for grant support. The renovation of public buildings in Upper Nitra and selected districts in Banská Bystrica and Košice regions will be supported.

A data collection system on public buildings shall be**put in place and a central database for their registration shall be established in order to plan efficiently the renovation of public buildings and optimise their operating costs.** The data will be part of the digital data platform on the energy performance of the building stock in Slovakia, the creation of which will be financed through REPowerEU. The platform will enable the collection, processing, storage and provision of all relevant and consistent information, which will be a key tool for planning policies and measures on the energy performance of buildings, including public buildings, at national level, for the long-term planning and prioritisation of the renovation of the building stock in Slovakia and for the need to prepare and deduct the National Building Renovation Plans and the Long-Term Strategy for the Renovation of the Building Stock. The database of public buildings also contains the data required by the Energy Efficiency Directive.

The reduction of energy consumption in public buildings will also be implemented through guaranteed energy service projects implemented by a guaranteed energy service provider to the public sector on the basis of an energy performance contract with guaranteed energy savings for the public sector. The repayment of the investment is assumed from the resources that the beneficiary of the GES would use to cover energy costs in the future. The use of guaranteed energy services also for the modernisation of public lighting continues to be envisaged. Comprehensive investments in the energy and telecommunications infrastructure of cities and municipalities are essential to support the development of public lighting. In addition to replacing original luminaires with lower energy consumption, smart control systems that ensure optimal operation of individual lighting points and ultimately optimal operation of the whole system at city/municipality level will contribute significantly to energy savings.

Green public procurement will play an important role in meeting energy efficiency targets. In Slovakia, it constitutes a specific form of public procurement, in which requirements are applied in the relevant steps to ensure that the procured subject-matter of the contract, including activities related to, for example, its delivery, assembly, installation and operation, will have a more favourable environmental impact than products with comparable functional or performance parameters, for which environmental impact is not normally taken into account.

Putting in place systematic energy planning at regional level, interlinked and coordinated with energy and climate policy planning and development at national level, is key to building sustainable energy. At the same time,systematic planning and coordination of regional energy development is essential for optimising energy needs and consumption, sustainable use of available renewable resources, achieving high levels of self-sufficiency and energy security, and thus economic stability of regions. Regions in Slovakia have long been lacking professional capacity, which is a necessary condition for systematic energy planning. The objective of the measure is to ensure that all regions of the Slovak Republic have such capacities at the same time, while ensuring that the newly created regional capacities are closely coordinated at national level, that they have in advance a clear territorial delimitation, uniform methodological management, high-quality expert support, a high-quality technical and information base, and that they are mutually reinforcing. All these needs will be ensured by new infrastructure for the planning and coordination of sustainable energy and decarbonisation of regions.

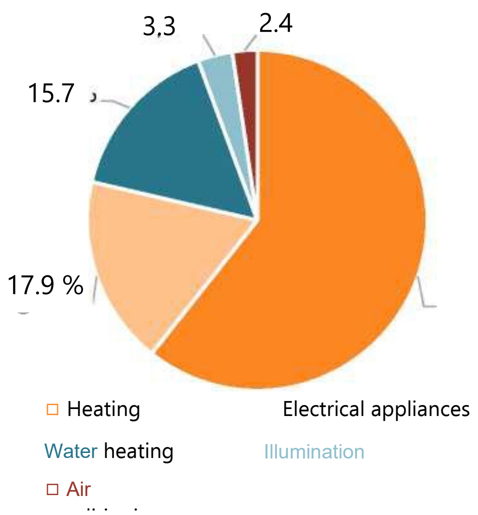
The pace of renovation of public buildings, given the new obligation under Article 6 of Directive 2023/1791 on energy efficiency,**will need to be increased.** The target calculation basis shall be increased by more than 100 %, from 52.17 GWh to 104.25 GWh. On average over the 2014-2020 period, energy savings of 76.2 GWh were achieved per year. This shows that around 200 GWh will need to be saved by 2030 to reach the 3 % renovation rate per year. However, account should be taken, in particular, of the fact that only the energy savings achieved by the renovation of buildings into energy class A0 can be counted towards compliance with the obligation under Article 6, which may further increase funding requirements.

The contribution of energy savings achieved through approved financing mechanisms by 2030 is estimated at 67.9 GWh per year. The contribution of energy savings achieved exclusively from the state budget and the municipal budget is estimated at 36.3 GWh until 2030, based on the evolution of savings achieved in 2014-2021.

Impact of measures on the development of final energy consumption by 2030

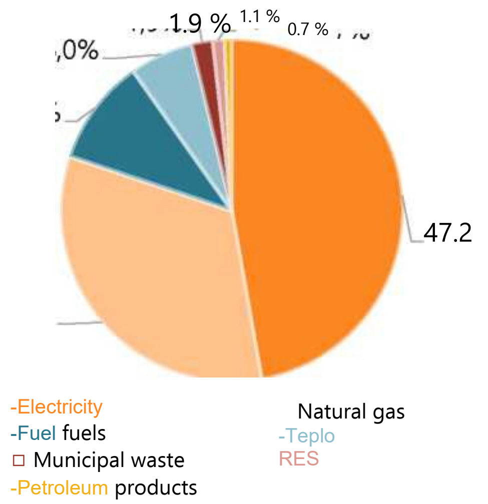
In 2019, the final energy consumption of fuels in services was 14.1 TWh. Up to three-fifths of consumption consisted of heating buildings (60.7 %), electrical appliances (17.9 %) and hot water heating (15.7 %) the bulk. In terms of fuels, electricity (47.2 %) and natural gas (32.9 %) were the most used in 2019. The share of central heating is significantly lower compared to the household sector.

Figure 32: Fuel consumption in services in 2019 by use (in TWh)



Source: IEP according to Eurostat

Figure 33: Fuel consumption in services by energy carrier in 2019 (in TWh)



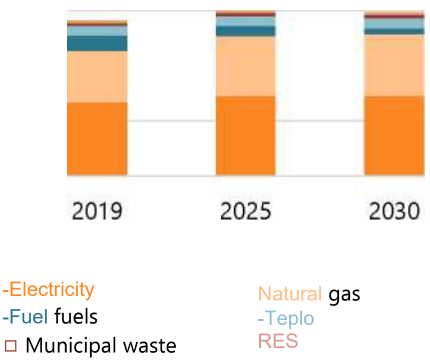
Source: IEP according to Eurostat

In view of the trend of increasing temperatures, the ratio of energy uses will change. A higher share of air conditioning to the detriment of heating is expected in thelong term. In the context of technological change and improved technology availability, energy use through electrical appliances will be increased. On the other hand, this effect is mitigated by the higher efficiency of these appliances. From a macroeconomic perspective, a slight strengthening of the services sector can be envisaged in terms of the added value generated by the sector. This may lead to an increase in the floor area of the buildings used for this purpose, which may have the effect of increasing the final energy consumption of the sector.

In the WEM scenario, final energy consumption will increase by 5.1 % by 2030. This is mainly due to the expected growth in value added of the sector, but also to the rise in living standards. In the WAM scenario, final energy consumption will be reduced by 5 %, with the most significant energy savings being achieved in heating and heating water. Significant savings, estimated to be up to 25 %, will also be achieved through the replacement of lighting.

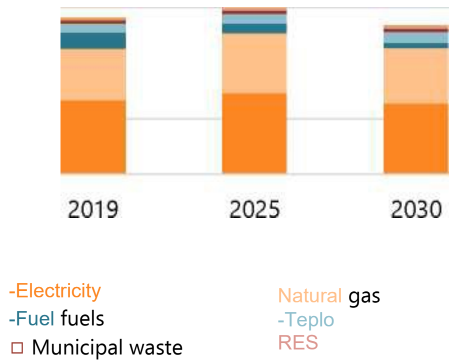
In particular, the WAM**scenario envisages a significant impact of legislative measures.** The scenario envisages the introduction of the Building Emissions Trading System (ETS2) as of 2027. One important prerequisite for the implementation of the scenario is the achievement of energy efficiency targets for the public sector and public buildings. Investments in energy-saving appliances, efficient lighting and the installation of heat pumps and solar water heating will be widely supported, resulting in a sharp reduction in the share of solid fossil fuels in heating.

Figure 34: Final energy consumption of the services sector in year 2030 by fuel (WEM, in TWh)



Source: IEP under CPS

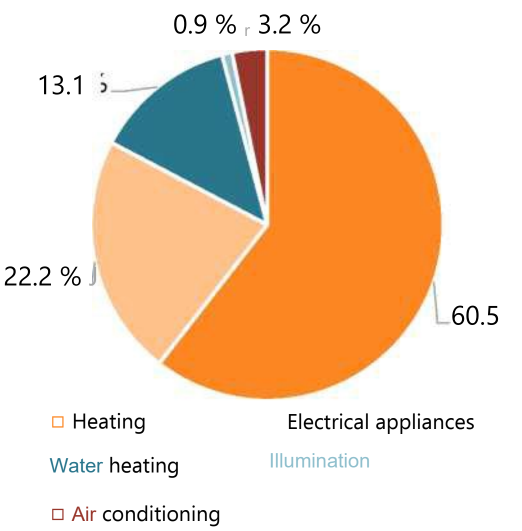
Figure 35: Final energy consumption of the services sector in year 2030 by fuel (WAM, in TWh)



Source: IEP under CPS

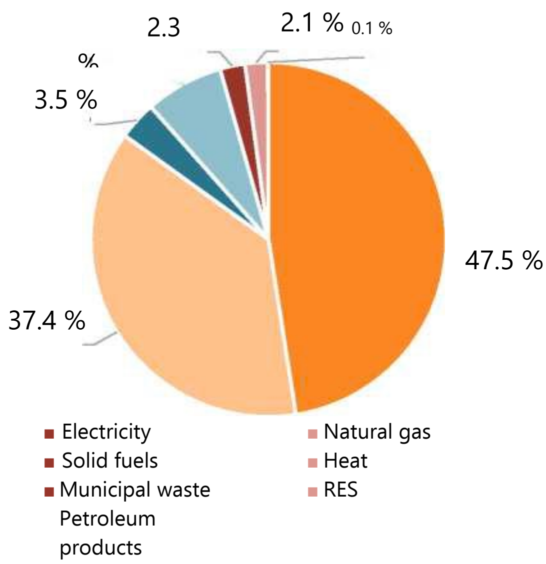
Heating will significantly reduce the consumption of solid fossil fuels and petroleum products, which will be replaced mainly by electricity and natural gas. On the contrary, more energy will be used through electrical appliances and air conditioning. Biomass use will also grow slightly. Approximately constant amounts of heat will continue to flow from central supply, but due to the decline in overall consumption, its share will grow slightly.

Figure 36: Fuel consumption in services by use in 2030 (WAM, in TWh)



Source: IEP under CPS

Figure 37: Fuel consumption in services by energy carrier in 2030 (WAM, in TWh)



The estimated contribution of the measures for Article 8 of Directive 2023/1791 on energy efficiency to the reduction of final energy consumption in the tertiary sector is set out in Annex 2.

Costs

The additional funding needed to finance the renovation of public buildings by 2030 over and above the existing financial mechanisms is estimated at between **0.7 and EUR 2 billion depending on the level of renovation. EUR &**I. The actual level of costs will depend on the take-up of guaranteed energy services and the involvement of the private sector in co-financing the renovation of public buildings.

ii. A long-term renovation strategy to support the renovation of the national housing stock; and non-residential buildings of private and public[51], including policies, measures and actions to incentivise cost-effective deep renovation and policies and actions to target the worst segments of the national building stock in accordance with Article 2a of Directive 2010/31/EU

The long-term strategy for the renovation of residential and non-residential buildings in the Slovak Republic was submitted to the European Commission in 2021.52

iii. Description of policies and measures to promote energy services in the public sector and measures

to remove regulatory and non-specific barriers to the uptake of guaranteed energy service and other energy efficiency service models[53]

As such, energy services have legislative support in Act No 321/2014 on energy efficiency and amending certain acts ('Act No 321/2014 on energy efficiency'). That law introduced, in Paragraphs 15 to 20, the entire system for defining and promoting energy services. Energy services are subdivided into enabling energy services and guaranteed energy services. An energy support service is specified in Section 15 and covers, in particular, advice, training and the provision of similar services with a view to improving energy efficiency.

A guaranteed energy service is an energy service provided under an energy performance contract with guaranteed energy savings. **The contract is concluded between the provider of the guaranteed energy service and its beneficiary.** Under this contract, the provider of the guaranteed energy service is remunerated for the services provided according to whether it has actually achieved the contracted energy efficiency improvement values. The provision of an energy service with guaranteed energy savings is a tied business. The law also lays down the mandatory content of an energy performance contract where the provision of an energy service affects the public sector. The Slovak Innovation and Energy Agency shall promote and raise awareness of the development of the guaranteed energy service. It also conducts training and refresher training for the qualified person to provide the guaranteed energy service and informs the public body about the possibilities of implementing energy efficiency improvement measures within its remit. The Ministry of Economy keeps lists of providers of qualified persons for the performance of the guaranteed energy service. The method of listing is dealt with in the form of Ministry of Health Decree No 99/2015 on providers of supporting and guaranteed energy services.

Barriers to the development of guaranteed energy services, such as low awareness, low trust in providers, as well as a lack of basic regulatory framework, have been identified at the outset of deployment. Some of the above barriers have been removed by Act No 321/2014 on energy efficiency, which introduced the basic system for the provision of an energy service, introduced the institute of a qualified person for the provision of guaranteed energy services and the content of an energy

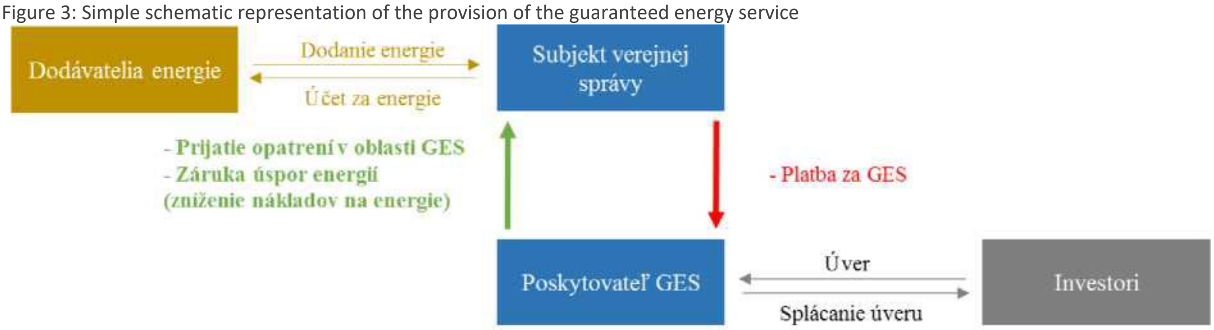
52 https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/long-term-renovation-strategies_en

performance contract for the public sector, as well as information obligations for the Slovak Innovation and Energy Agency. Basic policy and regulatory barriers to energy services have thus been largely removed. However, removing barriers, in particular in the areas of demand flexibility, regulation and the setting up of appropriate support schemes, remains a challenge.

The biggest barrier to the development of energy services is the way of financing so far, which is exclusively grant funding with a non-reimbursable proportion above 85 % of eligible expenditure. A key factor in the ambition to move forward the development of the energy services market is the possibility to combine grant-repayable funding with repayable funding in the use of financial instruments in one operation. Such an instrument, prepared for municipalities and cities by the Slovak Ministry of Finance and Slovak Investment Holding, has an in-built multiplier effect which will allow (depending on the share of the grant component) for example, for the allocation of EUR 100 million, to finance projects amounting to approximately EUR 200 million, which will also significantly increase the number of projects implemented.

One of the key barriers to GES is still the issue of the possibility of using private sector capital expenditure for the renovation of public buildings under the GES Treaty, which, however, according to Eurostat's understanding, increase public debt. The financing provided by the GES provider is calculated as a loan to the public sector, thereby increasing public debt and deficit. Therefore, Eurostat issued methodological guidance of 19.9.2017, which allows, subject to strict rules, the use of the guaranteed energy service in the public sector that does not lead to an increase in public debt. In the User's Guide of 8 May 2018, Eurostat, in cooperation with the European Investment Bank, then specified in detail which particulars must be fulfilled by GES contracts in order to be recorded outside the public finance sector, i.e. without affecting public debt. The new methodology and user guide aimed to significantly improve the conditions for the use of GES in the public sector. On this basis, a concept for the development of guaranteed energy services in the Slovak public administration was established. Subsequently, an adjustment to the legislative framework allowing the use of GES under Eurostat rules was prepared. The amendment to Act No 321/2014 on energy efficiency contains the necessary adaptations for the use of GES in the public sector in accordance with the Eurostat methodological manual and the adaptations to other related legislative provisions on the disposal of State, Municipalities and Municipalities' property and the VÚC. A model contract approved by Eurostat is also available. A schematic representation of the provision of the guaranteed energy service is shown in Figure 3.

Figure 3: Simple schematic representation of the provision of the guaranteed energy service



The introduction of the mandatory application of the rules of Eurostat's methodology for energy services in the public sector in Slovakia has caused a significant slowdown in the provision of GES in the public sector and has resulted in a situation where more commercial loans and concession contracts have started, thereby circumventing the Energy Efficiency Act and the rules for the provision of classical GES in the public sector. Options to address the problem are in the relaxation of GES rules for the public sector also outside the Eurostat rules. However, the use of a financial mechanism with co-financing from different European funds must be the basis, as called for by the new Energy Efficiency Directive. It will therefore be necessary to set up rules for the sharing of private and public capital for investments in energy efficiency measures in the public sector.

The further development of guaranteed energy services in the public sector will also be significantly affected by the transposition of the new Energy Efficiency Directive. The new Directive does not require the mandatory application of Eurostat's methodology for GES in the public sector, but only that it be taken into account in the proposed financial mechanisms with the GES. Enabling the implementation of GES projects, even with impacts on public debt, without complying with Eurostat's methodology, has the potential to maximise the efficiency of both public and private investments in increasing the energy efficiency of public sector buildings and facilities. This implies the need to develop methodologies and financial instruments combining GES requirements and EU financial mechanisms and funds in a way that keeps sovereign debt under control.

In order to ensure the effectiveness of the methodologies developed and to support the implementation of GES projects, it is necessary to establish a permanent technical assistance scheme for the identification of GES options for public buildings, enabling public authorities to use and finance the services of qualified advisors in the process of preparing and implementing energy efficiency projects, as well as other requirements from the new Energy Efficiency Directive.

The regulatory framework will have to comply with the energy efficiency first principle, according to which energy efficiency improvements need to be made whenever they are more cost-effective than equivalent supply-side solutions.

Public bodies must be incentivised to spend State resources economically in order to achieve the best possible result at the most favourable cost possible. It will be important in this context to set up support schemes efficiently, as well as to extend the list of applicants for non-refundable financial assistance to include guaranteed energy service providers.

Last but not least, distortions of the guaranteed energy services market through the provision of exclusively non-repayable, high intensity financial support will have to be avoided. The use of non-repayable financial assistance in this area has potential, but it is necessary to combine non-repayable financial assistance with repayable assistance from financial instruments within the same operation.

iv. Other planned policies, measures and programmes to achieve indicative national energy efficiency contributions up to 2030 as well as other objectives referred to in point 2.2 (such as measures to promote the exemplary role of public buildings, and energy efficiency of public procurement, measures to promote energy audits and energy management systems[54], consumer information measures and educational measures[55], and other measures to promote energy efficiency[i])

In order to meet the energy efficiency targets, measures whose contribution cannot be precisely quantified are at least as important as those for which the estimated contribution to the targets can be determined. These include, in particular, support measures from Directive 2023/1791 on energy efficiency. The planned policies and measures to meet the 2030 targets should be set for the whole period and cover the required energy and climate targets. Measures with identified energy savings are listed directly in the methodological tables.

The application of the energy efficiency first principle will be an automatic part of project planning and investment needs. To this end, it will be necessary to develop guidelines for selected sectors such as buildings, ICT, financial sector, etc. The application of the principle in the planning and design of policies will be important. The introduction of an energy efficiency first assessment will be mandatory for investments in the energy sector above EUR 100 million. Investments related to transport infrastructure will need to be taken into account for projects worth more than EUR 175 million in transport infrastructure. The application of the principle will also need to be methodologically calibrated in relation to public procurement.

Training in the energy sector in order to increase the number of skilled, skilled and competent professionals, from planning to implementation, will be an absolute key priority. In the framework of energy training and with a focus on reducing climate change, a national SIEA Odborne project on energy was carried out. A series of Build-up skills and BUSS Doubledecker projects are continuing for construction and building renovation skills. The Ministry of Education has renewed projects for sectoral professional councils, including the energy and buildings sectors. These projects are an important input to meet the requirements of the new Fit for 55 directives in the field of vocational training, up-skilling and skills, as well as the identification of the necessary professions. Increasing professional capacity in the municipality through targeted and financially supported training for local authority staff is a prerequisite for achieving the objectives set.

By the end of 2024 and every 4 years thereafter, an analysis of energy expertise and skills will be carried out to propose recommendations and programmes in this area. The focus will be on increasing the number of qualified, skilled and competent energy auditors, energy managers, RES installers, persons certifying the energy management system in line with the requirements of the international standard ISO 50001, qualified persons for energy certification of buildings, installers of building elements and builders with a focus on comprehensive renovation of buildings, guaranteed energy service providers, inspectors of heating and cooling systems, etc. Training programmes to up-skill workers from selected energy sectors will be put in place to support new technologies. The analysis will be the basis for the establishment and development of a learning network that achieves the appropriate level of competences and skills corresponding to market needs in order to ensure sufficient professionals in the shortest possible time.

[27] In accordance with Article 8 of Directive 2012/27/EU

[28] In accordance with Articles 12 and 17 of Directive 2012/27/EU

[29] In accordance with Article 19 of Directive 2012/27/EU.

The creation of a hub for energy data management and analysis at national level is a prerequisite for efficient planning, policy development and optimisation of energy costs for both the private and public sectors. In addition to data collection and processing, the consolidation of data in energy and energy statistics according to the latest requirements and trends in all sectors of the national economy will be an important part of the centre. The European Union's current energy needs, in particular following the achievement of energy and climate targets and the acute need to reduce dependence on fossil fuels, require the establishment of a system and ensuring the collection of relevant data, the implementation of data-based system analyses, the introduction of innovations in monitoring and evaluating needs, flows and energy savings, digitalisation, the interconnection of the data system and the need for comprehensive knowledge-based planning of energy and climate targets based on real data. A central system for the collection, processing and analysis of energy data, serving as a fundamental data pillar, is necessary for decision-making and policy decisions relating to the direction of energy in Slovakia at national level and the contribution of Slovak energy to the European Union. Data collection will be built primarily on the extraction of data from already existing information systems. New data sources will only be created where necessary, subject to their integration into the central system. This will contribute to reducing administrative complexity and bureaucracy while at the same time contributing to the overarching rule of the once-only computerised public administration strategy. The system will also include the integration of external data, dials and registries (e.g. database and data exchange system on energy performance of buildings, REPowerEU). They will achieve a high degree of compatibility with other data sources that use or will use these registries in the future. In particular, the single platform should include processes ensuring the collection, processing, methodological approach and presentation of data, expertise ensuring the operation of the platform, covering operational, analytical and legislative processes and tools supporting expertise. The total cost is estimated at EUR 10-20 million.

Further to the establishment of the Energy Data Management and Analysis Centre, the expansion of analytical capacities at national level will also be necessary. This will make it possible to react flexibly to legislative and other energy-related proposals, particularly affecting businesses and households. The preparation of input into planning, legislative and reporting documents at national and European level, the setting of energy and climate targets, as well as data and analytical support for the preparation of Slovak and European legislation will be an important element of capacity. The data whose nature allows it will be available and accessible at the same time to all levels of government for the implementation of activities at regional and local level.

Consolidation of energy statistics in energy will be essential to ensure the highest possible quality of data. In addition to the usual sectors of final energy consumption, this is particularly true for the heating sector, data centres and the public sector. New statistical surveys, as required by the new European legislation, will need to be introduced to meet the objectives and targets.

The level of contribution of each measure to the objectives depends directly on the manner and quality of information and awareness-raising, therefore it will be necessary to ensure the funding of the programme that will fulfil this function in the field of energy at national level. According to Article 22 of the Energy Efficiency Directive 2023/1791, an information strategy is to be designed to raise awareness and inform about energy efficiency measures at all levels and with the involvement of all actors concerned. This will ensure that information on energy efficiency is disseminated to all levels of government, government, public administration and the private sector. Different ways of providing information from different perspectives, such as fiscal, access to finance, vouchers, grants, subsidies, demonstration projects, education, digitalisation, information for people with impaired access, will need to be designed for measures aimed at final customers and end-consumers. These information tasks will need to be provided financially, administratively and technically, and an enabling framework for information on energy efficiency measures, in particular in the form of first-contact points, and by providing technical, administrative and financial assistance. First contact points for counselling and specialised first contact points for people in energy poverty shall be set up. It will also be necessary to create the conditions for targeted counselling. In this area, conditions need to be ensured in Slovakia so that the Commission can provide technical assistance that Slovakia should be able to absorb. The tasks shall also include the promotion of the use and, where appropriate, the establishment of an Ombudsperson or other non-judicial mechanism covering also energy efficiency measures. Measures are to be taken with regard to the split incentives of the owner and tenant and measures to promote multilateral dialogue in the renovation of buildings.

Following the obligation to coordinate energy efficiency financing at national, regional and local level, the Ministry of Economy will establish an Energy Efficiency Financing Coordinator. In particular, the coordinator's role will be to centrally coordinate the financing of energy efficiency measures at national, regional and local level, in cooperation with relevant authorities and organisations of national, public and local administrations, to develop a comprehensive strategy for addressing energy efficiency financing mechanisms, to develop the necessary methodologies for the financing of energy efficiency measures, including multi-source funding methodology, to put in place a planning and design mechanism for the measures to be designed because of their contribution to energy efficiency targets, to support the creation and use of financial instruments to finance energy efficiency measures so as to maximise the benefits of financing and others.

In the area of public procurement, new energy efficiency measures are introduced, obliging contracting authorities and contracting entities, when awarding above-threshold public contracts and concessions, to procure, to the extent technically possible, only energy-efficient products, services and works and buildings with high energy efficiency. Building on this as well as other public procurement obligations stemming from the Energy Efficiency Directive 2023/1791, it will be necessary to set up a system for checking and recording data and to ensure sufficient staffing capacity.

Measures in the heating and cooling sector:

<u>Operating aid for the transition to efficient CZT</u>:
In Slovakia, there remains a need to incentivise operators of district heating and cooling systems to switch to efficient district heating. To this end, operating aid within the meaning of Act No 309/2009 on the promotion of renewable energy sources and high-efficiency cogeneration and amending certain acts, as amended, is granted to producers of electricity and heat from high-efficiency cogeneration. The aid scheme was approved by Commission Decision SA.54318 (2020/NN) of 4.3.2021 and is valid until 31.12.2025. The implementation of the investment plans in this area was marked by the Covid-19 pandemic and the energy crisis triggered by the war in Ukraine, therefore Slovakia will seek to extend the duration of the scheme beyond 2025, taking into account the recommendations stemming from point 468(a) CEEAG 2022. As part of the identification and removal of regulatory distortions leading to resource adequacy issues, options to incentivise flexible operation of heating plants for regulatory purposes will also be assessed, for example by paying aid for available capacity (in MW) rather than electricity generation (in MWh). Particular attention will be paid to the needs of smaller CZT networks in the municipality when setting up support.

Legislative basis/laws and decrees to promote energy efficiency

- Act No 321/2014 on energy efficiency
    - on Decree of the Ministry of the Economy No 88/2015 laying down the scope of the evaluation, the method of calculation and the value of energy efficiency of energy sources and distribution

- on Decree of the Ministry of the Economy No 99/2015 laying down detailed rules for the provision of an enabling energy service and a guaranteed energy service
- oDecree of the Ministry of the Economy No 179/2015 on energy audit
- oDecree of the Ministry of the Economy No 319/2015 on the professional examination competences to act as an energy auditor
- on Decree of the Ministry of the Economy No 327/2015 on the calculation and fulfilment of energy efficiency targets
- on Decree of the Ministry of the Economy No 13/2016 laying down the details of the set of data to be provided for the energy efficiency monitoring system
- on Decree of the Ministry of the Economy No 14/2016 laying down technical requirements for the heat insulation of heat and hot water distribution systems
- on Decree of the Ministry of the Economy No 192/2015 on monitoring the energy intensity of public buildings

- Act No 555/2005 on the energy performance of buildings

  - on Decree No 364/2012 of the Ministry of Transport, Construction and Regional Development of the Slovak Republic implementing Act No 555/2005 on the energy performance of buildings and amending certain acts, as amended

- Law 657/2004 on Thermal Energy

  - on Decree of the Ministry of the Economy No 151/2005 establishing a procedure for preventing and remedying the consequences of a state of emergency in the thermal energy sector
  - on Decree of the Ministry of the Economy of the Slovak Republic No 152/2005 on specified time and specified quality of heat supply to the final consumer
  - on Decree of the Ministry of the Economy No 159/2005 laying down the scope of training and the required knowledge for examinations of professional competence, details of the establishment and operation of examination committees and the content of the certificate and professional competence
  - on Decree of the Ministry of the Economy No 308/2016 laying down the procedure for calculating the primary energy factor of a district heating system
  - on Decree of the Ministry of the Economy No 3240/2016 laying down the temperature of domestic hot water at the sampling point, the rules for the calculation of the amount of heat delivered in domestic hot water and the calculation of the amount of heat

- Act No 182/2011 on the labelling of energy-related products and amending certain acts
- Act No 529/2010 on Ecodesign
- Law 314/2012 on the periodic inspection of heating systems
    - Decree of the Ministry of the Economy No 422/2012 on the procedure for periodic inspection of the heating system
    - Decree of the Ministry of the Economy No 44/2013 on the scope of the examination for professional competence for the inspection of heating systems
    - Decree of the Ministry of the Economy No 226/2013 on up-to-date training

v. Where applicable, description of policies and measures to promote the role of local energy communities in contributing to the implementation of the policies and measures in points (i), (ii), (iii) and (iv)

In particular, the Capacities for Regions project will contribute to the implementation of the policies and measures in points (i), (ii), (iii) and (iv) at regional level.

VI. Description of measures to develop measures to utilise energy efficiency potentials of gas and electricity infrastructure56

Description of measures to utilise energy efficiency potentials of gas and electricity infrastructure

The assessment of the energy efficiency of electricity and gas infrastructure is introduced in the form of an obligation for individual market participants operating in accordance with the requirements of Act No 251/2012 on energy in the field of electricity and gas and operating electricity or gas infrastructure.

Electricity

The main contributors to increasing energy efficiency in electricity include the transmission system operator, Slovenskáelektrá Transová Systema, a.s. (SEPS) and Distribution System Operators (DSOs).

The primary objective of the SEPS is to ensure the security and reliability of the electricity supply in the defined territory and also to fulfil the international obligations arising from membership of ENTSOE. Measures to exploit the energy efficiency potential of electricity infrastructure are fully under the responsibility of the Ministry of Economy. As a transmission system operator, SEPS considers the controlled phase-down of 220 kVPS SR to be a measure related to ensuring the management of the energy efficiency of the transmission system. SEPS thus gradually shut down the old and energy-intensive 220 kV PG equipment and, if justified, replaces them with modern 400 kV PG equipment. The replacement of PS/RDS transformers can be included among other such investments, as today's modern transformers already meet much stricter criteria in terms of the size of losses in electricity transformation. The use of new types of cables with higher transmission capability on newly built power lines will increase the energy efficiency of the transmission of electricity, but the use of existing PS towers needs to be verified by a static-dynamic assessment of the steel design of the specific transmission line. These design measures, while costly, are beneficial in the long term for improving energy efficiency and achieving energy savings of the SEPS's own electricity infrastructure.

[56] In accordance with Article 15(2) of Directive 2012/27/EU.

In Slovakia, electricity distribution is currently ensured by three regional distribution systems (East, Central and West of Slovakia) and about 150 local (local) distribution systems. The assessment of the energy efficiency of distribution systems is carried out in accordance with the requirements of Act No 321/2014 on energy efficiency and Decree of the Ministry of the Economy No 88/2015 laying down the scope of the evaluation, the method of calculation and the value of the energy efficiency of energy sources and distribution networks, which replaced Decree No 428/2010. Under current Slovak legislation, distribution system operators are responsible for:

- calculation of the energy efficiency of the distribution system and its transmission to the energy efficiency monitoring system;
- the deployment of smart metering systems pursuant to Decree 358/2013;
- the installation of HN/NN transformers pursuant to Commission Regulation 548/2014 implementing Directive 2009/125/EC on ecodesign with regard to small, medium and large power transformers;
- a distribution network development plan to be sent annually by distribution system operators with more than 100 thousand demand points to the Ministry of Energy under the Energy Act;
- implementation of ÚRSO Methodological Guideline No 05/12/2015 of 11 June 2015.

Main measures by which distribution system operators contribute to increasing energy efficiency:

- replacement and upgrade of existing equipment, in particular the replacement of transformers
- installation and deployment of smart metering systems in grids
- refurbishment of electrical stations
- optimisation of operation and number of transformers depending on forecasted electricity demand in the system
- implementation of control and diagnostic processes in the system
- reactive power compensation and introduction of automatic compensation control
- replacement of HR, CPR and NN cable
- mapping of wiring and modernisation of cabinets
- replacement of luminaires for LED lighting and installation of motion sensors for lighting
- installation of remote data collection equipment
- improving the energy efficiency of the buildings in which these facilities are located.

Gas – infrastructure

In the field of gas, the assessment shall be carried out by the transmission system operator, the gas distribution system operators and also the gas storage system operators. In addition to the necessary identified investments in the gas sector for the entire ten-year period, large investment projects for cross-border interconnections listed in the TYNDP shall be added.

The transmission system operator eustream, a.s. implemented most of the key actions in 20052015. This was mainly about optimising the operation of the transmission network and optimising the compressor technology. Major projects contributing to the reduction of energy intensity, which are planned to be implemented in the next period, include upgrades and upgrades of gas transmission technology:

- upgrade of Compressor Station Control System
- Redizajn of RENet compressor stations
- further improving the accuracy and objectivity of measurement systems
- improving the safety of operations

- increasing the flexibility of the transmission system linked to new cross-border interconnections that have been opened in the last three years or are planned for the next period.

About 50 distribution system operators provide gas distribution. The assessment of the energy intensity of gas distribution is drawn up in accordance with Ministry of Health Decree No 88/2015. The most important measures envisaged include:

- introduction of shut-off and switching off mode of natural gas flow depending on the size of the distribution
- replacement of boilers necessary for gas heating
- optimisation of compressors, measurement and long-distance data performance and network pressure height
- insulation of heat pipelines and exchangers
- improving the energy efficiency of the operation of heaters in control stations
- checking the adjustment of gas and gas pre-heating and heating converters, checking route caps, gas tightness and additional gas insulation
- introduction of smart metering systems in gas distribution and supply

The potential for energy savings is very limited, especially given the way gas installations operate and maintain. Its value due to technical losses is around 300 GWh. Even with a maximum effort and sufficient resources to deliver energy-intensity reduction measures, this potential can be reduced by a maximum of around 10 %, representing around 30 GWh of savings per year.

Gas storage operators identified as their most important actions the optimisation of storage operations, the modernisation of the monitoring system, as well as decarbonisation projects, which include, in addition to the above-mentioned hydrogen storage projects, the following projects:

a) Modernisation of compressors TK1,2
NAFTA a.s. is also continuously engaged in increasing the stability and reliability of its natural gas storage facilities and the potential storage of natural gas/hydrogen blends, emphasising compliance with the principles of the European Union's initiatives on security of supply and reduction of greenhouse gas emissions. In this context, NAFTA a.s. plans to upgrade compressor units on an operating reservoir. The essence of the project is to replace two compressors with two new electric compressors.
Retrofitting would lead to significant emission reductions of 9 000 tonnes CO_2 per year compared to 2020, an increase in the energy efficiency of installations, as well as a reduction in the use of fossil fuels. At the same time, the use of electricity from renewable sources is considered to drive compressors. The completion of the project is expected in 2027. This project is also included in the TYNDP 2024.
b) Reducing methane emissions
NAFTA a.s.'s project aims to minimise methane emissions released during the operation and maintenance of the underground storage facility by implementing best available techniques. Managing and reducing methane emissions is a major priority for the European gas industry. NAFTA a.s. aims to reduce current methane emissions by 50 % by 2030 compared to 2020.

In terms of final gas consumption, a significant measure is to promote the replacement of older gas boilers with modern low-emission gas condensing boilers. The measure is further described in Annex 2.

Energy efficiency criteria for network tariffs and network regulation (Article 15 EED)

Description of measures planned or taken to ensure the removal of incentives in tariffs detrimental to the overall efficiency of electricity generation, transmission, distribution and supply (Article 15(4) EED)

Pursuant to Section 11(1)(d), access to the transmission system and the transmission of electricity (subparagraph (d)) and access to the distribution system and distribution of electricity are also subject to price regulation (e). The method of calculating the maximum price is set out in the ÚRSO Decree.57

Description of measures planned or taken to incentivise system operators to increase efficiency in infrastructure design and operation (Article 15(4) EED)

Pursuant to Section 9(1)(j) of Act No 250/2012, the Office for the Regulation of Network Industries is organising a tender procedure for a technology supplier that ensures an increase in the energy efficiency of networks or a reduction in electricity consumption and a supplier that prepares and builds new electricity installations for which economic incentives are granted.

Description of measures planned or taken to ensure that tariffs enable suppliers to improve customer participation in system efficiency, including demand response (Article 15(4) EED)

The ÚRSO Decree on price regulation in the electricity sector favours individual tariffs for the operation of the system and the tariffs for system services to final electricity customers meeting the conditions for the granting of individual tariffs. In this context, it is also necessary for the regulatory policy to take sufficient account of the energy efficiency first principle within the meaning of Directive 2023/1791 on energy efficiency, for example by introducing incentives to optimally incentivise energy suppliers and distributors to achieve energy savings on the part of final users.

vii. Regional cooperation in this area, where applicable

The Slovak Republic is one of the founding members of CESEC (Central and South Eastern Europe energy connectivity). The original objective of the group was to coordinate efforts aimed at facilitating the rapid completion of cross-border and trans-European projects that diversify the gas supply to the region and the development of regional gas markets and the implementation of harmonised EU rules to ensure the optimal functioning of the infrastructure. At the 4th Ministerial Meeting of CESEC in Bucharest in September 2017, energy ministers signed a Memorandum of Understanding extending the scope of CESEC cooperation, including energy efficiency and renewables as part of the expanded content.

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

The key financial mechanism to support the development of electricity in Slovakia will be the Recovery and Resilience Plan – REPowerEU. The main investment will be the modernisation and digitalisation of the transmission system and regional distribution networks. The development of the electricity grid is a key part of the green transition. The objective of the investment is the development of the transmission system, including the creation of sufficient capacity to enable the connection of additional RES to the electricity grid or the import of RES electricity from abroad. In order to ensure Slovakia's energy security and resilience, it is crucial to have a robust transmission system with sufficient regulatory performance and a corresponding distribution system. Investments in the transmission system are directly followed by investments in regional distribution networks (RDS) to strengthen the distribution capacity of individual RDS lines, transformers and other facilities. In the context of the development of decentralised renewable electricity generation, the proposed investments will

57E.g. Decree of the Office for the Regulation of Network Industries No 17/2017 laying down price regulation in the electricity sector and certain conditions for carrying out regulated activities in the electricity sector.

contribute to the creation of new grid capacity for the connection of new renewable energy sources in specific locations and increase local permeability in the distribution grids. Such improvement of the technical preconditions for connecting new RES electricity generation facilities is crucial for meeting national RES targets and decarbonising the economy. The creation of the Energy Data Centre (EDC) will streamline and accelerate the access of new entrants to the electricity market. Investment 1 proposes support in four areas:

- transformation of the transmission system/regional distribution system;
- modernisation of transmission lines;
- investments in regional distribution networks;
- creation of an EDC.

In order to absorb increased electricity generation from RES, it will be important to prepare support programmes aimed at:

- increasing the transmission capacity of limiting national and cross-border interconnections;
- increase of transformation capacity in PS/DS limiting nodes;
- increasing the offer of electricity producers/consumers to supply PSPs to TSOs.

3.3. Dimension: energy security58

1. Policies and measures related to the elements set out in point 2.359

Diversification of sources and transport routes is appropriate for the stability of the provision of primary energy sources, helping to increase energy security and dependence on energy imports.

As a consequence of the war in Ukraine and the unpredictability of supplies from Russia, and with a view to reducing dependence on these supplies as quickly as possible, the European Commission has proposed the establishment of an EU Energy Platform to aggregate gas demand for individual Member States or companies that are consumers of gas and subsequently contract, if agreed by individual participants.

The legal basis of the Energy Platform was laid down in Council Regulation (EU) 2022/2576 of 19 December 2022 on enhancing solidarity through better coordination of gas purchases, reliable price benchmarks and exchanges of gas across borders.

Electricity

In line with the requirement of Regulation (EU) 2019/941 of the European Parliament and of the Council on risk-preparedness in the electricity sector ('Risk Preparedness Regulation'), the competent authority of a Member State is required to develop a risk-preparedness plan based on regional and national electricity crisis scenarios. The aim is to identify national crisis scenarios in the electricity sector, to examine their potential impact on the operation of the electricity system and to set out measures to address or prevent crisis situations from arising. The risk-preparedness plan in the electricity sector is drawn up by the MH SR, in cooperation with the TSO, Slovenskáelektrá Transová Systema, a.s.

The transmission system operator ('TSO') shall have at its disposal measures to address or prevent emergencies. The PS operator shall have in place a defence plan for the prevention of major disturbances, arrangements for accidental frequency and voltage changes, as well as a plan to restore the system after a full or partial blackout state.

If changes occur in the system during its operation that cause sudden congestion, the operator of the PS in order to remove congestion;

a. activates purchased support services;
b. make use of contractually agreed emergency reserves;
c. alter the involvement of electricity installations in the transmission and distribution system;
d. activates redispatching or countertrading.

The issue of safety and reliability is given high attention by the PC operator. In order to secure it, the following are implemented within the Slovak electricity system:

- preventive measures – analysis of the results of network and short-circuit calculations, protection settings, optimisation of the shutdown plan, regular maintenance of transmission equipment and processing of measures to deal with emergency situations. Furthermore, measures against the proliferation of large system failures and measures to eliminate the

58 Policies and measures shall reflect the energy efficiency first principle.

59 Consistency shall be ensured with the preventive action and emergency plans under Regulation (EU) 2017/1938 of the European Parliament and of the Council of 25 October 2017 concerning measures to safeguard the security of gas supply and repealing Regulation (EU) No 994/2010 (OJ L 280, 28.10.2017, p. 1) as well as the risk preparedness plans under Regulation (EU) 2018/... [as proposed by COM(2016)0862 on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC].

consequences of major system failures (the so-called ‘defence plan’), operational preparation measures and measures to optimise the maintenance and development of PS;

- dispatching measures – emergency relief (guaranteed/unguaranteed), interruption of work on PSO facilities in coordination with distribution system operators (DSOs), use of PSPs and system services, use of emergency response measures, topological changes to PBS, redispatching and countertrading;
- technical measures – setting protection action, use of PpS, application of frequency characteristics and automatic voltage control.

In addition to the above-mentioned measures in the event of an emergency and its eradication, the legislation provides for restrictive measures:

- consumption reduction plan;
- emergency stopping plan,
- frequency switch-off plan.

The PS operator’s electricity dispatching shall update each year all three plans in accordance with the Standards and Recommended Practices, whether European or national legislation, and the internal procedures of the PSO operator.

II. Regional cooperation in this area

Energy security is an important part of the EU’s positions in the debate in regional fora. Slovakia is a member of the Visegrad Group. In addition, CESEC (Central and South Eastern Europe Energy Connectivity) group discusses energy security, infrastructure development and market integration.

Gas

Slovakia-Hungary Interconnector

The gas interconnection between Slovakia and Hungary connects high-pressure transport systems between Greater Zlievec on the Slovak side and the Hungarian municipality of Vecsés on the suburb of Budapest. The two-way gas pipeline with an annual capacity of 4.5 billion m^3 has a length of 113 kilometres (of which 94 kilometres in Hungarian and 19 kilometres in Slovakia). The Slovak-Hungarian gas pipeline is not only of a new business opportunity, but also of strategic importance for the whole country. Slovakia shall ensure access to the planned Southern Gas Corridors or LNG terminal in Croatia. Hungary will get a new approach to Western European gas networks. The project, which is part of the planned European North-South corridor, will contribute to European energy security and diversification of transport routes.

Inter-State interconnection of the Slovak Republic’s and Hungary’s transmission systems is a priority not only for Eustream and its Hungarian partner, but also for national governments and the European Commission.

Slovakia-Ukrainian interconnection point Budince

The Memorandum of Understanding, signed on 28 April 2014 between Ukrtransgaz and Eustream, concerned the operationalisation of the pipeline, which would allow a reverse gas supply to Ukraine. The solution implemented consisted of the rapid operationalisation of the unused Vojany-Uzhhorod pipeline (Budince border point; “small-reverse”).

It was launched on 2 September 2014 with the participation of the Prime Ministers of Slovakia and Ukraine as well as the High Representative of the European Commission. This solution is optimal from the point of view of security of gas supply for both Slovakia and the EU and also from the point of view of technical, legal, temporal and full compatibility with the EU legislative framework.

The pipeline can deliver a transmission capacity of up to 40 million m^3 per day (of which 27 million m^3 are provided on a fixed basis), with up to 14.6 billion m of^3 natural gas to be transported to Ukraine per year.

As of 1 April 2016, the Budince border point became a bi-directional point, with an entry capacity to Eustream's transmission network from Ukraine, with a maximum fixed entry capacity of 17 million m^3/day. The Ukrainian carrier Ukrtransgaz expects that the launch of two-way operations will increase interest in the use of underground gas storage facilities in Ukraine.

Slovakia-Poland interconnection

On 22 November 2013, the Agreement between the Government of the Slovak Republic and the Government of the Republic of Poland on cooperation in the implementation of the gas pipeline project connecting the Polish transmission network and the Slovak transmission network was signed in Bratislava. On 18 September 2018, the launch ceremony took place at the premises of the Veľké Kapušany compressor station. Slovakia – Polish interconnection entered commercial operation in mid-November 2022.

Once the interconnection with Poland becomes operational, Slovakia is connected at transmission network level to all neighbouring states – Austria, Hungary, the Czech Republic and Ukraine. This means that gas can be transported to Slovakia from all directions in the area of diversification of transmission routes. As required by European legislation, interconnections are two-way.

In addition to the interconnections mentioned above, another potential contribution to increasing the level of security of gas supply is the Solidarity Ring pipeline project, which is further described in section 2.3. This project is important not only for Slovakia, but also for the whole region of Central and Eastern Europe, given the creation of a direct physical connection of south-eastern Europe areas with liquid markets in Western Europe, as well as the possibility to transport gas from possible new mining areas from the Caspian Sea.

Nuclear energy

The diversification of nuclear fuel falls within the competence of the Community by virtue of Article 2(d) of the Euratom Treaty. For the purpose of implementing this Article, a Euratom Supply Agency has been set up to ensure that Member States are not disproportionately dependent on a single supplier from third countries and that a regular and equitable supply of nuclear fuel is ensured.

In 2018, Slovak Power Plants, a.s., under the supervision of the Euratom Supply Agency, conducted an international tender for the supply of nuclear fuel to which all relevant suppliers in the world have subscribed. Based on the results of the international tender, Slovenské elektrárne, a.s., TVEL and Euratom Supply Agency signed a contract in 2019 for the supply of nuclear fuel to nuclear power plants in Slovakia. The fuel will be used in operating units in both Mochovce and Bohunice. The contract is valid for the period 2022-2026, with the option to extend it until 2030 and allows for the implementation of nuclear fuel deployment programmes from alternative suppliers.

Since the beginning of the war in Ukraine, diversification efforts have increased significantly. The Czech, Slovak and Hungarian energy companies, together with the Finnish company Fortum, started to work closely together to secure alternative suppliers of nuclear fuel. Although the basic design of the VVER440 fuel is the same, there are differences in the detailed design of the fuel used in the VVER440 reactors in each country. So far, two potential fuel manufacturers have been identified:

- Westinghouse (WH) – an American energy company that has been active in VVER nuclear reactors for many years. Slovak power plants have signed a confidentiality agreement with WH, on the basis of which the data and information on the design of the VVER440 fuel design necessary to enable WH to start developing fuel suitable for our nuclear power plants is being exchanged. What would provide manufacturing, part of the documentation required for licensing, and transportation of fuel. The use of this fuel and even its storage is subject to a complete licensing process.
- Framatome – a French energy company with a wealth of experience in the field of nuclear energy, including the production of nuclear fuel. It has not yet been active in the VVER type reactors, but it is currently discussing possibilities for cooperation with TVEL for both VVER1000 and VVER440 reactors.

Due to technical complexity and licensing process, Slovenské elektrárne decided to order for 2023 a partial volume of nuclear materials and services for the supply of nuclear fuel from suppliers based in the EU and outside the Russian Federation.

The alternative supplier of nuclear fuel VVER 440 for reactors operated by Slovak Power Plants, a.s. will be the US company Westinghouse Electric Sweden AB, based on the results of the tender procedure. At the same time, a project was created between the operating companies VVER 440 and the French company Framatome, which resulted in a second potential fuel supplier for the VVER 440 reactors. A Memorandum of Understanding between SE, a.s. and Framatome was signed in June 2023 and a nuclear fuel supply contract for Bohunice and Mochovce power plants was signed in July 2024, thereby taking an important step towards enhancing Slovakia's energy security. The first fuel deliveries from Framatome are expected in 2027.60

As regards the diversification objective, Slovenské elektrárne, a.s. significantly outpaced the plan in some elements of the supply chain, with the first supply of nuclear materials from new suppliers taking place in the course of 2023. In addition, cooperation and close coordination with other nuclear power plants when negotiating with suppliers (Westinghouse and Framatome) makes it possible to exploit existing synergies and similarities in the nuclear fuel used.

60 https://www.seas.sk/

III *Where appropriate, national funding measures in this area including Union support and use of Union funds*

Slovakia-Hungary Interconnector

The financial support under the European Energy Programme for Recovery (EEPR) amounted to EUR 30 million. The total investment cost amounts to around EUR 170 million (of which about EUR 21 million on the Slovak side).

Slovakia-Poland interconnection

In 2015, the Slovak transmission system operator eustream a.s. and the Polish transmission system operator GAZ-SYSTEM S.A. signed a tripartite agreement on EU financial assistance for the project 'Development of project documentation and engineering activities for the Polish-Slovak Gas Interconnection' project with the European Commission's Innovation and Networks Executive Agency (INEA). Under this agreement, the project received financial support from the European Union of EUR 4.6 million under the Connecting Europe Facility (CEF).

On 18 December 2017, INEA, GAZ-SYSTEM S.A. and eustream, a.s. signed a grant agreement for construction works for the Poland-Slovakia interconnector.

In 2019, an amendment to the grant agreement for the construction of the interconnection in question entered into force, on the basis of which the grant agreement allowed both the Polish and Slovak transmission system operators to receive financial support from the European Union from CEF funds totalling EUR 104.5 million.

Eastring

In May 2017, the EU Innovation and Networks Executive Agency and eustream a.s. signed a grant agreement under which eustream a.s. can benefit from a grant for a feasibility study on the planned pan-European Eastring pipeline. Under this contract, the European Union supported a study of up to 50 % of its eligible costs (up to a maximum of EUR 1 million) from CEF funds. The results of the study were presented on 20 September 2018.

3.4. Dimension: internal energy market[61]

3.4.1. Electricity infrastructure

I. Policies and measures to achieve the objective of connectivity as set out in Article 4(d)

As set out in chapters 2.4.1, 3.4 and 4.5.1 of the NECPs, the interconnection targets for European electricity networks at Member State level are also met in the case of a conservative approach to the expected burden and development of RES by transposing the National Action Plan (NAP) by 2030 in view of Slovakia's current and planned transmission capacities. Slovakia is currently meeting the 15 % interconnection target of the Member States of the European Union by 2030. Slovakia's current connectivity has long been above the 15 % connectivity target set for 2030 and is not expected to fall below 15 % even in the case of extreme connection of new RES.

II. Regional cooperation in this area[62]

In order to support the preparation and implementation of cross-border investment plans in the field of electricity infrastructure, where appropriate, bilateral cooperation shall in particular take place

[61] Policies and measures shall reflect the energy efficiency first principle.
[62] Other than the PCI Regional Groups established under Regulation (EU) No 347/2013.

at the level of the concerned PSO operators. Wider regional cooperation to support cross-border transmission projects and other key electricity infrastructure projects is currently not shown to be necessary. Discussions on future cross-border interconnections take place either bilaterally or multilaterally within ENTSO-E in the System Development Committee.

In April 2021, new Slovak-Hungarian interconnections between the electricity stations Veľký Ďur (SK) – Gönyű (HU) – Gabčíkovo (SK) and Rimavská Sobota (SK) – Sajóivánka (HU) were put into operation, increasing the tradable electricity capacity on SK-HU profile. At the same time, the bottlenecks in the Slovak transmission system (PS SR) were removed from the point of view of system permeability, which allowed new electricity generating installations (completion of STOP-STAVs) to be re-connected to the Slovak electricity system (ES SR) and increased installed capacity of existing resources connected to the ES SR.

The Slovak-Czech profile is under a project to upgrade the existing 400 kV Varín (SK) – Nošovice (CZ) line, aimed at reconstructing outdated masts and upgrading the distributions for higher permeability. (from 1700A to 2400A). Its reconstruction is expected to be completed in 2027. In order to increase the transmission capacity to the Slovak-Czech profile, SEPS cooperates with the Czech transmission system operator ČEPS, a.s. to prepare the**construction of a new 400 kV cross-border interconnection between ESt Ladce (SK) and Otrokovice (CZ)**. The expected date for the entry into operation of the cross-border line is 2035. This project has received the status of Project of European Importance (PCI) under the TEN-E Regulation.

Due to the need to strengthen the Slovak-Ukrainian profile, the operators of the SR (SEPS) and Ukraine (NPC Ukrenergo) agreed to **reconstruct the existing cross-border 400 kV line V440 Veľké Kapušany (SK) – Mukačevo (UA)**. This is a priority strategic project on cross-border energy infrastructure of European importance, whose strategic importance is increasing in the context of the military conflict between the RF and Ukraine and the impact on Ukraine's energy infrastructure. In addition to the direct reconstruction of the cross-border line V. Kapušany-Mukačevo, other parts of the transmission system in the eastern part of the Slovak Republic need to be reconstructed in order to achieve the maximum effect of the above-mentioned reconstruction of the cross-border line. On 11 April 2024, the Prime Ministers of Ukraine and Slovakia signed a joint document known as the Roadmap, which includes, inter alia, projects to strengthen the interconnection of SK and UA transmission systems. On 9 October 2024, both SEPS PS operators and Ukrenergo signed a cooperation agreement for the reconstruction of the 400 kV Mukačevo (UA) – Veľké Kapušany (SK). According to the current project schedule, the **first phase** of the project (reconstruction of the V. Kapušany-Mukačevo line, 12 km on Slovak territory from Est V. Kapušany to the fourth border with Ukraine) is planned to be **completed by the end of 2028 at the latest and the second phase** (on the Slovak side, duplication of the profile from ESt Lemešany to ESt V. Kapušany, including the new V. Kapušany electricity station) **by 2032**. The evolution of the war situation in Ukraine has a significant impact on the state of Ukraine's electricity infrastructure and the resulting risk of shifting the project on the UA side. On the Slovak side, project and engineering activities have started to obtain the necessary permits and to prepare the procurement of construction works.

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

The financing of SEPS electricity transmission infrastructure projects is primarily secured from TSOs' own resources, which are also acquired through payments by system users for the electricity consumed. The principles and rules are laid down by the Office for the Regulation of Network Industries of the Slovak Republic. National support mechanisms (financial) to support the construction of transmission infrastructure are not in place. The investment priorities of TSOs are defined in the Ten-Year

Development Plan.

Selected key infrastructure projects (e.g. the set of constructions of the project "Transformation 400/110 kV Bystričany") were co-financed by the BIDSF Support Fund, managed by the European Bank for Reconstruction and Development, which is designed to reduce the consequences of the early closure of the V1 nuclear power plant in Jaslovské Bohunice.

Annex D of the 2019 Report on Slovakia defines the priority to implement solutions for smart distribution grids and electricity storage – linked to local demand and supply planning.

Support for energy distribution and storage facilities, including monitoring, optimisation and management systems, will contribute to increasing the efficiency of energy use facilities as well as the possibilities for installing new RES facilities. This will accelerate the transition to a cost-effective, sustainable and secure energy system in Slovakia, in line with Article 2.1 of Commission Communication COM/2020/299. Support will focus on the creation of local distribution networks, in particular within renewable energy communities, including energy storage, creating opportunities for active involvement of end-users in the process of optimising and reducing their energy demand and costs. The further integration of RES in the electricity sector is conditional on the comprehensive reinforcement and development of the transmission and distribution system in order to increase its flexibility in relation to the involvement of diverse renewable sources. Activities will contribute to the integration into the concept of smart management of the whole electricity system in order to improve the quality, security and sustainability of electricity supply to final customers. Investment in energy infrastructure will also be essential given its vulnerability to climate change. Support is needed for the creation and implementation of a central platform to ensure more data sharing and greater transparency in the provision of information on the operation of electricity systems that facilitates the integration of new entrants, communities and aggregators. At the same time, the focus on cybersecurity is growing as the volume of data and communication links grow.

In the area of the transmission and distribution system, the Slovak programme will also support the construction, reconstruction and modernisation of lines and transformers, which will contribute to the integration into the concept of smart management of the whole electricity system in order to improve the quality, security and sustainability of electricity supply to final customers and to integrate decentralised energy sources (in particular RES). Cybersecurity measures will always be coordinated with the superior system in such a way as to ensure that interconnected systems are mutually compatible.

The modernisation and development of the transmission and distribution system is currently supported by the resources of the Slovak Recovery and Resilience Plan. In particular, Investment 1 under Component 19: Modernisation and digitalisation of the transmission system and regional distribution systems. Under this investment, EUR 125 million of support to transmission system operators and regional distribution system operators was granted in the form of direct awards. The aim of the investment activities under the PPO SR was to create capacity for the connection of RES to the electricity system.

In particular, at transmission system level, at least 225 km of transmission lines shall be upgraded from the overall target of 250 km by 2026. As part of the modernisation of the distribution networks in the Slovak Republic, of the overall target of 521 MW, at least 469 MW of cumulative additional capacity to connect RES to the distribution networks in Slovakia will be reached.

The support from the Slovak Recovery Plan builds on the planned support from the Modernisation Fund, broadening the scope of activities in particular in the field of electro-mobility.

Between 2025 and 2030, the Modernisation Fund plans to support investments in the production and use of renewable energy, energy efficiency, energy storage, the modernisation of energy grids and networks, including district heating, pipelines and networks, as well as a just transition in coal-dependent regions. The Modernisation Fund complements other European funding instruments such as the cohesion policy and the Just Transition Fund.

The Ministry of the Economy, in cooperation with the electricity and transmission system operator and regional distribution system operators, identifies projects to increase the efficiency of the electricity system, increase the integration of RES and support the increase of flexibility of electricity systems, including through the Modernisation Fund. Key projects at transmission and distribution system level are primarily (but not exclusively):

- Construction of new lines at transmission and distribution system level
- Remote management and transformation of PS/DSs
- Upgrade of electricity grids for e-mobility/deployment of charging points
- Replacement of transformers
- Reactive power reduction measures (e.g. construction of compensatory buffers)
- Modernisation and digitalisation of the grid at low-voltage level

The objective of the activity is the necessary modernisation for the further development of the transmission and distribution networks and, accordingly, to increase their efficiency. Likewise, support for electrification, RES connection and the continuous development of transmission and distribution systems, ensuring secure, reliable and stable transmission and distribution systems in the face of ever-increasing RES connection requirements.

3.4.2. Energy transmission infrastructure

1. *Policies and measures relating to the elements set out in point 2.4.2, including, where applicable,*

concrete measures to enable the implementation of projects of common interest and other key infrastructure projects;

In order to promote the smooth implementation of Projects of Common Interest (PCI), a modification of the relevant legislation (Energy Act, Act on Significant Investments, Building Act, etc.), the so-called ‘one-stop-shop’ approach within the meaning of Regulation (EU) 2022/869 of the European Parliament and of the Council on guidelines for trans-European energy infrastructure, has been adopted in Slovakia. This allows the Ministry of the Economy to monitor and participate effectively in the authorisation process of PCI projects in Slovakia in order to speed up the issuing of the relevant permits.

II. *Regional cooperation in this area63*

Cf. previous sections, point 3.4.1 ii.

111. *Where appropriate, national funding measures in this area including Union support and use of Union funds*

63Other than the PCI Regional Groups established under Regulation (EU) No 347/2013.

See previous sections, point 3.4.1 iii.

3.4.3. Market integration

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

The objectives of the Slovak Republic in the field of electricity market integration in all timeframes, the increase in flexibility of the energy system and the projects concerned stem from and are in line with the requirements of the overriding European legislation, which is directly applied in the Member States (i.e. the relevant market network codes and regulations). Therefore, those objectives, as defined today, do not follow from the conceptually defined objectives at national level, national policies and official government decisions in the field in question.

In general, demand response becomes popular in Slovakia as a flexibility tool by strengthening the prosumer position, using smart meters, but also commercial products of some suppliers, such as virtual batteries. With the increased deployment of renewable energy sources, they are also exploring options for energy storage, in particular by producers and investors looking for new business models aimed at producing, supplying and selling electricity. In terms of storage facilities, battery energy storage systems (BESSs) tend to be the most prominent investor technology currently used.

The Slovak nominated electricity market operator (OKTE) is currently implementing an Energy Data Centre (EDC), which will allow market participants to aggregate flexibility through an independent aggregator.

The government supports the use of batteries by providing financial support for the installation of new battery systems under the Slovak Recovery and Resilience Plan (call for investments in batteries behind electricity meters, for stand-alone batteries and for the modernisation of pumped storage plants – storage dams).

Support for the integration of gas markets is primarily aimed at projects that increase the flexibility of the transport service under optimal operating conditions and maximum use of existing infrastructure. As a result, final customers shall have access to a secure and affordable gas supply.

The implementation of the gas network codes on the basis of transnational legislation has created the conditions for integrating gas markets and increasing their liquidity. In the coming period, measures will be put in place that will contribute to their further development by reducing the administrative burden on the operators concerned.

ii. Measures to increase the flexibility of the energy system with regard to production from renewable energy sources such as smart grids, aggregation, demand response, storage, distributed generation, dispatching, redispatching and curtailment mechanisms, real-time price signals including the deployment of intraday coupling and cross-border balancing markets

See previous sections, point 2.4.3, description of objectives, objectives and measures.

Measures for the development of smart metering systems and smart grids (energy policy of the Slovak Republic, chapter 3.5.10):

- incentivise the electricity system operator to actively monitor the development of smart grid technologies so that relevant technologies are applied where it is cost-effective in terms of system security and security of supply;

- promote the deployment and efficient use of smart elements in the grid, including through support for the development of fibre-based communication infrastructure at high-voltage and low-voltage voltage levels;
- continuously review the scale of IMS deployment and increase the penetration of IMS in a cost-effective manner in order to maximise the societal benefits from the deployment of IMS and the development of smart grids, taking into account technological progress;
- ensure that IMS technical parameters meet the requirements of European energy efficiency legislation in order to create the conditions for informing customers in order to manage their consumption efficiently;
- ensure that IMS technical parameters support solutions for the building and development of IS by ensuring the interoperability of IMS components and adequate communication capabilities;
- promote local and/or blanket testing of IS and, in 2035, the development of smart cities, municipalities and regions, the development of network management towards the building of IS at the level of the distribution and transmission networks of the Slovak Republic;
- create conditions for the development of near-balanced local smart grids, minimising flows towards the surroundings;
- use IMS and IS to support electro-mobility;
- increase the number of households equipped with smart appliances and IMS with the possibility of remote surveillance of the household electricity consumption diagram;
- develop conditions for electricity storage as close as possible to the point of consumption.

iii. Where appropriate, measures to ensure non-discriminatory energy participation from renewable sources, demand-side response and storage, including through aggregation, in all energy markets

See related sections, point 2.4.3, description of objectives, objectives and measures.

iv. Policies and measures to protect consumers, in particular vulnerable consumers; and where appropriate, consumers in energy poverty and to improve competitiveness and increase the ability to compete in the retail energy market

See related sections, point 2.4.3, description of objectives, objectives and measures.

The Slovak Republic applies price regulation for the supply of electricity to vulnerable customers pursuant to Section 2(k) of Act No 250/2012 on regulation in network industries ('the Regulation Act').

Under the Regulation Act, a vulnerable customer in the electricity market is:

- household customers;
- a non-household customer with an annual electricity consumption of up to 30 000 kWh ('small electricity customer');
- other groups of selected non-household electricity customers pursuant to Section 2(k)(5) and (8) of the Regulation Act.

On 29 March 2023, the Office for Regulation in Network Industries ('ÚRSO' or 'the Regulatory Office') adopted a **Regulatory Policy** for the 6th regulatory period from 1.1.2023 to 31.12.2027. The main basis for regulatory policy for the next regulatory period from 1 January 2023 was to assess the need for further regulation and to justify the scope and manner in which price regulation is implemented. The new regulatory policy also seeks to take into account and adequately respond to external factors and the context of events in Europe, in particular the high price level and volatility rate in the wholesale electricity market, which started in the second half of 2021, continued in 2022, mainly due to the ongoing military conflict in Ukraine and related developments in the wholesale gas market.

In the area of the retail electricity market, Slovakia's conditions include, in accordance with the Regulation Act, the regulation of the **supply of electricity and gas** to a defined segment of vulnerable customers within the framework of the universal service, i.e. the supply of electricity (and gas) to exhaustively defined categories of customers under primary legislation. In carrying out price regulation, the regulatory authority relies on the current wording of primary legislation, with flexibility in the way and scope of price regulation to respond to current market needs and the need for consumer protection. Close monitoring of competition, market concentration and overall price developments, price volatility and liquidity in wholesale commodity markets is important for the regulator and will therefore carry out an ongoing analysis. In the area of price regulation of electricity (and gas) supply, linked to the upcoming primary energy legislation, the regulator envisaged a gradual price deregulation of the supply of electricity and gas to vulnerable electricity/gas customers (by abolishing the application of price regulation for the small business segment and by applying price regulation for the supply of electricity and gas to household customers during a transitional period until the end of 2025, where household customers will be entitled to energy supply in the form of a price-regulated universal service).

In parallel to the preparation of the Regulatory Policy **in early 2022, the Slovak Republic also prepared new legislation on retail price setting for electricity** (and gas) following the requirements of Article 5 of Directive (EU) 2019/944 of 5 June 2019 on common rules for the internal market in electricity ('the Electricity Directive') by amending Act No 251/2012 on energy and the Act on Regulation in Network Industries, which required the phasing out of regulated prices in the electricity supply market and the transition to full market supply prices, had to be reviewed and adjusted in response to the surge in prices in wholesale electricity/gas markets.

Changes in the regulation of retail price regulation for electricity and gas responded to the requirements of the Article of Directive (EU) 2019/944, according to which price regulation is generally considered one of the biggest (if not the biggest) barriers to increasing competitiveness in retail markets in the EU Member States. In principle, Directive (EU) 2019/944 provides in general terms that a Member State may not interfere in the setting of the price for the supply of electricity, but may, under specified conditions, apply regulated prices for energy poor or vulnerable household customers and, subject to additional conditions, other household customers and micro-enterprises.

The initial proposal for a new regulation on retail price regulation in the electricity (and gas) market and the deregulation plan under Article 5 of the Electricity Directive, which required the phasing out of regulated prices in the electricity supply market, had to be reviewed and adjusted in early 2022 in response to price spikes in wholesale electricity/gas markets. A so-called partial price deregulation model in the electricity and gas supply market has been designed, allowing for the coexistence of regulated and unregulated (market) prices/products (applicable from 1 January 2023) with equal access to electricity supply and gas supply.

In**response to the particularly unfavourable situation on the European market from energy commodities, in particular electricity and natural gas, which threaten the affordability of the supply**

of electricity and natural gas for household customers and certain other groups of electricity and natural gas customers, the Slovak Republic adopted an update of the retail price regulation in the electricity (and gas) market with effect from 1 April 2022. Draft Act No 85/2022 amending Act No 250/2012 on regulation in network industries strengthens and streamlines the element of price regulation in the market for the supply of electricity and gas to current price-regulated groups of electricity and gas customers and extends the range of entities with the right to supply electricity and gas at prices regulated by the Regulatory Authority for Network Industries, but while allowing switching to a market product (or, in the case of entities with unregulated electricity/gas supply, remaining in a market product and not using price-regulated electricity/gas supply). These amendments apply to electricity/gas supplies after 31 December 2022.

The proposed mechanism, based on the right of a vulnerable customer to voluntarily leave the current regulated environment (opt-out) or to enter it if it was previously out of the regulated environment (opt-in), ensures the coexistence of regulated and unregulated products for vulnerable customers, increasing supply for vulnerable customers and allowing the market to react flexibly. The right to switch supplier continues to be maintained by a vulnerable customer. At the same time, it is proposed to allow the Office for the Regulation of Network Industries to adapt flexibly the scope of price regulation for the supply of electricity or gas to vulnerable customers, where justified by the market situation.

The draft law also aimed to strengthen the security of electricity and gas supply through the Supplier of last resort. It introduces specific liability for electricity or gas suppliers that have lost their capacity to supply electricity or gas for damage caused by loss of capacity to supply or supply of last resort itself, and an obligation for an electricity or gas supplier that has lost its capacity to supply electricity or gas without delay to offer the quantity of electricity or gas it has provided to its customers.

The partial deregulation of prices for the supply of electricity and gas was linked to **changes in consumer protection legislation**, with an emphasis on the free choice of supplier/aggregator, the right to switch supplier/aggregator and the rules on fees associated with it, rights in the event of collective switching, the legal establishment of a tool for comparing suppliers' offers, rules on the content and formalities of invoices and billing information, the right to out-of-court dispute settlement and rules on the negotiation of contracts, including dynamic price contracts.

In view of the exceptionally high energy prices during 2022, the Slovak government took **extraordinary measures** to eliminate the impact of the increase in electricity prices on selected groups of customers in 2023 (vulnerable electricity and gas consumers – household and small electricity customers and selected non-household customers) pursuant to Article 13 of Council Regulation (EU) 2022/1854 (temporary option to set electricity prices below cost).

The exceptional measures are implemented by setting caps on final electricity prices for household customers and selected vulnerable non-household electricity customers for 2023 at the level of 2022 on the basis of a decision of the Government of the Slovak Republic in the general economic interest ('SGEI') pursuant to Section 24 of Act No 251/2012 on energy and on the basis of Slovak Government Regulations (Government Regulation No 465/2022 and Government Regulation No 19/2023) in the framework of the so-called 'crisis regulation' pursuant to Section 16a of the Regulation and fixing the maximum amount of selected regulated charges (tariff for losses in the distribution of electricity, the tariff for system services, the tariff for the operation of the system) for household customers and for selected vulnerable non-domestic customers under the Slovak Government Regulation No 4/2022 to the so-called 'Government Regulation' for the year 2023 to the so-called 'Government Regulation' for non-household electricity distribution. Between May 2023 and the end of 2023, Slovak Government Regulation No 465/2022 was frozen at 2022 level for all final electricity consumers, by means of an amendment to Slovak Government Regulation No 465/2022 for all regulated charges (system operating tariff, system service tariff and system loss tariff).

The Slovak legislation in force on price regulation in the Slovak electricity supply market and the extraordinary government measures taken to mitigate the impact of high energy prices are in line with the Commission's 'Guideline on the application of Article 5 of the Electricity Directive in the current energy market situation' (Annex 1 of the Commission's REPowerEU Communication of 8 March 2022) and Articles 12 and 13 of Council Regulation (EU) 2022/1854, reflecting the adverse situation on wholesale energy markets and the need to continue to protect vulnerable groups of customers from related price fluctuations.

v. Description of measures to enable and develop demand response, including measures aimed at tariffs to support dynamic pricing[64]

See previous sections, point 2.4.3. i. a description of the intentions and measures and the regulatory policy of the Regulatory Authority for Network Industries for the 6th regulatory period until 2027.

3.4.4. Energy poverty

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

The eradication and reduction of energy poverty is a long-term process of adopting legislative adjustments, cross-ministerial measures, setting up support mechanisms, systemic and operational solutions.

There are several generally binding legal standards in force in Slovakia that create the conditions for tackling energy poverty:

- Act No 321/2014 on energy efficiency and amending certain acts, as amended, laid down measures to promote and improve energy efficiency and contributes to the reduction of energy poverty.
- Act No 555/2005 on the energy performance of buildings and amending certain acts, on the basis of which a long-term strategy for the renovation of the building stock was drawn up as a basis for the preparation of financial instruments to support the renovation of residential buildings from the Slovakia Programme and the Slovak Recovery and Resilience Plan (Renovation of single-family houses, 'Improving the energy efficiency of multi-apartment buildings'), which are implemented. The Act also allows for the granting of an allowance for the insulation of a family house
- Act No 250/2012 partially implementing the third EU energy package for the internal market in electricity and natural gas of 2009 as well as the EU legislative package 'Clean energy for all Europeans' on the internal market for electricity
- Act No 443/2010 on subsidies for housing development and social housing, as amended, under which subsidies are granted for the elimination of systemic breakdowns in multi-apartment buildings
- Act No 150/2013 on the State Housing Development Fund, as amended, under which

64In accordance with Article 15(8) of Directive 2012/27/EU.

preferential loans may be granted for the renovation of existing residential buildings

- Act No 417/2013 on assistance in material need and amending certain acts, as amended, under which the right to housing assistance, which is part of the total assistance provided in material need, may be obtained;
- Decree No 18/2017 establishing price regulation in the electricity sector;
- Decree No 107/2023 establishing price regulation for the supply of electricity
- Decree No 312/2022 laying down price regulation in the thermal energy sector;
- Decree No 450/2022 laying down price regulation for the supply of gas.

The implementation of the vast majority of direct measures to protect households at risk of energy poverty requires an amendment to the primary legislation in order to establish the rights and obligations of the individual participants concerned (in particular: ÚRSO, suppliers, customers, but also other affected market participants), as well as the conditions and arrangements for implementing the various measures in practice. Some measures have already been implemented and for some there are concrete proposals to adapt the relevant provisions of the legislation.

As part of the transposition of the Energy Efficiency Directive, action will need to be taken and measures will need to be developed on the basis of its requirements, including in the area of energy poverty. Specific energy efficiency measures and their contribution to reducing energy poverty are presented in the energy efficiency sections of this document.
The EED requires calculating the share of energy savings to be achieved through energy poverty measures. This share has the exact calculation procedure set out in Article 8(3) of the EED:

'Member States shall set and achieve a share of the required amount of cumulative end-use energy savings among people affected by energy poverty, vulnerable customers, people in low-income households and, where applicable, people living in social housing. This share shall at least be equal to the proportion of households in energy poverty as assessed in their national energy and climate plans established in accordance with Article 3(3), point (d), of Regulation (EU) 2018/1999.

Member States shall, in their assessment of the share of energy poverty in their national energy and climate plans, consider the following indicators:

a) the inability to keep the home adequately warm (Eurostat, SILC [ilc_mdes01]);
b) the arrears on utility bills (Eurostat, SILC, [ilc_mdes07]);
c) total population living in dwellings with leaking roof, damp walls, floors or with foundations or rot in window frames or floor (Eurostat, SILC [ilc_mdho01]);
d) at-risk-of-poverty rate (Eurostat, SILC and ECHP surveys [ilc_li02]) (cutoff point: 60 % of median equivalised income after social transfers).

Where a Member State has not notified the share of households in energy poverty as assessed in its National Energy and Climate Plan, the share of the required amount of cumulative end-use energy savings among people affected by energy poverty, vulnerable customers, people in low-income households and, where applicable, people living in social housing shall be at least equal to the arithmetic average share of the indicators referred to above for 2019 or, where indicators are not available for 2019, a linear extrapolation of the values of those indicators over the last three available years.';
As a result of the arithmetic average of the above parameters, the share of energy savings to be achieved with energy poverty measures in the Slovak Republic was 8.4 % in 2019.

Draft measures from the Conclusions of the whole-of-government working group of ÚRSO

The conclusions of the inter-ministerial working group defined proposals for concrete measures to protect households at risk of energy poverty. These measures will be further adapted to the requirements of the new EU legislation on energy poverty.

1 Proposals for measures within the remit of ÚRSO

1.1 Use of pre-paid (credit) electricity demand schemes for the provision of targeted support for the recovery of energy and water costs

The concept as one of the regulatory measures in network industries (measures under the responsibility of ÚRSO) identifies the supply of electricity and the forward-looking supply of other forms of energy and water through a pre-paid credit model. Households in energy poverty would be installed free of charge with a smart meter (IMS), which would allow them to pay upfront a certain amount of money in the form of credit against electricity costs. This will enable the household to monitor the progress of consumption and the residual value of the credit on an ongoing basis, as does the credit system with mobile communication services. At the same time, the scheme will allow state authorities to provide targeted assistance to the households concerned in the form of a 'recharge' credit with a social benefit intended to support the reimbursement of energy costs (a social benefit linked to support for the reimbursement of total housing costs). The social benefit may be lump-sum by household type or differentiated according to the specific situation of the household in question.

The proposed measure builds on a solution that builds on IMS technologies and connects a number of actors, including the involvement of municipalities. The IMS is able to manage electricity subscriptions and, when exhausting the credit, to 'off' the meter until the credit is renewed, thus avoiding debt and arrears from the point of view of the final energy customer, creating scope for more efficient consumption behaviour and thus falling energy savings in the household, or allowing for the gradual disposal of historical past due claims, if such final customers have such claims. The Facility is based on a pilot project by Vychodoslovenská distribučná, a.s., which ÚRSO has granted patronage under the regulatory sandbox scheme.

Outside the electricity sector, there is for the time being no clear legal basis for the installation of smart meters with designated functionalities, which are essential infrastructure for the implementation of this measure. It therefore seems appropriate to amend the Decree of the Ministry of the Economy on the installation of smart metering systems in such a way as to oblige distribution system operators to install IMS free of charge for customers meeting the definition of energy poverty, while extending the legislative mandate of the Decree following the amendment of primary legislation to the gas sector. This would ensure the implementation of that measure in the field of both electricity and gas supply.

In the case of heat and water supply, further examination of the implementation aspects of the deployment of credit systems would be necessary. However, the mere implementation of credit systems for the supply of electricity and gas would make it possible to provide targeted financial assistance also for heating and water costs, as the identification of households in energy poverty is identical for all these sectors. The household concerned could receive a specified amount of financial assistance in the form of a credit against the costs of electricity and gas, as well as financial assistance (benefits) against the cost of heat from other forms of energy, such as central heating, wood, other heating fuels, but also water and sewer.

1.2 Creating EIC identifiers for energy and water customers for the purpose of uniquely identifying households in energy poverty

By issuing ÚRSO Decree No 207/2023 laying down rules for the functioning of the internal market in electricity, the content of the operating rules of the system operator, the short-term electricity market operator and the scope of commercial conditions that are part of the system operator's operating rules ('the electricity market rules'), the ÚRSO established the legal framework for generating EIC identifiers for all electricity customers in Slovakia, including households. The design identified this measure as feasible under the responsibility of ÚRSO and, once implemented, will start assigning an EIC identification code to each electricity market participant, which will combine additional information on all customer delivery points across the territory of the Slovak Republic owned by one and the same customer. This will create a system allowing for the unambiguous identification of electricity customers contractually related to one of the electricity suppliers, which can be an effective support tool in addressing other energy poverty protection measures.

In the field of electricity, no additional adaptation of primary or secondary legislation is needed to implement the EIC codes for customers and it can be expected that the electricity market operator OKTE a.s. will start generating the EIC identifiers of household customers immediately after the start of operation of the Energy Data Centre, whose functionalities are primarily focused on the practical implementation of electricity market rules.

In other energy and water sectors, the generation of unique customer identifiers in the household segment is problematic because there is no central system of customer registration, as is the case in the electricity sector. However, information on energy poor households registered in OKTE, a.s. could be shared with energy and water suppliers and relevant national authorities when implementing targeted support measures and tools for energy poor households.

In addition to the above, if, in the future, customer identifiers are to serve as a support tool for the implementation of measures also outside the network industries, it is necessary to adapt accordingly, in particular, primary legislation in particular to lay down the right and conditions of access to identifiers for other relevant entities, including outside the energy sector. Such use is intended, for example, to provide a basis for a future central register of households meeting the definition of energy poverty, to which the relevant State institutions or State-designated administrators of individual measures to protect households against energy poverty would have access, on the basis of the rules in question.

1.3 Strengthening consumer protection and households at risk of energy poverty

The concept identified a number of possible tools to strengthen the protection of customers meeting the definition of energy poverty. These include, in particular, the possible future competence of ÚRSO to determine the conditions for:

a) advice on optimisation of delivery and network tariffs;

b) the introduction of an obligation to provide free payment schedules in justified cases;

c) the introduction of an obligation to provide energy advice for individual customer groups;

d) discounts for the application of additional list services that are not subject to price regulation, such as the waiver of all unregulated charges for the energy poor (connectivity, disconnection, reminders);

e) protection against interruption ('disruption') of energy and water supply during the winter season;

f) a ban on doorstep selling of energy and drinking water;

g) a prohibition on the conclusion by telephone of services ancillary to the energy supply contract;

h) rules allowing all households, including those not in a direct contractual relationship with the supplier, to apply 'for regulation' (i.e. to be able to consume energy and water under conditions applied in a price-regulated environment).

The details and content of the different measures are further discussed in the Blueprint. It should be pointed out that the above-mentioned consumer protection measures meeting the definition of energy poverty can be implemented by the ÚRSO only after primary legislation has been amended and, therefore, after the relevant legislative mandate for ÚRSO has been defined, taking into account the specificities in the various network industries, which would be regulated in the relevant Decrees of the ÚRSO on price or material regulation.

The EED also calls for access to simple, fair, transparent, independent, effective and efficient out-of-court dispute settlement mechanisms related to the rights and obligations set out in this Directive, through an independent mechanism such as an energy ombudsman or a consumer body, or through a regulatory authority.

New and adapted consumer protection requirements and their link to energy poverty are set out in the new EU Directive 2024/825 of 28 February 2024 amending Directives 2005/29/EC and 2011/83/EU as regards empowering consumers for the green transition through better protection against unfair practices and through better information.

1.4 Universal adaptation of the legislative definition of final energy and water customers in household categories

The concept states that, in the version currently in force of Act No 251/2012 on energy and amending certain acts, as amended ('Act No 251/2012'), the definition of vulnerable customer (Section 3(a)(10)) and the definition of dependent customer (Section 3(b)(16) and Section 3(c)(16)) apply conceptually to the defined household customer. This presupposes, inter alia, that if the rights and obligations arising directly from energy legislation are to be applied to him, the household customer must have a direct contractual relationship with the supplier. Moreover, this concept is explicitly regulated only for the supply of electricity and gas.

In the field of heat, pursuant to Act No 657/2004, the supply of heat from district heating systems is generally carried out on the so-called 'voltage' of a house, the contracting customer being mostly a community of owners or a management company, which distributes heat to final consumers pursuant to Decree No 503/2022 of the Ministry of the Economy. In the case of the supply of drinking water, there may also be situations, in particular in apartments, where abstraction takes place at the common point of a given apartment and the common costs are only subsequently calculated by the users (or their manager).

This situation means that from the point of view of energy policy, social policy, as well as the topic of protecting households from energy poverty, the current legislative definition of energy poverty for final customers in the household category is not sufficiently addressed. For example, the definition will not take into account households taking electricity and/or gas and living in social housing or renting. Similarly, the definition does not cover customers of social services facilities in a residential form, which also translates the costs/expenditure incurred for the customer's gas and electricity into the level of remuneration required for the social service provided. The definition is incompatible with the structure of contractual relationships and settings in heat supply systems from centralised/drinking water supply systems and the collection of waste water in multi-apartment buildings, etc.

Also in the context of the proposed definition of energy poverty, it should be noted that the above considerations concerning the definition of final customers may be a limiting factor for the targeted identification of all households facing a real risk of energy poverty.

The whole-ministerial working group therefore recommends the adaptation and harmonisation of the legislative definitions of households in the various laws relevant to the network industries. ÚRSO has no responsibilities over primary legislation, but is ready to support the drafting of relevant legislative proposals.

1.5 Raising customer awareness

Another tool to protect energy and water consumers at risk of energy poverty is to increase the current, relatively low level of household customers' energy education and support in deciding on options to optimise their tariffs or consumption patterns. The measure proposes to introduce more mandatory information from energy and water suppliers for household customers. This educational information obligation for suppliers to publish important information for households would consist of making the specified information mandatory when billing energy and water supplies, published on suppliers' websites and, where appropriate, on the ÚRSO website.

The information disclosed would cover e.g. options for optimising energy and water consumption, recommended tariffs and tariffs for reducing charges for a given consumption, the possibility of setting payment conditions, contacts for advice, etc. Information on websites would also include information on grid and grid connection possibilities, information on available state support programmes for energy efficiency (e.g. insulation) and other options related to reducing energy and water costs. The aim should be to provide as much information as possible in multiple locations so that customers can easily and directly access it.

The proposed measure is also consistent with the initial proposals from the concept:

• publishing information on the website of the ÚRSO dedicated to energy poor, indicating, for example, model situations, explaining who is energy poor, who can contact the customer concerned, what rights and obligations, etc.

• adjusting the mandatory content of energy bills to make it more understandable and meaningful for the customer (e.g. the volume of billed consumption converted into a variable and fixed component, the indication of the average unit price per commodity on the bill so that the customer can compare prices from another supplier, the total quantity of electricity delivered for the billing period, etc.).

The implementation of this measure follows action 3, in particular points (a) to (c). The adaptation of primary legislation would specify the information obligations for suppliers as well as the modalities for their publication.

The whole-ministerial working group therefore recommends the modification of the legislative obligations in the laws relevant to the network industries as a follow-up to and in conjunction with the proposed measures in point 1.3.

As required by the EED, measures of an information nature to support the reduction of energy poverty are to be extended to include **tools** and policies to promote behavioural change, publicly supported assessments of energy consumption, targeted advisory services and support for household customers. The Directive's measure requires a broader scope than for households only. The content of invoices and billing information is included in the new legislation.

2 Recommendations for further possible state policy measures, in the remit of central government bodies

The issue of energy poverty is a problem that affects a number of sectors and therefore needs to be tackled together and looked at in a comprehensive way. ÚRSO has proposed a number of possible measures, drawing inspiration from existing programmes and schemes within the EU as well as relevant EU legislation. They may be considered as permanent measures or, alternatively, as time-limited measures during the prevailing energy crisis. Social policy, among other things, has a place in tackling energy poverty. In particular, financial support for low-income households at risk of energy poverty can be highlighted in this area. These measures may be accompanied by additional measures that will be developed to address the transposition of the proposed Energy Efficiency Directive under the Fit for 55 package.

2.1 Tax advantages for energy poor households

The concept states that one possible measure may be to favour households meeting the criteria of energy poverty through tax policy, for example in the form of reduced VAT. This measure could increase affordability:

- the supply of electricity, gas, heat, and water and sewerage through invoices from relevant suppliers;

- services linked to the renovation of single-family houses, where this leads to an increase in their energy efficiency. It could cover the purchase of materials, equipment and the provision of assembly services.

Following the examination of this measure, the whole-ministerial working group does not recommend the implementation of the measure. Tax advantages for personal income taxes are not an appropriate measure because they target only households with labour income. As income poverty and energy poverty are closely linked and it is households at risk of energy poverty that have lower work intensity (RUPs, single parents, MRC, UHP, 2020)[65]such measures would be unaddressed with a high degree of probability. For indirect taxes (VAT), the total cost of the targeting of such a measure is likely to be higher than its benefit to energy poor households.

2.2 Introduction of measures to strengthen financial support to households at risk of energy poverty

The Blueprint states that financial contributions can be important tools to support households at risk of energy poverty. In Slovakia, this is a housing benefit which is part of the assistance in material need. Pursuant to Section 14 of Act No 417/2013 on assistance in material need and amending certain acts, as amended, for example, the owner or tenant who is a member of a household receiving assistance in material need is entitled to housing assistance if he duly reimburses the costs of all housing services (e.g. rent, property tax, municipal waste charges) or, if he has arrears in respect of the payment of housing services, submits an instalment agreement and a certificate of proper implementation of the repayment plan. The Housing Allowance alone cannot solve the problem of energy poverty, but in combination with the benefit in material need and other allowances in the context of assistance in material need, it can be a tool to cover part of the energy expenditure. The Blueprint also proposes the adoption of further financially sustainable support measures targeting a wider population in order to mitigate the negative effects of energy poverty.

The Over-Secretary Working Party states that, in the light of the evolution of the current economic situation, the housing allowance for assistance in material need, both its structure and individual amounts, has been adjusted with effect from 15 July 2023. At the same time, with effect from 1 October 2023, the amounts of assistance in material need, including housing assistance, have been adjusted.

The super-ministerial working group recommends examining more detailed implementation aspects, as the practical design of the other measures in this chapter will also be known, as financial support to households should only be a complementary complementary instrument.

2.3 Increasing the availability of energy efficiency measures and the use of renewable energy from public sources

The Blueprint states that the objective of the measure is to reduce energy consumption in buildings, in

65 Source: https://www.mfsr.sk/files/archiv/65/ReviziavydavkovnaohrozeneskupinyZSverziaFINAL3.pdf

particular through comprehensive renovation of buildings. Under this measure, it would be necessary to focus support from state funding to households at risk of energy poverty.

The concept also states, inter alia, that the cost of heating or heating hot water in an optimally insulated house or apartment is the only sustainable way to reduce energy consumption and energy costs, while at the same time raising the standard of living of the household concerned. In addition, reductions in energy consumption tend to reduce greenhouse gas emissions, depending on the type of heating and fuels used.

Protecting households from the risk of energy poverty means, on the one hand, increasing the affordability of energy and drinking water, while at the same time leading to cost-effective use of energy and water and reducing waste of energy and drinking water in buildings.

Given the complexity of the issue and in view of the ongoing legislative process at EU level, the whole-ministerial working group recommends to examine the implementation aspects of the draft measure in the context of the transposition of Directive 2023/1791 on energy efficiency (in view of, inter alia, Article 8 of the Energy Savings Obligation; Article 24 Empowering and protecting vulnerable customers and alleviating energy poverty).

2.4 Creation of an easily accessible network of energy advisors

The concept pointed out that the topic of energy poverty places great demands on consumers in terms of energy and information literacy, which would enable them to actively address their situation. At the same time, it pointed out that there are already a number of options for consumers to address their consumer agenda or to assert their rights. Nevertheless, the Blueprint notes that there is a need to further promote household awareness of how to address their energy needs. As a forward-looking solution, the creation of an accessible network of energy advisors is proposed to fulfil the following attributes: free of charge, regional accessibility, comprehensiveness of the proposed solutions. The requirements set out in the Energy Efficiency Directive for a network of experts helping to reduce energy poverty are more detailed. The support and requirement to set up experts to help reduce energy poverty is also set out in the Energy Efficiency Directive.
The super-ministerial working group recommends examining the implementation aspects of this measure until the practical design of the other measures in Chapter 2 is known, since the network of advisors should be active in the implementation of these measures, among other things.

2.5 Active involvement of local and regional authorities in addressing energy poverty

As the concept points out, local and regional authorities can play a key role in combating energy poverty, given their local knowledge of the population and the housing stock, as well as their responsibilities and ability to represent the interests of local citizens.

The inter-ministerial working group recommends examining the implementation aspects of this proposed measure only after public consultation with the relevant representatives of the municipalities. The representatives of the municipalities were not part of the inter-ministerial working group set up following the recommendation of the Slovak Government. Without the active participation of local and regional representatives in the working group in the next period, it will not be possible to effectively establish a way forward for the identification of people affected by energy poverty or take actionable measures.
The EED requires Member States to involve local and regional authorities so that competent authorities take steps to mitigate significant negative direct or indirect impacts of energy efficiency measures on energy poor households when designing and implementing energy efficiency measures. Local and regional authorities are also to indicate and implement energy efficiency measures in their regional

plans also for vulnerable groups at risk of being affected or more vulnerable to energy poverty.

2.6 Creation of a single one-stop-shop website with comprehensive information on energy poverty

The concept also mentions as an appropriate information tool the creation of a separate information platform, with a module specifically dedicated to energy poverty, i.e. a website on the website of the Slovak Government, a ministry (e.g. the Ministry of Health, the MPSVaR of the Slovak Republic) or a state institution (e.g. ÚRSO, SIEA, STI). In order to provide all relevant information in one place, including the possibility of pre-verification through an automatic or contact form, whether the household meets the criteria of at-risk-of-energy poverty (the administration of the form would be provided by the institution operating the website as a whole).

The whole-of-government working group recommends examining the implementation aspects of this proposed measure only after public consultation with the institutions concerned, taking into account the overall complexity of the instrument and the need to know the specific implementation frameworks of other measures; the purpose of the 'one-stop-shop' website is precisely to distribute practical information in order to guide potential beneficiaries of assistance tools on issues and in the process of applying for tools.

Specific requirements for one-stop shops linked to the reduction of energy poverty are set out in the Energy Efficiency Directive and are aimed at providing technical, administrative and financial advice on energy efficiency issues, and creating the right conditions for market participants to provide adequate and targeted information and advice on energy efficiency to final customers.

3 Proposals beyond the concept of a whole-of-government working group

The EED contains specific requirements to identify energy efficiency measures, achieving energy savings and reducing energy intensity to be identified as contributing to the reduction of energy poverty and achieving a certain share of total energy savings. The requirements of the new EU legislation on energy poverty should be applied and the proposed measures adapted in this context.

3.1 Measures to reduce energy intensity

In general, housing policy support instruments for the renovation of the housing stock do not primarily target energy poor households or directly vulnerable groups, but meet energy criteria that reduce the consumption of electricity, gas, heat for heating and domestic hot water and thus ultimately lead to a reduction in the number of vulnerable or energy poor households and also prevent energy poverty.

It is recommended to continue implementing measures that can contribute to tackling energy poverty under the responsibility of the Ministry of Transport of the Slovak Republic. For more details on the proposals for these measures, see sub-chapters 3.1.1-3.1.3 below.

3.1.1 Support for the renovation of multi-apartment buildings through the State Housing Development Fund

The State Housing Development Fund (SFRB) has long supported the renovation of multi-apartment buildings through favourable lending conditions. The result of this support is more than 363000 apartments in multi-apartment buildings renovated through a SFRB loan. That support will continue in the next period. As the SFRB will implement in the current programming period a financial instrument aimed at improving energy efficiency and renovation of multi-apartment buildings, support for building renovation will be intensified and extended by a number of measures. From 1 January 2024, as part of the support for the renovation of multi-apartment buildings, support may also be granted for the construction of a technical installation using renewable energy sources – solar thermal collectors, photovoltaic panels and heat pumps; at the same time, the purchase costs of the renovation will be extended to the price for the implementation of water retention measures and the construction of external shading elements, as well as an incentive to reduce the primary energy demand of the residential building by at least 30 %, while at the same time installing technical equipment using renewable energy sources in the multi-apartment building by introducing the possibility to waive part of the loan up to 20 % of the loan amount.

3.1.2 Provision of concessional loans to natural persons for insulation of a family house through the State Housing Development Fund (SFRB)

The SFRB grants a favourable loan to natural persons for the insulation of their family home with a maximum repayment term of 25 years at a fixed interest rate of 1.5 % up to 100 % of the acquisition costs.

3.1.3 Provision of contributions for the insulation of a family house for the purpose of improving the energy efficiency of a family house in accordance with Act No 555/2005 on the energy performance of buildings and amending certain acts, as amended

In the context of the implementation of the Recovery and Resilience Plan and the provision of a financial contribution for the rehabilitation of the family house, the Ministry suspended the grant. At the end of the Renovation Plan, the MD SR wishes to continue to provide a contribution as part of the system support in line with the priorities of the State housing policy.

3.1.4 Recovery plan – Renovation of the House and Renovation of the House of Min

Other specific measures related to energy poverty are measures to renovate single-family houses from the Recovery and Resilience Plan. The 'Renovation of the House' measure is also part of the Renovation of the House.

The aim of the Renovation House is to address energy poverty by supporting the renovation of single-family houses of vulnerable groups. People defined as being at a risk of energy poverty shall cover for example persons in receipt of any social benefit for severely disabled and low-income persons. The measure is composed of three sub-measures (two investments and one reform). Support for gas boiler installation shall not be allowed under these investments. The sub-measures are: Partial Renovation Scheme, Comprehensive Renovation Scheme and Technical Assistance to support the renovation of single-family houses.

Out of the overall objective of 3400 renovations of single-family houses, the investment shall result in at least 3060 renovated houses, which shall be completed by Q3/2025. An additional 1,600 families at risk of energy poverty are to be supported to implement a comprehensive renovation of their single-family houses and achieve at least 30 % energy savings by providing a top-up allowance allowing 100 %

co-financing of eligible costs under existing investment 2 of component 2.

Under the measure 'Renovation of the mini house', households will be granted a non-repayable financial contribution for the partial renovation of single-family houses, up to 100 % of the eligible costs, with the possibility of providing part of the funds in advance. Insulation of parts of building structures, replacement of windows and doors, replacement of heat source, installation of renewable energy sources and others will be supported. Eligible applicants shall be natural persons who have fulfilled the energy poverty risk condition according to pre-defined economic indicators, which have been established in cooperation with the relevant authorities. In view of the need to address poor air quality primarily in critical sites in the Banská Bystrica and Košice Self-governing Regions, the Ministry of the Environment has identified specific municipalities and cities whose inhabitants may apply for a non-repayable financial contribution.

Green Solidarity

In June 2024, the Slovak Ministry of Economy and the Slovak Innovation and Energy Agency (SIEA) also presented a new and higher form of aid for low-income households, called 'Green Solidarity'. Under this project, low-income households will be able to apply for support up to 90 % of eligible costs. The aim is to help Slovak households reduce their energy costs while supporting the installation of renewable equipment. The project aims to help low-income households who cannot afford to invest in modern facilities with a standard contribution. Favourable conditions are being prepared for these households.

3.5. Dimension: research, innovation and competitiveness

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

National Research, Development and Innovation Strategy 2030 and Research and Innovation Strategy for Smart Specialisation of the Slovak Republic 2021-2027

The National R & D & I Strategy 2030 (hereinafter NS R & D & I) is a key strategic document at national level setting out the vision and long-term strategic objectives for R & D & I and forming the basis for other related strategic documents of the Slovak Republic, as well as the implementation of PSK resources allocated under Policy Objective 1, the Recovery Plan, the State Budget and other resources available at national level66. The NSI stresses the need to prioritise research areas through the continuous development of Slovakia's smart specialisation through missions. Missions are emerging through the progressive transformation of RIS3 smart specialisation domains. The NSI also proposes changes in the management and financing of science in order to improve the quality of the R & D & I activities supported by public funds, as well as to increase the involvement of businesses in the implementation of R & D & I activities. The topic of energy autonomy and security, together with the societal and economic impacts of the climate crisis, are highlighted in the NS R & D & I as major challenges on which Slovakia needs to concentrate its efforts and resources, including in the area of R & D and innovation.

Smart specialisation strategy SK RIS3 2021+

The NS RDI is in line with the Research and Innovation Strategy for Smart Specialisation of the Slovak Republic 2021-2027, which is a concept of innovation policy that aims to foster national or regional innovation, contribute to growth and prosperity. SK RIS3 2021+ is also the basic document determining the content of the support from the European Union's cohesion policy funds for the period 2021-2027 for the area of R & D & I and the concentration of resources related to this area. This document puts more emphasis on supporting applied research for economic and government needs and identifies key areas and research themes on which applied research should focus. The priorities defined in the RIS3 framework are identified by smart specialisation domains, which are developed with the representation of a wide range of actors of the innovation environment within the EDP process.

Within Domain 1: The following energy-related priority areas are identified for an innovative industry for the 21st century:

Priority area 1-4: Increasing energy efficiency in the economy

The aim is to achieve a substantial increase in energy efficiency by supporting the deployment of innovative solutions and, in the case of waste energy, by researching, developing and deploying systems for its efficient storage, transmission and use, but also by reducing its total amount produced. Innovation in this priority area is essential for Slovakia, as Slovakia, as a country with high energy intensity of industry, has great potential for energy efficiency. Industry accounts for the highest share of total energy consumption among all sectors. In addition, as an industrialised country, Slovakia produces a lot of surplus energy in a variety of forms, which is not further used and unnecessarily released into the environment. It is therefore necessary to promote solutions that either contribute to reducing the production of surplus energy or allow for its further efficient use. It is estimated that the amount of unused energy in the form of waste heat is approximately twice as high as the heat needed to heat all buildings. Local RES installations can result from overall electricity surpluses, but also from increased volatility of the transmission network. While surpluses can be effectively used for increased production of energy-intensive products, the volatility of the transmission system needs to be

66 NS RSI – Annex 1 Action Plan: https://vaia.gov.sk/wp-content/uploads/2023/03/Priloha_1_Akcny_plan_final.pdf

addressed by the transitional storage of part of the excess electricity and its subsequent use in case of shortages, including alignment with alternative energy carriers together with hydrogen in the decarbonisation of industry.

Priority area 1-6: Energy security of the Slovak Republic

The aim is to transform Slovakia's energy system into increasing the energy security, competitiveness and environmental sustainability of Slovakia's economy and to support research, development and deployment of innovative energy security solutions in industrial, local distribution systems.

The electricity system (ES) requires ensuring stability, quality of management and security at national EC level in line with the new EC regulations (network codes and regulations). With the required increase in the share of renewables and the creation of a single pan-European market, demands for grid management and maintaining a sufficient degree of security of electricity supply are significantly higher. In these circumstances, it is essential to carry out research activities leading to new knowledge, optimal practices and cutting-edge IT tools enabling the analysis of established and transition processes in the EC, the testing and implementation of new management approaches, new quality standards as well as prototypes of facilities to ensure balance of production and demand in the EC.

Nuclear energy forms the basis of the Slovak energy system. In the context of the EU energy system and the gradual increase in the share of renewables, research into increasing the power flexibility of currently operating nuclear installations is important. Furthermore, research into the possibilities of using spent nuclear fuel, safe disposal of spent nuclear fuel and analysis of advanced types of nuclear fuel is required. It is essential to involve Slovak organisations in the development of new types of nuclear installations with hydrogen production potential.

The implementation of smart grids, i.e. systems for efficient management of both consumption and supply in the changing conditions of operation of the energy system, with the integration of RES in distribution networks and the involvement of active customers (active customers or prosumers) help to achieve this strategic objective in line with European energy policy and Slovakia's strategic objectives in the EU.

Priority area 2-3: Decarbonisation and sustainability of mobility

The aim is to prepare Slovakia for the large-scale deployment of means of transport using alternative fuels and energy carriers in normal operation. The production of means of transport contributes significantly to Slovakia's wealth, GDP growth and involves a wide network of subcontractors. The automotive industry accounts for the largest part of Slovakia's exports. Slovakia needs to transform the production of means of transport through the value chain to a higher level and needs to respond to recent developments with its own innovations. This is important for maintaining the competitiveness of a key sector. Innovation activities need to be directed towards the required alternatives to drives and energy carriers for propulsion and the development and development of efficient distribution and filling infrastructure, as well as research and development of materials of products and technologies applied in modern means of transport and systems.

In this context, it is important to accelerate the transformation of manufacturing enterprises in this domain into manufacturing and development-suppliers. In addition, it is essential to prepare the domain ecosystem for the emergence of new mobility business models for sustainable development. In order to achieve the objective of this priority, it is necessary to strengthen R & I capacities focusing on alternative propulsions, decarbonisation of infrastructure, means of transport and material technology research. Innovation in this priority area is essential to achieve the reduction of transport emissions through alternative propulsion.

In 2024, an update of the Synthesis Report from the Business Discovery Process is underway, where each priority domain area will be revised in the light of changing regional and global trends and societal, economic or environmental developments.

The Synthesis Report of the Entrepreneurial Discovery Process was endorsed by Resolution No 1/25 of 10 May 2022 by the Council of Government for Science, Technology and Innovation.

Synthesis report from the entrepreneurial discovery process, Smart Specialisation Houses and priority areas

EU Member States were required to prepare their National Research and Innovation Strategies for Smart Specialisation in order to identify suitable forward-looking economic areas that should then be supported by EU funds. In this sense, the Slovak Republic has prepared its SK RIS3 2021+, which reflects the priorities of our economy on which EU funds programmes should focus, but also other selected R & D support programmes.

In SK RIS3 2021+, Smart Specialisation Houses have been defined through the entrepreneurial discovery process. They shall contain information related to the rationale for the choice of the domain, the objective of the domain, the priority areas, the transformation objectives and the assumption of cooperation and synergies with other domains.

Table 35 shows the priority areas related to energy R & D & I based on SK RIS3 2021+. The endorsement of this document by the Council of Government for Science, Technology and Innovation and by the European Commission was a necessary condition for receiving funding from the relevant EU funds (under 'enabling conditions').

Table 37: Priority areas related to energy R & D & I based on SK RIS3 2021+:

Priority area	Goal state
1-4 Increasing energy efficiency in the economy	Substantial reduction in primary energy demand in the economy, coupled with significant reductions
	Creating original competitive product and technological innovations that can be used in reducing energy demands (with high added and export value)
	Better use of available energy with an appropriate energy mix, minimising excess energy that is not effectively released into the environment
	Eliminating the negative effects of incineration of low-quality fossil fuels and waste in heating buildings by making better use of industrially produced waste heat
	Creating new options for efficient storage of energy surpluses for future needs
1-6 Energy security	Transform Slovakia's energy system in order to increase energy security, competitiveness and environmental sustainability of Slovakia's economy
	Smart grid implementation and efficient management of the energy system

	Flexible operation of nuclear power installations and support to the requirements of the electricity system
	Efficient and environmentally sound storage of spent nuclear fuel and concepts for its reuse in Generation IV reactors
	Developed concepts for new advanced technologies with hydrogen production potential
2-3 Decarbonising mobility	Prepare Slovakia for the large-scale deployment of means of transport using alternative fuels (including electricity)
	Supporting the transformation of industry and firms in the domain into a higher share of innovation
	Reducing emissions and other negative environmental impacts of transport

Source: SK RIS3 2021+ Transformation maps

Due to the limited resources allocated to R & D & I, the number of priorities in the continuous EDP process will be reduced during 2024. The aim will be to support topics with high innovation potential and applicability at home and within the EU as a matter of priority. The topics will be identified in areas where Slovakia has sufficient scientific and research potential, as well as businesses able to ensure successful commercialisation of the solutions developed.

Each year, the Ministry of Education carries out an in-depth analysis of research into energy technology, development and innovation of the Slovak Republic for the International Energy Agency, working at the OECD.

In order to obtain relevant information on the financing of energy research in Slovakia, the Ministry of the Environment of the Slovak Republic addresses the relevant institutions (the Slovak Academy of Sciences, the Research and Development Support Agency, the Slovak Innovation and Energy Agency, the Statistical Office of the Slovak Republic, the Ministry of Environment, the Ministry of Agriculture and Rural Development of the Slovak Republic, the Ministry of Agriculture and Rural Development of the Slovak Republic, the National Centre for Research and Applications of RES, the National Forestry Centre – the Zvolen Forest Research Institute, the National Agricultural and Food Centre, Horizon 2020 and the like), which have up-to-date information on R & D projects financed from the state budget, European Union and private sources.

Analysis of recent years shows that EUR 20,351 million was spent on R & D in 2014 and EUR 2.44 million in 2015, EUR 18,451 million in 2016 and EUR 1.02 million in 2017.

According to EC statistics provided via ECORDA and Funding and Tender Portal as of April 2023, the Slovak institutions participated in a total of 20 successful projects in which they received a financial contribution of EUR 4.67 million from the Commission.

Agency for the Promotion of Research and Development (R & D)

The APVV launches an annual open call for applications to address R & D projects in individual groups

of science and technology disciplines. The Agency's basic effort is to improve the quality of R & D through competition from all applicants in a competitive environment, taking into account the priorities of the government-approved R & D strategy "Knowledge for Prosperity – Research and Innovation Strategy for Smart Specialisation of the Slovak Republic" and subsequently "Research and Innovation Strategy for Smart Specialisation of the Slovak Republic 2021-2027 (SK RIS3 2021+)" The total amount of funding for the entire period of resolution of projects supported under this call is EUR 33 million. The funds are distributed according to the requirements in the different groups of science and technology disciplines. The total amount provided by the Agency to deal with one project is limited to a maximum amount of EUR 250000 for the entire duration of the solution.
Information on approved R & D projects in each field, as well as information on the amount of subsidy granted to energy R & D projects in 2021, is available at:
https://www.apvv.sk/grantove-schemy/vseobecne-vyzvy/vv-2021.html?tab=promoted_projects.

National Centre for Research and Applications for RES

In the field of RES, there is a National Centre for Research and Applications of Renewable Energy Sources at the Slovak Technical University (STU). The Slovak Technical University received support from the European Regional Development Fund under the Operational Programme Research and Development. Four STU faculties are involved in the project of the National Centre for Research and Applications for RES: Faculty of Chemical and Food Technology, Faculty of Electrical Engineering and Informatics, Faculty of Machinery, Faculty of Construction. Biomass, solar and hydropower are the main research circuits of the National Centre.

Smart Grid Research Lab

There is an interest in setting up a Smart Grid Research Lab. The task of the laboratory would be to test new technologies on the network, demand and generation side and interoperability. The laboratory should also be a presentational awareness centre.

Research and development (R & D) in hydrogen and hydrogen technologies

R & D linked to innovation and education for hydrogen technologies may be one of the strategic areas of Slovakia's energy and industrial policy in the future. The different areas of basic and applied R & D & I are in line with EU policies, approved by the National Hydrogen Strategy and its Action Plan or its future updates, as well as other Slovak strategic documents such as SK RIS3 2021+, focusing in particular on the following areas:

- managing key R & D pilot projects supporting hydrogen value chains;
- submission of proposals for calls under the Innovation Fund, which will support solutions for improving the EU Emissions Trading System;
- preparing innovation-oriented calls for hydrogen technologies in grey hydrogen regions;
- the creation of international partnerships and the subsequent preparation of calls for bilateral/multilateral applied research and industrial development projects;

- establishing partnerships on hydrogen use;
- Slovakia's involvement in EU programmes (the Hydrogen Europe Association, a partner of the Commission in the Fuel Cells and Hydrogen Joint Undertaking – FCH JU) and the International Energy Agency (Technology Cooperation Programme H2 – TCP H2), Horizon Europe.

R & D will specifically address the safety issues of hydrogen technologies arising from hydrogen properties.

The related protection of intellectual property will be an integral part of research, development and innovation in this field, as well as the promotion of knowledge transfer on hydrogen from the market environment, the use of hydrogen and its environmental benefits in education and study programmes, in vocational education at secondary and higher level, as well as in the dual and lifelong learning system.

ii. Where appropriate, cooperation with other Member States in this field, including, where appropriate:

appropriate, information on how the objectives and policies of the European Strategic Energy Technology Plan (SET-Plan) are reflected in the national context

Slovakia is widely involved in international R & D & I activities through bilateral S & T cooperation agreements with EU and non-EU countries.
The MŠVVaM SR ensures support for the participation of Slovak institutions and researchers in the Horizon Europe Framework Programme, including support activities for participation in EURATOM calls.

Within the Slovak Horizon Europe office in cooperation with the Slovak Ministry of Education and CVTI SR, support activities are provided through the National Contact Point and national delegates in the EURATOM programme. Information is provided on calls for projects, consultations and through participation in European Commission committees, the promotion of Slovakia's priorities in the work programme and subsequently the text of the EURATOM calls.

The MŠVVaM SR also actively participates in the regular meetings of the Governing Board of the European Fusion4Energy Joint Undertaking, which contributes to the international project of the ITER Thermonuclear Reactor. Participation is ensured at the level of the Director-General of the Science and Technology Section.

The European Commission has adopted a strategic document "Strategic Energy Technology Plan" (SET-Plan), which is the technological pillar of the EU's energy policy. Under one of the industrial initiatives relating to nuclear energy, Slovakia is involved in the Allegro project (cooperation on nuclear energy between Slovakia, Hungary and the Czech Republic and France).

iii. Where appropriate, national funding measures in this area including Union support and use of Union funds

The above-mentioned national funding measures, including EU support and the use of EU funds, have already been included in the previous chapters.

The financial provision foreseen for the implementation of the forward-looking objective is set out in Table 37 below. The proposed budget takes into account the projected evolution of GDP and covers all three SPV sub-programmes. If requested, the budget will be increased by 35 %.

Table 38: Indicative budget for S & D R & D Energy from 2024 to 2028

Year	**2024**	**2025**	**2026**	**2027**	**2028**	**Together**
National budget (million euro)	16,819	17,155	17,498	17,848	18,205	**87,525**

Source: MŠVVaM SR

SECTION B: ANALYTICAL BASIS67 68 69

4. CURRENT SITUATION AND PROJECTIONS BASED ON EXISTING POLICIES AND MEASURES[68.69]

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

i. Macroeconomic forecasts (GDP and population growth)

The most important inputs include macroeconomic and climate indicators, basic fuel prices and their emission factors, technical and economic characteristics of current and future installations, and parameters corresponding to the implementation of environmental measures.

The basic inputs for this modelling (GEM-E3-SK model) are the gross domestic product projections produced by the European Commission (DG ECFIN), which are also used in reference scenarios and the projection of demographic developments from Eurostat (ESTAT t+ 10 and EUROPOP2019). At the same time, national experts from the Ministry of Finance were consulted on these inputs.

Table 39: Assumptions for the reference values of the underlying macroeconomic indicators up to 2050

	Unit	**2019**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Population	million	5,45	5,49	5,41	5,35	5,28	5,20	5,11
GDP	billion 2017 USD	102	111	123	133	142	151	158

Source: Eurostat, DG ECFIN

An essential prerequisite for the model is activity data, which determines the added value of industries or services, but also of transport performance (number of passenger-kilometres and tonne-kilometres) or population size. These figures are the output of the macroeconomic model and do not foresee a reduction in activity for decarbonisation purposes. Given that it is a single country model, inputs also include imports and exports of electricity. For other fuels, the structure is maintained according to the resulting demand, i.e. if demand for fuel decreases, imports of fuel also decline.

The model also takes into account, on the demand side, the change in demand for individual energy uses brought about by climate change, e.g. reduced demand for heating of buildings or increased demand for cooling.

67 See Part 2 for a detailed list of parameters and variables to be reported in Section B of the Plan.

68 Current situation shall reflect the date of submission of the national plan (or latest available date). Existing policies and measures they include implemented and adopted policies and measures. Adopted policies and measures are those for which an official government decision has been taken at the date of submission of the national plan and there is a clear commitment to implement them. Implemented policies and measures are those for which one or more of the following applies at the date of submission of the national plan or progress report: directly applicable European or national legislation is in force, one or more voluntary agreements have been concluded, financial resources have been allocated and human resources have been mobilised.

69The selection of exogenous factors may be based on the assumptions made in the EU Reference Scenario 2016 or other subsequent policy scenarios for the same variables. Besides, Member States specific results of the EU Reference Scenario 2016 as well as results of subsequent policy scenarios may also be a useful source of information when developing national projections with existing policies and measures and impact assessments.

Table 40: Activity data values for selected sectors and sectors

Area	Unit	2019	2025	2030	2035	2040	2045	2050
Iron and steel	value added (EUR billion 2015)	0,78	1	0,99	0,99	1,01	1,01	1,02
Engineering	value added (EUR billion 2015)	9,5	11,0	12,8	14,0	15,0	16,0	17,0
Building materials	value added (EUR billion 2015)	0,82	0,84	0,91	0,99	1,05	1,10	1,14
Services	value added (EUR billion 2015)	51,7	56,6	62,9	68,1	72,9	77,5	81,9
Household	population (million	5,45	5,49	5,41	5,35	5,28	5,2	5,12
Passenger transportation	passenger-km e (billion)	48,3	52,2	58,2	62,2	64,9	66,6	67,6

Model outputs

The basic output of the model is the fuel use statistics for each activity. These are further aggregated at sector and sector level. On the basis of fuel data, other important outputs are then calculated, in particular energy-climate indicators and costs.

Energy and climate indicators

In the area of energy efficiency, the model, based on the efficiency of electricity and heat production and the projected demand for fuel imports, also counts gross domestic consumption and primary energy production, in addition to the final energy consumption it provides at activity level.

For the purposes of the RED III targets, the model also calculates the share of renewable energy sources in individual sectors (heating and cooling, electricity generation, transport), using the methodology described in this Directive (i.e. counting, for example, multipliers for calculating the share in transport).

Table 41: Projection of the share of renewables (%)

Scenario	Sector	2019	2025	2030	2035	2040	2045	2050
WEM	Share of total	17,0	19,9	19,7	22,5	24,4	26,5	30,9
	Heating and cooling.	19,7	23,9	24,6	28,2	30,7	32,3	35,2
	Production of el.	22,0	22,8	21,4	25,8	28,4	29,7	34,3
	Transport	8,3	9,4	9,6	10,9	13,6	19,1	27,9
WAM	Share of total	17,0	20,4	25,3	37,7	52,5	64,2	74,0
	Heating and cooling.	19,7	24,4	33,2	45,8	61,1	81,2	93,8
	Production of el.	22,0	23,1	26,0	38,9	48,4	47,0	51,4
	Transport	8,3	10,4	18,1	40,1	61,0	73,6	83,4

In addition, key outputs include the amount of CO2 emissions$_{generated}$, which are calculated through the emission factors of each fuel. CO_2 emissions are aggregated at sector level, with separate emissions from plant-based CHP plants and boilers for industrial sectors. The model also evaluates carbon intensity on the basis of a comparison with activity data (i.e., for example, in the household sector, it calculates the carbon intensity of one inhabitant).

The output of the GHG module is emissions from industrial processes, waste management and fugitive emissions, which also calculates other greenhouse gas emissions from the combustion of fuels.

Link to the macroeconomic model

The macroeconomic model (GEM-E3-SK) complements the energy model, using detailed results from the CPS energy model and assessing their economy-wide impacts. The link between models also works in the opposite direction – the outputs from the macroeconomic model are used as inputs to the CPS model.

The model represents producers that minimise their production costs, while consumers maximise their benefits. In addition to the underlying macroeconomic indicators, the model estimates the amount of emissions produced according to the activities of each sector. The results of the model show how sectors interact with each other and what impacts the measures and policies put in place have on sectors.

Other inputs, in particular related to sector coupling, are based on the international GTAP database and data from other international organisations (e.g. Eurostat, World Bank, UN, etc.). These inputs are also used to model results into impact clauses in the European Commission’s proposals. The EU SAV experts worked to adapt the model to the conditions of the Slovak economy.

ii. Sector-specific changes expected to have an impact on the energy system; and GHG emissions

At present, it can be concluded that the source of economic growth and development of the Slovak Republic, which was cost competitiveness based on low wages and other production costs, is gradually being depleted and by its very nature will not form the basis of future economic policy.

Dynamic technological change, new forms of entrepreneurship, a focus on sustainable growth, green solutions, innovation, science and research, as well as regional development, are the current challenges that the Slovak Republic will have to be able to reflect and develop in order to maintain and strengthen its competitiveness and ensure its development in all areas affecting the living standards of the population.

Changes related, for example, to the introduction of Industry 4.0 represent whole-of-society changes, ranging from industry, security, technical standardisation, science and research, the labour market, the education system to the legal framework.

The new nature of the Slovak economy’s competitiveness is therefore determined by five key areas, namely: development of human capital, technological change, green and energy efficiency of the economy, development of the business environment and regional development alongside agriculture.

An efficient economic policy will require a stable policy environment with clear responsibility for its implementation, the introduction of support mechanisms and measures for innovative and green solutions based on the Value for Money principle and a significant reduction of the administrative burden on the actors concerned.

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

Base fuel prices and emission factors

Prices of individual commodities in international markets are based on the same assumptions as in the Compact Primes model used by the European Commission to develop impact clauses for its proposals. These prices are further increased by excise duties for individual sectors of industry, while maintaining their current level. Based on the assumption of the price of the ETS/ETS2 emission allowance and the emission factors, the price of each fuel is increased by emission costs.

Table 42: Assumed commodity fuel price (EUR per MWh)

Fuel	2019	2025	2030	2035	2040	2045	2050
Coal	6,3	9,7	9,8	9,9	10,6	11,1	11,6
Petroleum	32	48,8	48,8	48,8	51,6	56,0	62,5
Natural gas	12,9	42,0	35,9	35,9	35,9	35,9	37,5

iv. Technology cost developments

The evolution of technology prices is estimated in terms of reference data provided by the European Commission in May 2017.

On the demand side, the model includes a description of the basic types of equipment used in industry, transport, households and the tertiary sector (such as several types of heating equipment and powered light commercial vehicles). Each of these devices is described by its technical (consumption of individual fuels, annual vehicle run, age, etc.) and its economic characteristics (e.g. purchase price, operating costs, etc.). The devices also have six technology levels for which the above characteristics differ.

On the supply side, the characteristics of power plants, CHP plants and heating plants are described in detail. These characteristics include, for example, the power supply of the source, the fuel mix, the year of its involvement, operating costs, but also technical parameters such as start-up time, minimum output, minimum operating hours, or the share of heat and power generation (for CHP installations).

Parameters corresponding to the implementation of environmental measures:

An essential factor in this area is the price of an ETS/ETS2 emission allowance. The price of an emission allowance is added to the price of individual fuels, thus significantly influencing the model’s economic choices in favour of solutions that achieve lower greenhouse gas emissions. Depending on the scenario, this price is set differently (see Table 43). At the same time, the model can also calibrate which installations (and their share) will be subject to individual prices and how many free emission allowances will be issued in each year.

Table 43: Projected price of allowances under scenario (EUR 2015)

Scenario	Emission allowances	2025	2030	2035	2040	2045	2050
WEM	ETS ETS2	88 —	96 —	108,8 —	120 —	135 —	150 —
WAM	ETS ETS2	88 —	120 42,5	177,5 70	235 100	292,5 130	350 160

Beyond the price of emission allowances, the model also offers additional possibilities for achieving measures – it is possible to prohibit the purchase of new installations with a particular fuel, to phase out installations that do not meet technical parameters (such as older coal boilers) or to allow the use of new technologies such as artificial carbon capture, hydrogen propulsion in heavy-duty vehicles or synthetic fuels, depending on the scenario.

The implementation of measures can also be supported through subsidies for selected types of installations (for example, to ensure higher energy efficiency of buildings through investments in improving heat reuse or more efficient heating sources).

Model outputs

The basic output of the model is the fuel use statistics for each activity. These are further aggregated at sector and sector level. On the basis of fuel data, other important outputs are then calculated, in particular energy-climate indicators and costs.

4.2. Dimension: decarbonisation

4.2.1. Greenhouse gas emissions and removals

1. *Trends in current greenhouse gas emissions and removals in the EU ETS, common efforts and sectors of LULUCF and different energy sectors*

As one of the parties to the UN Framework Convention on Climate Change, the Slovak Republic has the obligation to prepare and regularly update national greenhouse gas inventories. In addition, membership of the European Union imposes additional requirements on the Slovak Republic, such as the fulfilment of the obligations specified in Article 26 of Regulation (EU) 2018/1999. The results of the 2021 national inventory report present the level of greenhouse gas emissions for the time series 1990 to 2019. An inventory of greenhouse gas emissions and losses has been prepared in accordance with the Intergovernmental Panel on Climate Change’s methodological guideline: IPCC 2006 Guidelines (IPCC 2006).

According to greenhouse gas inventory data, Slovakia’s greenhouse gas emissions decreased by 44.10 % between 1990 and 2021, with LULUCF accounting and 47.88 % excluding LULUCF. The energy sector accounts for the largest share (70 %) of total emissions, of which 97 % are related to fuel combustion. Graph 38 and Table 44 show the evolution of emissions during this period.

Figure 38: GHG emissions SR 1990-2021 in Mt CO2 eq.

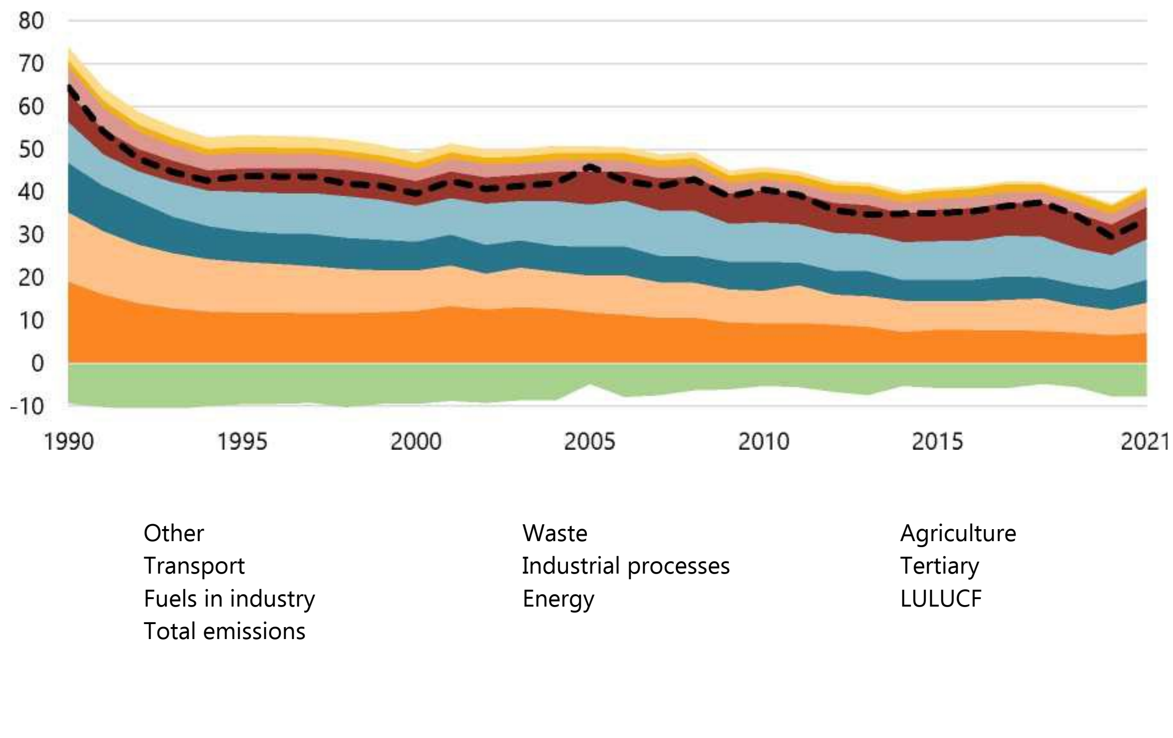


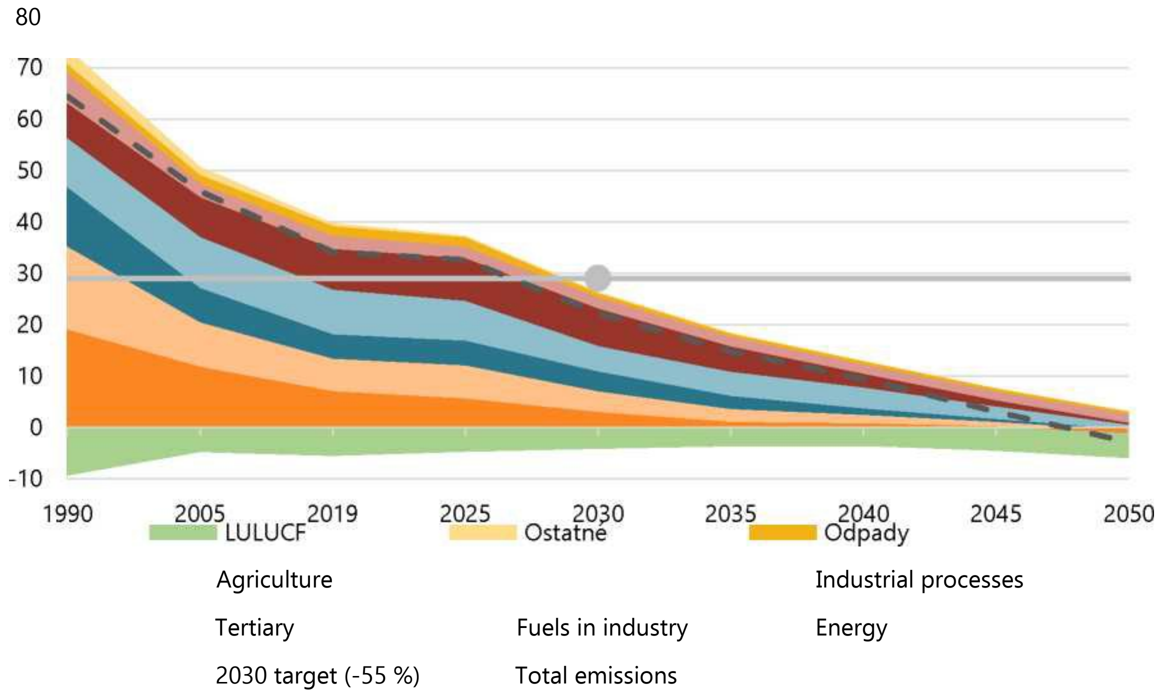
Table 44: Greenhouse gas emissions 1990-2021 [kt CO2 eq]

	CO_2 emissions without net CO_2 from LULUCF	CH_4 emissions with CH_4 from LULUCF	N_2O emissions with N_2O from LULUCF	HFCS	PFCs	SF_6	Total (without LULUCF, with indirect)	Total (with LULUCF, with indirect)
Base year[1]	61472,835	8189,3415	3924,0938	WELL	283,04563	0,06016	73826,439	64493,635
1990	61472,835	8189,3415	3924,0938	WELL	283,04563	0,06016	73826,439	64493,635
1991	53286,441	7794,4536	3099,3787	WELL	278,42619	0,03619	64429,941	54262,957
1992	48886,84	7036,8599	2560,9308	WELL	259,10853	0,043945	58710,212	47909,385
1993	46351,169	6714,36	2150,4242	WELL	162,10031	0,09259	55327,133	44735,123
1994	43756,979	6340,6433	2534,0021	0,2037235	137,74327	18,164795	52769,833	42735,873
1995	44144,949	6330,6388	2652,5865	12,381294	119,24069	10,466477	53262,059	43775,111
1996	44026,13	6180,3463	2807,1573	26,307421	36,618464	11,506681	53078,933	43677,759
1997	44098,213	5920,8581	2793,3613	38,332596	36,10776	11,825106	52899,491	43706,366
1998	43827,252	5765,6142	2508,79	50,72517	26,167046	13,036226	52197,017	41933,922
1999	43038,092	5713,2654	2151,4918	71,823079	14,624827	13,031032	50931,094	41507,691
2000	41138,782	5444,4486	2370,4547	98,201519	13,403135	13,444468	49051,654	39656,297
2001	43224,196	5273,6254	2663,2503	130,29161	14,400771	13,740168	51322,149	42609,459
2002	41978,126	5163,6789	2602,7725	167,95532	15,444565	15,233617	49941,911	40749,959
2003	42302,727	4960,0841	2573,8488	201,16895	23,783219	15,517685	50041,487	41419,372
2004	42792,358	4909,0556	2758,7829	240,28382	21,244543	15,906915	50755,65	42115,093
2005	42798,509	4894,7903	2732,4592	277,09357	21,724202	16,887194	50733,242	45983,222
2006	42563,847	4718,3102	2839,6965	323,93954	38,189716	17,223526	50516,543	42654,693
2007	40971,504	4608,8733	2779,0149	368,16008	26,459847	17,928902	48756,336	41361,345
2008	41364,302	4585,3838	2827,6585	431,49766	38,451112	19,429941	49276,857	42977,538
2009	37625,674	4423,06	2440,962	492,19597	18,885419	20,110384	45014,251	38941,208
2010	38408,616	4402,0914	2399,1122	569,22195	22,492358	20,226685	45815,832	40603,088
2011	37988,616	4362,3755	1934,9025	576,43445	18,080826	21,44046	44897,511	39333,862
2012	35913,257	4249,729	1741,4439	602,07396	23,077106	21,89589	42497,859	35836,595
2013	35569,507	4198,5405	1758,5951	620,99341	8,8222322	22,98817	42177,63	34746,546
2014	33658,639	3999,4575	1893,0052	626,13916	10,024603	14,60338	40189,745	34957,289
2015	34471,936	4009,3109	1729,7451	704,83507	7,6475673	14,753333	40925,921	35170,091
2016	34914,413	3951,0174	1854,7194	647,95199	5,8364295	5,9968005	41371,188	35542,118
2017	36114,092	3923,1472	1721,8163	710,19443	7,7540701	7,3003338	42466,762	36742,073
2018	36105,529	3809,227	1733,6502	675,62076	6,9963864	9,6809402	42329,544	37578,111
2019	33778,548	3786,4624	1758,7224	688,68588	4,6685495	9,1368755	40001,028	34486,23
2020	31096,626	3727,2661	1759,3741	646,64866	5,0436382	17,729152	37233,764	29538,431
2021	35166,805	3720,5597	1695,7942	672,37346	5,373494	17,437962	41270,16	33612,331

Based on the scenario modelling results for the National Energy and Climate Plan, Slovakia could achieve an emission reduction of 64.3 % by 2030, compared to 1990, excluding natural sinks (LULUCF) in the decarbonisation scenario.

The evolution of GHG emissions in the 64.3 % reduction scenario by 2030 is shown in Figure 39 below. The EU-wide 55 % reduction target by 2030 would be met by Slovakia under this scenario (grey line).

Figure 39: Slovakia's greenhouse gas emissions, WAM decarbonisation scenario (Mt CO2 eq.)



Source: IEP under CPS

The achievement of a binding short-term emission reduction target of 55 % by 2030 would be possible mainly due to the electrification of the cocktail irons. Other important measures are the advent of electric cars, insulation of buildings, and electrification across sectors. The closure of the coal-fired power plants in Nováky and Vojany and the launch of another unit of the Mochovce nuclear power plant have already contributed to a clean energy mix. The introduction of the Emissions Trading System (ETS2) from 2027 onwards in the buildings and transport sector (ETS2) with an estimated price in 2030 of around EUR 59 per tonne is still essential70.

Most important measures in the decarbonisation scenario 2020-2030:

In transport, decarbonisation measures are mainly aimed at supporting the development of electro-mobility:

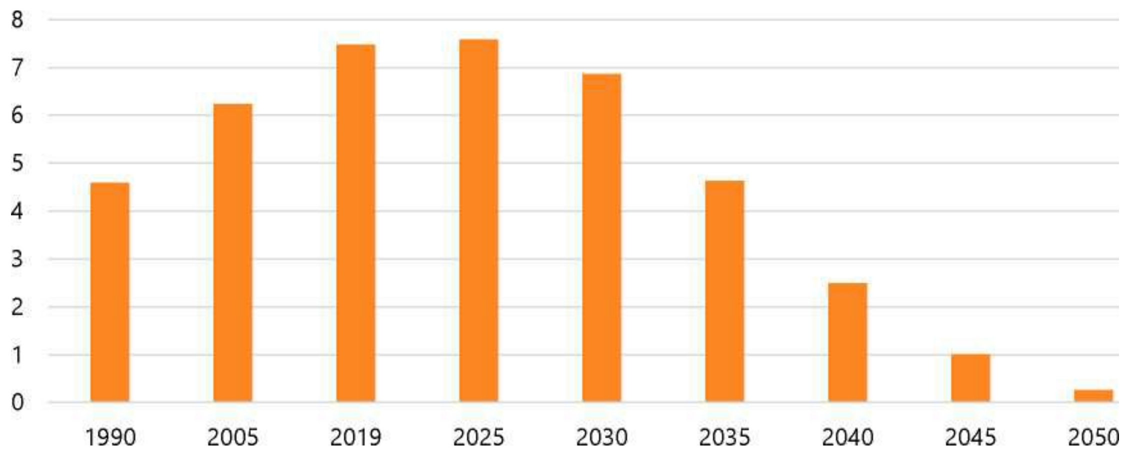
- introduction of the ETS2 emissions trading system

70In 2023 prices for Slovakia

- support for charging infrastructure, which will also result in a gradual increase in the range of electric cars linked to their higher annual range
- introduction of direct support for the purchase of vehicles in 2025 (at 20 % of the vehicle price, totalling EUR 81.6 million71 over five years)
- support for the transition to a new type of vehicle resulting from the application of measures in the Action Plan for the development of electro-mobility (e.g. tax support or take-up benefits for green EVNs)

These measures could contribute to an increase in the number of electric vehicles to around 195 thousand.

Figure 40: Greenhouse gas emissions in road transport (WAM, in Mt CO2 eq.)



Source: IEP under CPS

In **industry**, measures focus mainly on moving away from fossil fuels and electrifying industry while maintaining production capacities

- replacement of two blast furnaces in a basket iron plant associated with the cessation of coke production
- substitution of coal and petroleum products with natural gas or electricity
- replacement of petrolcoke for solid alternative fuels (TAP) in cement production
- gradual reduction of the share of free emission allowances
- promotion of high-efficiency cogeneration in industry

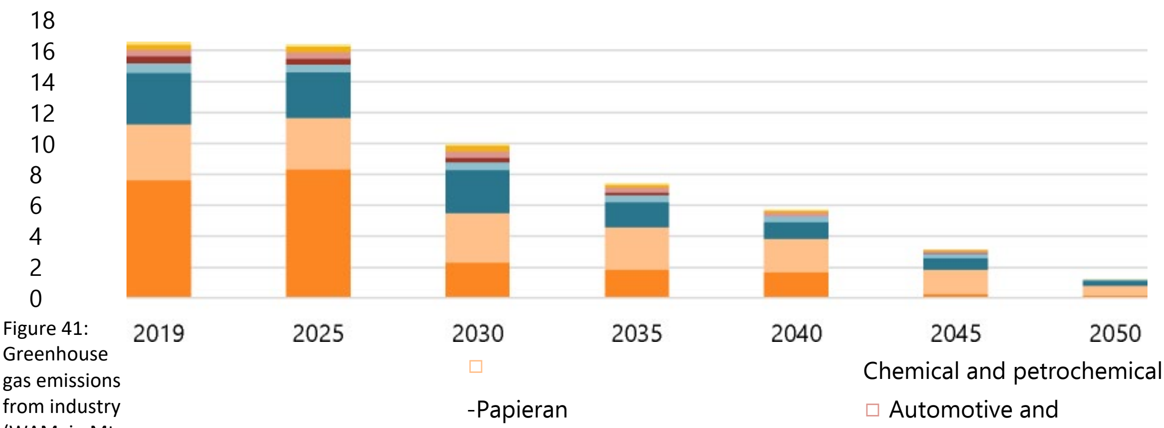


Figure 41: Greenhouse gas emissions from industry (WAM, in Mt CO2-eq.)

71All reported prices are at 2023 price level for Slovakia

Oceliarsky

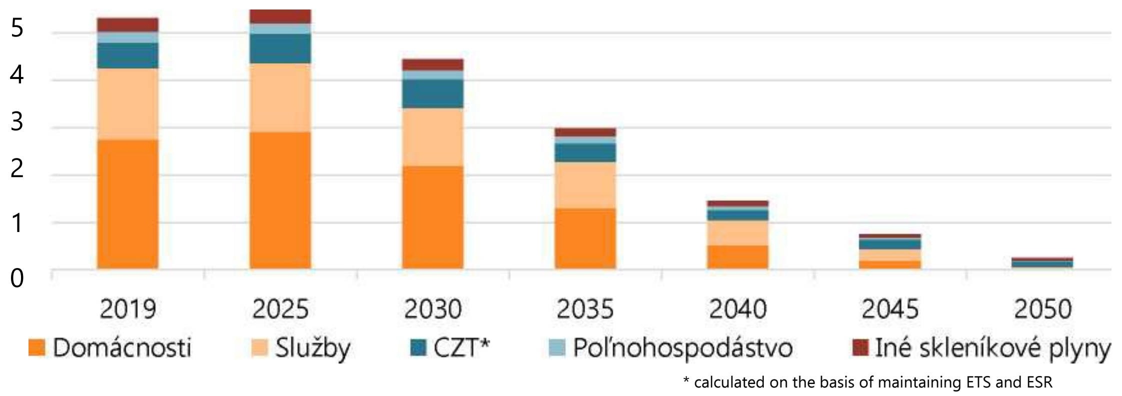
□ Manufacture of aluminium and alloys

Source: IEP under CPS

In **buildings**, measures focus mainly on improving thermal performance and electrification of heating

- introduction of the ETS2 emissions trading system
- introducing higher energy efficiency requirements for new constructions and renovated buildings corresponding to the application of stricter standards and the introduction of energy classes
- support for investments in improving the thermal characteristics of buildings
- promoting more efficient technologies in water heating and heating (e.g. heat pumps and solar water heaters) linked to the reduction of solid fossil fuels
- promoting investment in new technologies

Figure 42: Greenhouse gas emissions in buildings (WAM, in Mt CO2-eq.)



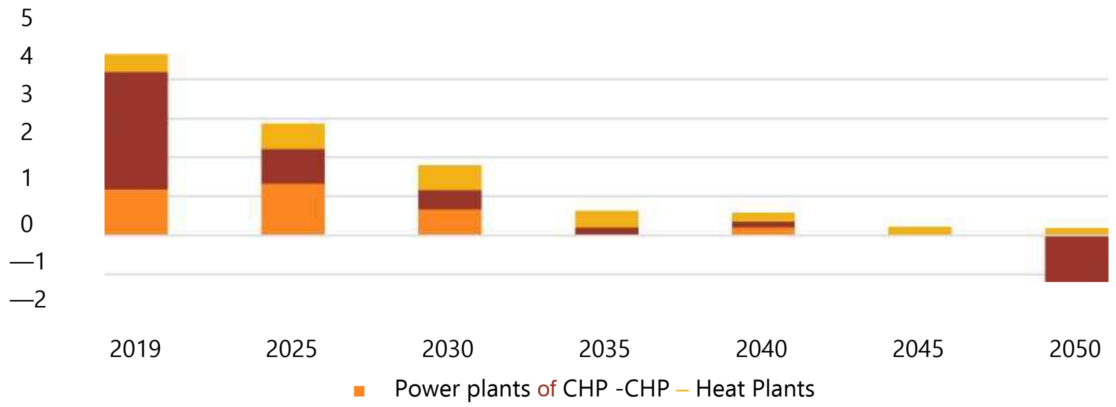
Source: IEP under

In electricity and heat generation, measures focus mainly on the transition from coal to less net-intensive sources and on increasing RES

- cleaner electricity generation thanks to the launch of units 3 and 4 of the Mochovce nuclear power plant
- closure of coal-fired electricity and heat production in Nováky and Vojanoch
- support for the installation of RES (wind and sun)
- replacing solid fossil fuels with natural gas in the heating sector
- support for RES, including geothermal energy, in heat production
- promoting efficient CZT systems with a significant share of RES

Electricity consumptionis expected to increase by 17 % in 2030 compared to 2019. Improving the energy efficiency of buildings will make it necessary to produce around 2.6 % less heat.

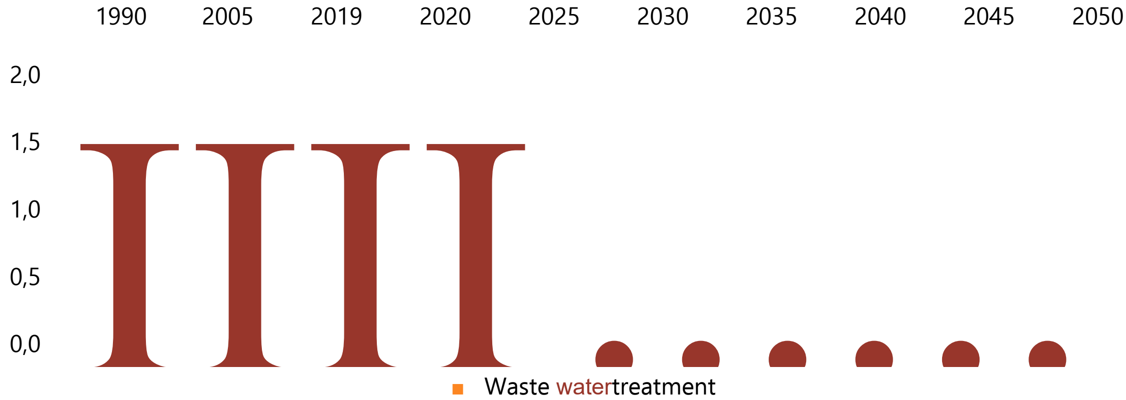
Figure 43: Greenhouse gas emissions in electricity and heat production (WAM, Mt CO2-eq.)



Source: IEP according to the CPS model

In the **waste** sector, emissions come mainly from methane in landfilling and waste water treatment, while the projected amount of waste is growing as GDP per capita grows. The main measure is the introduction of quantitative collection of municipal waste leading to increased recycling, diversion from landfilling and reduction of emissions.

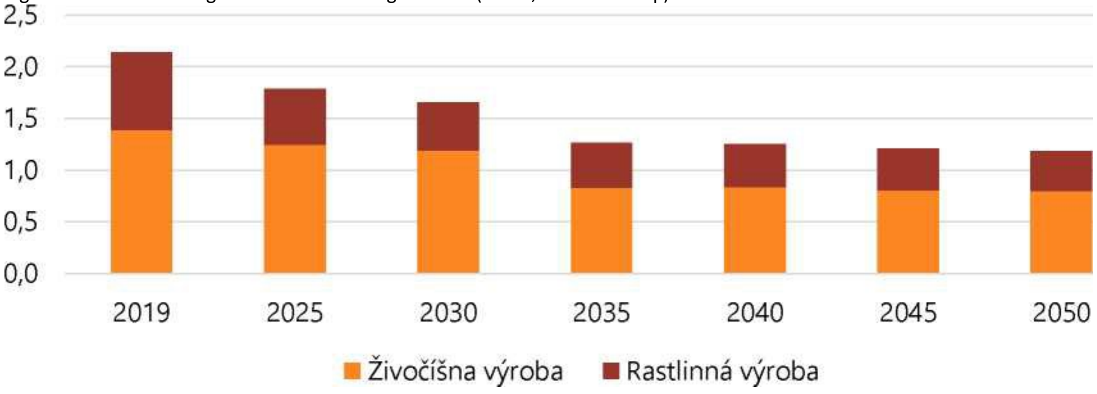
Figure 44: Greenhouse gas emissions from wastes (WAM, in Mt CO2 eq.)



Source: IEP under CPS

Agriculture is a sector with a certain limit on the possible application of decarbonisation measures. This is because its primary function of food production is not restricted and food security is ensured. The most influential measures in livestock production are the introduction of methane capture facilities and the addition of 3-NOP to feed. Crop production is a precision agricultural technique or the use of nitrifying inhibitors in fertilisation.

Figure 45: Greenhouse gas emissions from agriculture (WAM, in Mt CO2-eq.)



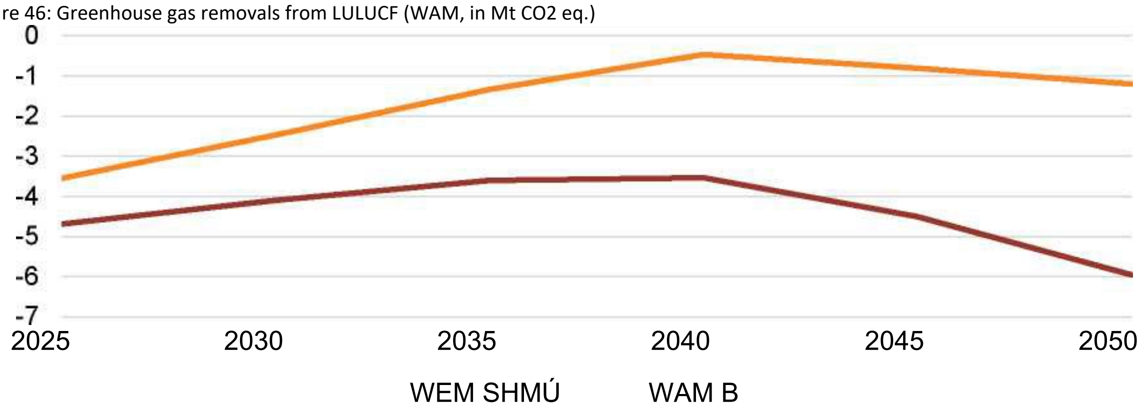
Source: IEP

In the **landscape sector, land-use change and forestry** (LULUCF), measures are aimed at promoting carbon sinks in forests and land. The most significant measures are:

- top-up of non-intervention areas in national parks
- close-to-nature forest management
- manuscript planting
- decrease in the restoration rate in forests (by 5-8 %)
- promoting sustainable farming practices
- increased construction of timber construction works

Natural sinks in the LULUCF sector are projected to decline due to the age structure of forests, which makes them suitable for restoration.

Figure 46: Greenhouse gas removals from LULUCF (WAM, in Mt CO2 eq.)



Source: IEP

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

Output modelling methodology for NECPs

Modelling is one of the main inputs to this doctrine. 3 scenarios for the evolution of both final and primary energy consumption by 2030 with varying levels of ambition were prepared using a CPS model linked to the macroeconomic model GEM-E3-SK. It builds on the well-known PRIMES model used for European Reference Scenarios (EUREF 2020) as well as in the European Commission’s impact clauses. CPS models the energy system and captures technological and engineering details, along with micro and macro interactions and dynamics across all energy sectors and markets. It includes energy demand, energy sector planning and allows for an impact assessment of climate and energy measures with a horizon to 2070. The structure of the model makes it possible to link with external (non-state) markets in order to obtain international fuel prices. All exogenous assumptions, including fossil fuel prices, price elasticities, technological or policy constraints, are presented in a transparent manner and can be tested in a sensitivity analysis

The methodological model represents the decisions of individual agents in the field of energy demand and supply and balances their supply and demand choices by minimising costs. According to economic theory, this approach leads, in conditions of perfect competition, to a solution with minimal energy costs for end-users. In this sense, the model explicitly translates electricity and heat prices into the future as derived from minimising supply-side costs and price elastic behaviour of energy demand, thereby achieving market balance. The output of the model is sector-specific projections of key energy indicators:

- Energy demand (from an energy efficiency perspective)
- Use of individual fuels
- Electricity consumption and use
- Share of renewable energy sources
- CO_2 emissions
- Amount of investments, fuel and other costs
- Fuel and electricity prices for the end-user

The model addresses two main problems – one for demand and one for supply. By connecting modules solving separate problems and subsequent iteration of solutions, it obtains the optimal equilibrium solution.

On the demand side, the model uses agents (representatives) who choose between available equipment suitable for the activity on the basis of parameters based on calibration. In addition to affordability, market elasticities, i.e. the specificities of demand for individual technologies and equipment, are also taken into account. This means that part of the market will also be covered by less cost-optimal equipment. This simulated consumer behaviour.

For example, in the case of passenger transport, based on the choice between an optimal and an inert (i.e. maintaining) solution, the car-owner may choose to stay with the current vehicle (i.e. the choice between remaining and purchasing new equipment), switching to another type of transport (railway, public road or ship), other equipment (motorcycle), other fuel or other technology.

On the supply side, the model optimises the costs of the energy system in order to cover demand and ensure stability of network operation (throughout the year). Technical and economic characteristics are included in the calculation, while the whole system is economically optimised, i.e. together with the costs of electricity generation (capital, operational, fuel and emission), costs caused by losses, distribution and transmission system costs and taxation costs are also included.

The most important inputs include macroeconomic and climate indicators, basic fuel prices and their emission factors, technical and economic characteristics of current and future installations, and parameters corresponding to the implementation of environmental measures.

Projections of emissions in the industry sector

Industry by 2030

In 2019, industry produced 16.6 Mt of greenhouse gas emissions, equivalent to 41.3 % of Slovakia's emissions. The steel industry accounted for the largest share (46.2 %), while production in the steel industry reached a lower level than in previous years. The production of construction materials (mainly cement) and the chemical industry (mainly refinery and fertiliser production) also accounted for an important share.

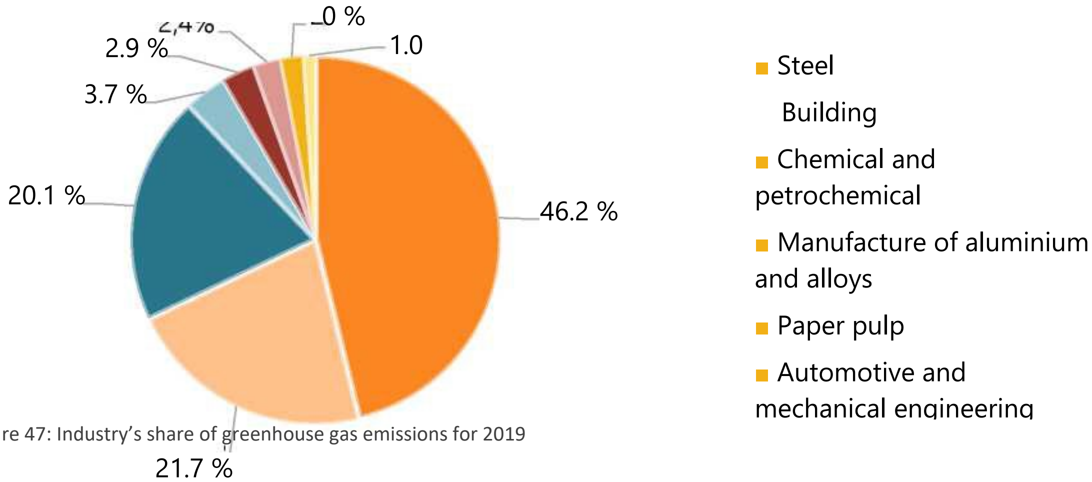


Figure 47: Industry's share of greenhouse gas emissions for 2019

Source: CPS according to Eurostat and SHMÚ

The different policies and measures used in modelling outputs are presented in chapter 3.1.1 Greenhouse gas emissions and removals.

The sectoral activity (i.e. quantity of products produced or value added) is determined in accordance with the macroeconomic model. At the same time, the assumption of industrial production is the same in both the WEM and the WAM scenario, so only the production technologies and the fuels used change. It is assumed that both the production of primary aluminium in Žiari above Hronom and full production in the basket steelworks are maintained.

Table 45: Value-added of industries between 2019 and 2030 (EUR million[72])

Industry sector	2019	2025	2030
Steel	1 081	1 389	1 371
Manufacture of aluminium and	340	427	440
Chemical	1 086	1 081	1 131
Building	1 147	1 169	1 272
Paper pulp	669	676	741
Foodstuff	1 390	1 692	1 860
Automotive and mechanical	13 238	15 357	17 836
Textile	1 107	920	891
Others	4 977	4 172	4 541

Source: IEP according to GEM-E3 SK

The basic mechanism that significantly affects investment in industry is the price of emission allowances (ETS) and the share of free allowances for individual parts of industry. The price of allowances varies depending on the scenario in later years – in the WAM scenario, the price increases more strongly. In the WEM scenario, the share of free emission allowances will decrease from 50 % to 25 % in 2030 (down to 0 % by 2040), free allowances are not provided in the WAM scenario.

Table 46: Forecast price of ETS allowance by scenario (EUR 2023)

Scenario	2019	2025	2030	2035	2040	2045	2050
WEM	35	122	134	151	167	188	209
WAM	35	122	167	247	327	407	487

Source: IEP according to the CPS model

To reduce emissions, schemes for industry financed by the Modernisation Fund and the Recovery and Resilience Plan have been announced. Based on their published results, the WAM scenario modelled investments across industries – with the highest investments made in the steel, chemical and construction industries.

Greenhouse gas emissions in industry will decrease by 3.1 % by 2030 in the WEM scenario compared to 2019. In particular, changes in the chemical and petrochemical industries, the gradual introduction of solid alternative fuels in cement production and, to a lesser extent, investments in biomass boilers in the paper industry will contribute to this reduction.

In the WAM scenario, in particular, the replacement of blast furnaces for electric arc furnaces will lead to a 39.7 % reduction in emissions compared to 2019. The construction and chemical and petrochemical industries will also contribute more significantly to the reduction. A large part of these savings will be ensured mainly through investments from the Recovery and Resilience Plan and the Modernisation Fund. However, due to the projected stronger increase in the price of the ETS allowance, other sectors (excluding the steel industry) will be decarbonised more strongly, especially after 2030.

[72] The prices are shown at the 2023 price level for Slovakia

20

Figure 48: Industrial GHG emissions by 2030 (WEM, Mt CO2-eq.)

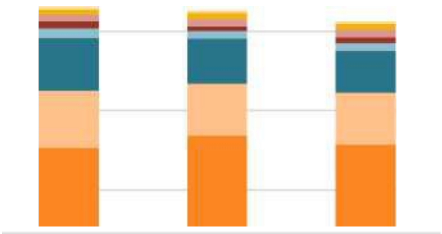
15

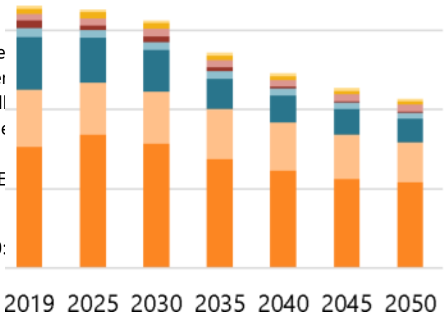
10

5

0

20





■ Stee
■ Cher
and all
■ Pape

Source: IE

Figure 50: eq.)

15

Building
□ Manufacture of aluminium and alloys
□ Automotive and

10

Source: IEP according to the CPS model

5

0

■ Steel
■ Chemical and petrochemical
■ Paper pulp
Foodstuff

20

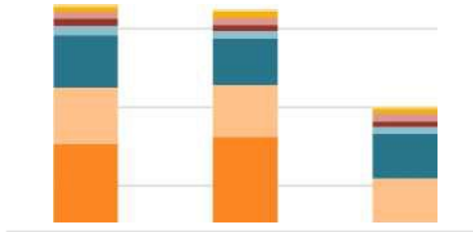
Figure 49: Industrial GHG emissions by 2030 (WAM, Mt CO2-eq.)

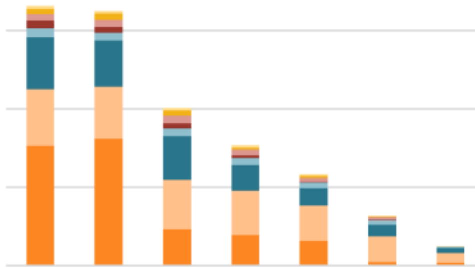
15

10

5

20





Oceliarsky
Chemical and petrochemical
-Papieran
Foodstuff

Building
Manufacture of aluminium and alloys Automobile and mechanical

Source: IEP according to the CPS model

Projections of emissions in the household sector

In 2019, greenhouse gases from households accounted for around 7 % of Slovakia's total greenhouse gases. The largest part of these emissions came from heating, to a lesser extent also from water heating and cooking. These activities mainly used natural gas and biomass, to a lesser extent solid fuels. Emissions from electricity and heat use from central supply are not accounted for in the household sector.

Figure 52: Share of CO2 emissions by end-use in 2019

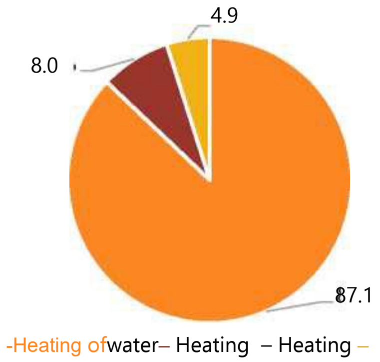


Figure 53: Share of CO2 emissions by fuel in 2019

4.1 %
0.7 %
95.2 %
Natural gas Solid fossil fuels
Petroleum products

Source: IEP according to Eurostat

Source: IEP according to Eurostat

Given that most domestic emissions come from heating, decarbonisation is closely linked to increasing the energy efficiency of buildings in the medium term. Energy efficiency in heating has two dimensions: reducing heat leakage rates and improving the efficiency of heating equipment. Leakages can be reduced by higher insulation rates or window replacements. Electrification of water heating and cooking equipment can also help. The obligations to decarbonise heating and energy production in buildings need to take into account the new requirements of EU Directives 2023/2413[73], 2023/1791[74] and 2024/1275[75].

In both modelled scenarios, under the impact of climate change, air-conditioning is expected to be higher at the expense of heating. As air conditioners operate on the principle of heat pumps and use electricity for their operation, their emissions are zero. This means that moderate emission reductions will also be a side effect of the impact of climate change in this area.

Key legislative means include the introduction of the Social Climate Fund (2023/955), which aims to support vulnerable households through direct income support and support for investments to increase energy efficiency in buildings. The introduction of the Emissions Trading System (ETS2) from 2027 will financially incentivise the transition to more efficient technologies.

The renovation of buildings and the construction of new buildings will be subject to stricter energy performance requirements under Directive (EU) 2024/1275 on the energy performance of buildings (recast). The impacts of these measures are integrated in the WAM scenario.

Other main measures modelled in the WAM scenario for the household sector are presented in chapter 3.1.1 Greenhouse gas emissions and removals.

The WEM scenario expects a significant reduction in solid fossil fuel consumption (-76.8 %) and a slight increase in the use of natural gas (2.5 %) by 2030. By 2030, these two contradictory trends will stabilise greenhouse gas emissions and keep them at roughly the same level as in 2019. Due to higher demand due to rising living standards, emissions from water heating will increase by 16 %. Demand for heating will remain at a similar level – the effect of the lower baseline of 2019 will be covered by energy efficiency investments.

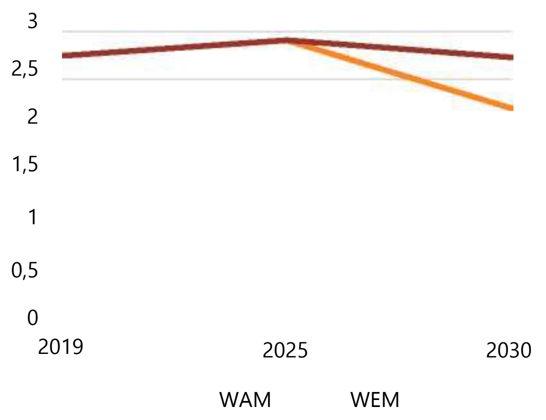
73Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (eU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652

74Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (recast)

75Directive (EU) 2024/1275 of the European Parliament and of the Council of 24 April 2024 on the energy performance of buildings (recast)

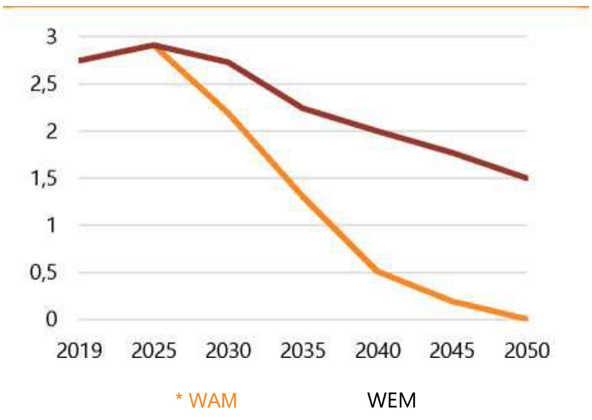
The WAM scenario expects a significant reduction in emissions (-20.3 %). This reduction will be mainly due to significant savings in heating. Due to investments in insulation and more efficient installations, heating demand will fall by 16.6 %. There will be a reduction in the consumption of natural gas (-17.6 %) and solid fuels (-88.7 %), while the share of heat pump use will increase.

Figure 54: Greenhouse gas emissions in the household sector by 2030 (in Mt CO2-eq.)



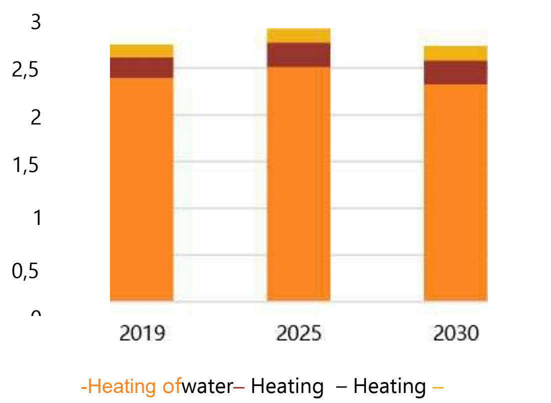
Source: IEP according to the CPS model

Figure 55: Greenhouse gas emissions in the household sector by 2050 (in Mt CO2-eq.)



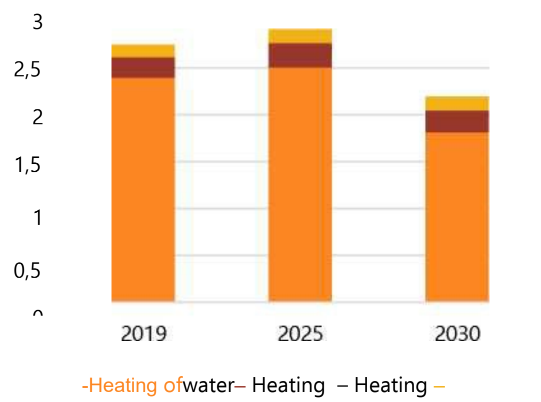
Source: IEP according to the CPS model

Figure 56: Emissions by final consumption by 2030 (WEM, in Mt CO2-eq.)



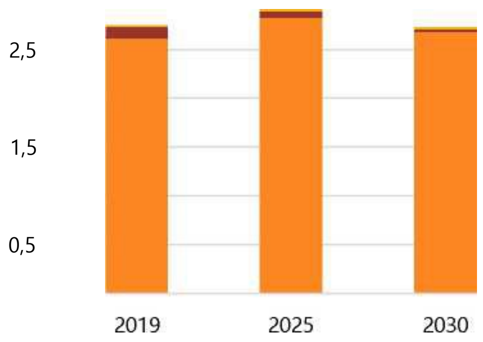
Source: IEP according to the CPS model

Figure 57: Emissions by final consumption by 2030 (WAM, in Mt CO2-eq)



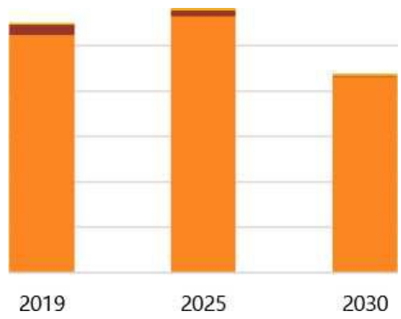
Source: IEP according to the CPS model

Figure 58: Household emissions by fuels by 2030 (WEM, in Mt CO2-eq.)



Source: IEP according to the CPS model

Figure 59: Household fuel-based emissions by 2030 (WAM, in Mt CO2-eq.)



Source: IEP according to the CPS model

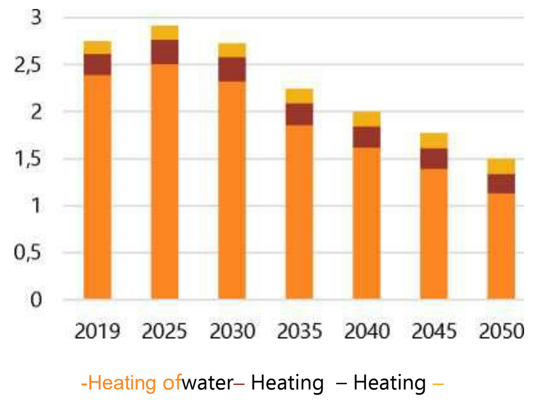
Beyond 2030, the WAM scenario continues to implement these measures more ambitiously, such as increased support for investments in more efficient installations and an increase in the price of emission allowances (see Table 48). Due to the increase in the price of emission allowances, the share of efficient technologies (in particular heat pumps and condensing gas boilers) in heating will also increase in later years. From 2035 onwards, the share of zero-emission gases in the pipeline mixture will gradually increase, with natural gas almost entirely replaced by a mixture of hydrogen, biogas and synthetic gases in 2050 (see Table 47). Slovakia will proceed to decarbonise heating and energy production in buildings in line with the new requirements of Directive (EU) 2023/2413 (amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources and repealing Council Directive (EU) 2015/652), Directive (EU) 2023/1791 (on energy efficiency and amending Regulation (EU) 2023/955 (recast) and Directive (EU) 2024/1275 on the energy performance of buildings (recast).

Table 47: Composition of the pipeline fuel blend in the WAM scenario (%)

Fuel	**2019**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Natural gas	100	100	100	98,99	79	49,86	0,74
Hydrogen	—	—	—	0,50	6	10,47	19,69
Biogas	—	—	—	0,01	6	10,47	19,69
Synthetic gas	—	—	—	0,50	9	29,20	59,88

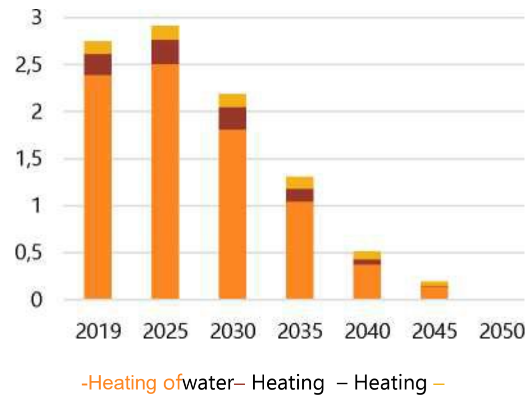
Source: IEP CPS assumption

Figure 60: Emissions by final consumption by 2050 (WEM, in Mt CO2-eq)



Source: IEP according to the CPS model

Graph 61: Emissions by final consumption by 2050 (WAM, in Mt CO2-eq)

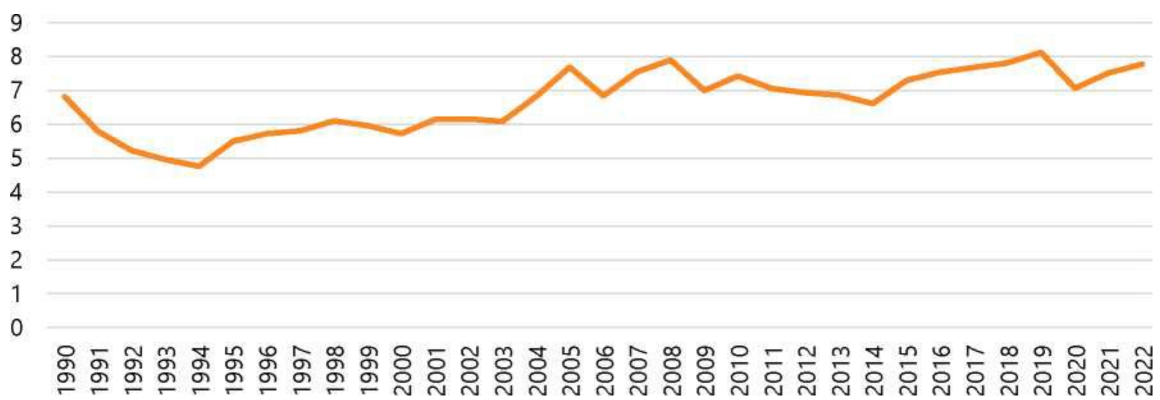


Source: IEP according to the CPS model

Projections of transport emissions by 2030

In 2019, the transport sector produced approximately 8.1 Mt CO_2 equivalents[76], corresponding to 20.4 % of all Slovakian greenhouse gas emissions. The vast majority of emissions come from road transport (93.9 %), a minor part comes from pipeline transport of natural gas (4.9 %) and rail (1.1 %). Domestic aviation and shipping account for less than 0.1 % of emissions. Emissions from international aviation and shipping are not accounted for under the national targets. Emissions from road transport are on an increasing trend in the long term. This is mainly due to an increase in the number of passenger cars but also commercial vehicles, with which their use and fuel consumption are also growing. This impact slightly reduces the increase in the share of the bio-based component in diesel and petrol, as well as the improvement of the energy efficiency of vehicles (lower fuel consumption).

Figure 62: Transport emissions 1990-2022 (Mt CO2 eq.)



Source:

Emission standards for passenger cars, light-duty and heavy-duty vehicles (EU Regulations 2019/631 and 2019/1242) have been approved in the past to reduce greenhouse gas emissions in transport, and there has also been a slight increase in the share of bio-component in fuels (compared to 2019). These measures have been modelled in the WEM scenario for the purposes of this document.

In the WAM model scenario, strengthened emission standards were applied following the revision of those Regulations – for new passenger cars and light commercial vehicles (2023/851) and heavy-duty vehicles and buses (2023/0042)[77]. The bio-component share in fuels was also increased in the scenario, including a higher share of advanced fuels (based on Annex IX, part (a) of the Renewables Directive (2018/2001)). The introduction of the Buildings and Transport Allowance Trading Scheme (ETS2) from 2027 is also an important measure. These measures were part of the 'Fit for 55' package presented in 2021, several of which are now in force.

Table 48: Projected price of ETS2 allowances (EUR 2023)

Scenario	2019	2025	2030	2035	2040	2045	2050
WAM	—	—	59,2	97,4	139,2	181,0	222,7
WEM	—	—	—	—	—	—	—

Achieving emission standards for the average emissions of the fleet is possible by significantly increasing the share of battery electric vehicles or hydrogen electric vehicles. In the medium term, plug-in hybrid vehicles and blending of biofuels into fuel blends also help to achieve them in part.

At the end of 2023, according to the PZ SR's records, there were a total of 9631 passenger and 638 battery electric light commercial vehicles in the Slovak fleet. At present, the PZ SR also registers 5701 plug-in hybrid passenger cars.[78]

The increase in the number of battery-electric vehicles is to be supported in particular through the implementation of the Action Plan for the development of electromobility, which consists of financial, legislative and other measures. In particular, these measures aim at an initial increase in the number of vehicles which, based on experience from other countries, increase the willingness to switch to an alternative fuelled vehicle (so-called substitution elasticity).

In the light of the above, the following measures are applied in the WAM scenario:

- gradual increase of the range of battery electric vehicles associated with a higher annual run
- introduction of direct support for the purchase of vehicles in 2025 (at 20 % of the vehicle price, totalling EUR 81.6 million[79] for the whole fleet)
- support for the transition to a new type of vehicle resulting from the application of measures in the E-mobility Action Plan (e.g. by reducing the behavioural effect of shorter driving ranges due to increased availability of charging)

Given that the long-term cost of ownership of battery electric cars is already comparable to that of internal combustion vehicles and is expected to decrease further, in particular on the cost of capital (due to economies of scale), an increase in their share can be expected also in the WEM scenario.

As a result of the combination of measures and expected price developments, the number of battery electric passenger cars will increase to around 192 thousand units in the WAM scenario. There will also be a substantial increase in the number of battery-electric buses and commercial vehicles (see Table

77Final proposal not yet approved at the time of drawing up the model
78The actual number may be slightly higher as plug-in hybrid vehicles were not separated from other hybrid vehicles before 2019.
79All reported prices are at 2023 price level for Slovakia

52). The number of plug-in hybrid vehicles will also be increased (see Table 53).

Table 49: Number of battery-electric vehicles

Vehicle type	2023	2030 (WAM)	2030 (WEM)
Private car	9 631	192 337	44 364
Light commercial vehicle	638	21 153	6 628
Heavy-duty vehicle	15	9 956*	0*
Bus + HHD	—	2 734	915

*the*model is based on the 2019 calibration, when the number was zero* Source: PZ SR, IEP according to CPS model

Table 50: Number of plug-in hybrid vehicles

Vehicle type	2023	2030 (WAM)	2030 (WEM)
Private car	5 701	112 078	15 636
Light commercial vehicle	8	21 982	6 985

Source: PZ SR, IEP according to CPS model

From 2030, the model also assumes the use of hydrogen electric vehicles in the WAM scenario – to a greater extent for heavy and, to a lesser extent, light commercial vehicles. In the passenger car category, entry is expected only after 2030, mainly due to lower demand and high price.

Table 51: Number of hydrogen electric vehicles

Vehicle type	2023	2030 (WAM)	2030 (WEM)
Light commercial vehicle	0	1 233	0
Heavy-duty vehicle	0	5 414	0

Source: PZ SR, IEP under CPS

A slight reduction in emissions can be expected in pipeline transport due to a reduction in the use of natural gas, and this trend will be significantly strengthened after 2030. In aviation, emission reductions can only be expected after 2030, when synthetic fuels and biofuels will become more blended into the fuel mix. Rail transport was not modelled in the model, but no significant electrification of lines using diesel locomotives is expected by 2030.

In the WEM scenario, greenhouse gas emissions from road transport will increase by around 6.4 % by 2030 compared to 2019. After 2030, there should be a gradual reduction, driven by an increase in the share of battery electric vehicles.

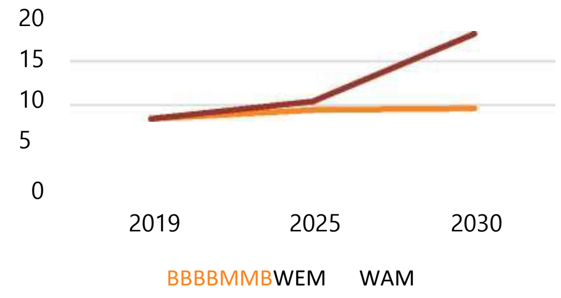
In the WAM scenario, emissions will start to decrease from 2025 onwards, decreasing by around 14.8 % by 2030 compared to 2019. This is due to a higher number of electric vehicles (including fewer hydrogen electric vehicles). The increase in the share of biofuels in final energy consumption from 5.5 % to 9.7 % due to the increase in the share of the biodiesel component in diesel and petrol will also help to reduce emissions.

Increasing the share of electricity and biomass in the fuel mix will reduce emissions from road transport despite the continued growth in the number of vehicles. It will only be around 9.6 % higher in the WAM scenario in 2030 compared to 2005.

Figure 63: Emissions from road transport (Mt CO2 eq.)

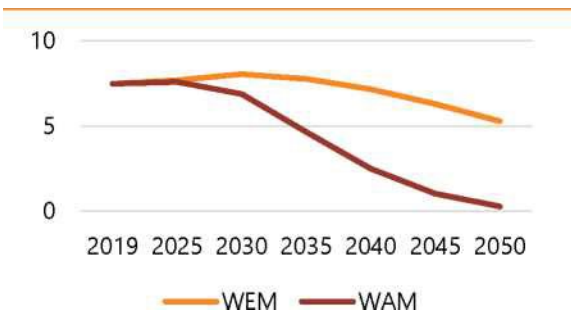
Source: IEP according to the CPS model

Figure 64: Share of RES in transport (%)[80]

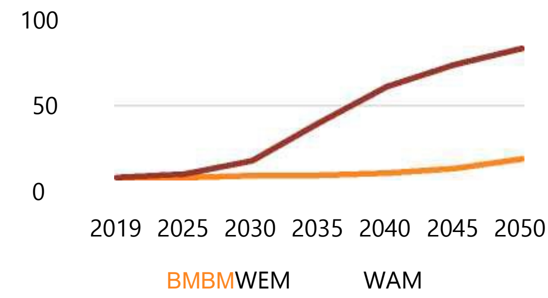


Source: IEP according to the CPS model

Figure 65: Emissions from road transport (Mt CO2



Source: IEP according to the



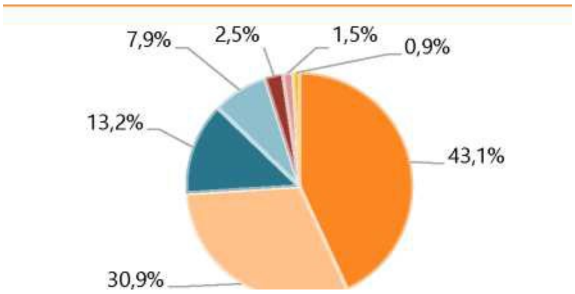
Source: IEP according to the CPS model

Projections of emissions from the services sector by 2030

In 2 019.1500 kt CO 2 eq. was emitted in the services sector, equivalent to 3.8 % of Slovakia's total greenhouse gas emissions. Emissions in this sector come from water heating and heating. The most fuel used in these activities is natural gas (43.1 %), followed by electricity (30.9 %) and solid fossil fuels (13.2 %). Oil products and the energy use of municipal waste account for a significantly smaller share. Emissions from the use of electricity and heat from central supply are not accounted for in this sector.

[80] For the purposes of RED III, i.e. counting multipliers.
[81] For the purposes of RED III, i.e. counting multipliers.
[82] Calculation of the CPS model according to fuel data

Figure 67: Fuel consumption in heating and water heating in 2019



Natural gas
Solid fossil fuels
Municipal waste
Electricity
Heat
RES

Source: IEP according to Eurostat

Figure 68: Contribution of individual fuels to emissions in the services sector in 2019

2.9 %
1.6 %
33.3 %
62.1 %

Natural gas
Solid fossil fuels
Municipal waste
-Petroleum products

Source: IEP according to Eurostat

Greenhouse gas emissions in the services sector result from the combustion of fossil fuels for the purpose of heating and heating water. Therefore, in particular in the medium term, there is a strong link between decarbonisation and improving the energy efficiency of buildings.

Given the trend of rising temperatures, a higher share of air conditioning is expected to be at the expense of heating. Since air-conditioning is based on the principle of heat pumps (and uses electricity), greenhouse gas emissions in this sector should decrease as a result of this change. The effect of reducing demand for heating may be slightly reduced as a result of the expected increase in the floor area of buildings in the sector, coupled with an increase in the sector's share of a country's gross domestic product.

The demand for heating and heating of water is mainly influenced by two main factors, namely the efficiency of the heating equipment used and the rate of heat leakage, which is mainly reduced through insulation or window replacement. The combination of measures in both areas can bring about a substantial reduction in final energy consumption and thus lead to a reduction in greenhouse gas emissions.

In particular, an important measure in this area is the introduction of the Emissions Trading Scheme (ETS2), which can financially incentivise the transition to less carbon-intensive technologies.

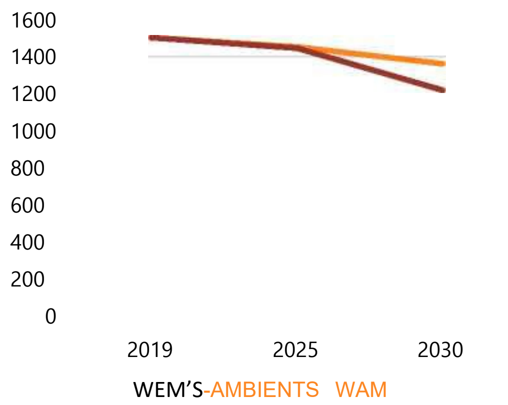
In particular, the Energy Efficiency Directive (2023/1791), which requires a 11.7 % reduction in energy consumption in the EU by 2030 and the Energy Performance of Buildings Directive (2024/1275), is a key European legislation for improving energy efficiency. The impacts of these standards are incorporated in the WAM scenario.

Greenhouse gas emissions in the services sector will decrease by 9.3 % by 2030 in the WEM scenario. This is mainly due to a significant drop in solid fossil fuel consumption (by 62.2 %), mainly replaced by natural gas (by 20.8 %) and electricity (by 6.1 %). The share of electricity is increasing mainly due to a gradual increase in the use of heat pumps. Total fuel consumption in heating and water heating will increase by 2.5 % and 4.7 % respectively, mainly due to the low 2019 baseline, which was one of the warmer ones.

In the WAM scenario, the decrease in emissions is more pronounced (by 18.7 %), mainly due to a higher share of integer buildings and additional investments in lower fuel-consuming equipment. Natural gas consumption will increase significantly (by 8.4 %) than in the WEM scenario and electricity consumption will decrease by 15.1 %. Total fuel consumption in heating and water heating fall by 5.4 % and 20.5 %

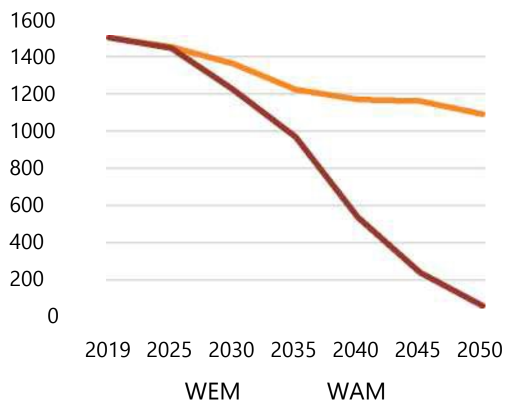
respectively.

Figure 69: Greenhouse gas emissions in the services sector by 2030 (in kt CO2-eq.)



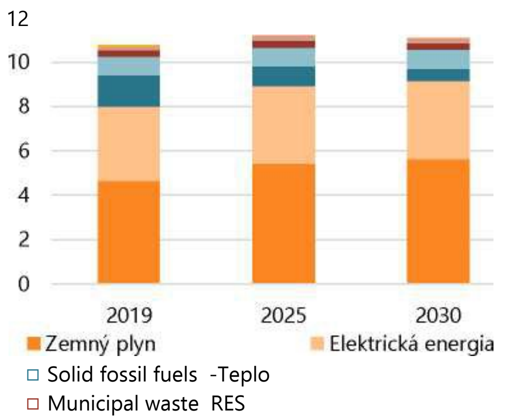
Source: IEP according to the CPS model

Figure 70: Greenhouse gas emissions in the services sector by 2050 (in kt CO2-eq.)



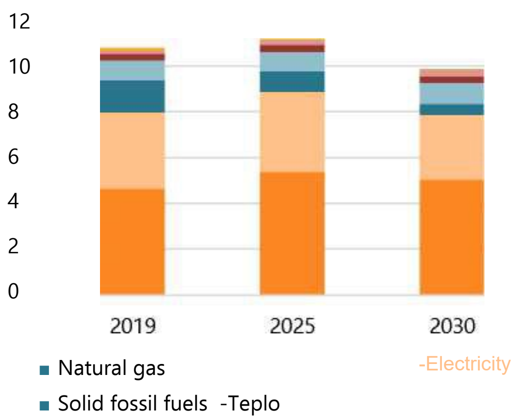
Source: IEP according to the CPS model

Figure 71: Fuel consumption in heating and water heating by 2030 (WEM, TWh)



Source: IEP according to the CPS model

Figure 72: Fuel consumption in heating and water heating by 2030 (WAM, in TWh)



Source: IEP according to the CPS model

After 2030, the WAM scenario mainly modelled increases in the price of ETS2 allowances (see more in Table 51). As fossil fuel prices rise, the share of more efficient technologies (in particular heat pumps and solar water heating) is increasing and solid fossil fuels but also natural gas decline. From 2035, the WAM scenario assumes an increase in the share of zero-emission gases in a pipeline gas blend, with natural gas almost entirely replaced by a blend of hydrogen, biogas and synthetic gases in 2050.

Strengthening and strengthening energy efficiency measures, such as increased support for investments in more efficient equipment and insulation of buildings, linked to the application of the stricter conditions set out in the recast of the EPBD (2024/1275), will also have an important effect.

Agriculture by 2030

In 2 019.2529 kt CO2 equivalents were produced in the agriculture sector, i.e.83around 6.4 % of Slovakia's greenhouse gas emissions. About half of these emissions correspond to nitrous oxide emissions from fertilisation and manure management. The rest mainly consists of methane emissions from enteric fermentation (47.3 %), then, to a lesser extent, carbon dioxide emissions from urea and liming (2.7 %).

83Based on SHMÚs included in the 2023 emission inventory

Over the past 15 years, emissions in agriculture have been stable. A significant decrease occurred still in the 1990s as a result of a significant reduction in livestock and fertiliser use.

Figure 73: Emissions from agriculture between 1990 and 2021 (in Mt CO2-eq.)

7
6
5
4
3
2
1
0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020

Source: SHMÚ

At both agriculture and international level, emission reductions have been slower. This is mainly due to the need to ensure a high level of food sovereignty, which is important for food security. At the same time, it is a sector with a large number of small resources and low margins, making the implementation of mitigation measures more demanding.

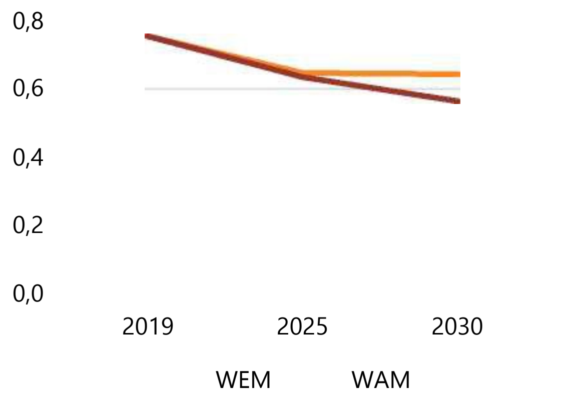
In order to reduce emissions, the agricultural sector has been classified under the so-called effort sharing legislation, under which Slovakia has a binding greenhouse gas emission reduction target of 22.7 % by 2030 compared to 2005. To this end, the EU has also published a Farm to Fork Strategy that aims to reduce fertiliser use or increase the share of organic farms. Currently, measures to reduce emissions in agriculture in Slovakia are supported by the common agricultural policy.

Greenhouse gas emissions projections for agriculture by 2030

In the WEM scenario, emissions are reduced by about 9.5 % by 2030. Emissions from livestock production will decrease by 6.7 %, mainly due to an increase in feed quality and improved management in meat and sheep farming. Crop production will fall by 14.8 % mainly due to expected changes in plant species shares and increased manure use instead of urea.

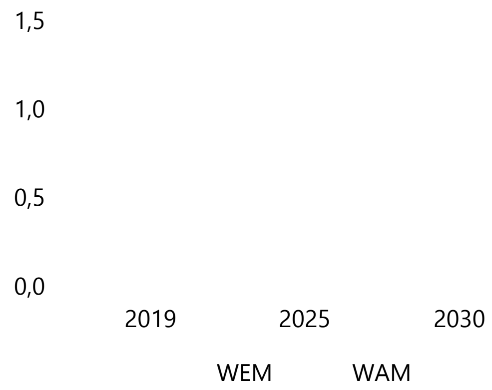
In the WAM scenario, a number of measures are applied until 2030, in particular in the field of animal production. In addition to the measures in the WEM scenario, there will also be a gradual increase in the use of additives in dairy farming or methods for increasing sheep productivity. Plant production will start using nitrification inhibitors and precision agricultural techniques leading to a reduction in fertiliser consumption. As a result of the application of these measures, emissions in livestock and crop production will decrease by 10.5 % and 25.3 % respectively. Overall, greenhouse gas emissions in agriculture will decrease by 15.7 % compared to 2019.

Figure 74: Emissions from plant production by 2030 (in Mt CO2-eq.)



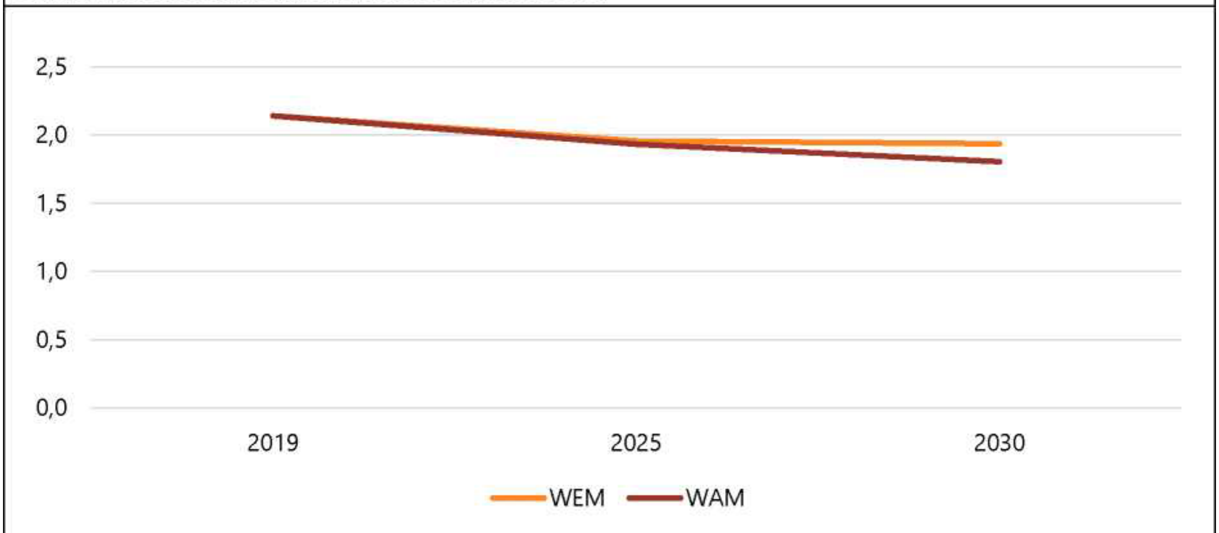
Source: IEP

Figure 75: Emissions from livestock production by 2030 (Mt CO2) eq.)



Source: IEP

Graf 76: Emisie z poľnohospodárstva do roku 2030 (v Mt CO2 ekv.)



Zdroj: IEP

Projections of greenhouse gas emissions in agriculture by 2050

The decrease in emissions in the WEM scenario will continue after 2030, in particular in crop production, where production volumes will gradually decrease. On the contrary, livestock production is expected to stagnate, especially after 2035, without additional measures. This is mainly due to the lower application potential of the measures available in the scenario or their high price. In livestock production, almost all measures will be applied in the WEM scenario already in 2035.

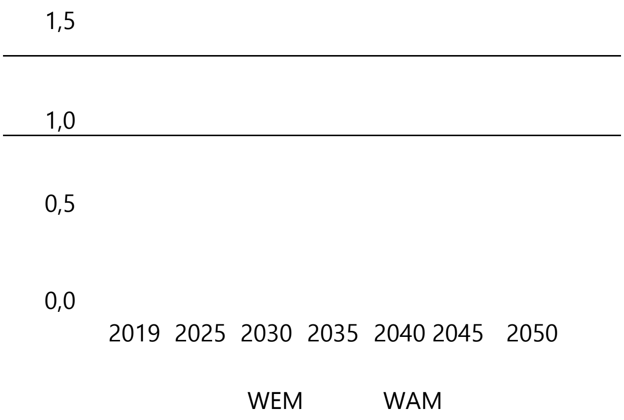
In the WAM scenario, emissions will decrease more significantly around 2035, when several new technologies are expected to increase availability and scale up. After 2035, the introduction of additional measures will continue only in livestock production. In particular, the application of 3-NOP as an additive or the neutralisation of methane with a ZELP-type device are among the most important measures in terms of emissions savings. There will also be application of manure management measures (such as anaerobic digestion or daily manure treatment in pigs) after 2030.

Overall, the WEM scenario will reduce emissions by 14 % by 2050. Crop production (22.5 %) will account for a higher share of this reduction, less will be accounted for by livestock production (9.4 %). By contrast, in the WAM scenario, emissions from animal production will decline more strongly (38.8 %), where the impact of additional measures is higher than in crop production (40.8 %). In the WAM scenario, total emissions from agriculture will be reduced by 39.5 % by 2050.

Figure 77: Emissions from plant production by 2050 (in Mt CO2-eq.)

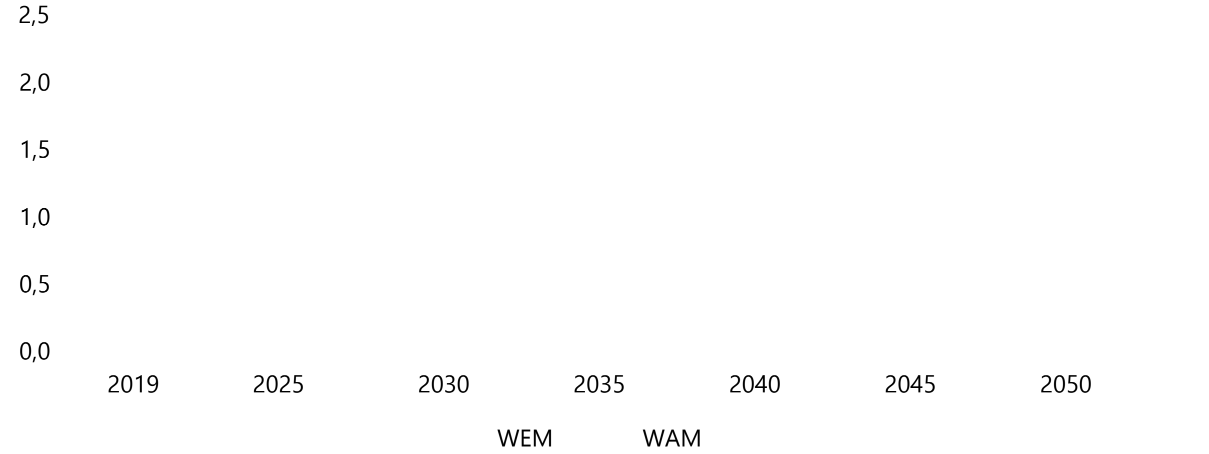
Source: IEP

Figure 78: Emissions from livestock production by 2050 (in Mt CO2-eq.)



Source: IEP

Figure 79: Emissions from agriculture by 2050 (in Mt CO2-eq.)



Source: IEP

LULUCF by 2030

The LULUCF sector is the only sector that captures more emissions than it will emit. In 2 019.5515 kt CO2 equivalents were captured in the LULUCF sector,[84]equivalent to about 13.9 % of Slovakia's total greenhouse gas emissions. The largest share was forest and forest land (68.7 %). Emissions were also captured in arable land, mainly in permanent crops (19.7 %), wood products (4.5 %) and the conversion of arable land use and other land without vegetation into permanent grassland (1.7 %)[85]. On the contrary, the residential and other land sectors have emitted more emissions than they captured.

Historically, reforestation rates are most affected by the amount of natural sinks. Sinks make up the

[84]Based on SHMÚs included in the 2023 emission inventory
[85]These figures exceed 100 % intentionally, as the remaining sectors generate emissions that add up to 100 % in total

difference between the amount of carbon captured in the annual increment of woody biomass and its amount harvested in the context of reforestation. Given that biomass increment depends on the age and species structure of the forest, interventions and measures in this area have a long-lasting impact. Furthermore, the amount of sinks depends on the way the land is used, with Slovakia the most carbon per hectare being captured on forest land, less as a result of grassing and the lowest sink rate per hectare with agricultural land (arable land and permanent crops).

Figure 80: LULUCF emissions 1990-2021 (Mt CO2 eq.)

Source: SHMÚ

Significant increases in removals are difficult to achieve in the short and medium term without reducing logging. In addition to forestry adjustments, the main sources of potential increases are mainly conversions between land-use categories, i.e. changes in the type of use, which, however, face constraints in agricultural production. In order to achieve changes in the way land is managed (e.g. less deep ploughing or setting up agroforestry systems), training for farmers in this area and possible financial or non-financial incentives are needed. Complex land ownership relationships and lack of incentives (no interest) for owners to change use are also a problem.

At European level, the LULUCF Directive (2023/839) was adopted in 2023, with a target for Slovakia to increase sinks by 504 kt in 2030, compared to the average of 2016-2018. This target is also accompanied by milestones, the fulfilment of which has been continuously assessed in recent years. In Slovakia, measures related to agricultural soils are currently supported to a lesser extent by the Common Agricultural Policy. In the area of forests and forest land, support is based on the National Forest Programme.

Greenhouse gas emissions projections in LULUCF by 2030

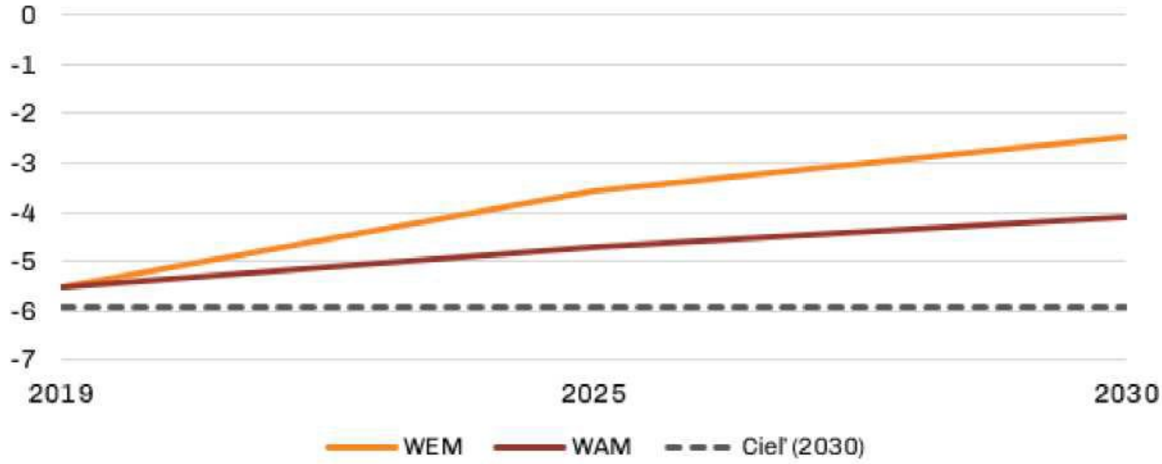
The LULUCF sector is specific in that it only reports the amount of emissions captured in a given year and does not take into account the increments or captured carbon from previous years. At the same time, even without the application of measures, the quantity of seizures varies over time. The WEM scenario is produced in cooperation with SHMÚ, NLC and NPPC and we consider it as a reference. Its basic prerequisite is the maintenance of historical trends and practices in reforestation and conversion of land use categories.

The WAM86 scenario will increase sinks by around 1 600 kt by 2030, mainly due to a decrease in forest harvesting of around 7 % in 2030. A moderate effect is also the expansion of close-to-nature forest management and a higher proportion of non-intervention areas in national parks. Measures are also being introduced in the field of arable land and timber products, which, however, have a significantly lower overall effect. Despite the application of these measures, Slovakia is not in a position to approach

86Also referred to as WAM B

the 2030 target set in the LULUCF regulation.

Figure 81: LULUCF emissions by 2030 (Mt CO2 eq.)



Source: IEP, SHMÚ, NLC

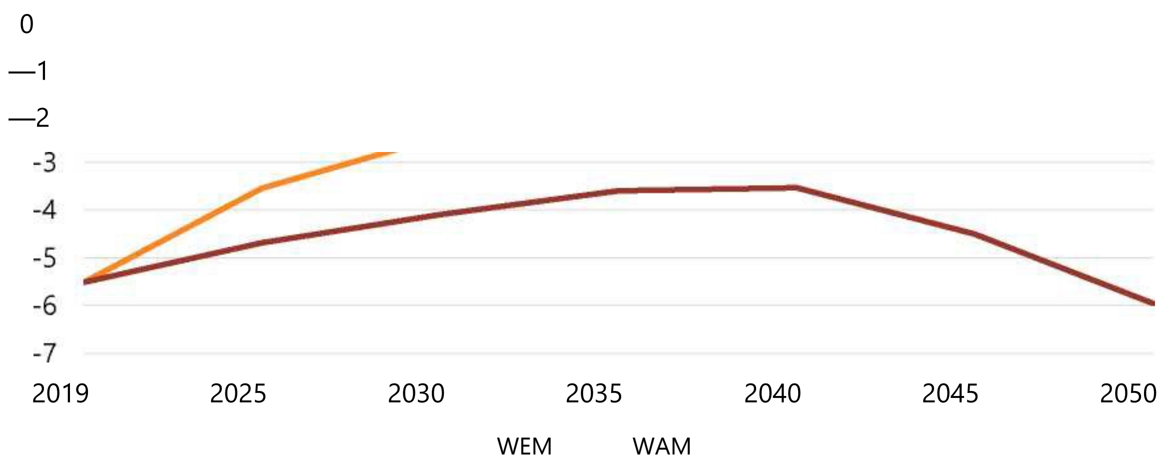
Greenhouse gas emissions projections in LULUCF by 2050

After 2030, the decline in sinks will continue in the WEM scenario until 2040, mainly due to a lack of carbon sink capacity in forest stands and a high rate of restoration of forests that are in good ruby times. In the other categories, seizures will remain at approximately the same level.

In the WAM scenario, measures such as changes in cattle grazing or the planting of higher-priced leguminous crops will start to be applied more widely after 2030. At the same time, they also offer a relatively large potential for increasing sinks outside forest stands. In the forest and forest land category, a similar harvest rate will continue to be achieved until 2030, but other measures based in particular on the National Forest Scheme, such as mixed forest planting, will be progressively more extensively applied.

By 2050, the application of decarbonisation measures will bring the rate of sinks back to around 2019 levels in the WAM scenario. Around 4 700 kt CO2 equivalents are captured annually by around 4 700 kt CO2 equivalents compared to the WEM scenario.

Figure 82: LULUCF emissions by 2050 (Mt CO2 eq.)

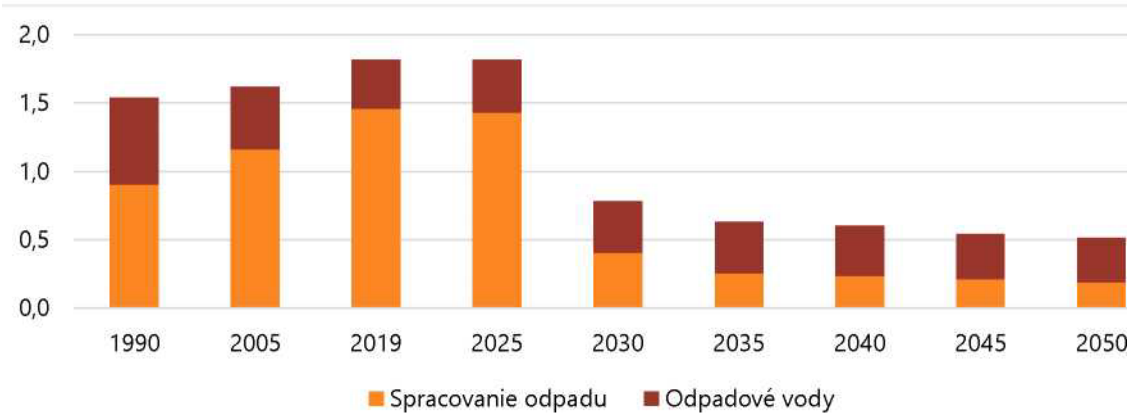


Source: IEP, SHMÚ, NLC

Projections of emissions in the waste sector

In the waste sector, emissions come mainly from methane in landfilling and waste water treatment, while the projected amount of waste is growing as GDP per capita grows. The main measure is the introduction of quantitative collection of municipal waste leading to increased recycling, diversion from landfilling and reduction of emissions.

Graf 83: Emisie skleníkových plynov z odpadov (WAM, v Mt CO2 ekv.)



Projections of emissions from non-EU ETS sectors (road transport, buildings, non-ETS industry, agriculture and waste)

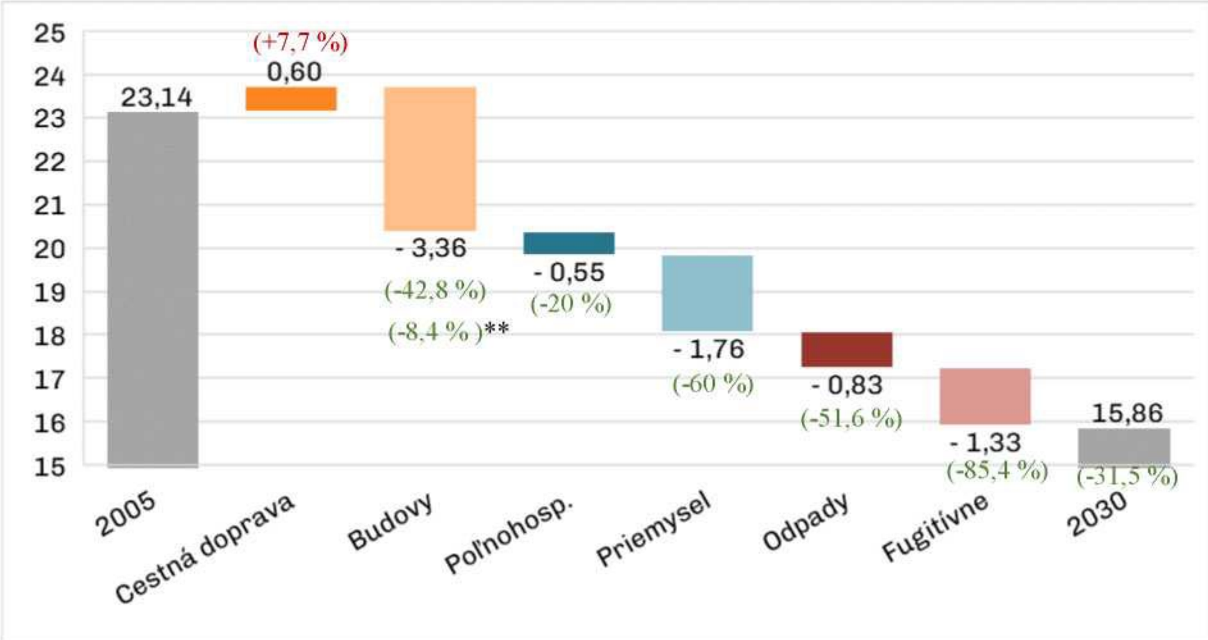
The legislative framework for Member States' effort sharing to reduce greenhouse gas emissions is divided over the period from 2013 to 2020 and from 2021 to 2030. The basis for the second period is Regulation 2018/842 of the European Parliament and of the Council on binding annual greenhouse gas emission 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 (the so-called Effort Sharing Regulation – ESR). National targets are to ensure that greenhouse gas emissions are reduced at European level by 10 % by 2020 and by 30 % by 2030 compared to 2005. These targets cover emissions from most sectors not covered by the EU Emissions Trading System (EU ETS) include: transport, buildings, non-ETS industry, agriculture and waste.
However, in the context of increasing the EU-wide target for reducing greenhouse gas emissions by 55 %, Regulation 2018/842 was revised by Regulation 2023/857, where one of the main changes is to increase national reduction targets. **The current commitment of the Slovak Republic represents a 22.7 % reduction in emissions in the** sectors falling within the scope of the Regulation. For the period from 2013 to 2020, the Slovak Republic has met all the annual limits and thus the target set for 2020.

The modelling in the WAM scenario showed the possibility of reducing non-ETS GHG emissions by 31.5 % in 2030 compared to 2005, should the reduction assumptions of these emissions by sectors covered by the ESR be fulfilled as follows:

- the**road transport sector** does not exceed a 10 % increase in emissions compared to the 2005 reference year by 2030;
- the**buildings sector** will reduce emissions by 43 % by 2030 compared to the 2005 reference year;
- the**agricultural sector** will reduce emissions by 20 % by 2030 compared to the 2005 reference year;
- the**waste sector** will reduce emissions by 51 % by 2030 compared to the 2005 reference year;
- the**industrial processes and solvent use sector**, including fluorinated greenhouse gases, will reduce emissions by 45 % by 2030 compared to the reference year 2005;
- **fugitive emissions** will be reduced by 85 %.

Realising non-ETS emission reductions requires the adoption of ambitious policies and measures in these sectors. The take-up of electric cars, insulation of buildings, and electrification across sectors are important measures to achieve this. The introduction of an emissions trading scheme for buildings and transport (ETS2) from 2027, with an estimated price in 2030 of around EUR 59.2 per tonne of carbon, is also an essential measure.

Figure 84: ESR change in emissions by sectors in 2030 compared to 2005 (in Mt CO2-eq)



Source: IEP according to the CPS model

* 2005 reference value obtained by calculation (modelling)

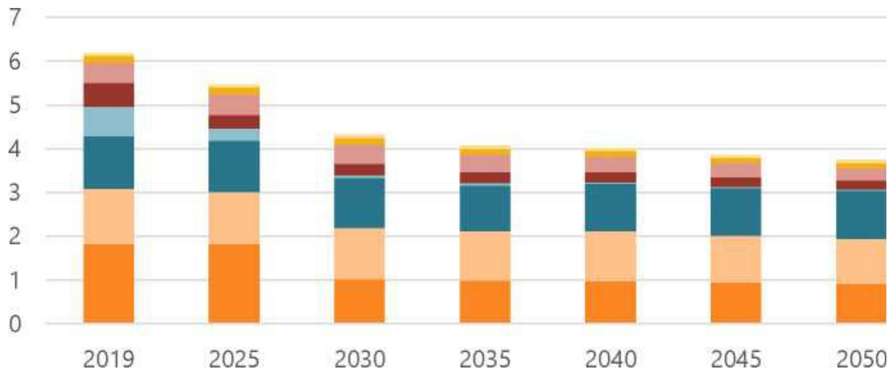
** Versus average 2018-2020

Projections for the evolution of Non-CO2 emissions in light of existing policies and measures up to 2030 (including projections up to 2050)

Table 52 and Figure 85 show the results of projections of Non-CO2 emissions through the CPS model (waste, fugitive emissions, other energy and industrial uses), the agricultural optimisation model and the expected impact of introducing new regulation for F-gases. These non-CO2 emissions are expected to decline across the sectors mentioned above for the future. In the WAM scenario (see Figure 77), this decrease is more pronounced than in the WEM scenario due to the implementation of more ambitious measures in sectors in terms of the policies and measures presented in Chapter 3. The most significant decrease in emissions compared to the current situation in both scenarios is expected for hydrofluorocarbons (HFCs). The use of HFCs is strictly limited by European legislation but also at global level (adding HFCs to the Montreal Protocol list of controlled substances). A more moderate decrease in emissions is also expected for NO_2 and CH_4 in the agriculture sector.

Table 52: Development of Non-CO2 emissions by 2030 (WEM, in Mt CO2-eq.)

Non-CO2	2019	2025	2030	2035	2040	2045	2050
Waste and waste water	1 816	1 817	1 008	990	966	939	910
Farmland (N2O)	1264,56	1203,57	1178,73	1130,79	1155,31	1072,24	1022,10
Farmland (CH4)	1196,20	1157,324	1143,772	1038,22	1071,28	1084,188	1105,172
F-gases	689	287,3204	62,92015	58,19096	42,28208	33,38526	28,93892



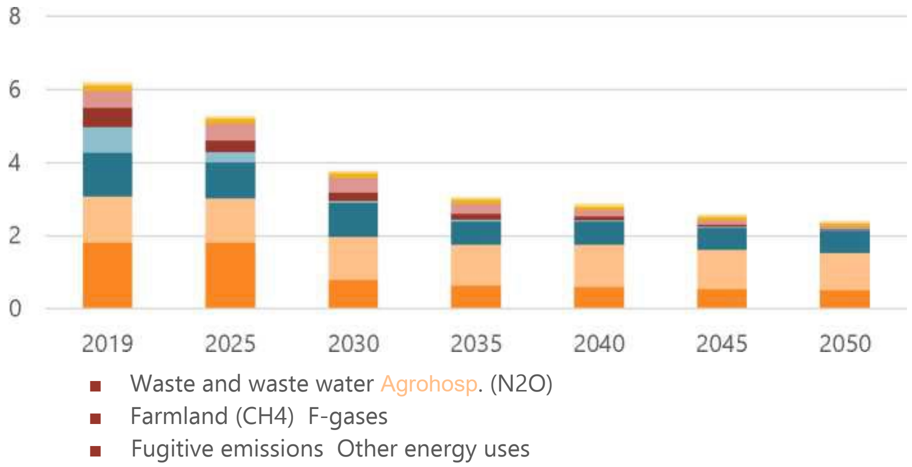
Fugitive emissions (CH4)	530	306	256	241	226	222	212
Other energy uses	463	458	439	397	356	313	274
Other industrial uses	155,0711	169,7191	154,2224	141,5688	131,8867	124,6705	119,3504
LULUCF	70,50	70,50	70,50	70,50	70,50	70,50	70,50

Figure 85: Non CO2 emissions (WEM, in Mt CO2 eq.)

Waste and waste water
Agrohosp. (CH4)
Fugitive emissions (CH4)
Other industrial uses
Agrohosp. (N2O)
F-gases
Other energy uses LULUCF

Source: IEP under CPS

Figure 86: Non CO2 emissions (WAM, in Mt CO2 eq.)



Source: IEP under CPS

4.2.2. Renewable energy

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

The current share of RES use since 2019 is shown in the table below:

Table 53: Current share of energy from renewable sources in gross final consumption of energy

	2019	**2020**	**Year 2021**	**2022**
Renewable energy sources – heating and cooling87 (%)	19,7	19,4	19,5	19,9
Renewable energy sources – electricity generation88 (%)	22,1	23,1	22,4	22,9
Renewable energy sources – transport89 (%)	8,3	9,3	8,8	8,9
Overall share of renewable energy sources90 (%)	**16,9**	**17,3**	**17,4**	**17,5**
*Of which the cooperation mechanism is*91 *(%)*	0	0	0	0
*Surplus for cooperation mechanism*92 *(%)*	0	0	0	0

Slovakia has met the binding RES target of 14 % for 2020. The share of RES in gross final energy consumption reached 17.3 % in the assessment year.

The proposal submitted to the European Commission in December 2018 proposed Slovakia's contribution to the 2030 RES target of 18 %. Taking into account the need to increase ambition in RES and based on the PRIMES-EUCO model scenario, which showed the possibility of achieving a RES share of 19 % in 2030 as well as taking into account other additional factors, the approved plan raised the RES target to 19.2 %.

Based on the increased ambition for greenhouse gas emission reduction policies, new modelling took place in 2023 with the PRIMES model. Preliminary results have shown that in order to achieve these greenhouse gas emission policies, it is necessary to increase the share of RES to between 23 % and 25 %. On the basis of these preliminary modelling results, the Slovak Republic determined the share of RES under Chapter 2.1 as its RES contribution to decarbonisation.

87Share of renewable energy in heating and cooling: gross final consumption of energy from renewable sources for heating and cooling (as defined in Article 5(1)(b) and Article 5(4) of Directive 2009/28/EC) divided by gross final consumption of energy for heating and cooling. The procedure is the same as that applied in Table 3 of the NREAP.

88Share of renewable energy in electricity: gross final consumption of electricity from renewable sources (as defined in Article 5(1)(a) and Article 5(3) of Directive 2009/28/EC) divided by gross final electricity consumption. The procedure is the same as that applied in Table 3 of the NREAP.

89Share of energy from renewable sources in transport: final energy from renewable sources consumed in transport (see Article 5 paragraph.
1(c) and 5(5) of Directive 2009/28/EC) divided by the transport consumption of 1. petrol; 2. Diesels; (3) biofuels used in road and rail transport and (4) electricity in land transport (as shown in row 3 of Table 1). The procedure is the same as that applied in Table 3 of the NREAP.

90Share of renewable energy in gross final energy consumption. The procedure is the same as that applied in Table 3 of the NREAP.

91In percentage point of overall RES share.

92In percentage point of overall RES share.

Analysis of the current situation and potential for the future

Hydroelectric plants

Water energy use has a long tradition in Slovakia. 25 large hydropower plants above 10 MW are in operation, of which 4 hydropower plants have pumped capacity and whose operation is necessary to cover daytime peaks and provide ancillary services (PpS). The technically usable potential of hydropower plants in Slovakia is 6 683 GWh and is currently used at around 65 %, while the possibilities for the construction of large hydropower plants with installed capacity above 10 MW are limited. Slovakia currently has 1 629 MW installed hydropower capacity and 916 MW installed hydro-pumped capacity.

In the category of small hydroelectric power plants with an installed capacity of up to 10 MW, no incentive for the construction of a new MEE has been submitted for the environmental impact assessment since 2021. By 2030, the renovation of existing and the construction of new MVEs can be envisaged, resulting in an increment of 20 MW of installed capacity.

From the perspective of large hydropower plants with installed capacity above 10 MW, there is one project in the EIA – Čunovo II hydropower plant. For this VPP, the installed capacity of 14 MW is calculated and construction starts in 2028. In addition to this VPP, it is also desirable to exploit the potential of upgrading existing VPPs (the so-called "Gabčíkovo cascade") in order to increase installed capacity and exploit the potential for providing support services. The efficient use of the potential of large TEs is also important due to the increasing demand for electricity for heating and cooling, in particular through heat pumps.

Looking ahead to 2030, it can be noted that the construction of other hydropower plants will be severely restricted, both due to the maximum use of the effective potential of watercourses and to the environmental impacts of these hydropower works. Further increases in installed capacity and production from VPP will mainly take the form of their reconstruction or modernisation.

Geothermal energy

Geothermal energy has the second largest energy potential examined in Slovakia, amounting to 48 500 GWh. The technical potential is around 6 300 GWh. The increased development of these RES technologies is particularly hampered by the high investment costs associated with geothermal exploration, administrative barriers linked to environmental impact assessments and time-consuming other administrative and permitting processes. The estimated contributions (installed capacities, gross amount of each RES technology, i.e. including geothermal energy are presented in Table 10 (Estimated contributions per RES technology in electricity generation 2023-2030) and Table 11 (Estimated contributions per RES technology for heating and cooling over the period 2023-2030 (ktoe).

Geothermal energy means all energy below the earth's surface. In Slovakia, apart from heat pumps that use shallow heat, this energy is also explosioned by deep geothermal wells. Deep geothermal energy sources are mainly represented by geothermal waters, which are linked to hydrogeological aquifers located (outside natural credit areas) at depths of 200-5 000 m. The potential of geothermal energy is unevenly distributed in Slovakia due to different geological conditions, meaning that some bodies have a higher potential to use it than others. 282 geothermal wells are drilled in Slovakia, with a depth of 92-3 616 metres, and 31 prospective geothermal areas and possibly geothermal water bodies are currently designated under the Water Framework Directive. Currently, 122 wells are active in the use of geothermal energy in Slovakia, with an estimated amount of heat used from geothermal energy of 367-486 GWh per year.

Support for the prospection and exploration of geothermal energy resources with a view to making them available for energy purposes is also included in the Slovakia Programme. In particular, the objective of this measure is to support exploration wells, which are the riskiest part of the geothermal resource investment. In accordance with the Slovak recovery and resilience plan (REPowerEU component 19 – Reform 1 Promotion of sustainable energy – Sub-measure 3 Improving the use of geothermal energy), at least 60 geothermal wells shall be passported. This will ensure public access to geothermal site information at

Slovakia.

The most important geothermal energy project in Slovakia is the national project 'Use of geothermal energy in the Košice Basin', funded by the Just Transition Fund.

This project is the most important geothermal energy use project for heating in Slovakia. The geothermal area located in the cadastre of the municipalities of Ďurkov, Svinica, Olšovany and Bidovce has a depth of 2100-3 200 metres of water with a temperature of up to 135 °C, making it one of the best geothermal zones in Slovakia. The main objective of the project is to exploit the potential of geothermal energy in the Košice Basin and bring heat from geothermal wells (in the municipality of Ďurkov, ca. 15 km) to the hot water district heating network in Košice. The projected installed capacity of the new geothermal resource is around 30 MWt, producing approximately 180 GWh of heat per year. This represents almost 25 % of the total energy supplied to the basket heating plant. The overall share of renewables in the production of heat for Košice will increase up to 42 % through the implementation of this project.

The start of the plant in Ďurkov is foreseen during 2027, with a gradual increase of the thermal output from 15 MW to 30 MW, with the project having the potential to create the preconditions for the use of up to 100 MW of thermal energy in the future. This would increase the share of heat generation from geothermal energy for Košice to up to 50 % in the medium term. The residual heat could be used for agricultural, recreational and other purposes in municipalities along the 15-kilometre hot-water route, from Ďurkova to Košice.

Currently, geothermal power generation facilities are designed:

- in Prešov with a planned 20 MW installed capacity,
- in Žiari nad Hronom with a planned installed capacity of 20 MW.

Solar energy – PV

The total installed capacity of solar power plants reached around 850 MW in 2023 and exceeded 1 GW in 2024.

Since 2019, there has been a large increase in photovoltaic installations, mainly linked to the interest in the use of businesses in the form of local resources and the gradual increase of smaller installations (small sources) by households. Since April 2021, when the footprint was released, investors have booked around 577 MW of grid connection permits.

Photovoltaics with battery storage of electricity are expected to develop in the coming years. This will be the case, in particular, for installations where electricity will be consumed at the place of production in households and businesses, with the greatest potential for location being:

- rooftop installations (manufacturing halls, households and public sector)
- ground installations on degraded and unmanaged land;
- agrivoltaic to enable the use of agriculturally active areas.

The mandatory deployment of solar photovoltaic and solar thermal technology in buildings after 2026 will contribute to the use of renewable energy in this sector. The support mechanisms for the installation of photovoltaic panels for households are:

- Green households; and
- home Renovation Programme.

For businesses, investment support will focus on the joint construction of these facilities with electricity storage to cover self-consumption.

A prerequisite for maximising the use of photovoltaics is their ability to integrate them effectively into the electricity grid, which entails the need to adapt and strengthen the electricity system so that it can provide capacity for these energy sources. An annual installation of 100 MW is expected.

Moreover, the speed of development of commercial resources that feed power directly into the grid will depend in particular on the ability to increase the flexibility of the electricity system through battery storage sites, demand management and smart grid management.

Wind energy – onshore

At the end of 2023, the Slovak Republic has 3 MW installed wind turbine capacity in the form of 5 installed wind turbines:

- Cerová wind power plant with 4x660 kW installed capacity
- The Ostrý Hill wind power plant, with an installed capacity of 500 kW.

Since the release of the 'footprint' in 2021, interest in the construction of wind farms and parks has restarted. This development is also facilitated by advances in technical and technological solutions for wind turbines, whose unit installed capacity is constantly increasing. More than 20 intentions are currently in the permitting process with a total installed capacity of more than 1 400 MW.

The development of wind energy also includes the creation by 2026 of two 'pilot acceleration zones' for wind energy development (renewable acceleration areas for wind energy), which will allow faster permitting and construction of wind farms. Under component 19 of the RRP, wind energy development will also be supported through a new methodology for the identification of areas suitable for wind energy use, acceleration of permitting processes (in particular EIA) and possible investment support from the RRP, or other financial mechanisms (Modernisation Fund, ESIF).

The development of the methodology is in line with the requirements of RED III, which requires in particular the mapping and designation of acceleration zones considered particularly suitable for the development of one or more RES, while speeding up the permitting procedure.

Forward-looking renewables acceleration areas for wind energy:

1. areas with identified renewable energy needs (electricity, renewable gas), i.e. areas where energy-intensive industries are located and whose replacement for renewable energy sources will significantly contribute to the decarbonisation objectives;
2. areas where there is adequate wind potential – identified on the basis of existing data;
3. areas with appropriate infrastructure and transport availability.

If sufficient electricity grid capacity is not available and the areas meet the first two points, the designation of that acceleration area will be linked to the realisation of sufficient capacity building.

Renewables acceleration areas for wind will not include:

- areas excluded from RES acceleration, such as Natura 2000 sites and other protected areas of national and international importance;
- areas unsuitable for the use of wind energy from the point of view of State security and defence.

The size of the acceleration area should ensure more significant installed capacity (min. 100 MW) of wind farms. At the same time, it is appropriate to take into account the multi-purpose use of territories, e.g. a combination of RES and industry or RES and agriculture.

The Perpecutive Areas for mapping the areas needed for national contributions for wind power are mainly located in Trnava, Nitrianski and Košice Self-governing Regions.

In December 2023, Slovakia joined the European Wind Charter, which includes, inter alia, the acceleration of permitting processes and the commitment of Member States to build new capacities.

The current interest of investors in constructing and designating an acceleration area for wind energy gives a realistic expectation that wind farms with a total installed capacity of 750 MW will be able to become operational by 2030.

Biomass – solid biomass fuels, biogas/biomethane

Solid biomass was key in meeting Slovakia's overall renewable energy target of 14 % by 2020. In 2022, Slovakia had 201 MW installed capacity of biomass and biogas energy installations. In 2014, more than 140 biogas plants were active. Despite the gradual release of the 'footprint', no new equipment connected to the network has been added to this day and the new installations are exclusively for local use. Plans for new biogas plants are currently under preparation and several biogas plants are in the process of being transformed into biomethane production, two of which are due to start operations in the coming years.

Biogas/biomethane – state of play

Biogas in Slovakia:
In Slovakia, there are about 100 biogas stations with a total capacity of approximately 103 MW with a production potential of 810 GWh of electricity. Most of them focus on electricity generation from the processing of maize silage. The vast majority of biogas plants – more than 70 – have installed capacity in the range of 0.9-1.0 MW. According to the analysis of SPP – Distribution a.s., around a third of them have the possibility to connect to high pressure and around the same number have the potential to connect to medium pressure.

In addition, 52 anaerobic biogas stations are built in Slovakia to stabilise sewage sludge.

Biomethane in Slovakia:
Biomethane production is not sufficiently developed. Additional units are considered after the start of the first production facility in Jelsave.

Biomethane production target for 2030:
The ambition is to produce 300 million m³ of biomethane by 2030

Commission recommendation:
Include further measures to promote the sustainable production of biomethane, given Slovakia's sustainable biogas/biomethane potential and production, profile of natural gas consumption and existing infrastructure, digestate use and biogenic CO2 applications.

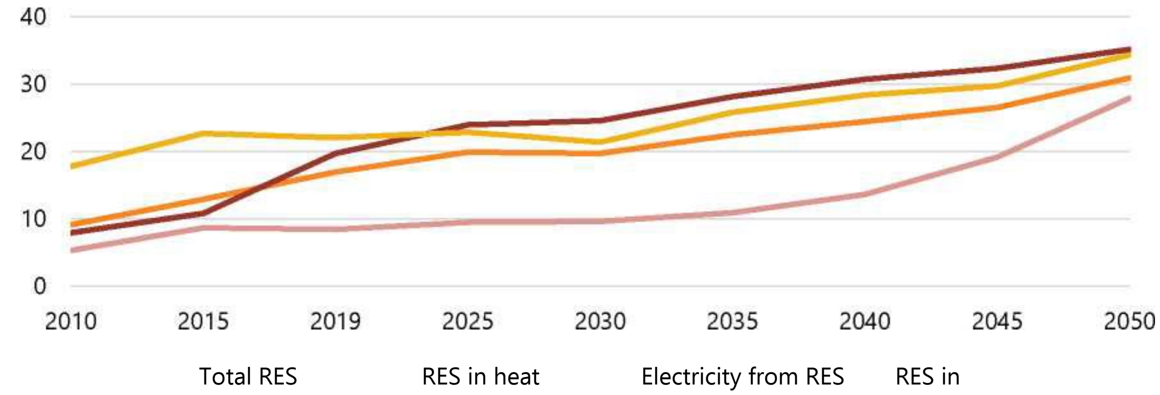
Several projects are currently under preparation, including new biogas plants in Leopoldov and Žiari nad Hronom, and an increase in the installed capacity of an already existing biomethane plant in Jelsha. The conversion of currently active biogas stations into biomethane stations is also planned. The biomethane produced will be used mainly as a fuel in heating plants in high-efficiency combined electricity and heat generation, to a lesser extent in transport.

Existing biogas plants with 30 % VTL connection potential can produce around 64 million m³ of biomethane. Existing biogas plants with 60 % potential to connect to VTL and STL can produce approximately 127 million m³ of biomethane.

In order to achieve the 2030 targets, it is appropriate to start investing in the development of new biomethane production facilities as soon as possible. The physical construction of the biomethane source takes one year.

II. Indicative projections of development with existing policies for the year 2030 (with an outlook to the year 2040)

Figure 87: Indicative trajectory taking into account existing policies and measures (WEM



Source: IEP under CPS

4.3. Dimension: energy efficiency

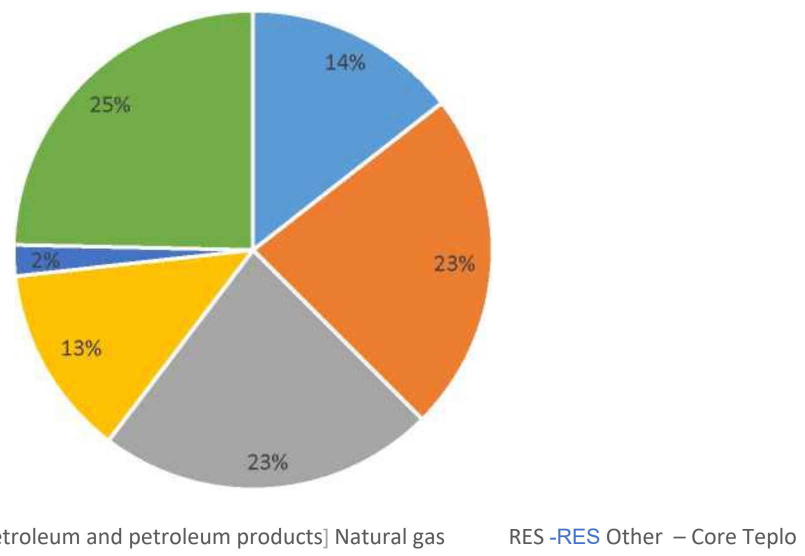
i. Current primary and final energy consumption in the economy and per individual sectors (including industry, households, services and transport)

Slovakia's energy intensity has been on a declining trend in recent years. Significant progress in reducing energy intensity is evidenced by its development between 2000 and 2015, when, according to Eurostat data, Slovakia reduced energy intensity by 50.8 %. This positive development is the result, inter alia, of successful industrial restructuring, the introduction of low-energy production processes in industry, the improvement of the thermal performance of buildings and the replacement of appliances for more cost-efficient purposes. Despite this, the Slovak Republic nevertheless has the seventh highest energy intensity based on constant prices in the EU-27. This is mainly due to the structure of industry in Slovakia, where energy-intensive industries account for a large share, so energy efficiency measures, including sources of financing, will in the future also focus more strongly on industry and downstream services, including energy. Slovakia's priority in the field of energy efficiency is to further reduce the energy intensity of the Slovak economy in order to reach the level of the European average.

The Slovak Republic has transposed the entire strategic and legislative framework of the European Union in the field of energy efficiency into the national strategic and legislative framework.

Primary energy consumption for 2022 was 16618 ktoe, of which natural gas, core heat, oil and petroleum products accounted for more than 70 %. The rest consisted of renewables, fossil solid fuels and non-renewable waste.

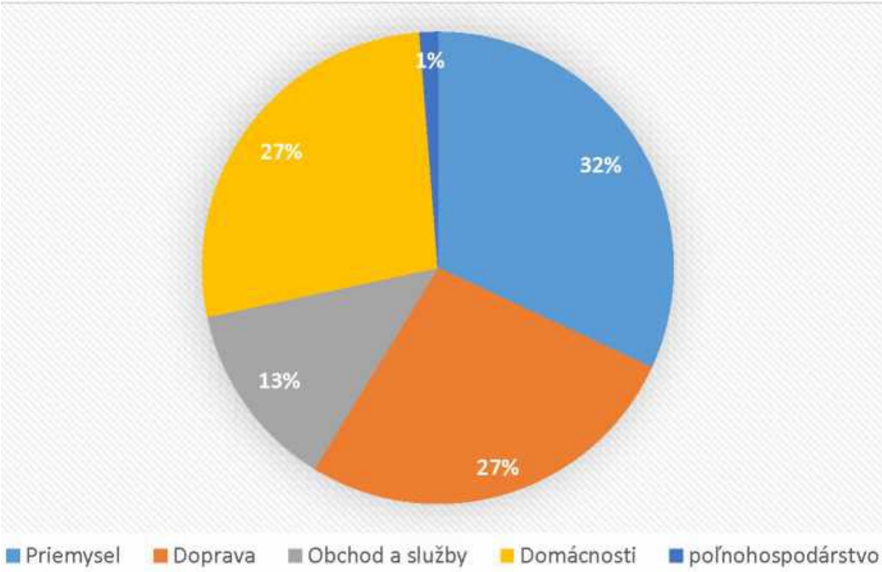
Figure 88: Primary energy consumption 2022



Source: Eurostat

In 2022, final energy consumption was 9915 ktoe. With the exception of 2020, this is the lowest consumption since 2017 (inclusive). The decrease compared to 2021 occurred in all sectors, with the exception of transport, which saw an increase of less than two per cent. The strongest decline, over 9 %, was recorded in the trade and services sector and in the household sector. Industry consumption decreased by 6.3 %.

Figure 89: Final energy consumption 2022



Source: Eurostat

ii. Current potential for high-efficiency cogeneration and efficient district heating and cooling93

The greatest potential for additional high-efficiency cogeneration is in the existing CZT systems, which provide heat supply to final customers. The further development of these CZT systems is limited by the demand for useful heat within the range of existing heat networks. A significant increase in the supply of heat from these installations is not envisaged in the coming years. The potential increase in relation to the development of supply areas will be largely covered by the projected reduction in the supply of existing heat customers and by the reconstruction and modernisation of the existing CZT systems.

Based on the actual energy balances of heat sources in individual districts of the Slovak Republic (annual heat production and supply split for heating and hot water) until 2030, there is a potential for additional construction of new CHP installations with a total installed electricity capacity of 128 MWe.

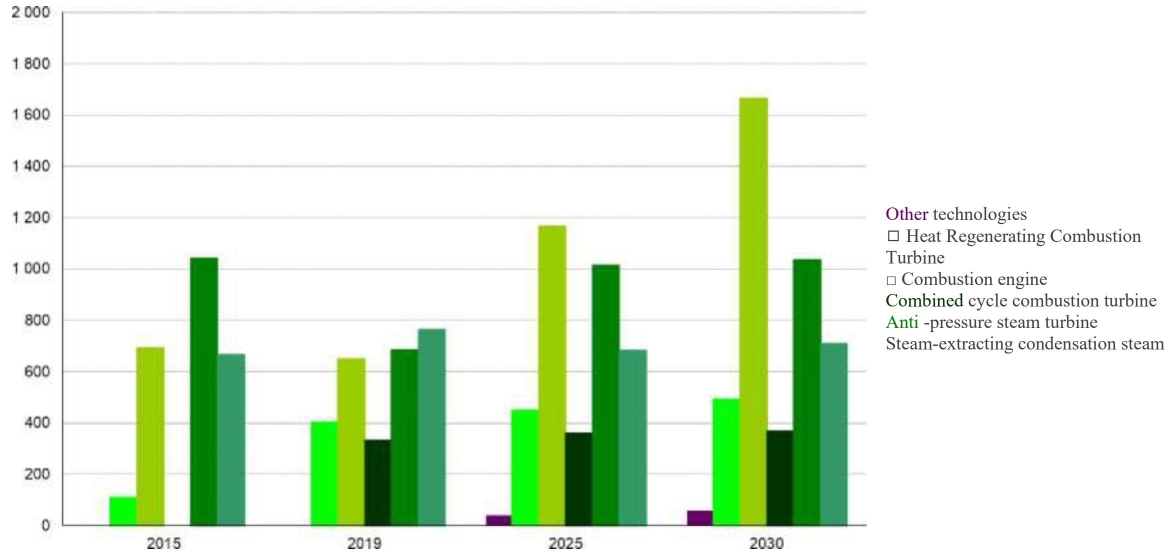
The greatest use of the technical potential of high-efficiency cogeneration is expected to occur mainly in the heat generators segment of heating plants and central boiler plants in which natural gas is combusted using cogeneration technology with an internal combustion engine by replacing or complementing separate production with cogeneration. In large power cogeneration plants with steam and combustion turbines, only a slight increase is foreseen, which will be achieved through necessary reconstructions of existing cogeneration technologies.Current and projected electricity generation by type of cogeneration technology is shown in Graph 81.

Combined heat and power technology for very small and small-scale power with combustion engines running on natural gas or renewable gas has the greatest potential, namely 70 MWe.

The estimation of this potential is based on the assumption that the internal combustion engine technology is suitable for the installation of a heat pump and can provide ancillary services in aggregation.

93In accordance with Article 14(1) of Directive 2012/27/EU.

Figure 90: Existing and projected electricity generation in the high-efficiency cogeneration process (GWh)



Source: SIEA

A methodology has been used for CBA processing in line with the requirements of Part III of Annex X to Directive 2023/1791.

The decisive factors affecting the CBA are the price of fuels and the price of emission permits. From a society-wide perspective, the CBA demonstrated the need to continue creating the conditions for the development of high-efficiency cogeneration in Slovakia.

iii. Projections taking into account existing policies, measures and programmes aimed at energy efficiency as described in point 1.2(ii), primary and final energy consumption in each sector at least until 2040 (including projections for 2030)94

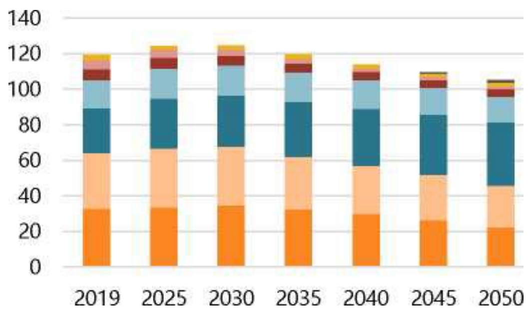
Baseline scenario (WEM)

In the baseline scenario, final energy consumption is expected to increase to 10716 ktoe and primary energy consumption to 18038 ktoe in 2030. A slight increase in final consumption of natural gas (+ 6 %) and oil (+ 6 %) will be accompanied by an increase in electricity consumption (+ 15 %). The decrease in solid fossil fuel consumption is estimated by 30 % compared to 2019. All sectors will see an increase in final energy consumption, with the slowest growth expected in industry (+ 2 %) and most important in transport (+ 10 %). Emissions in the ETS sector will decrease by almost 17 % compared to 2019 and decrease by around 7 % in the ESR sector.

The scenario projects an increase in the number of electric cars to around 50 thousand by 2030, equivalent to five times the value in 2023. The pace of achieving energy savings in industry by 2030 will be in line with the pre-pandemic pace. In the household sector, the current high pace of renovation of multi-apartment buildings is expected to slow down. For single-family houses and buildings in the services and trade sector, the low renovation rate to date will continue.

94This reference forecast of the unchanged energy developments in 2030 as described in point 2.3 and for the conversion factors.

Figure 91: Final energy consumption (WEM, in TWh)

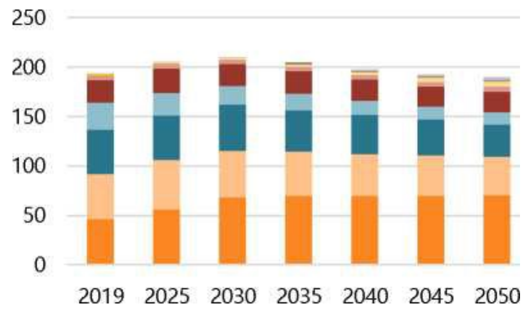


—Hydrogen and Synthetic Gases
□ Solid fossil fuels
-Renewables and waste

Derivative gases
Teplo and water vapour
-Electricity

Source: IEP under CPS

Figure 92: Primary energy consumption (WEM, in TWh)



Nuclear energy
□ Ropa
—Biomass and waste
-Electricity
□ Geothermal Energy

Natural gas
□ Solid fossil fuels
Hydropower
Solar energy
Wind energy

Source: IEP under CPS

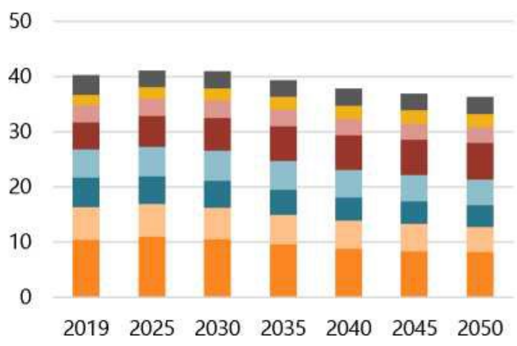
Final energy consumption by 2050

Industry

The WEM scenario leads to a reduction in final energy consumption in the most energy-intensive sectors. Final energy consumption will increase in the automotive, mechanical and food industries, which corresponds to the assumption of an increase in their sectoral value added. Overall, there will be an 11.3 % reduction in final energy consumption between 2030 and 2050. Without including the steel industry, final energy consumption would have decreased by 7.6 %.

After 2030, the WAM scenario continues to reduce final energy consumption in each industry sector. The increase will only come from 2045 in the steel industry, where the decarbonisation of the last of the blast furnaces requires a shift to direct reduction of iron with hydrogen. This would lead to an increase of around 37 % in final energy consumption in the steel industry. Overall, industry will see an additional 13.1 % reduction between 2030 and 2050. Without including the steel industry, final energy consumption would fall by 21.6 %.

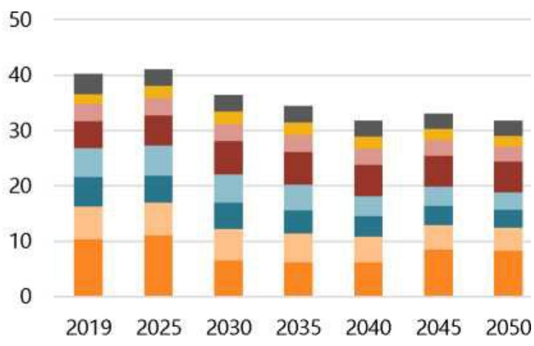
Figure 93: Fuel consumption by sector by 2050 (WEM, in TWh)



Steel
Chemical
Automotive and mechanical engineering
-Papieran
□ Construction
□ Manufacture of aluminium and alloys

Source: IEP under CPS

Figure 94: Fuel consumption by sector by 2050 (WAM, in TWh)

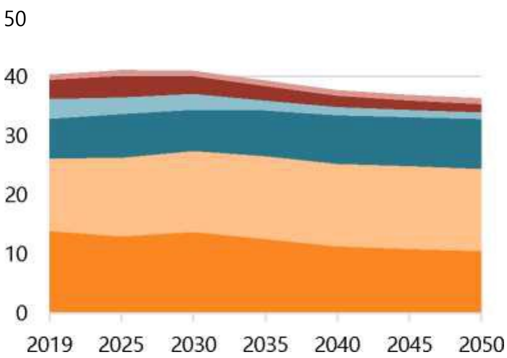


Steel
Chemical and petrochemical Automobile and mechanical
-Papieran
□ Construction
□ Manufacture of aluminium and alloys

Source: IEP under CPS

In terms of fuels used, the key difference is the stronger electrification in the WAM scenario leading to a complete phase-out of solid fuels and natural gas by 2050. The remaining amount of natural gas is replaced by hydrogen in 2050. In processes where electrification is not possible, in addition to the use of hydrogen, the use of biomass will also be increased. In the WEM scenario, changes in the fuel base are more moderate – partial electrification as well as a gradual decline in the share of solid fuels and petroleum products. Natural gas consumption will only decline slightly by 2050 compared to 2030 (by 23.5 %).

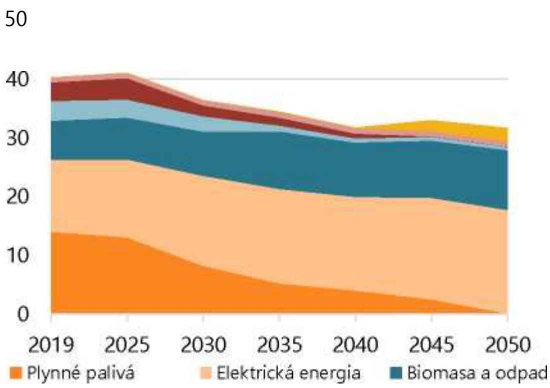
Figure 95: Fuel consumption in industry by 2050 (WEM, in TWh)



Gaseous fuels Electricity
—Biomass and waste -Petroleum products
-Fuel fuels Water vapour

Source: IEP under CPS

Figure 96: Fuel consumption in industry in 2050 (WAM, in TWh)



-Petroleum products -Fuel fuels Water vapour
-Hydrogen

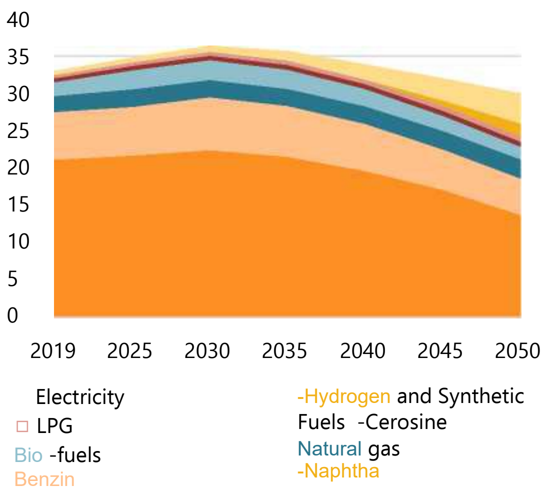
Source: IEP under

Transport

In the WEM scenario, there is an increase in the use of electricity in road transport after 2030, leading to improvements in energy efficiency. Compared to 2030, final energy consumption in transport will decrease by 17.6 % by 2050. There will be no significant reduction, in particular because of the assumption of an increase in living standards, resulting in higher activity (number of passenger-kilometres and tonne-kilometres), particularly in road transport.

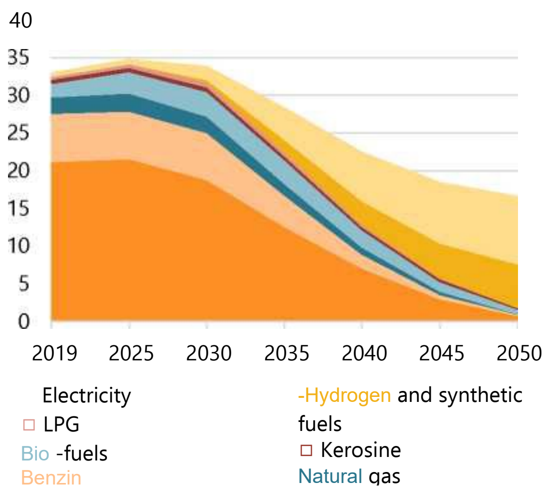
The WAM scenario expects transport to be almost fully decarbonised by 2050, implying a significantly higher use of electricity. However, in addition to battery drives, the use of hydrogen and synthetic gases, which do not deliver significant energy efficiency savings, will increase more. Compared to 2030, final energy consumption in transport will fall by 50.9 % by 2050.

Figure 97: Transport fuels by 2050 (in TWh, WEM scenario)



Source: IEP under CPS

Figure 98: Transport fuels by 2050 (in TWh, WAM scenario)



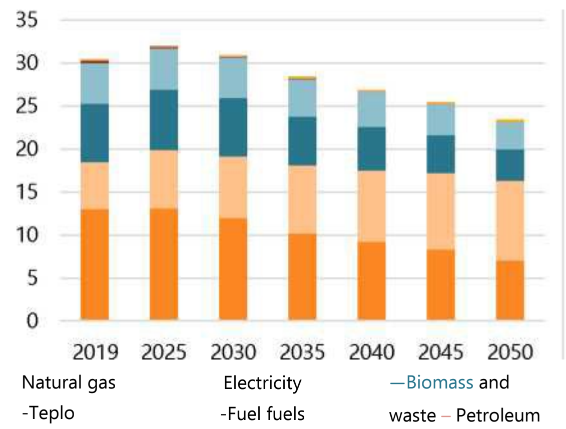
Source: IEP under CPS

Household

In the household sector, there will be an increase in the share of heat pumps in heating after 2030. In the WEM scenario, the share of useful energy obtained from heat pumps will reach 205 034.7 %, increasing to 50.6 % in the WAM scenario. The use of heat pumps will lead to partial savings in final energy consumption. These will be strongly supported, especially in the WAM scenario, by investments in improving the thermal characteristics of buildings. Household final energy consumption will decrease by 24.3 % between 2030 and 2050 in the WEM scenario and by 52.3 % in the WAM scenario.

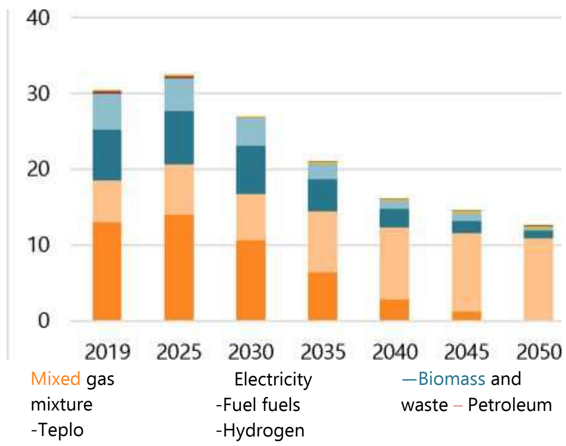
Before 2050, also, due to decarbonisation, there will be a complete deviation from natural gas in the WAM scenario, which will be replaced to a lesser extent by biogas and hydrogen, with the rest of the gas blend composed of synthetic gases, biogas and hydrogen. In the WEM scenario, the share of natural gas will also decrease significantly, in particular in favour of electricity. Due to the significant electrification of heating (notably through the use of heat pumps), both scenarios will reduce the use of biomass between 2030 and 2050. The WAM scenario will also significantly reduce the share of households heated through central supply.

Figure 99: Domestic fuels by 2050 (in TWh, WEM scenario)



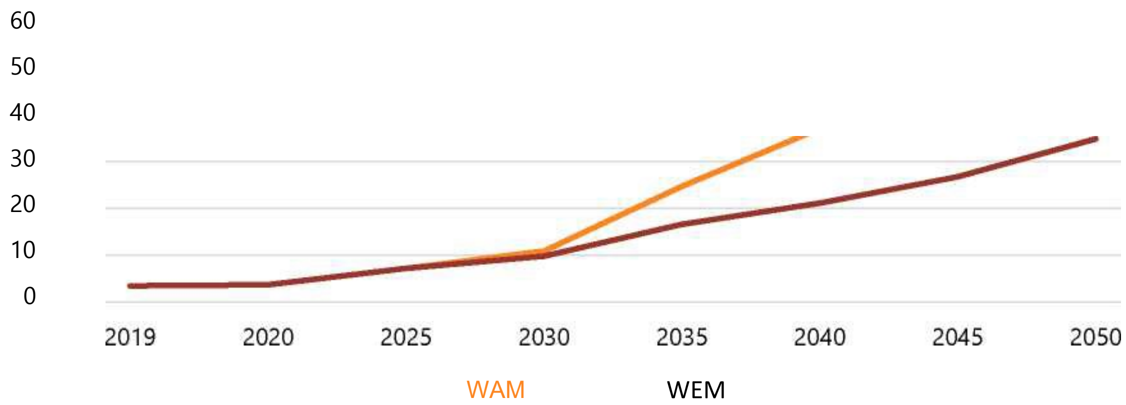
Source: IEP under CPS

Figure 100: Domestic fuels by 2050 (in TWh, WAM scenario)



Source: IEP under CPS

Figure 101: Share of useful energy from household heat pumps (%)



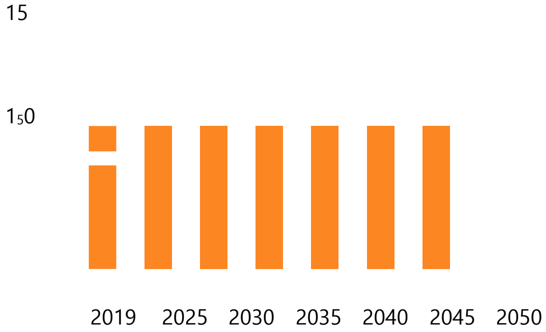
Source: IEP under CPS

Services

The service sector provides significantly less potential for improving energy efficiency than the household sector. This is largely due to the expected increase in the sector's share of total value added in the Slovak economy and, to a lesser extent, to a higher share of electricity in final energy consumption.

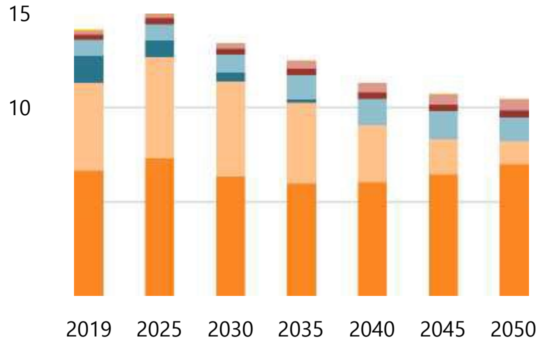
Increasing the share of heat pumps and improving the thermal performance of buildings will reduce final energy consumption by 2.3 % in WEM and 22 % in WAM between 2030 and 2050. As in households, there is a decline in the use of natural gas between 2030 and 2050 in the WAM scenario, the share of which is decreasing in the gas blend, with close to zero in 2050. In the WEM scenario, the share of natural gas remains broadly constant. The share of useful energy obtained from heat pumps in the WEM scenario will reach 205 023 %, increasing to 53 % in the WAM scenario.

Figure 102: Fuels in services by 2050 (in TWh, WEM scenario)



Source: IEP under CPS

Figure 103: Fuels in services by 2050 (in TWh, WAM scenario)



Source: IEP under CPS

Figure 104: Share of useful energy from heat pumps in services (%)

WAM WEM

Source: CPS

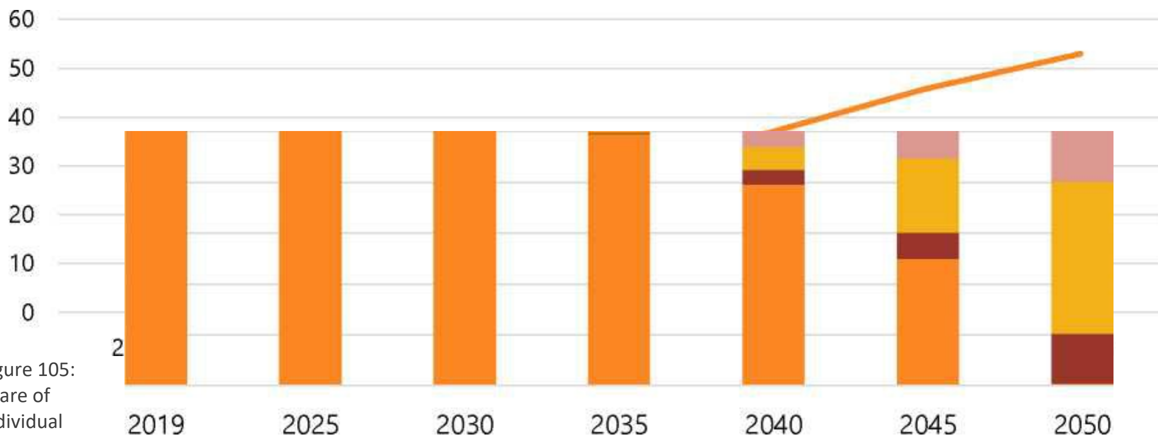
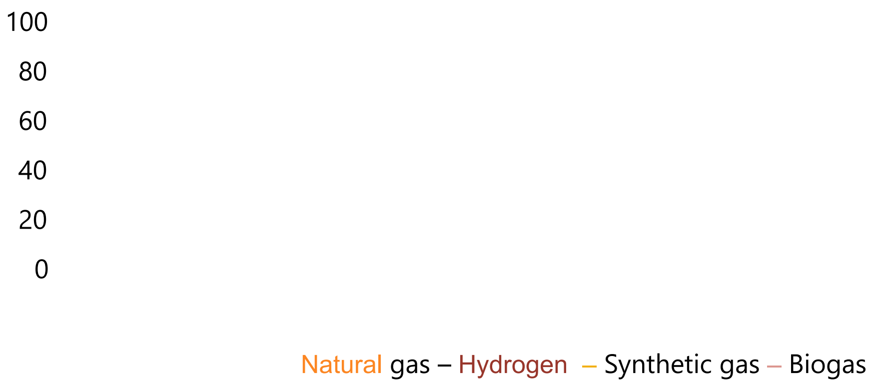


Figure 105: Share of individual components of the gas mixture in the WAM scenario (% of units of energy)



Source: IEP under CPS

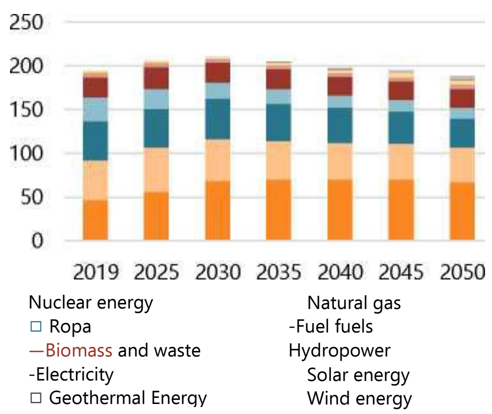
Primary energy consumption by 2050

Between 2030 and 2050, primary energy consumption will decrease by 10.3 % (or 2.6 % compared to 2019) in the WEM scenario, by 23.7 % (or 24.4 % compared to 2019) in the WEM scenario. Important changes will occur in the WAM scenario in particular around 2030.

From 2030, the consumption of solid fuels (by 34.4 % by 2050) and natural gas (by 16 %) is gradually reduced in the WEM scenario. This is mainly due to the shift to less net-intensive energy sources in electricity and heat generation. Oil consumption will also fall (by 27.9 %) due to an increase in the share of electricity in transport. The consumption of nuclear energy and biomass remains roughly the same between 2030 and 2050. There is an increase in solar and wind energy consumption, reaching around 9.4 TWh by 2050.

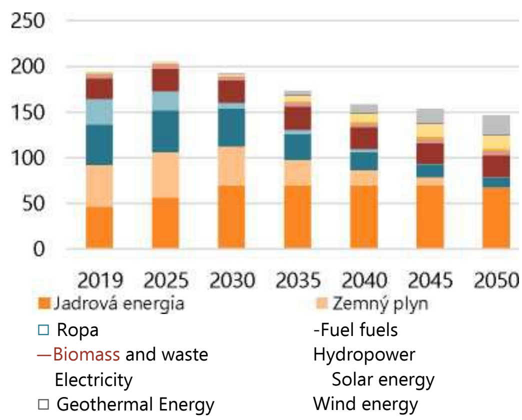
In the WAM scenario, in the context of the decarbonisation of the Košice steel plant, coke production is phased out and its further use reduced (corresponding to around 75 % of the consumption of solid fuels). As electricity consumption in transport increases, oil consumption is also decreasing. Significant savings in households and services will also significantly reduce the use of natural gas. For the same reasons, oil and gas consumption will continue to decline significantly beyond 2030. After 2030, there is a significant increase in wind and solar energy consumption, but this will only cover a small part of the reduction in primary energy consumption caused by the decline in fossil fuel use.

Figure 106: Primary energy consumption (in TWh, WEM scenario)



Source: IEP under CPS

Figure 107: Primary energy consumption (in TWh, WAM



Source: IEP under CPS

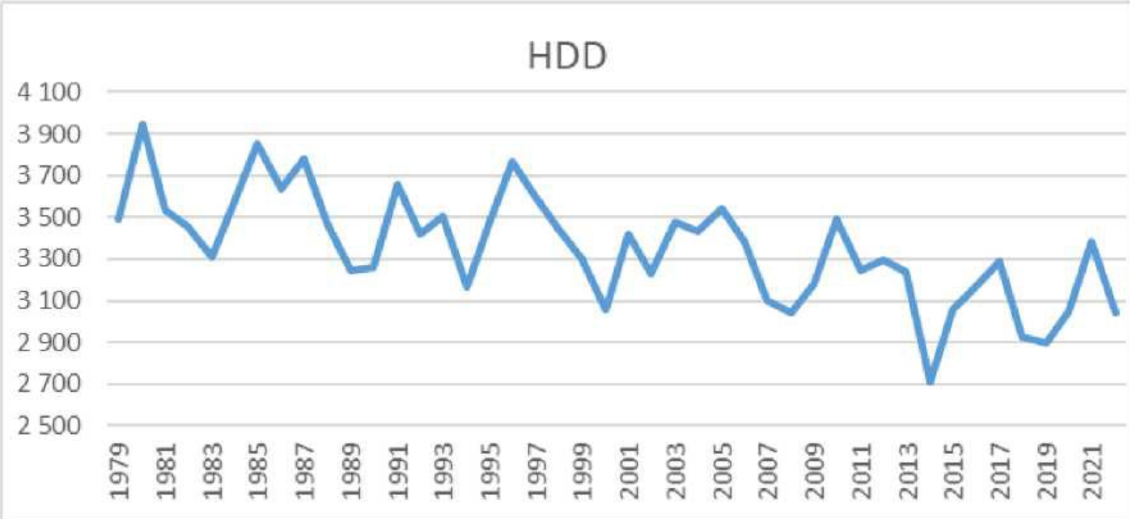
Projected evolution of heat consumption

The downward trend in heat consumption is projected to continue, mainly due to the planning and implementation of rationalisation measures for energy efficiency in different sectors of final energy consumption of heat and the modernisation and efficiency improvement of existing heating systems. Energy efficiency measures in buildings have the greatest impact on heat consumption assumptions. From the perspective of heat sources and fuels for heat generation, there is a shift towards alternative and low-carbon fuels with high support for renewable energy sources. It is also important to analyse the impact of different policies aimed at reducing the consumption of heating and cooling in society.

The commitment to climate neutrality should maintain but also slightly accelerate the process of reducing heat needs, especially in public buildings, in the services sector and in residential buildings. In the industrial sector, further measures are also envisaged to reduce the need for heat, but also the possibility of using the heat produced by industry for the purpose of its location in heating or cooling.

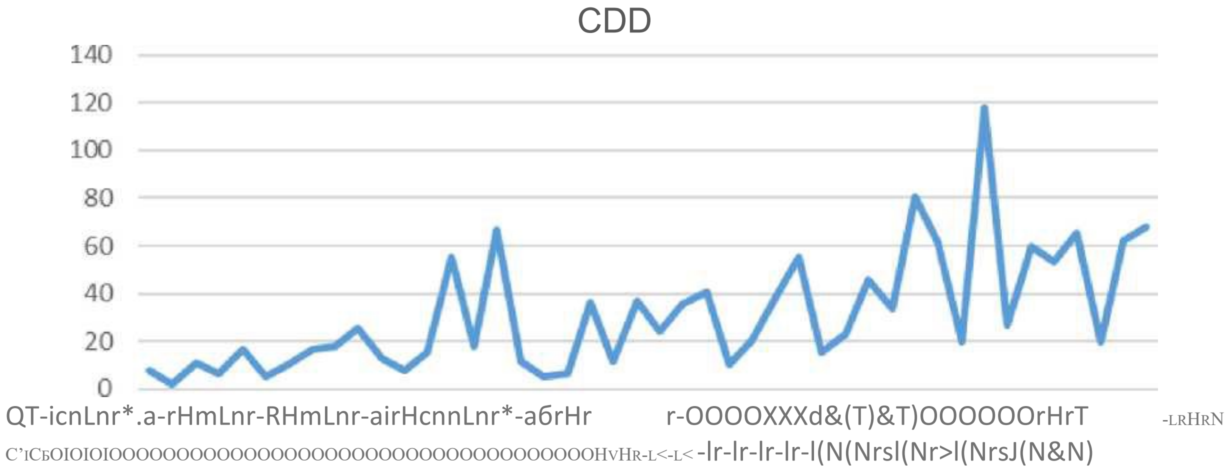
Climatic conditions in the heating season have a significant impact on the consumption of heat for heating and cooling. Winter weather conditions were the most moderate in 2014, as reflected in the absolute lowest heat production in the years under review. The long-term trend in climatic conditions is a slight decrease in daytime levels (for heating needs). However, there is an opposite trend for day-to-day cold stages, with a slight increase in day-to-day cold levels over the last ten years, mainly reflected by an increase in the cooling needs of buildings in the summer months. The evolution of the daily stages in Slovakia is shown in the following graphs.

Figure 108: Long-term evolution of the Days since 1979



Source: Eurostat

Figure 109: Long-term evolution of daytime cold levels since *1979*



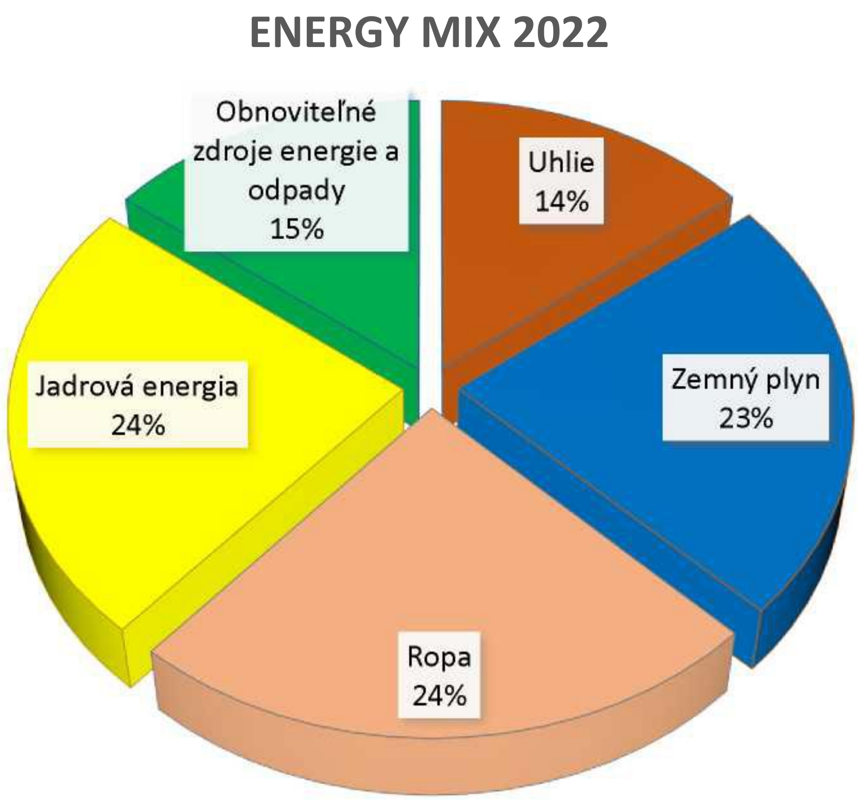
Source: Eurostat

4.4. Dimension: energy security

I. Current energy mix, indigenous energy sources, import dependency, including relevant risks

The main indigenous energy sources are renewables. In December 2023, coal mining in Slovakia was discontinued. The decarbonisation of Slovakia’s economy will entail additional costs and therefore its implementation requires a sensitive and gradual replacement of high-emission sources with low emission sources that are available and cost-effective. Renewables are one of the decarbonisation tools and, together with other low-emission energy sources, will have their place in the energy mix.

Figure 110: Energy mix of Slovakia 2022



Slovakia is almost 100 % dependent on imports of primary energy sources: nuclear fuel 100 %, natural gas 98 %, oil 99 % and coal since 2 024 100 %.

Petroleum

Oil deliveries to and transit through Slovakia are relatively reliable and relatively fluent, in line with the volumes agreed in the contracts concluded between the Slovak and Russian companies, despite the ongoing war conflict on the territory of Ukraine and the resulting sanctions of the European Parliament and the Council. The supply of oil supplies is currently provided in accordance with the Agreement between the Government of the Slovak Republic and the Government of the Russian Federation on cooperation in the long-term supply of crude oil from the Russian Federation to the Slovak Republic and the transit of Russian oil through the territory of the Slovak Republic, which entered into force on 1 January 2015 and expires on 31 December 2029.

Following the introduction of sanctions measures at the level of the European Parliament and the Council, due to the ongoing war conflict on the territory of Ukraine, it will be necessary to adapt existing oil transport logistics to future oil supply options in line with end-customer requirements and to prepare the conditions for possible changes in the storage of emergency oil stocks, including their renewal. Of the above, Transpetrol a.s. is preparing the construction of new large-scale oil storage facilities at the Tupá and Bučany storage sites. These bunkers will significantly contribute to increasing the flexibility of oil transport logistics, as there is a high probability of transporting different oil blends as a substitute for the Russian export mix.

Under the provisions of Council Directive 2009/119/EC of 14 September 2009, Member States were required to maintain minimum stocks of crude oil and/or petroleum products at a level of at least 90 days of average daily net imports or 61 days of average daily inland consumption, whichever is greater. Slovakia has implemented it by Act No 218/2013 on emergency stocks of crude oil and petroleum products and on addressing the state of oil emergency and amending certain acts.

In the light of the above, Slovakia currently maintains emergency stocks of crude oil and petroleum products in accordance with the legislation in force. Emergency stocks of crude oil and petroleum products are maintained by the Agency for Emergency Stocks of Petroleum and Petroleum Products, established on 13 September 2013, which are currently maintained at 100.8 days of average daily net imports. The total emergency stocks represent about 883 thousand tonnes (63 % in the form of crude oil, 37 % in the form of petroleum products, by category).

The Agency owns, procures, maintains and remunerate emergency stocks of crude oil and petroleum products and is responsible for protecting the state in this segment as required by Council Directive 2009/119/EC. Emergency stocks must be continuously prepared for prompt removal in order to deal with emergencies.

The minimum limit for emergency stocks for a given calendar year is determined by the Administration of State Material Reserves of the Slovak Republic (SŠHR SR) on the basis of data obtained in the context of the national statistical survey. Emergency oil stocks are held in Slovakia. The management of national tangible reserves shall cooperate with the European Union and the International Energy Agency in the field of prevention and management of oil emergencies.

In the field of security of supply of crude oil and petroleum products, the Oil Security Commission (NESO), which is an advisory body to the Chairman of the SJHR of the Slovak Republic, is responsible. In its activities, the Commission acts in accordance with the legislation in force in the Slovak Republic and the international agreements by which the Slovak Republic is bound. Monitor and analyse: the state of the oil market, the state of oil safety and the impending or acute oil emergency. The members of the NESO Commission include, in particular, the major representatives of the oil industry, the substantively competent national authorities, as well as the Agency for Emergency Stocks of Petroleum and Petroleum Products.

The European Commission (EC), in coordination with the Member States, can assess the emergency preparedness of individual EU Member States and, if the EC considers it appropriate, verify the level of emergency stocks. When preparing such assessments, the EC takes into account the work carried out by other institutions and international organisations and consults the Oil Coordination Group set up for crisis prevention. In the event of a serious disruption of supply, an extraordinary meeting of that working party may be convened within a short period of time or may take the form of consultations – by electronic means.

Electricity

Electricity generation and consumption balance

From an electricity balance perspective, Slovakia has been an import country since 2015. After the start of Units 3 and 4 of Mochoviec, it will become a net exporter of electricity.

In 2022, total electricity consumption in the Slovak Republic amounted to 28 328 GWh. Domestic resources were generated by 26 916 GWh and import volumes amounted to 1 412 GWh in 2022 (5 % share of Slovakia’s consumption). The main reason was the evolution of the price of electricity on the market, which is below the production costs of some types of technology in Slovakia.

Table 54: Production, consumption and burden of the ES SR between 2015 and 2022

Year	Production [GWh]	Total consumption [GWh]	Balance* [GWh]	Average load ** [MW]	Maximum load [MW]
2015	27 191	29 548	—2 357	3 377	4 146
2016	27 451	30 103	—2 652	3 427	4 382
2017	28 027	31 056	—3 029	3 545	4 550
2018	27 149	30 947	—3 798	3 533	4 506
2019	28 610	30 309	—1 699	3 460	4 571
2020	29 010	29 328	—318	3 339	4 485
2021	30 093	30 867	—774	3 524	4 448
2022	26 916	28 328	—1 412	3 234	4 442

* Positive/negative balance means export/import
** Total consumption divided by the number of hours in the relevant year

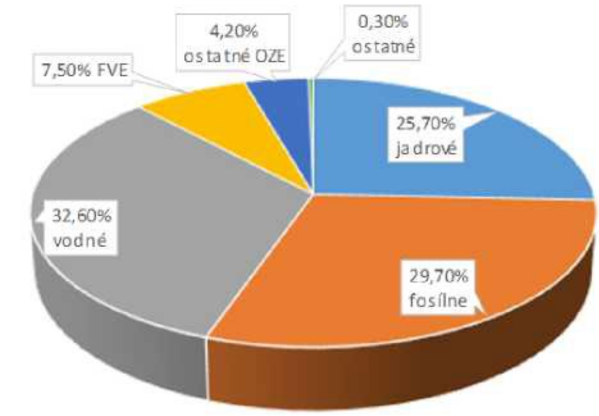
The maximum grid load in 2022 was recorded at 17:00 on 12 January at 4 442 MW, down from the previous year by 6 MW. The minimum load (by 3:00 on 11 September) was 881 MW, down 324 MW from the previous year.

Source base for electricity production in Slovakia

The installed capacity of electricity production installations in the ES SR reached 7 798 MW in 2022. Currently, the transmission system operator is registering an interest in the construction of a new nuclear resource on the Jaslovské Bohunice site and, in particular, projects using RES technologies.

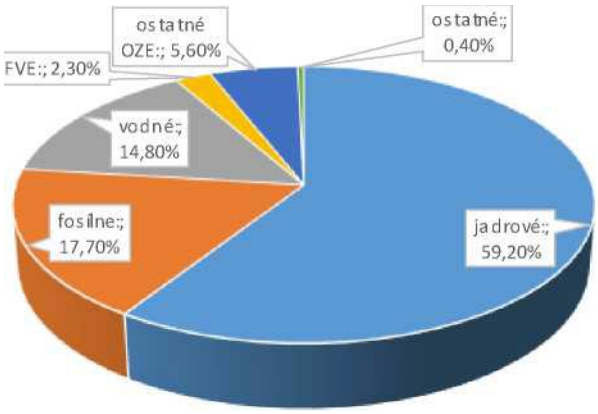
Figure 111: Structure of installed capacity in the ES SR in 2022

Zdroje	Inštalovaný výkon [MW]	%
jadrové	2 003	25,7
fosílne	2 316	29,7
vodné	2 545	32,6
FVE	588	7,5
ostatné OZE	324	4,2
ostatné	22	0,3
celkom	7 798	100



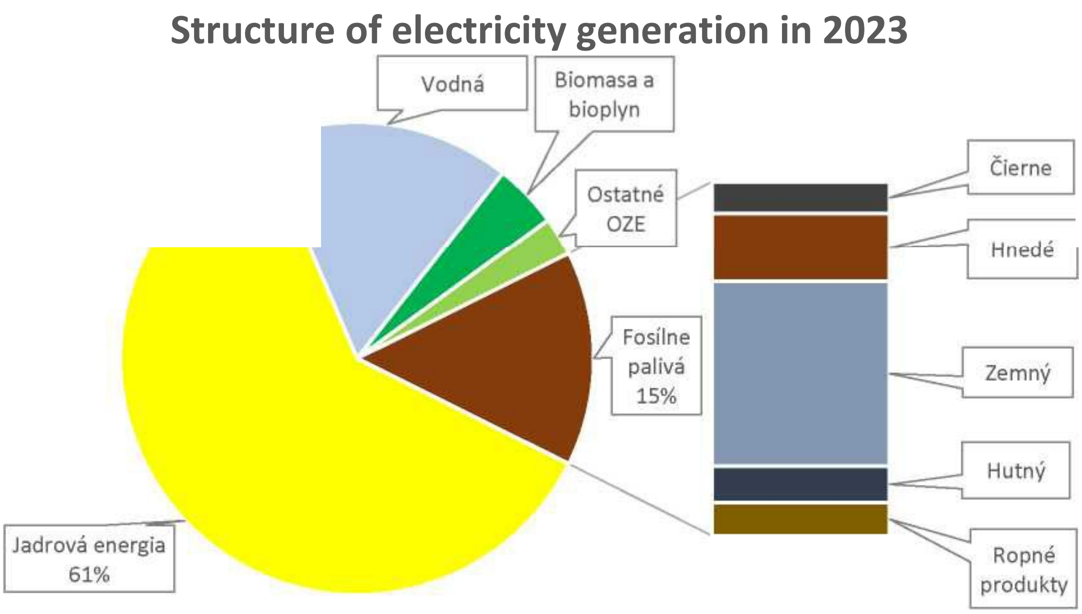
Graph 112: Structure of electricity production in the ES

Sources	Electricity generation [GWh]	%
nuclear	15 920	59,2
fossil	4 769	17,7
water	3 992	14,8
FVE	629	2,3
other RES	1 496	5,6
other	110	0,4
total	26 916	100



In 2023, core electricity generation increased to the detriment of fossil-based electricity generation (Figure 113):

Figure 113: Structure of electricity generation in 2023



Source: MINISTRY OF THE ECONOMY

Nuclear power plants

Nuclear power plants are the most important source in terms of share of electricity generation. Units 1 and 2 of the Mochovce Power Plant were put into operation in 1998 and 2000 respectively. The technical adjustments have increased their capacity from the original value of 2 x 470 MW to the current 2 x 501,44 MWe.

Bohunice V2 units were commissioned in 1984 and 1985. By technical adjustments, the capacity was gradually increased to 500 MWe. In addition to electricity production, AE Bohunice supplies heat to Trnavu, Leopoldov, Hlohovec and the municipality of Jaslovské Bohunice. The planned duration of the operation of existing nuclear power plants is currently at least 60 years. The safety of nuclear units is verified at regular intervals every 10 years and results in a report submitted by the operator (holder of the authorisation) to the Nuclear Regulatory Authority of the Slovak Republic.

EMO Block 3 was deployed to the network on 31 January 2023. The start of operations of EMO 4 is foreseen in 2025. Slovakia will thus operate 6 nuclear units with a total installed capacity of 2 944.88 MW. In the future, a number of nuclear power plants are being considered to increase their capacity.

Given the strategic role of nuclear energy in Slovakia’s energy mix, ensuring the long-term operation of existing nuclear resources and, where possible, increasing their effectiveness in the future is a key aspect.

Fossil fuel power plants

Coal-based electricity generation has been declining for a long time. In 2013, EVO 2 was decommissioned with 4x110 MW installed capacity, units 1 and 2 of Vojany 1 have not been operated since 2014. Units 3 and 4 of the Nováky power plant were discarded due to technical obsolescence and non-compliance with emission limit values. In 2016, two additional units of Vojany and one unit of the Nováky power plant were decommissioned. In total, 1 210 MW of power was lost.

From coal-fired power plants, 2 units of Nováky and 2 units of Vojany were in operation. The Nováky power plant, with annual gross electricity generation of approximately 870-1 100 GWh, consisted of an ENO A unit of 46 MWe, which supplied heat to the Nitra region, and ENO B units with a capacity of 2x110 MWe. Vojany EVO 1 with a capacity of 2x110 MW and annual gross electricity generation of approximately 460 GWh was deployed operationally based on the evolution of demand and the price of electricity on the market. The closure of the Nováky Coal Power Plant in December 2023 and of the Vojany Coal Power Plant in March 2 024 marks an important milestone for the phase-out of coal in the energy sector.

Apart from heat production, heating plants in Bratislava, Košice, Žilina, Martine, Zvolene, Martine and Považská Bystrici account for more than 3 % of total electricity production in Slovakia. Another activity is the provision of ancillary services to the electricity system.

The source of Malženica’s steam-gas cycle (430 MWe) was only operational in the months of January, February and with a minimum production in the month of May in 2022. By virtue of its parameters, PPC Malženice is one of the most advanced sources of electricity of that kind, in particular in terms of its power range.

Renewable electricity sources

Of the total installed hydropower capacity of 2547 MWe, 1630 MWe are in flow-through and 916 MWe in pumped storage plants. The largest hydropower plant is VE Gabčíkovo with an installed capacity of 720 MWe. Its output in 2022 was 1 837 GWh, representing more than 40 % of the total electricity production of hydroelectric power plants in Slovakia.

Photovoltaic plants experienced the largest development between 2011 and 2013, when 530 MWe of installed capacity was commissioned. Following the introduction of the new inter-State lines 2×400 kV Veľký Ďur – Gabčíkovo – Gönyű and 1×400 kV Rimavská Sobota – Sajóivánka on the Slovak-Hungarian cross-border profile, a bottleneck in the PS SR was removed from the point of view of system permeability. This allowed capacity allocation for the increase of installed capacity for FVE and VTE.

There are currently 5 wind turbines operating in Slovakia with a total installed capacity of 3.1 MW and production of approximately 3.203 GWh of electricity in 2022. Biomass is currently represented in the energy mix with 210 MWe installed capacity, with 551 GWh produced by this technology in 2022.

Safety and reliability of operation of the Slovak energy system

In terms of compliance with the criteria and recommendations of the European Association of Transmission System Operators (ENTSO-E), good results have been reported in the past period and security of electricity supply in Slovakia is at a high level. At the same time, Slovakia also meets all the objectives of the Commission Communication on strengthening energy networks.

Appropriate solutions for the operation of the ES SR are proposed at all stages of operational preparation and the necessary space is created for the maintenance, innovation and construction of electricity installations to ensure the long-term reliable, safe and efficient operation of the system under economic conditions. In order to deal with or prevent emergencies, the PS operator shall have a defence plan to prevent the occurrence of serious disturbances, measures in the event of accidental frequency and voltage changes, as well as a plan to restore the system after the occurrence of a black-out failure. Operational security meets the requirements for the transmission of electricity and is controlled at every stage of operational preparation, namely annual, monthly, weekly and daily. Releases of PS facilities from operation shall be carried out in coordination with neighbouring PS operators at all stages of operational preparation.

II. Projections of developments with respect to existing policies and measures at least until 2040 (including projections for 2030)

Forecast of the evolution of the source base until 2030

The evolution of electricity consumption will be influenced by the success of energy efficiency/energy savings measures and the speed of development of electro-mobility by year, as well as by the achievement of decarbonisation targets.

Sufficient power electricity is projected to be ensured by 2030 and the need to build more additional resources is not foreseen. In the expected scenario, the available capacity from the net installed capacity of electricity sources by 2030 is positive. Once EMO 4 has been completed, the system will be sufficient in terms of ensuring strong electricity even if the largest fossil electricity sources (Malženice and PPC Bratislava) are not operated. However, if these fossil resources are not operated, there will be a lack of regulatory capacity in the grid, a scenario that requires appropriate solutions to be found.

The total installed capacity of generating installations in 2030 is projected to be 8 720 MW, of which RES (including installed hydropower) will be between 3790 and 4 630 MW. The maximum load will increase proportionally with 1.2 % year-on-year growth in consumption up to 5 250 MW.

Thanks to the developed existing infrastructure, the Vojana site can continue to play a role in electricity generation, either in the form of support services from a rotating source or by exploiting the potential of the site to install renewable sources. It is also important for the future of the site to include it in the Phoenix project, which explores options for the location of small modular reactors in Slovakia.

Given the evolution of the gas price in the previous period, the economicity of the operation of CCG resources remains an issue. The high price of gas and the low price of electricity on the market would not allow them to operate profitably and their future is thus dependent on the evolution of fuel prices and emission permit prices.

Natural gas installations play a very important role in stabilising the transmission system. Stabilising the electricity grid is a growing challenge for the growth of installed capacity of variable RES across the region. In line with the resource adequacy assessment up to 2040, which indicates the need to connect to the electricity grid with additional capacity of flexible installed capacity to meet the chosen safety standard, it is necessary to review the introduction of a support scheme for highly efficient natural gas-based flexible resources with heat supply to CZT beyond 2025. The resource adequacy modelling shall also take into account an assessment of the impact of the end of support with the surcharge for electricity sources based on high-efficiency cogeneration and heat on their further remaining in the electricity market as base-band generating sources. On the basis of these conclusions, the need and scope of State aid for gas sources, forward-looking gas sources convertible to hydrogen flaring or synthesis gas flaring, will be identified.

Most biogas plants were put into operation between 2011 and 2013 and after 15 years they are expected to continue operating after upgrading or converting to biomethane production. The larger new investment in biomethane production is for Enviral Leopoldov, with a capacity of approximately 30 million m^3 biomethane/year (primary for the use of biomethane in transport). Four intentions for biogas plants are currently under preparation and eight biogas plants are in the process of being transformed into biomethane production, two of which are due to start operations in the course of 2025.

There is scope for improving the operational possibilities of existing Slovak VEs, mainly due to their contribution to RES integration. The operational improvements needed for RES integration could be achieved in particular by:

- the definition of the Váh as a river for energy and industrial use;
- releasing handling codes;
- solving the long-standing problem of sedimentation in water reservoirs in order to increase the storage volume of the reservoirs, improve the possibilities for electricity storage as well as improve water retention measures in the country;
- supporting investment plans aimed at increasing the regulatory scope and performance of existing installations.

From the perspective of large hydropower plants with installed capacity above 10 MW, there is one project in the EIA – Čunovo II hydropower plant. The objective of the project is the energy use of subsidy flows passed through the Čunovo stage for electricity generation. This new energy source will be directly spatially and operationally linked to the existing Chunovo hydropower plant. The environmental impact assessment process is ongoing. The implementation of the project is planned to start in 2028.

An important element in providing flexibility to the electricity transmission system is the operation of the Montenegrin Váh PES. The Montenegrin Váh was designed 50 years ago for a different type of operation than will be needed after 2030 with a high share of RES. In view of its end-of-life in 2032, it is desirable to upgrade it to allow it to continue operating with significantly improved parameters, following the example of the modernisation of similar RES built in the 1970s and 1980s. Such modernisation has the potential to effectively address future flexibility and CSR needs.

One major planned project aimed at increasing the provision of support services to pumped storage is the SE Integrator project, which has been included on the EU list of PCIs (see Chapter. 2.3.iv National objectives with regard to increasing the flexibility of the national energy system).

Forecast of the evolution of the resource base after 2030

After 2030, there will be a loss of financial support for existing photovoltaic plants with an output of around 530 MWe that were connected to the grid between 2010 and 2012, therefore, they can be expected to be disconnected from the system or replaced. Developments in this area will be monitored and any measures with a minimum impact on the final price of electricity communicated to the relevant electricity market participants in order to meet the stated objectives and the safety of the operation of the Slovak electricity system will be proposed in good time.

The construction of a new nuclear resource on the Jaslovské Bohunice site ('the NJZ project') and nuclear energy constitute a safe, reliable, environmentally acceptable component of the energy mix and is in line with Slovakia's direction of decarbonisation of the Slovak economy on the basis of the 'low carbon strategy of the Slovak Republic until 2030 with a view to 2050', according to which Slovakia has scope for decarbonising energy mainly in the substitution of coal with low-emission sources, in energy efficiency measures and in the decarbonisation of transport, mainly because of the high share of nuclear resources in electricity production.

The main parameter for assessing the justification for constructing a resource will be the future evolution of electricity consumption in Slovakia. The construction of a new nuclear resource must therefore be made conditional on its adequacy. The projections made in the framework of the "Low Carbon Study" project confirm the possibility of substituting nuclear resources with the construction of the NJZ after 2045. The new nuclear resource will also be assessed in the light of state-of-the-art existing technologies and its competitiveness (technical and economic) over the period.

The main parameter for determining the forecast for the evolution of Slovakia's source base by 2040 and 2050 is the assessment of the sufficiency of Slovakia's source base in the period under consideration, including planned new sources for electricity production.

In order to meet the objectives of the European Union and the Slovak Republic in terms of reducing greenhouse gas emissions, it is essential, given the climatic conditions in Slovakia, to maintain a high proportion of electricity produced from nuclear sources. For the restoration of the nuclear resource base, it is necessary to create the conditions for the successful implementation of the project, a new nuclear source on the Jaslovské Bohunice site (hereinafter referred to as the 'NJZ project'), with a total installed capacity of up to 1 200 MW, approved by the Slovak Government by its Resolution No 279/2024 ('NJZ Resolution').

The NJZ project will thus be one of the major forward-looking Slovak energy projects and will ensure the basic security interest of the Slovak Republic.

According to the current timetable for the implementation of the NJZ project, the expected date for commissioning the NJZ project is 2040. Work on permitting procedures is currently ongoing in the forecast horizon of 2026. Pursuant to the NJZ resolution, the Ministry of Economy and the Ministry of Finance are to present, by 31 October 2024, a proposal for the conditions for the construction of a new nuclear source (block 5) at the Jaslovské Bohunice site, the dates for the preparatory and implementation work, the envisaged construction schedule, the financial security for construction and the process of selecting the investor and technology suitable for the construction of the new nuclear resource, thereby promoting and taking into account the objectives and measures to ensure energy security and self-sufficiency in electricity production for the period after 2040.

In the past period, certificates of compliance of the investment project with energy policy have been issued for both potential projects under preparation and the following new sources:

The Sereď hydropower project aims to exploit the untapped energy potential of the River Váh in the Sereď-Hlohovec section for electricity generation of around 180 GWh per year. The waterwork with the lock is part of the project 'Manuary Waterway' and its completion will create a fairway from the Komárno to Hlohovec. The main obstacle to the realisation of the work is the long-term return on investment.

The Ipeľ pumped hydropower pumped-storage project, with the proposed 560 MW installed capacity, represents a significant potential for providing a wide range of ancillary services, it appears to be one of the appropriate options for integrating new RES into the Slovak electricity grid with spillovers and abroad. This is a weekly pumping cycle that would be able to shift weekend "surplus" energy from nuclear power plants to peak load periods on working days. It is also an optimal balancing element for wind and photovoltaic power plants. However, the intention of the Ipeľ PVE needs to be assessed in detail, given that the needs of the electricity system have changed substantially since the project was originally designed and the Slovak electricity system is becoming part of a larger whole beyond Slovakia's borders. It is necessary to consider all environmental and social impacts, as well as the investment, organisational and time-consuming nature of the project, which will require not only sufficient financial capital, but also sufficiently experienced and large engineering teams with real experience in implementing comprehensive energy infrastructure. Before deciding on implementation, the feasibility of this project needs to be reviewed in technical, commercial, financial and environmental terms. The implementation of the project will depend on the development of the international electricity market and the interest of the strategic investor.

New innovative technologies

From the point of view of security of energy supply and diversification efforts, it is now important for Slovakia to explore new innovative technologies. An advanced reactor producing electricity of up to 300 MW is considered to be a small modular reactor. Small Modular Reactors have the potential to cover flexible power generation and for a wider range of applications (e.g. electricity generation, hydrogen, heating). These reactors have advanced design characteristics and can be deployed as one or more modular power plants. The construction of small modular reactors is designed in such a way that their construction takes place in factories from where they are then transferred to a pre-defined location.

The main benefits of SMRs include:

- less difficulty on the size of the nuclear site
- use of new technologies and materials
- essential and passive safety features
- modular design

- shorter construction time for a nuclear installation
- potential for a possible shortening of permitting processes
- cost of construction of such a nuclear installation – assumption

In 2023, the Slovak Republic saw a concrete shift in the construction of SMRs. By participating in an international competition organised by the US Department of State, the participating partners – Slovenské elektrárne, USS Košice, MHSR, SEPS, ÚJD, VURE and STU – received a grant to finance a feasibility study for the construction of SMRs. This study, which was entitled 'Fénix project', is based on the idea of supporting the transition from coal-based electricity production towards clean power generation by nuclear power plants to support global decarbonisation efforts. This project is the natural trigger of the initiative for the development and development of the SMR programme in the Slovak Republic, which is tasked with analysing in detail the selected sites (Jaslovské Bohunice, Mochovce, Nováky, Vojany and U.S. Steel Košice, s.r.o.), suitable SMR technologies, financing possibilities and challenges with licensing new types of nuclear resources. The further development and potential construction of SMRs will largely depend on the outcomes of the study and the knowledge accumulated during its implementation, which will serve as a basis for the next stages of the development of nuclear energy through small modular reactors.

Another shift in the implementation of SMRs was the success of the Slovak Republic in a grant project called 'NEXT', funded by the Department of State of the United States of America. The NEXT grant project aims to finance activities that will help countries to decide on the construction of SMRs and build capacity for implementation. The NEXT project is a successful follow-up to the Fénix project, also focusing on consultations on the next SMR strategy in Slovakia.

It is important that the Slovak Republic continues to participate in projects tasked with exploring the possibilities and potential of SMR technology in order to maintain energy security and stable electricity supply.

The Slovak Republic is a member of several prestigious international discussion platforms in the field of nuclear energy. Slovakia, together with the Czech Republic, co-organises annually an International Forum on topical nuclear topics – the European Nuclear Fora (ENEF), which was established by the European Commission in 2007. The Ministry of the Economy is also an active member of the Nuclear Alliance, which was founded in 2023 by France as an association of the EU Member States, acting together on the topics of creating fair conditions for all low carbon energy sources, including the core. The Nuclear Alliance currently has 16 members, including an invited member GB. The latest international core support activity is the European Industrial Alliance for Small Modular Reactors (SMRs). The aim of the Alliance is to facilitate and accelerate the development, demonstration and deployment of new nuclear technologies, including SMR reactors, in Europe. On behalf of the Slovak Republic, the Ministry of the Economy and industry participated in this alliance. The Industrial Alliance has the ambition to become a transparent European platform for removing barriers and creating the closest possible cooperation between the public and private sectors to support and deploy new nuclear technologies.

4.5. Dimension: internal energy market

4.5.1. Electricity interconnectivity

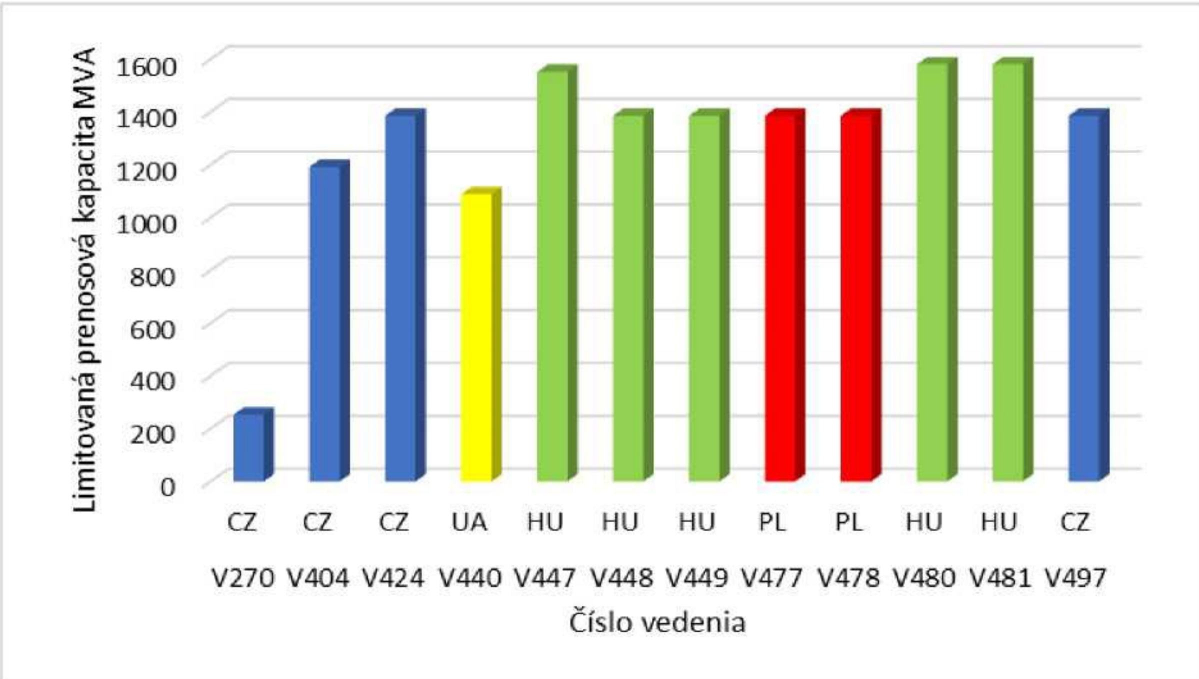
1. *Current interconnection level and main interconnectors95*

The current level of interconnection of the transmission system, including the main interconnectors, is shown in the table below and the current transmission capability of the main interconnectors is documented.

Table 55: Transmission capacities of cross-border lines

Leadership	Electricity station			Electricity station SK		Voltage kV	**Imax** A	Limited transmission capacity MVA
	country	name	company	name	company			
V270	CZ	Lískovec	ČEPS	POV. Bystrica	SEPS	220	665	253
V404	CZ	Nošovice	ČEPS	Varín	SEPS	400	1720	1192
V424	CZ	Sokolnice	ČEPS	Crushed	SEPS	400	2000	1386
V440	UA	Mukacheve	Ukrenergo	V. Kapušany	SEPS	400	1570	1088
V447	HU	Sajóivka	MAVIR	R. Sobota	SEPS	400	2240	1552
V448	HU	Gyôr	MAVIR	Gabčíkovo	SEPS	400	2000	1386
V449	HU	G from	MAVIR	Levice	SEPS	400	2000	1386
V477	PL	Krosno	PSE	Lemiešany	SEPS	400	2000	1386
V478	PL	Krosno	PSE	Lemiešany	SEPS	400	2000	1386
V480	HU	Gon(s)	MAVIR	V. Ďur	SEPS	400	2280	1580
V481	HU	Gon(s)	MAVIR	Gabčíkovo	SEPS	400	2280	1580
V497	CZ	Sokolnice	ČEPS	Stupava	SEPS	400	2000	1386

Figure 114: Transmission capacities of cross-border lines



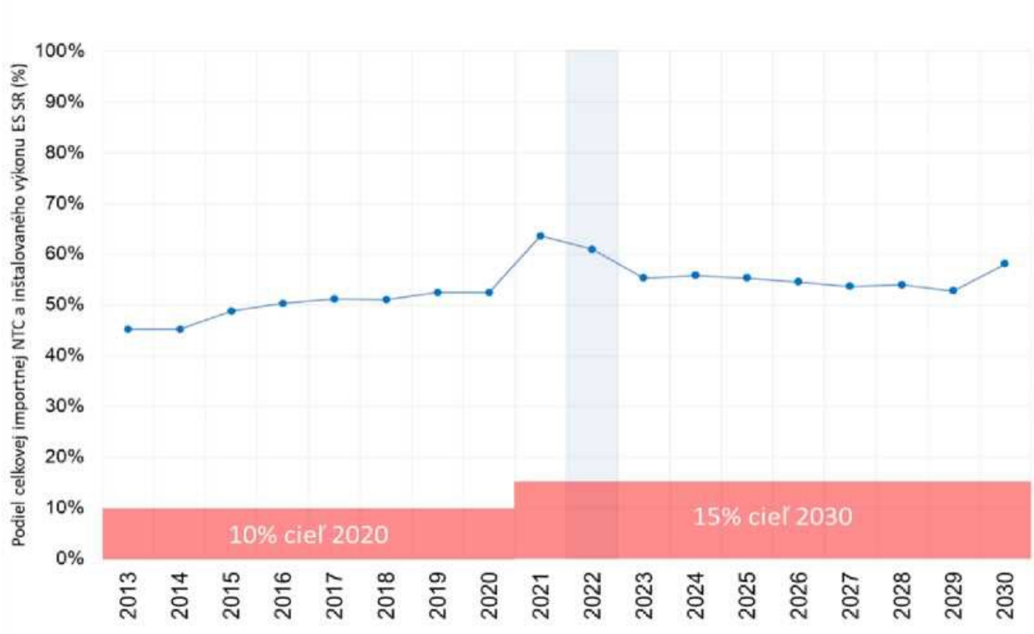
Note: The permitted current capacity of the V440 V Kapušany-Mukačevo line (UA) is seasonally adjusted. Current capacity of the V440 line at 1980 A (a summer period 1570 A) is permitted.

95With reference to overviews of existing transmission infrastructure by Transmission System Operators (TSOs).

II. Projections of interconnection extension requirements (including projections up to 2030)[96]

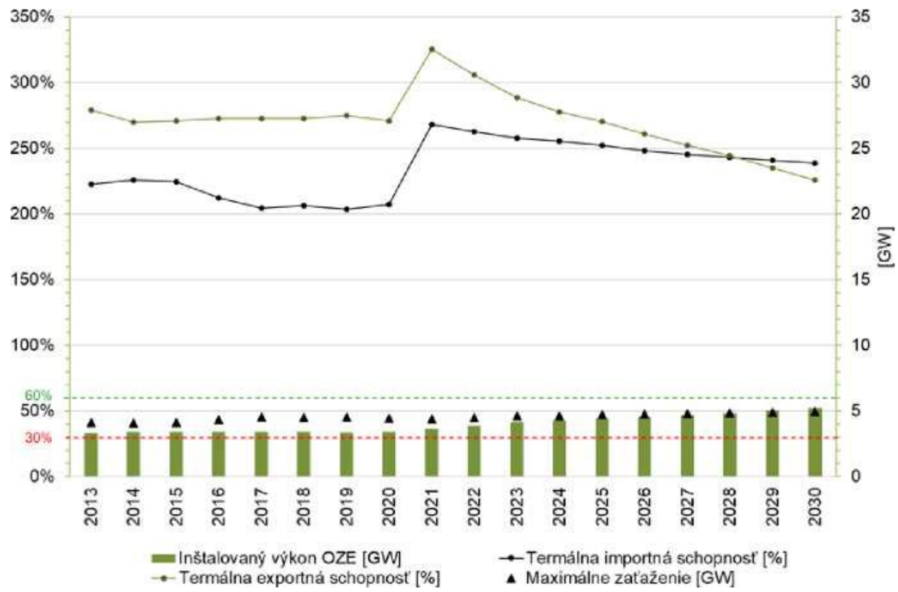
The evolution of Slovakia's overall level of interconnection up to 2030, i.e. the share of the projected net import transmission capacity to the total projected installed capacity of power generating installations in Slovakia, is shown in the graph below.

Figure 115: Targets for indicative connectivity parameters



The projected development of indicative interconnection parameters to reach a minimum level of 30 % of the import of the expected maximum load and 30 % of the level of export of installed RES capacity, including hydropower, is shown in Grafe 106:

Figure 116: Projected development of indicative connectivity



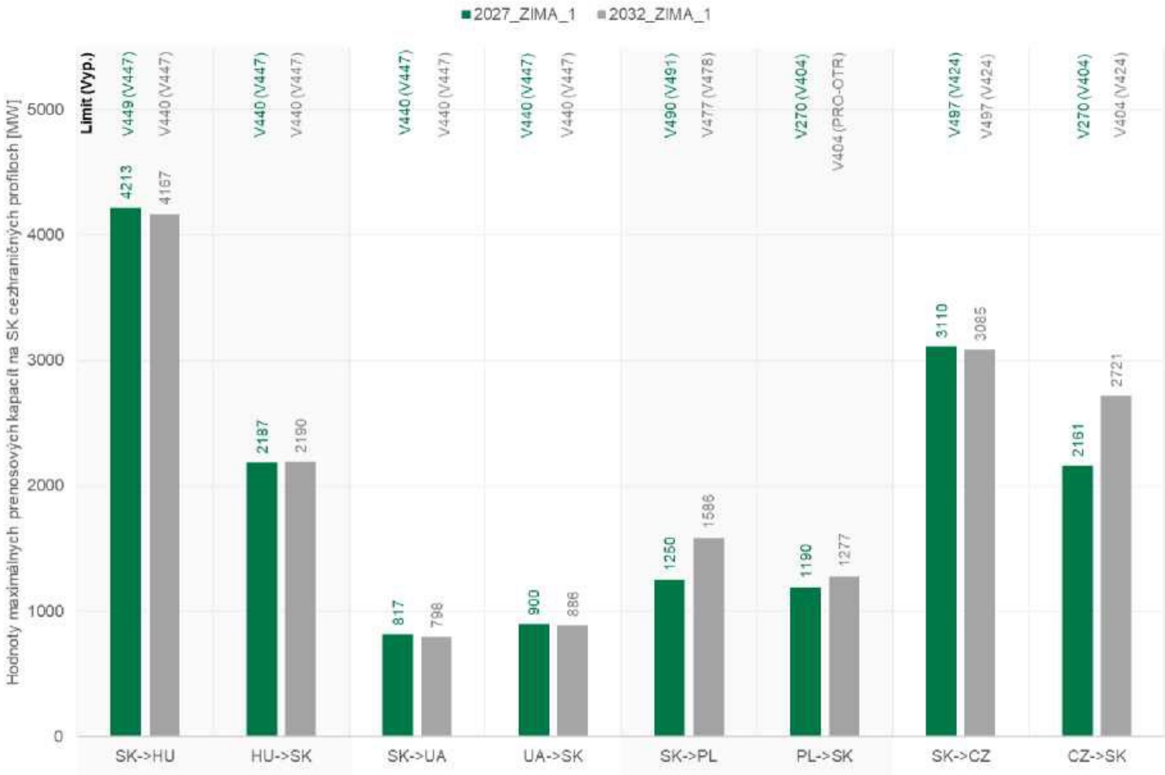
This shows that the 15 % target for 2030 as well as the indicative parameters will be met. The price difference between trading zones will depend on the electricity market situation in 2030.

For the development time horizons 2027 and 2032, the values of the maximum transmission capacities on individual cross-border profiles of the PS SR were calculated for the import and export direction of power flows in SK cross-border profiles, checking the validity of the basic safety criterion N-1 only in the PS SR. The calculation of transmission capacity values on cross-border profiles depends in particular on topology and grid involvement, the location and deployment of generation of power generating facilities and the maximum permissible current loads of PS lines.

The values of the maximum transmission capacities of SK cross-border profiles are calculated for the baseline state of grid connection, deployment of power generating facilities and loads considered for each development time horizon (R+ 5 and R+ 10). The values of SK's operational transmission capacities for cross-border profiles set for the current state, the maximum R+ 1, are also calculated by taking into account the current network involvement, the deployment of power generating facilities (maintenance of power generating facilities and elements of the PS SR) and the loads of the ES SR in that calculated hour. Tradable transmission capacities, which already take into account the necessary safety margins, are also foreseen for the current state and for the R+ 1 time horizons, so that even in unexpected events and for situations with large differences between commercial and real power flows, so-called loop flows, the PS operator is able to meet the essential safety criterion N-1. Considering these states, the quantification of which is very difficult to estimate for the following years, the calculated values of tradable transmission capacities for the time horizons 2027 and 2032 would be lower compared to the reported maximum transmission capacity values.

From the topological changes in the PS SR between 2027 and 2032 more significantly affecting changes in the maximum transmission capacity values on cross-border profiles, it is important, on the basis of calculations, to mention the disposal of 220 kV system in the Central and Western Slovakia region, in particular the closure of the last 220 kV cross-border line V270 P. Bystrica – Lískovec on the SK-CZ profile. The shutdown of V270 will result in an increase of 26 % of the maximum transmission capacity to the CZ-SK profile in the import direction and an increase of the maximum transfer capacity on SK-PL profile in the import direction by 7 % and in the export direction by 27 %. The other cross-border profiles analysed have a negligible impact on the decommissioning of the V270 line. For both variants, it was envisaged to reconstruct the V404 Nošovice (CZ) – Varín (SK) cross-border line and thus to increase the maximum permissible current capacity from the original 1720 A to 2000 A, whose completion and entry into commercial operation is expected in the course of 2026.

Graph 117: Results of maximum transmission capacities at selected time horizons



All the considerations and assumptions described above on the evolution of the maximum transmission capacities of the individual cross-border profiles of the PS SR over the time horizons 2027 and 2032 are based on the analyses and assumptions of the SEPS and ENTSO E. The values for the maximum transmission capacities of the analysed development horizons 2027 and 2032 must therefore be understood as indicative and non-binding annual values that apply exclusively to the analysed variants of development of the SR SR. The values of net tradable transmission capacities for the next period are/will be refined by the SEPS power dispatching.

4.5.2. Energy transmission infrastructure

i. Key characteristics of the existing transmission infrastructure for electricity and gas97

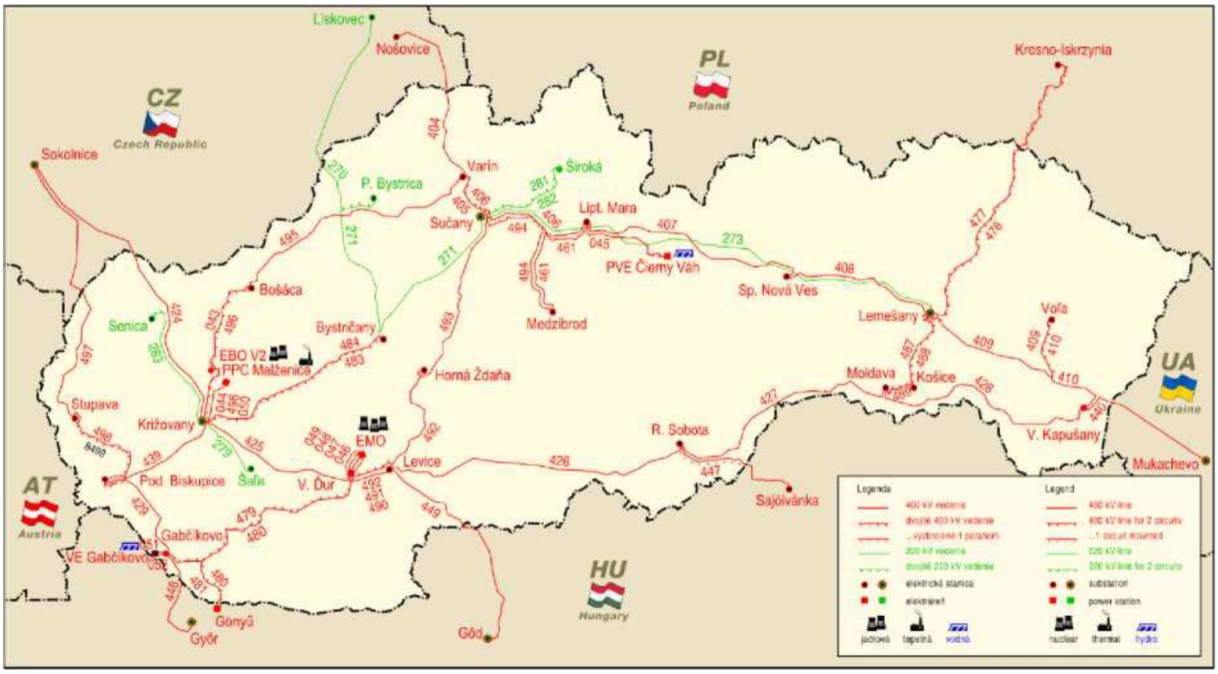
Characteristics of the Slovak transmission system

In particular, the Slovak transmission system is a set of galvanically connected technology equipment of 400 kV, 220 kV and selected 110 kV installations, through which electricity is transferred from its producers to individual customers from the Slovak transmission system ('PS SR') as well as the cross-border transmission of electricity. In particular,

- national and cross-border lines 400 kV, 220 kV and selected 110 kV lines;
- transformers 400/220 kV, 220/110 kV and 400/110 kV;
- 400 kV substations, 220 kV and 110 kV selected substations,
- compensation facilities.

Figure 4: Slovak transmission system

97With reference to overviews of existing transmission infrastructure by TSOs.



The PS SR also includes relevant support, so-called secondary installations, without which the transmission of electricity and the management of the Slovak electricity system would not be possible. These are management information systems (RIS), commercial measurement, security and automation systems, telecommunications transmission equipment, etc. Users are also directly connected to the PS SR through their electricity installations, who are currently:

- three regional distribution system operators (hereinafter referred to as “DS”);
- five electricity consumers;
- four electricity producers.

In addition, the PS SR is also synchronously connected to neighbouring transmission systems in the following range (state as at 31.12.2023):

- one single 220 kV interconnection and three simple 400 kV interconnections towards the Czech Republic (‘CZ’),
- one double 400 kV link to Poland (PL);
- one simple 400 kV link towards Ukraine (UA);
- one double and three simple 400 kV interconnections towards Hungary (‘HU’).

Through these interconnections, Slovakia’s electricity system is also synchronously connected to PBS in Europe, the operators of which, together with SEPS, are associated with ENTSO-E.

When planning investments in the transmission and distribution grid, care should be taken to ensure that the investments lead to an integrated electricity system at the lowest possible total cost: i.e. the sum of electricity generation costs and transmission, distribution and other charges and tariffs. Such an approach is the only way to achieve reasonable costs for the end customer. The integration of RES is a major challenge for the electricity system and integrated planning is needed to successfully address this challenge, which would make it possible to identify the most suitable investments to achieve the above objective.

Power lines

SEPS owns fifty 400 kV transmission lines of 2 357 km, ten 220 kV transmission lines for a total length of 688 km and seven 110 kV transmission lines of a total length of 80 km. Out of a total of 400 kV and 220 kV transmission lines, one 220 kV line and ten 400 kV cross-border electricity lines are in operation, together with a developed length of approximately 570 km in Slovakia, connecting the PS SR on the relevant cross-border profiles to the neighbouring transmission systems CZ, HU, PL and UA.

Additional information – e.g. the number of pylons is published on the website of the SEPSPS operator (https://www.sepsas.sk/pre-partnerov/technicke-parametre/zakladne-udaje-prenosovej-sustavy/).

Characteristics of the transmission network

The transmission network is characterised in law as: ‘the network of compressor stations and, in particular, the network of high-pressure pipelines which are interconnected and serve to transport gas in a defined territory, except upstream pipeline network and storage facility and high-pressure pipelines which serve primarily to transport gas to parts of the defined territory’.

One company is active in the area of gas transmission in Slovakia – eustream, a.s. – the operator of the national transmission network. On the basis of the decision of the Government of the Slovak Republic of 28 November 2012, the form of unbundling as required by European legislation was determined using the model of the independent transmission system operator (the so-called ITO model).

The quantities of gas transported were significantly affected by the conflict in Ukraine. The TSO is exploring possibilities to increase the use of gas infrastructure in the context of several projects, which are also intended to contribute to increasing the level of security of supply not only in Slovakia but across the Central and Eastern European region.

The transmission network consists of parallel pipelines DN 1200 and DN 1400 in four to five lines, the total length of the gas pipelines of the transmission network being almost 2 376 km. The transmission network comprises 4 compressor stations (CS) – CS Veľké Kapušany, KS Jablonov nad Turňa, KS Veľké Zlievce and KS Ivanka pri Nitre – which provide the pressure differential needed for a seamless gas flow with a total capacity of 425 MW. They are located about 110 km from one another. The total transmission capacity of the network is more than 90 billion m^3 per year. From the transmission network, natural gas in the defined territory enters the distribution system through national discharge stations and is transported to final customers.

Slovakia’s interconnection with neighbouring countries at transmission network level currently exists with Austria (border point Baumgarten), the Czech Republic (border point Lanžhot), Hungary (Border Point Veľké Zlievce), Poland (Border Point Výrava) and Ukraine (Belgé Kapušany border point and Budince border point).

Figure 5: The transport network of Eustream, a.s.

Table 56: Capacities of the interconnections of the Slovak and surrounding transmission networks

Border point	Exit firm technical capacity (GWh/day)	Input fixed technical capacity (GWh/day)
Large Kapušany [SK/UA]	0	1 799,2
Budince [SK/UA]	280,8	176,8
Baumgarten [AT/SK]	1 570,4	247,5
Lanžhot [CZ/SK]	322,4	1 399,0
Form [SK/PL]	173,9	144,5
Large Zlievce [SK/HU]	128,9	76,3

(state of July 2024)

ii. Projections of network expansion requirements up to at least 2040 (including projections by year 2030)98

By 2040, the SEPS operator is considering really strengthening the SK-CZ profile by 1x400kV Ladce (SK) – Otrokovice (CZ). In line with the information in point 2.4.2 ii, this is to minimise the impact of the planned decommissioning of 220 kV PS on SK-CZ profile and PS SK and PS CZ respectively. It is realistic to assume that the preparation of this project will start after 2025 so that the management becomes operational around 2032, with both SEPS and ČEPS trying to reduce this deadline as much as possible. To this end, both SEPS and ČEPS signed a Memorandum of Cooperation, where both companies declare their willingness to coordinate cooperation on operational and development objectives on the SK-CZ profile. Between 2030 and 2040, the SEPS does not envisage the construction of other cross-border connections. In terms of reflection and potential intentions, there is a 2x400kV SK – Poland line and a fifth line between SK and Hungary. There are no discussions on this subject between the SEPS and the neighbouring PCA operators concerned.

98With reference to national network development plans and regional investment plans of TSOs

After a longer break, communication was established with the PS operator in Ukraine, NPC 'Ukrenergo'. Slovakia – Ukraine's cross-border profile is often a bottleneck (together with a profile to Hungary) in cross-border electricity transmissions and causes operational and management problems also for Slovakia's electricity dispatching system. The project 'Obnova 400 kV Mukacheve (UA) – Veľké Kapušany (SK)' was included in the PECI/PMI 2018 list approved by the Ministerial Council within the Energy Community (Engl. "Energy Community") in November 2018. The expected date for the comprehensive renewal of the V440 line in Slovakia is 2030.

Implementation of the investment plans of the transmission system operator

Following the decision to phase out the operation of 220 kV system, the development of the PS SR is mainly focused on the development of the 400 kV system from the point of view of transmission infrastructure (powering and transformation of PS/DSs). Managed at 220 KVPS is a long-term, technological, temporal, organisational and cost-intensive project, which requires repairs to the extent necessary by PS 220 kV equipment, maintenance activities or partial renovations to ensure the operational capacity of some 220 kV system installations until or after the period around 2025, when they are already at the limit of their technical and moral lifetime.

In particular, the development of new production capacities and the change in their structure both within the Slovak Republic and in the surrounding States have a significant impact on the development of PS 400 kV. Both factors have a direct or indirect impact on the load on ES SR facilities, which makes it necessary to strengthen the infrastructure of the PS SR. In addition, Slovakia's strategic objective in electricity generation is directed towards Slovakia's export balance (EMO 3.4, decentralised production and RES, also a new nuclear source around 2035), which has or will have an impact on the export flow burden of cross-border profiles. In addition to the above mentioned phasing-out of 220 KVPS, the expansion and associated strengthening of 400 KVPS is also subject to no less important effects, whether in the form of existing investment plans as well as potential new users of 400 KVPS or indirectly influencing incentives from lower voltage levels of individual distribution systems (in particular in terms of decentralised generation), as well as external influences such as transit flows typically from north to south. The PSO operator needs to respond flexibly to these impacts at all times, resulting in the necessary planning and implementation of both national and cross-border investment projects from the point of view of the PSO's development objectives.

The information on the investment intentions of the PSO is based every two years under the TYTP (last valid document covering the years 2024-2033). Information on selected SEPS projects is also available in the Ten Year Network Development Plan ENTSO-E, an up-to-date version of which is available at http://tyndp.entsoe.eu/.

Implementation of the investment plans of the distribution system operator

The permanent objectives are to strengthen the critical points of the system, to restore the system in terms of its physical state, to comply with quality standards, to reduce losses in electricity distribution and to connect new demand points. The investment activity shall reflect current needs for the development and quality of the distribution system, past developments as well as legislative requirements for the distribution system operator. The quality of distribution and the smooth operation of the distribution system are very important for customers. The planned activities and investments in the distribution system aim at achieving the expected quality of service and SSE-D makes every effort to best meet customers' expectations. The investment process is divided into three core chapters – new connections, quality and increase of transmission capacity of the lines and other investments linked to the distribution activity.

NEW CONNECTIONS

Development actions for the construction of the distribution network have been addressed under this investment chapter due to the need to connect larger demand points at the high voltage voltage level (VL), such as industrial parks, multifunctional objects and commercial premises, as well as the connection of new low-voltage demand points (NN), such as standard delivery points (family houses, residential constructions, smaller business and civic amenities). In this chapter, 214 constructions were completed at CPR and NN level in 2017 and EUR 8.49 million were reinvested.

QUALITY AND INCREASE OF TRANSMISSION CAPACITY OF EQUIPMENT

From the point of view of investment construction in the area of quality and increasing the transmission capacity of the facilities, 178 constructions at the voltage level of CPR/NN and 21 at the extra high voltage (VHV) voltage level in a cumulative annual investment cost of EUR 23.74 million were completed in 2017. The purpose of these investments was to ensure the reliability and continuity of electricity distribution. The continued priorities of this construction were compliance with quality parameters, the removal of adverse physical conditions caused by external influences and the lifetime of equipment, the reduction of malfunctions, the modernisation of equipment, the deployment of elements with remote monitoring and control functions, and the improvement of electricity distribution capabilities. These contribute to lowering the parameters of SAIDIP, i.e. the scheduled time without flow in clients, and SAIFIP, i.e. the planned frequency in client failures.

MAIN ACTIVITIES AND INVESTMENTS IN TERMS OF DEVELOPMENT OF THE DISTRIBUTION SYSTEM

For the gas sector, eustream, according to the relevant regulations, prepares a 10-year network development plan on an annual basis. The objective is to provide gas market participants with information on the planned infrastructure gas projects of eustream a.s. The plan contains a description of the network, a scenario for the evolution of gas consumption in the Slovak Republic, as well as a description of effective measures to guarantee system adequacy and security of gas supply. The 10-year plan also lists the main parts of the transmission network that need to be built or upgraded in the next ten years, together with the expected dates for their implementation.

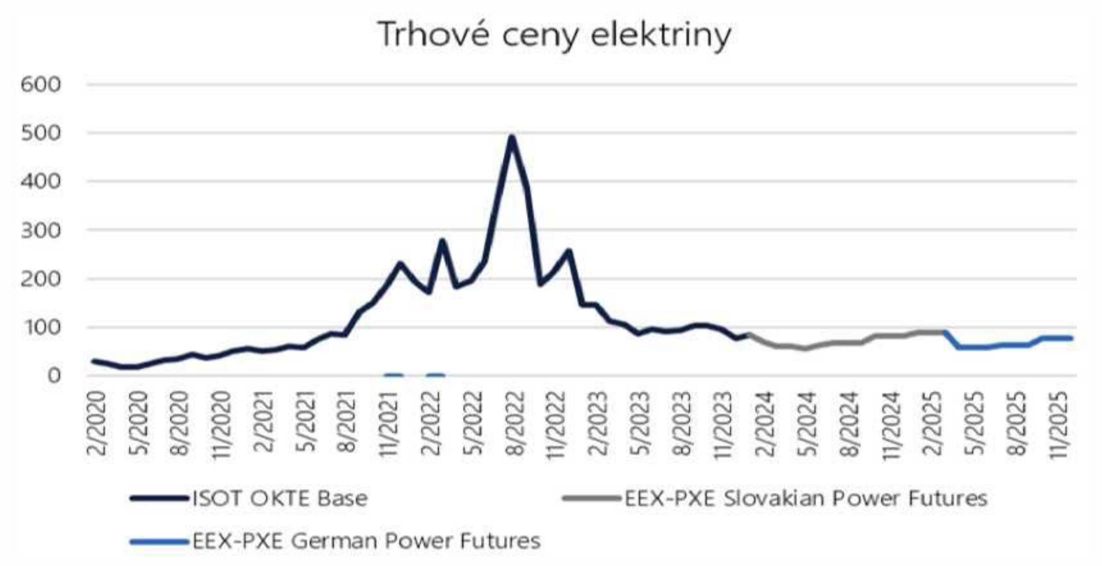
4.5.3. Electricity and gas markets, energy prices

1. *Current situation of electricity and gas markets, including energy prices*

The problem of wholesale electricity markets in individual EU Member States remains significant distortions. It is also amplified to some extent by various types of support, in particular support for the development of renewable electricity sources. The simplest form is the introduction of direct operating subsidies, which are also part of the Slovak legislation. Wholesale electricity prices are also negatively affected by the existence of capacity mechanisms in place or under preparation in some countries. These but also other factors affect prices in the EU markets, which also has a significant impact on the Slovak market. At the same time, the EU's energy system as a whole suffers from the shutdown of conventional and flexible resource capacities and from insufficient investment in new capacities.

Wholesale electricity prices have experienced record increases and unprecedented volatility since the summer of 2021 and during 2022. European electricity prices were particularly affected by gas prices, which were recordly expensive due to Russia's tight supply and the global energy crisis. In particular, the price and energy crisis has highlighted the high dependence of electricity prices on the price of gas, as gas sources are often a marginal source (last deployed to meet demand). The electricity and gas exchange prices decreased during 2023 and 2024.

Figure 118: Evolution of the exchange wholesale electricity price from 2020 with projected electricity price evolution by 2025



Source: PXE, IHA

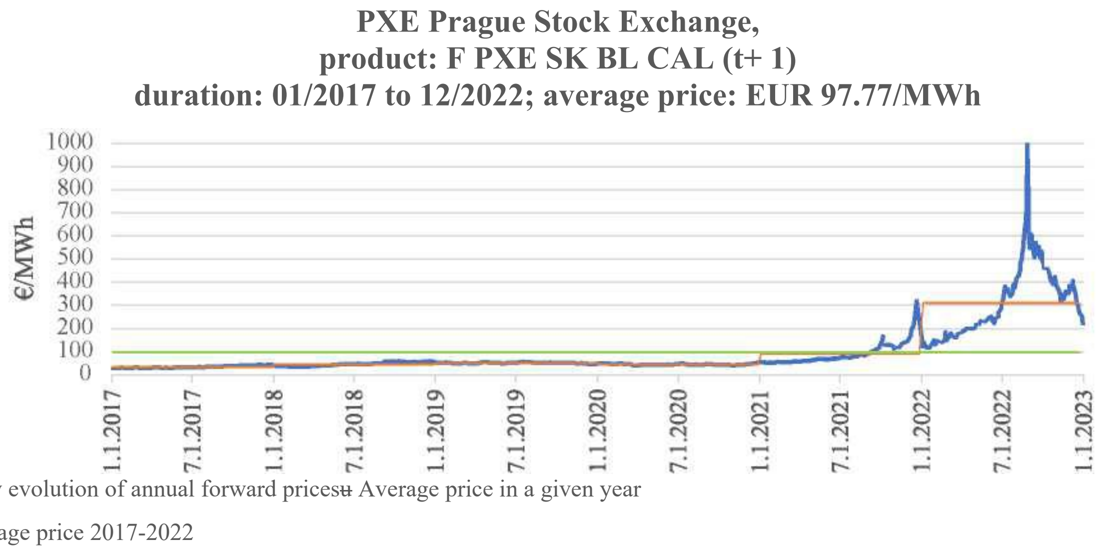
In response to particularly high and volatile electricity prices in the wholesale market, in addition to the above-mentioned emergency regulations of the Council of the EU, the European Commission published a proposal for structural reform of the EU electricity market design.

The reform of the EU's electricity market design aims to strengthen the stability and predictability of electricity prices and thus strengthen the EU's competitiveness. The EC's proposal for a reform of the electricity market design has, inter alia, responded to the energy crisis, which has shown the limitations of the current electricity market set-up. The EC proposal builds on the European Green Deal's efforts to boost European competitiveness through innovation and the transition to a climate-neutral economy, and is closely linked to the Commission's Green Deal Industrial Plan. The main objective is to accelerate the deployment of renewables, together with the flexibility of the electricity grid to replace fossil fuels following the REPowerEU plan.

Electricity market

Wholesale electricity markets are increasingly interconnected across the Union. In the wholesale electricity market, the competences of the national regulatory authority (the Regulatory Authority for Network Industries – ÚRSO) are limited to creating legislative conditions and monitoring compliance.
Electricity on the wholesale market trades freely within the EU and the wholesale electricity price is made within the interconnected single European electricity market and does not reflect the actual cost of electricity production (EUR/MWh) in individual Member States (e.g. Slovakia) but is the electricity market prices published by the relevant energy exchange for the product in question (for Slovakia and the Czech Republic, the determining factor is the Prague commodity exchange PXE). Another factor causing extremely high wholesale electricity prices is the current electricity market model and price formation in the EU's interconnected wholesale electricity market, which is highly dependent on current market prices for natural gas (with natural gas prices at extremely high levels (around EUR 200/MWh) during 2022 due to the scarcity of natural gas and the war conflict in Ukraine. Therefore, the EU seeks to reduce the dependence of electricity prices on gas prices and thus reduce the wholesale electricity price and consequently the electricity prices for final customers.

Figure 119: Exchange wholesale electricity price developments 2017-2022



Source: PXE, ÚRSO

The chart shows that while developments were relatively calm between January 2017 and mid-2021, there is a period of turbulence and unpredictable increases in the overall price level since summer 2021.

Description and definition of electricity market participants

- electricity generators (Slovenské elektrárne, a.s. – dominant producer, 63.51 %);
- supported producers of electricity from RES and HCHP;
- short-term electricity market operator

  (OKTE, a.s.), an institution for evaluating and organising the short-term electricity market and ensuring the settlement, evaluation and settlement of imbalances in Slovakia;
- the Slovak transmission system operator (SEPS, a.s.), the sole holder of a permit for the transmission of electricity, the transmission system operator, which also performs energy dispatching tasks (ensuring a balanced balance in the defined territory of the Slovak Republic);
- three regional distribution system operators (ZSD, a.s., SSD, a.s., VSD, a.s.),
- local Distribution System Operators (MDS), 142 MDS operators on sites of generation but also non-production companies;
- electricity suppliers;
- electricity customers;
- electricity feeder.

Table 57: Number of delivery points in Slovakia in 2017-2022

OM numbers	Total number of OMs in Slovakia	Of the total number of OMs in			Of the total number of OMs in Slovakia			
		SEPS,a.s.	Cumulative RDS	MDS Cumulative	Om at voltage level NN	Om at the voltage level of HV	Om at the Vulnerable Voltage Level – Distribution	Om at the Vulnerable Voltage Level – transmissio
2017	2 539 349	33	2 524 70	14 616	2 525 55	13 611	157	30
2018	2 566 529	33	2 550 94	15 549	2 552 64	13 692	158	30
2019	2 595 124	33	2 578 44	16 647	2 581 24	13 695	158	30
2020	2 623 880	33	2 605 32	18 524	2 609 94	13 749	160	30
2021	2 654 515	33	2 634 27	20 203	2 640 59	13 728	161	30
2022	2 682 543	33	2 660 10	22 404	2 668 66	13 685	159	30

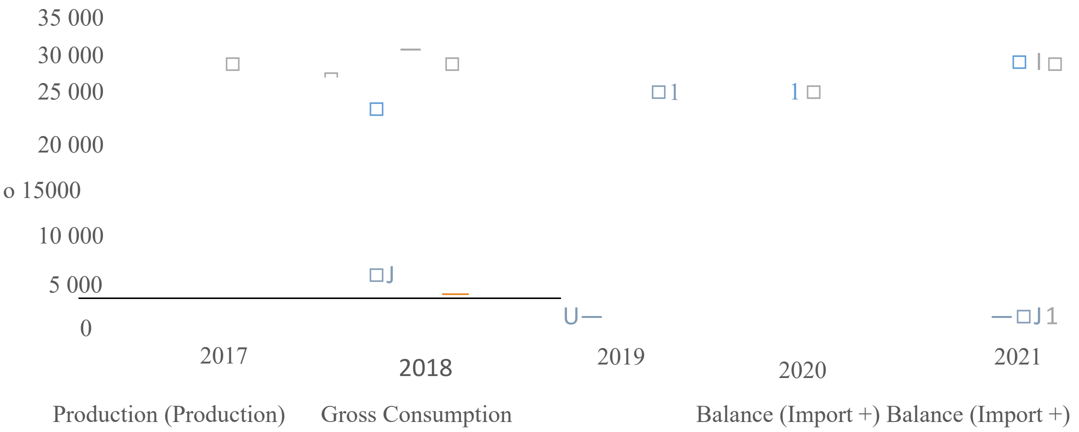
Source: OKTE, a.s.

Table 58: Number of delivery points according to more detailed specification in Slovakia in 2017-2022

OM numbers	ZSDIS			SSD			VSD		
	NN	CPR	CPR	NN	CPR	CPR	NN	CPR	CPR
2017	1 131 745	4 813	51	745 569	5 370	49	633 943	3 114	46
2018	1 147 697	4 861	52	749 970	5 358	48	639 756	3 158	47
2019	1 163 649	4 902	52	755 727	5 311	48	645 539	3 169	47
2020	1 178 321	4 946	52	761 565	5 273	50	651 873	3 196	47
2021	1 193 783	4 971	52	768 805	5 219	50	658 148	3 203	48
2022	1 207 009	4 985	52	775 665	5 156	50	663 933	3 210	46

Source: OKTE, a.s.

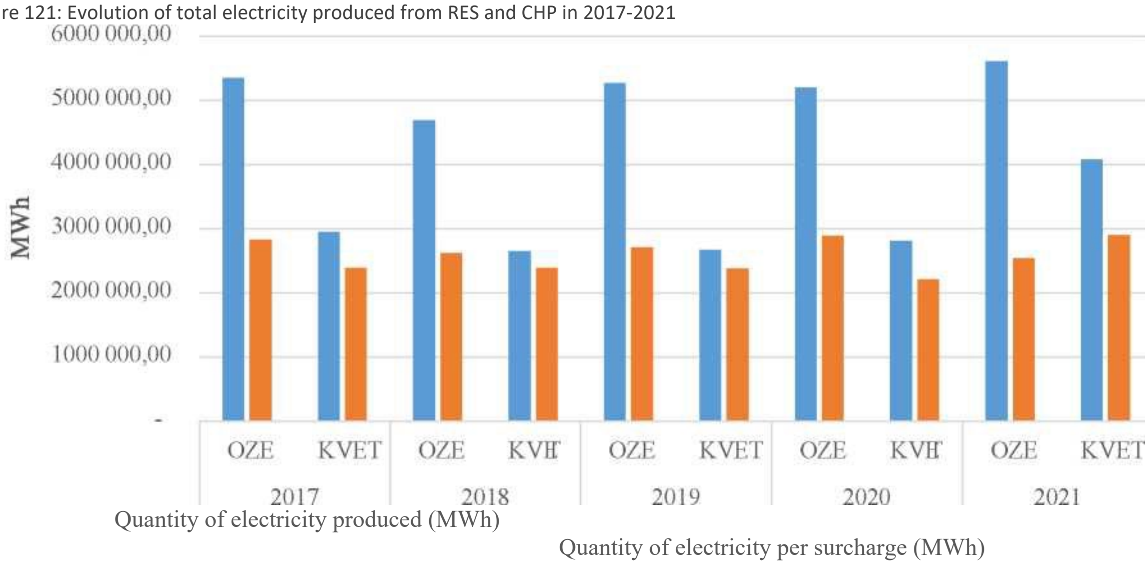
Figure 120: Evolution of total production volume, total gross electricity consumption and balance in 2017-2021



Source: Slovak Electricity Transmission System (SEPS; a.s.). Available online:

Commentary on Graph 120:
Generation – metering data at generator terminals, power supply to the grid, self-generated power generation (or measurements at a designated handover point).
Balance – measured cross-border exchanges, Import (+), Export (--).
Gross consumption – including consumption for pumped storage of hydropower storage.

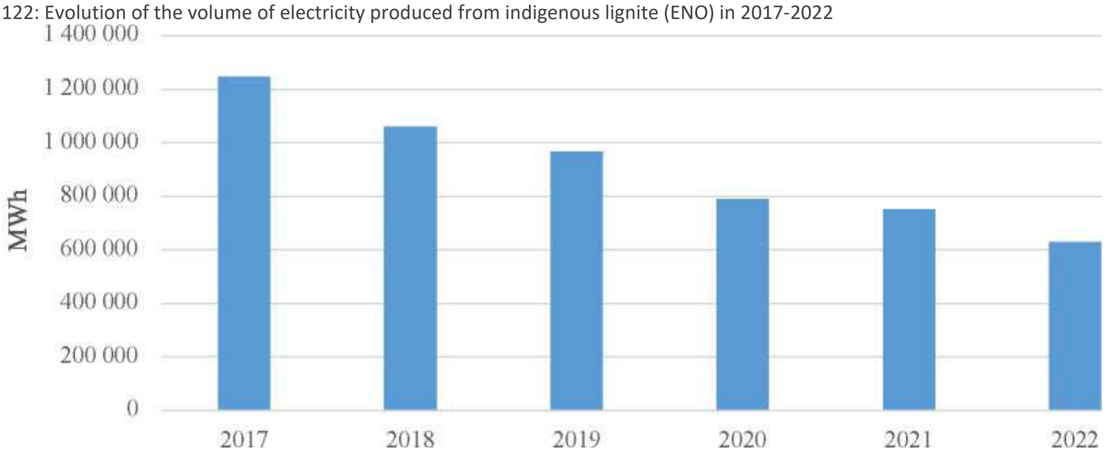
Figure 121: Evolution of total electricity produced from RES and CHP in 2017-2021



Source: Internal translations of ÚRSO based on data from OKTE, a.s.

Commentary on Graph 121: The data concern only those entities (or producers) which, within the meaning of Act No 309/2009, fall within the 'support scheme' for the production of electricity from RES and CHP.
N.B.: data for 2022 were not available at the time of processing.

Figure 122: Evolution of the volume of electricity produced from indigenous lignite (ENO) in 2017-2022



Source: Slovak Power Plants, a.s.

End-user market

The adoption of Act No 250/2012 on regulation in network industries introduced price regulation for the supply of electricity to vulnerable customers, household customers and small enterprises.

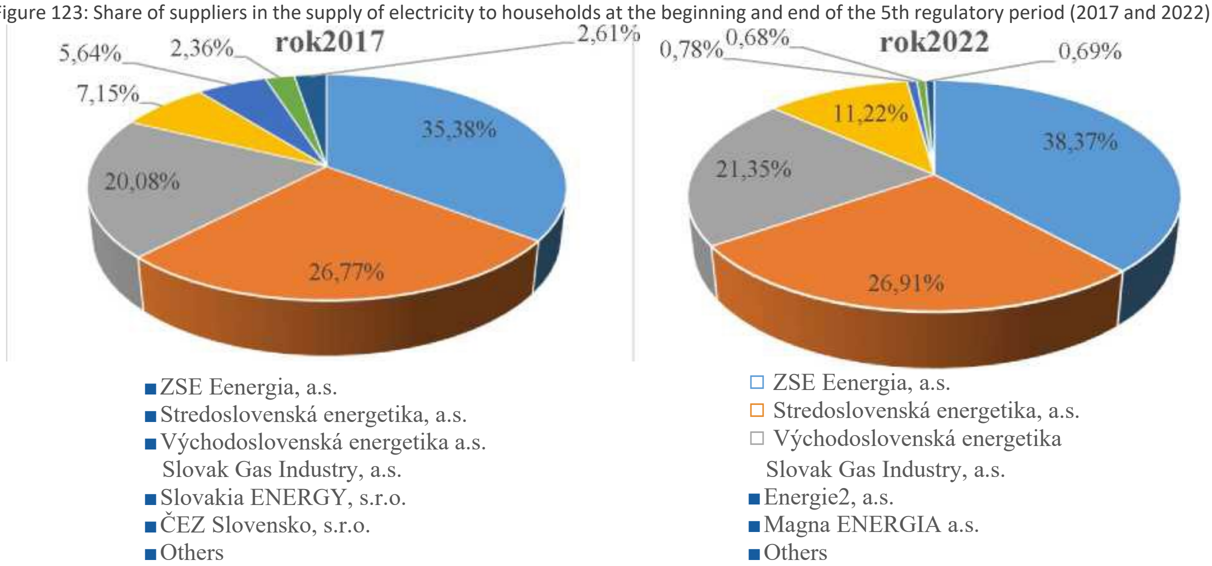
The following shall be subject to price regulation in the supply of electricity:

- van electricity for households,
- van electricity small enterprises;
- van electricity supplier of the last instances.

Supply of electricity to households

The maximum prices for the supply of electricity to households shall be two-component and shall consist of a monthly payment per delivery point and a price for electricity consumed in a low or high band. The supply of electricity to households is divided into eight tariffs.

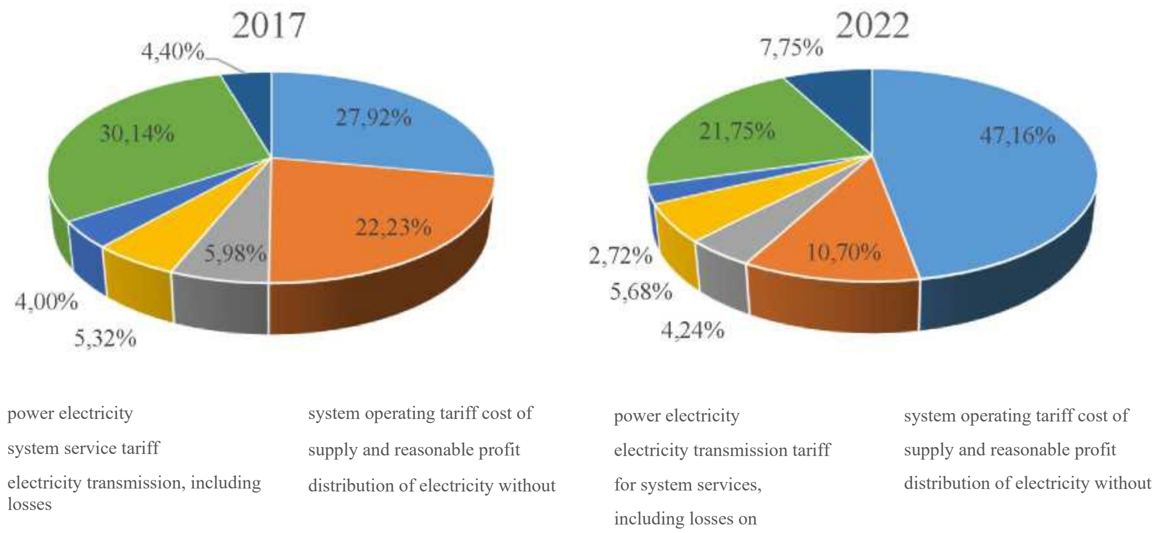
Figure 123: Share of suppliers in the supply of electricity to households at the beginning and end of the 5th regulatory period (2017 and 2022)



Source: Internal translations of ÚRSO.

Commentary on Graph 123: On the basis of a shareholder decision, the supplier ČEZ Slovensko, s.r.o. ceased operating in the regulated segment during the 5th regulatory period (it sold the portfolio to another supplier). SLOVAKIA ENERGY, s.r.o. lost its capacity to perform the electricity supply activity in autumn 2021 and its portfolio was mainly taken over by suppliers of last resort.

Figure 124: Structure of the price for the supply of electricity to households at the beginning and end of the 5th regulatory period (2017 and 2022)

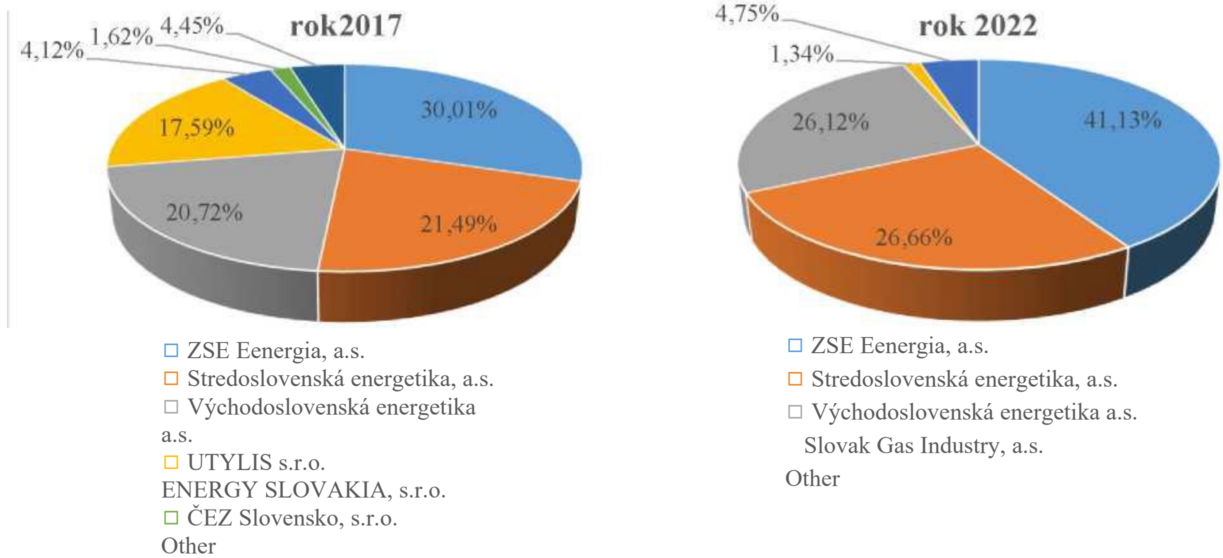


Source: Internal translations of ÚRSO.

Electricity supply to small enterprises

A final electricity customer with annual electricity consumption shall be considered to be a small enterprise for all its delivery points of no more than 30 000 kWh per year preceding the year of submission of the price proposal. The supply of electricity to small businesses was divided into 11 tariffs.

Figure 125: Share of suppliers in electricity supply to regulated small enterprises at the beginning and end of the 5th regulatory period (in 2017 and 2022)



Commentary on Graph 125: On the basis of a shareholder decision, the supplier ČEZ Slovensko, s.r.o. ceased operating in the regulated segment during the 5th regulatory period (it sold the portfolio to another supplier). SLOVAKIA ENERGY, s.r.o. lost its capacity to perform the electricity supply activity in autumn 2021 and its portfolio was mainly taken over by suppliers of last resort.

Change of electricity supplier

To assess the level of liberalisation of the electricity and gas markets, a ‘switching’ percentage, which reflects the ratio of the number of electricity or gas switching points to the total number of demand points in that year, is used.

Table 59: Switching 2017-2021

SWITCHING	2017	2018	2019	2020	2021	2022
Household delivery points	3.45 %	2.28 %	2.34 %	2.78 %	5.10 %	0.79 %
Non-household delivery points	5.90 %	4.55 %	4.08 %	4.68 %	6.58 %	4.13 %
Together	3.74 %	2.55 %	2.54 %	3.01 %	5.27 %	1.14 %

Source: Internal translations of ÚRSO.

Table 60: Cumulative data on the supply of electricity to customers in last resort mode 2017-2022

	2017	2018	2019	2020	2021	2022
Number of demand points concerned (total)	0	23	0	0	176 959	4 922
Number of suppliers that have lost their capacity to perform the supply activity	0	2	0	0	3	3

Source: Statistics compiled on the basis of data provided by designated suppliers of last resort

Comment:

During the 5th regulatory period, the following electricity suppliers lost their capacity to supply:

In 2018: Lumius, spol. s r.o.; Energy Europe, SE.

In 2021: Slovakia ENERGY, s.r.o.; BCF ENERGY, s.r.o.; Smart Energy Contractor SEC, a.s.

In 2022: A.En. Slovensko s.r.o.; TWINLOGY s.r.o.; GEON, a.s.

Gas market

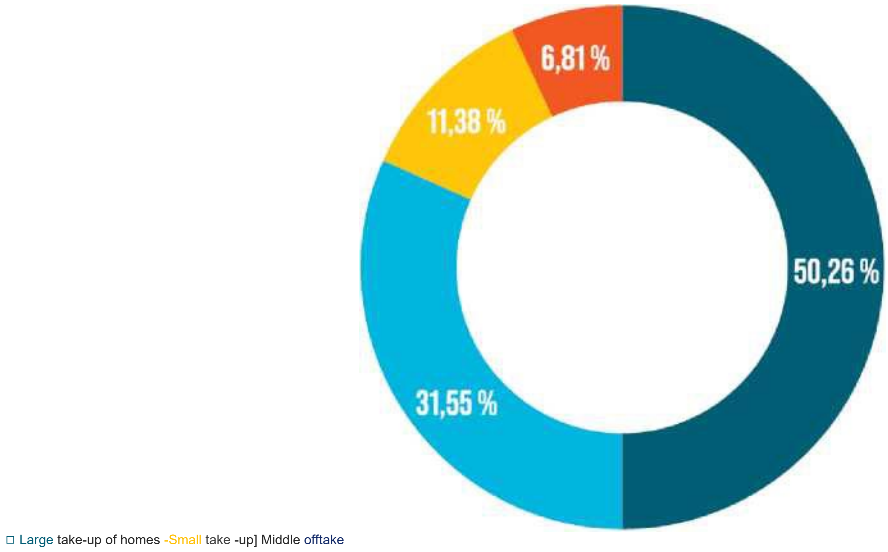
The gas sector in Slovakia is mainly specific to the extent of the gas networks and the associated high degree of gasification and transit use of the transmission system.

Table 61: Gas consumption 2018-2023

Year	2018	2019	2020	2021	2022	2023
Consumption (billion m^3)	**4,9**	**5,0**	**5,2**	**5,6**	**4,5**	**4,3**

Source: MINISTRY OF THE ECONOMY

Figure 126: Gas consumption in 2022 broken down by customer category



Source: Annual report 2022, Office for the Regulation of Network Industries

Traditionally, industrial customers included in tariff groups have the highest share of final gas consumption in Slovakia, for which the annual gas consumption at the demand point was around 40 TWh. The share of household customers in total gas consumption in Slovakia is 29.14 %.

Gas market participants:

- transmission system operator (eustream, a.s.);
- distribution network operator in the defined territory of the Slovak Republic (SPP – Distribution, a.s.);
- local distribution system operators;
- two storage operators;
- gas suppliers;
- gas customers.

Wholesale market

The wholesale gas market is characterised by:

- the purchase of gas on the basis of long-term contracts;
- the purchase of gas on commodity exchanges;

- purchasing gas from another trader – gas supplier
- trading at a virtual trading point of the transmission system operator;
- trading or changing ownership of gas stored in underground storage facilities.

End-user market

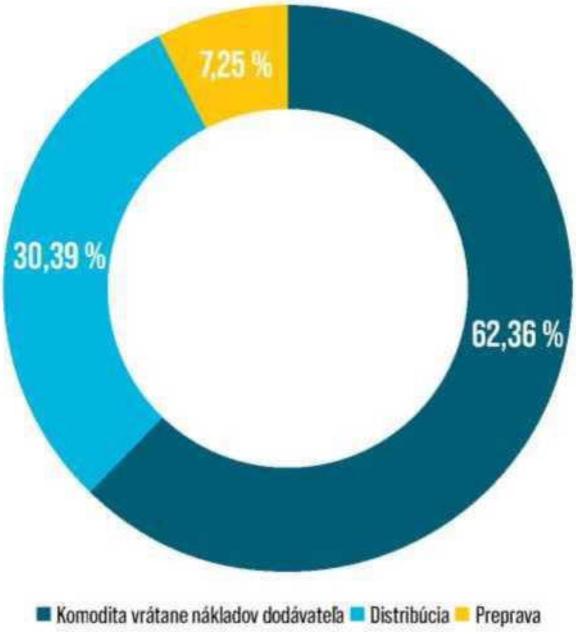
The maximum prices for the supply of gas to vulnerable customers consisted of two components, the maximum fixed monthly rate and the maximum rate for the gas consumed. Until 2023, consumer tariffs were divided into six tariff groups 1 to 6 according to annual gas consumption, since 2023 ÚRSO has set tariffs for 8 tariff groups. A vulnerable gas customer under the Regulation Act is a household customer and a gas customer of the category small gas customer (so-called ‘small enterprise’). A small gas customer within the meaning of the Regulation Act is a final customer of natural gas with an annual consumption of natural gas at all delivery points of not more than 100 thousand kWh over the preceding year and belongs to the group of vulnerable customers.

The price regulation for the supply of gas shall be subject to:
- vangas for households,
- vangas small customers,
- van gas supplier of the last instances.

In 2022, non-household customers were also included among vulnerable customers during the energy crisis, namely:

- a non-household customer with a total annual gas consumption of the preceding year not exceeding 100 000 kWh;
- a non-household gas customer who collects gas for the operation of a social service facility entered in the register of social services;
- non-household gas customer purchasing gas for the operation of the installation social and legal protection of children and social guardianship;
- non-household gas customer purchasing gas for the operation of a multi-apartment building rented dwellings owned by a municipality or a higher territorial unit which are intended for social housing pursuant to special legislation or for the operation of a multi-apartment building with rental dwellings within the framework of state-supported rental housing pursuant to a special regulation,
- the group of final gas customers, namely owners of apartments and non-residential premises in a multi-apartment building, supplying gas for the production of heat and domestic hot water, legally represented by a natural or legal person managing a common heater supplying a multi-apartment building with heat and hot water.

Figure 127: Structure of the average final price of gas supply to households 2022



Source: Annual report 2022, Office for the Regulation of Network Industries

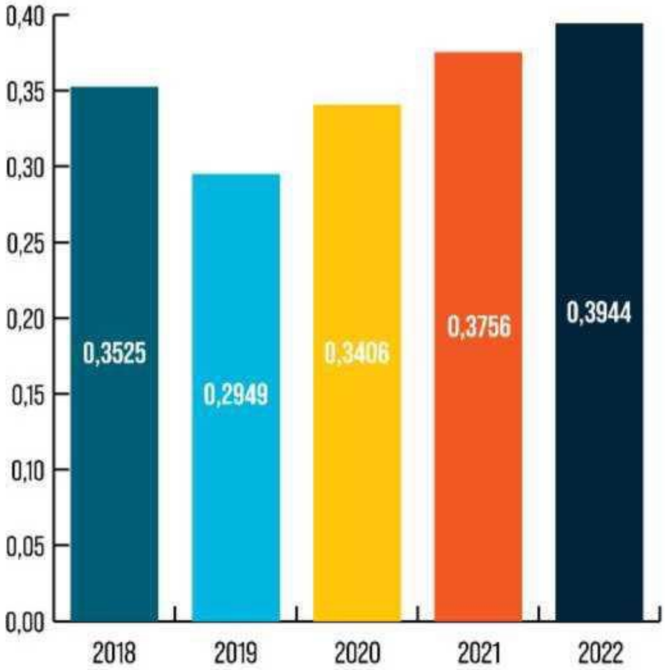
Table 62: Structure of demand points and switching (2018-2022)

Categories of off-take customers' locations	number of gas customers with switching gas supplier					switching (%)				
	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
large-scale buyer	71	90	179	145	204	9,69	10.22	25,03	20.86	28,18
medium Customer	314	284	478	415	535	11,30	8,99	17,05	15,52	19,33
small-customer	4765	3687	5093	5151	5 251	6,23	4,82	6,64	6,59	6,95
household	36627	48000	48 481	67067	20738	2,54	332	3,35	4,28	1,43
together	41777	52061	54231	72778	26728	2,74	3,41	3,55	4,41	1,74

Source: Annual report 2022, Office for the Regulation of Network Industries

The level of concentration in the gas market can also be measured by the HHI (Herfindahl-Hirschman Index). The market is concentrated if the HHI is more than 0,1 and highly concentrated at a value exceeding 0,2. The graph below shows the evolution of the HHI between 2017 and 2021.

Graf 128: Herfindahl–Hirschman Index 2018 – 2022



Source: Annual report 2022, Office for the Regulation of Network Industries

11. Projections of developments with respect to existing policies and measures at least until 2040 (including projections for 2030)

Rather, gas consumption is expected to stagnate for the next period.

Factors that will influence consumption levels include the annual average temperature as well as the continuation of various energy efficiency related measures, e.g. building insulation or advanced technology solutions for buildings. In the household segment, the evolution of the gas price as well as the availability of alternative fuels will have an impact on the level of consumption. Competition from individual gas suppliers active on the market can play a positive role in terms of prices.

Table 63: Forecast of natural gas consumption with a view to 2027

Year	2023	2024	2025	2026	2027
Total consumption [billion m^3]	4,3	4,3	4,3	4,3	4,3

Source: Ministry of the Economy, SPP-Distribution, a.s.

From the point of view of electricity production, the Slovak Republic supports nuclear energy as well as cost-effective RES in order to achieve the 2030 targets and thereby meet Slovakia's priorities in this area, as stated at the beginning of this document.

Future developments in energy prices remain unpredictable. While declining wholesale electricity and gas prices are good news, energy prices are very likely not to return to their pre-2020 levels, which may be negatively reflected in energy bills for many households in the future. The global energy market and our high dependence on energy imports, in particular gas, will continue to affect them. Moreover, unforeseen geopolitical events can easily disrupt the wholesale market again. Reducing every consumer's energy consumption is crucial in this respect.

4.6. Dimension: research, innovation and competitiveness

i. The current situation of the low-carbon technology sector and, to the extent possible, global market position (this analysis is to be carried out at Union or global level)

Since 2007, Slovakia has been a member of the International Energy Agency, which is also engaged in research into low-carbon energy technologies with a view to achieving long-term global greenhouse gas emission reduction targets.

In 2016, Slovakia was the first country in Central and Eastern Europe to become a member of the IEA *Solar Heating & Cooling Programme* (SHC) technological cooperation programme. Slovakia's participation in this programme will enable the development of scientific knowledge in the Slovak Republic and a better involvement of Slovak scientists in the international research community.

ii. Current level of spending on public and, where available, private research and innovation in areas of low carbon technologies, current number of patents and current number of researchers

Only data are available from the IEA RDD questionnaire, which tracks energy R & D funding in a structured way, which provides information on R & D funding also in low carbon technologies for 2015-2017.

iii. A breakdown of the current price elements, which form the three main price components (energy; network, taxes/fees)

Transparency of energy prices in the EU is guaranteed through the obligation for EU Member States to send to EUROSTAT price information for different categories of industrial consumers, as well as data on market shares, sales conditions and pricing systems. The provision of prices to household consumers is voluntary.

Gas tariffs and electricity tariffs vary from supplier to supplier. They may result from negotiated contracts, especially for large industrial consumers. For smaller consumers, they are generally set according to the amount of gas consumed along with a number of other characteristics; most tariffs also include some form of fixed charge. There is therefore no single price for natural gas or electricity. The information published in EUROSTAT statistics on natural gas prices is collected together for three different types of households and information on electricity prices is collected together for five different types per annual consumption band. For industrial consumers, price information is collected together for six different types of users for gas prices, and for industrial consumers, information on electricity prices is collected together for seven different types of users.

The legal basis for the survey of statistics on natural gas prices charged to consumers in industry is the European CommissionDecision (2007/394/EC) of 7 June 2007 amending Council Directive (90/377/EEC) with regard to the methodology to be used for determining the gas and electricity prices charged to industrial end-users. Directive 2008/92/EC of the European Parliament and of the Council of 22 October 2008 concerns a Community procedure to improve the transparency of gas and electricity prices charged to industrial end-users.

The price of natural gas and electricity for final customers within the meaning of Regulation (EU) 2016/1952 of the European Parliament and of the Council of 26 October 2016 on European statistics on natural gas and electricity prices and repealing Directive 2008/92/EC consists of the sum of three main components: 'energy and supply', 'network' (transport and distribution) and a component comprising taxes, levies and charges. The following items are included in the individual components:

Gas

Energy and supply shall include the commodity price of natural gas paid by the supplier or the price of natural gas at the point of entry into the transmission system and, where applicable, storage costs and costs related to the sale of natural gas to final customers.

Network charges shall include the costs of: gas transmission and distribution tariffs, transmission and distribution losses, network charges, after-sales service costs, system operation costs and meter rental and metering costs.

Taxes, duties and levies are made up of the sum of all taxes, duties and charges.

Electricity

Energy and supply shall include the following costs: electricity generation, storage, balancing energy, costs of delivered energy, customer services, after-sales management and other delivery costs.

The network price must include the following costs: electricity transmission and distribution tariffs, transmission and distribution losses, network charges, after-sales service costs, system operation costs and meter rental and metering costs.

Taxes, duties and levies are made up of the sum of all taxes, duties and charges.

iv. Description of energy subsidies, including for fossil fuels

*Slovak*Government Regulation No 426/2010 laying down details of the amount of the levy on electricity supplied to final customers and the method of its collection for the National Nuclear Fund for the decommissioning of nuclear installations and for the management of spent nuclear fuel and radioactive waste

The State aid to cover part of the costs related to the decommissioning and management of spent nuclear fuel from nuclear power plants (A1 and V1) (No SA.31860 (N506/2010)) is being implemented pursuant to European Commission Decision C(2013) 782 of 20 February 2013. These costs are partly financed in the form of levies on transmission system operators and distribution system operators into the revenue budget account of the MH SR chapter and are paid to the budget of the National Nuclear Fund for the decommissioning of nuclear installations and the management of spent nuclear fuel and radioactive waste within the meaning of Government Regulation No 426/2010 laying down the details of the amount of the levy on the electricity supplied to final customers and the manner in which it is collected for the NJF.

Aid scheme for undertakings in sectors and subsectors deemed to be exposed to a significant risk of carbon leakage due to the cost of EU ETS allowances passed on in electricity prices as amended by Appendix 1 (No SA.51172 (2018/N))

State aid*scheme to promote international cooperation in the field of industrial research and experimental development, as amended by Appendix 1 (No SA scheme. 427653)*

State aid scheme for a loan facility to promote the energy efficiency of buildings (housing houses) (Scheme No SA.48640)

Aid scheme for the provision of aid in the form of reductions in environmental taxes, as amended by Appendix 1

State aid scheme to increase the competitiveness of energy-intensive enterprises (No SA.110954 (2023/PN)).

Table 64: Fiscal measures

Measures	**Legal basis**	**From**	**Into (if any)**
Exemption from excise duty on mineral oil – Air transport	Act No 98/2004	1 May 2004	
Exemption from excise duty on mineral oil – Waterborne transport on the Danube	Act No 98/2004	1 May 2004	
Exemption from excise duty on mineral oil – Production of electricity	Act No 98/2004	July 2008	
Exemption from excise duty on mineral oil – CHP	Act No 98/2004	July 2008	
Exemption from excise duty on mineral oil – all types of exemption	Act No 98/2004	1 May 2004	
Exemption from excise duty on mineral oil – used for essential operational or technological purposes in an undertaking for the production of mineral oils, with the exception of use as propellant for means of transport	Act No 98/2004	1 May 2004	
Exemption from excise duty on electricity – RES	Act No 609/2007 Coll.	July 2008	
Exemption from excise duty on electricity – CHP	Act No 609/2007 Coll.	July 2008	
Excise duty exemption on electricity – energy-intensive industry	Act No 609/2007 Coll.	July 2008	
Excise duty exemption on electricity – transport	Act No 609/2007 Coll.	July 2008	
Excise duty exemption for electricity – Households	Act No 609/2007 Coll.	July 2008	
Exemption from excise duty on coal – electricity production	Act No 609/2007 Coll.	July 2008	
Exemption from excise duty on coal – CHP	Act No 609/2007 Coll.	July 2008	
Exemption from excise duty on coal – rail and river transport	Act No 609/2007 Coll.	July 2008	
Exemption from excise duty on coal – Households	Act No 609/2007 Coll.	July 2008	
Exemption from excise duty on coal – all types of exemption	Act No 609/2007 Coll.	July 2008	
Exemption from excise duty on natural gas – electricity production	Act No 609/2007 Coll.	July 2008	

Measures	**Legal basis**	**From**	**Into (if any)**
Exemption from excise duty on natural gas – CHP	Act No 609/2007 Coll.	July 2008	
Exemption from excise duty on natural gas – Households	Act No 609/2007 Coll.	July 2008	
Exemption from excise duty on natural gas – rail transport	Act No 609/2007 Coll.	July 2008	
Exemption from excise duty on natural gas – all types of exemption	Act No 609/2007 Coll.	July 2008	
Exemption from the air pollution charge (for carbon monoxide emissions – large and medium sources) included in the emissions trading scheme	Act No 190/2023	January 2025	
Air pollution charge (for carbon monoxide emissions – large and medium sources) included in the emissions trading scheme for emissions from the combustion of biomass and biogas.	Act No 190/2023	January 2025	
Air pollution charge (for particulate emissions – large and medium sources)	Act No 190/2023	January 2024	
Air pollution charge (for sulphur oxide emissions – large and medium sources)		January 2024	
Air pollution charge (for nitrogen oxide emissions – large and medium coal sources)		January 2024	
Air pollution charge (for carbon monoxide emissions – large and medium sources)		January 2024	
Air pollution charge (for emissions of organic substances – large and medium sources)		January 2024	
Air pollution charge (for ammonia emissions – large and medium sources)		January 2024	
Air pollution charge (for emissions of other pollutants – small source using hard coal, lignite, coke or burning biomass, if so provided by the municipality in a generally binding regulation within the meaning of Annex 3		January 2024	
Fee for the disposal of waste in a landfill – municipal waste on the basis of the level of sorting within the meaning of Annex 2 to the Act	Act No 319/2018.	March 2021	
Fee for the disposal of industrial waste in a landfill	Act No 319/2018.	March 2021	
Contribution to the National Nuclear Fund	Government Regulation No 22/2019 Coll.	February 2019	
Max. amount of the National Nuclear Fund levy for 1 final electricity customer	Government Regulation No 22/2019 Coll.	February 2019	
Dedicated subsidy to the National Nuclear Fund	Act No 308/2018	January 2019	

Measures	Legal basis	From	Into (if any)
System operation tariff – RES	Ordinance of the ÚRSO establishing price regulation in the electricity sector and certain conditions for carrying out regulated activities in the electricity sector (current Decree No 154/2024 Coll.)	August 2007	annual update
System operation tariff – CHP		August 2007	annual update
System operation tariff – Electricity generation from indigenous coal		August 2007	annual update
System operation tariff – OKTE		August 2007	annual update
System operation tariff – total		August 2007	annual update
Reduced system operating tariff – Stable Demand		July 2011	annual update
Reduced system service tariff – stable demand		August 2007	annual update
Regulated prices for the supply of natural gas – Households	Act No 250/2012 Coll.	1 January 2005	
Regulated prices for the supply of natural gas – small enterprises	Act No 250/2012 Coll.	September 2012	
Regulated prices for the supply of electricity – Households	Act No 250/2012 Coll.	1 January 2005	
Regulated electricity supply prices – small enterprises	Act No 250/2012 Coll.	September 2012	
Allowance for thermal insulation of a single-family house	Act No. 555/2005 Coll.	January 2016	
Soft loans for insulation of multi-apartment and single-family houses	Act No 150/2013 Coll.	1 January 2004	
Soft loans for insulation of social services facilities	Act No 150/2013 Coll.	September 2007	
Green Households project – supporting the installation of RES equipment in households	SIEA – General conditions for promoting the use of RES in households	January 2015	
Bohunice International Decommissioning Support Fund (BIDSF)	EBRD International Agreement, SIEA	February 2002	
Allowance for the purchase of electric car I.	MINISTRY OF THE ECONOMY	November 2016	June 2018
Allowance for the purchase of electric car II.	MINISTRY OF THE ECONOMY	2019	2019
Colour-differentiated vehicle registration numbers for electric vehicles	Act 42/2024 Coll.	2024	
Motor vehicle tax exemption – electric car	Act No 361/2014	January 2015	
Reduced motor vehicle tax – hybrids, CNG and hydrogen	Act No 361/2014	January 2015	
Subsidies to the Envirofond, Area A – Protection of the Earth's air and ozone layer	Act No. 587/2004 Coll.		

Measures	Legal basis	From	Into (if any)
Envirofond Subsidy, Area C – Development of waste management	Act No. 587/2004 Coll.		
Envirofond Subsidy, Area L – Increasing the energy efficiency of existing public buildings, including insulation	Act No. 587/2004 Coll.		
Public economic interest – electricity generation from indigenous coal	Government Resolution (termination of EEZ No 336/2019)	2005	Completed in December 2023

Source: MINISTRY OF THE ECONOMY

State aid SA.55038 (2019/N) – Slovakia – Aid to cover exceptional closure costs of Hornonitrianske bane Prievidza (HBP)

Closure of the mine requires the implementation of safety measures on the ground, the destruction of original mine works and estuaries. The end of mining will also result in redundancies.

State aid to cover HBP's extra costs in connection with the closure of mining operations was notified to the Commission 25. 7. 2019. The Commission assessed the compatibility of the notified scheme and 28. 11. 2019 decided to consider the aid compatible with the internal market under Council Decision 2010/787/EU of 10 December 2010 on State aid to facilitate the closure of uncompetitive coal mines and not to raise objections to the notified measure.

The category of eligible costs includes extra expenditure for workers who have lost or lost their jobs, subsurface security works resulting from the closure of coal production units, all duly justified costs related to the rehabilitation of former angle mining sites and the costs of surface remediation.

Coal mining from the last exploited mining field was physically closed in December 2023.

The closure of State aid in connection with the closure of mining activities in Bani Handlová and Bani Nováky is within the meaning of the State aid notification and Government Resolution No 705 of 12. 12. 2023 and N°275 of 15. 5. 2024 foreseen by the end of 2027 at the latest.

Table 65: Taxes, exemptions, fees and tariffs

Tax Name	Legal basis	Payer, sector (if only the selected circuit is valid)	From	Into (if any)
Excise duty on mineral oil (motor gasoline)	Act No 98/2004		1 May 2004	
Reduced rate of excise duty on mineral oil (motor gasoline)	Act No 98/2004		January 2011	
Excise duty on mineral oil (motor gasoline)	Act No 98/2004		1 May 2004	
Excise duty on mineral oil (medium oil)	Act No 98/2004		1 May 2004	
Excise duty on mineral oil (gas oil)	Act No 98/2004		1 May 2004	
Reduced rate of excise duty on mineral oil (gas oil)	Act No 98/2004		January 2011	
Excise duty on mineral oil (fuel oil)	Act No 98/2004		1 May 2004	

Tax Name	Legal basis	Payer, sector (if only the selected circuit is valid)	From	Into (if any)
Excise duty on mineral oil (liquefied gaseous hydrocarbons)	Act No 98/2004		1 May 2004	
Excise duty on mineral oil (lubricating oils and other oils)	Act No 98/2004		January 2012	
Exemption from excise duty on mineral oil	Act No 98/2004	business enterprise sector	1 May 2004	
Exemption from excise duty on mineral oil	Act No 98/2004		July 2008	
Excise duty on electricity	Act No 609/2007 Coll.		July 2008	
Excise duty on coal	Act No 609/2007 Coll.		July 2008	
Excise duty on natural gas	Act No 609/2007 Coll.		July 2008	
Exemption from excise duty on electricity	Act No 609/2007 Coll.		July 2008	
Exemption from excise duty on electricity	Act No 609/2007 Coll.	industry	July 2008	
Exemption from excise duty on electricity	Act No 609/2007 Coll.	business enterprise sector	July 2008	
Exemption from excise duty on electricity	Act No 609/2007 Coll.	household	July 2008	
Exemption from excise duty on coal	Act No 609/2007 Coll.		July 2008	
Exemption from excise duty on coal	Act No 609/2007 Coll.	business enterprise sector	July 2008	
Exemption from excise duty on coal	Act No 609/2007 Coll.	household	July 2008	
Exemption from excise duty on natural gas	Act No 609/2007 Coll.		July 2008	
Exemption from excise duty on natural gas	Act No 609/2007 Coll.	household	July 2008	
Exemption from excise duty on natural gas	Act No 609/2007 Coll.	business enterprise sector	July 2008	
Determination maximum prices for regulated delivery heat for	Slovak Government Regulation No 475/2023 Z.		January 2023	updated annually
Fixing tariffs for final electricity and gas customers	Slovak Government Regulation No 472/2023		January 2023	updated annually
Setting a maximum price for the part of the regulated deliveries gas for end-to-end subscribers gas v households, maximum price for the part of the regulated electricity supply for selected vulnerable electricity customers and maximum price for the part of the regulated electricity deliveries gas for selected vulnerable gas customers and	Slovak Government Regulation No 463/2023		January 2023	updated annually
VAT on mineral oils	Act No 222/2004		April 2004	
VAT on petrol			April 2004	
VAT on medium oil			April 2004	
VAT on gas oil (diesel)			April 2004	

Tax Name	Legal basis	Payer, sector (if only the selected circuit is valid)	From	Into (if any)
VAT on fuel oil			April 2004	
VAT from liquefied gaseous hydrocarbon			April 2004	
VAT on lubricating and other oils			April 2004	
VAT on electricity			April 2004	
VAT on coal			April 2004	
VAT on natural gas			April 2004	
Air pollution charge (for particulate emissions – large and medium sources)	Act No 401/1995 Coll.		January 2000	
Air pollution charge (for sulphur oxide emissions – large and medium sources)	Act No 401/1995 Coll.		January 2000	
Air pollution charge (for emissions of nitrogen oxides – large and medium sources)	Act No 401/1995 Coll.		January 2000	
Air pollution charge (for carbon monoxide emissions – large and medium sources)	Act No 401/1995 Coll.		January 2000	
Air pollution charge (for emissions of organic substances in the gaseous phase – large and medium sources)	Act No 401/1995 Coll.		January 2000	
Air pollution charge (for emissions) other polluting substances/Class 1 – Large and Medium	Act No 401/1995 Coll.		January 2000	
Air pollution charge (for emissions) other polluting substances/Class 2 – Large and Medium	Act No 401/1995 Coll.		January 2000	
Air pollution charge (for emissions) other polluting substances/Class 3 – Large and Medium	Act No 401/1995 Coll.		January 2000	
Air pollution charge (for emissions) other polluting substances/Class 4 – Large and Medium	Act No 401/1995 Coll.		January 2000	
Reduced air pollution charge (for emissions rigid pollutants – large and medium sources using indigenous lignite)	Act No 401/1995 Coll.		15 May 2001	
Reduced air pollution charge (for sulphur oxide emissions – large and medium sources using indigenous lignite)	Act No 401/1995 Coll.		15 May 2001	
Reduced air pollution charge (for nitrogen oxide emissions – large and medium sources using indigenous lignite)	Act No 401/1995 Coll.		15 May 2001	
Reduced air pollution charge (for carbon monoxide emissions – large and medium generators using indigenous lignite)	Act No 401/1995 Coll.		15 May 2001	

Tax Name	Legal basis	Payer, sector (if only the selected circuit is valid)	From	Into (if any)
Reduced air pollution charge (for emissions of organic matter in the gaseous phase – large and medium sources using indigenous lignite)	Act No 401/1995 Coll.		15 May 2001	
Reduced air pollution charge (for emissions other pollutants/Class 1 – Large and medium sources using indigenous lignite)	Act No 401/1995 Coll.		15 May 2001	
Reduced air pollution charge (for emissions other pollutants/Class 2 – Large and medium sources using indigenous lignite)	Act No 401/1995 Coll.		15 May 2001	
Reduced air pollution charge (for emissions other pollutants/Class 3 – Large and medium sources using indigenous lignite)	Act No 401/1995 Coll.		15 May 2001	
Reduced air pollution charge (for emissions other pollutants/Class 4 – Large and medium sources using indigenous lignite)	Act No 401/1995 Coll.		15 May 2001	
Landfill fee – inert waste	Act No 17/2004 Coll.		13 February 2004	
Landfill fee – other non-hazardous waste	Act No 17/2004 Coll.		13 February 2004	
Landfill fee – municipal waste after sorting of less than 4 components	Act No 17/2004 Coll.		January 2014	
Landfill fee – municipal waste after separation of four components	Act No 17/2004 Coll.		13 February 2004	
Landfill fee – municipal waste after separating 5 components	Act No 17/2004 Coll.		13 February 2004	
Landfill fee – Hazardous waste	Act No 17/2004 Coll.		13 February 2004	
Landfill fee – Other waste	Act No 17/2004 Coll.		13 February 2004	
Landfill fee – Hazardous waste	Act No 17/2004 Coll.		January 2014	
Payment for gas storage – natural gas	Government Regulation No 50/2002 Coll.		1 January 2008	
Payment for quarrying – coal	Act No 44/1988 Coll.		1 January 1992	
Defrayal of minerals – coal	Government Regulation No 50/2002 Coll.		1 January 2008	
Tariff for exploiting the hydro-energy potential of watercourses	ÚRSO Decree No 445/2022		may 2016	Continuously updated
Max. amount of National Nuclear Fund levy for 1 final electricity customer	Government Regulation No 21/2019 Coll.	industry	January 2014	

Tax Name	Legal basis	Payer, sector (if only the selected circuit is valid)	From	Into (if any)
Contributions from holders of an operating authorisation for nuclear installations – fixed component	Regulation Government No. 478/2022 Coll.		July 2007	
Contributions from Operating Authorisation Holders nuclear equipment —	Regulation Government No. 478/2022 Coll.		July 2007	
Contributions from holders of an operating authorisation for nuclear installations –	Regulation Government No.		July 2007	
Nuclear installation tax -municipalities within 1/3 of the radius of the danger area	Act No 582/2004 Coll.		December 2009	
Nuclear installation tax – municipalities between 1/3 and 2/3 radius of the danger area	Act No 582/2004 Coll.		December 2009	
Nuclear installation tax -municipalities above 2/3 radius of the danger area	Act No 582/2004 Coll.		December 2009	
Contributions from the permit holder pursuant to Section 34a of Act No 541/2004 on the peaceful use of nuclear energy (the Atomic Act) and amending certain acts, as amended.	Act No 541/2004 Coll.			
Vehicle registration fee	Act No 145/95 Coll.		February 2017	
Decreased fee for registration electric car	Act No 145/95 Coll.		October 2012	
Motor vehicle tax – by engine capacity	Act No 361/2014	business enterprise sector	January 2015	
Motor vehicle tax exemption – electric car	Act No 361/2014	business enterprise sector	January 2015	
Reduced motor vehicle tax – hybrids, CNG and hydrogen	Act No 361/2014	business enterprise sector	January 2015	
System operation tariff – RES	Ordinance of the ÚRSO laying down price regulation in the electricity sector and certain conditions for the exercise of regulated activities in the electricity sector (current Decree No. 154/2024 Z. z.)		August 2007	annual update
System operation tariff – CHP			August 2007	annual update
System operation tariff – Electricity generation from indigenous coal			August 2007	annual update
System operation tariff – OKTE			August 2007	annual update
System operation tariff – total			August 2007	annual update
Decreased tariff for operation system – Stable Download	Ordinance of the ÚRSO laying down price regulation in the electricity sector and certain conditions for carrying out regulated activities in the electricity sector (current Decree No 154/2024 Coll.)	industry	July 2012	annual update
Reduced system service tariff – stable demand	ÚRSO Decree No 225/2011 and ÚRSO Decree No. 154/2024 Coll.	industry	July 2012	annual update

Source: MINISTRY OF THE ECONOMY

5. IMPACT ASSESSMENT OF PLANNED POLICIES AND MEASURES[99]

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).

1. *Projections of energy system developments and greenhouse gas emissions and removals; as well as air pollutant emissions, where relevant, in accordance with Directive (EU) 2016/2284 as part of the planned policies and measures for at least ten years after the period covered by the plan (including the last year of the period covered by the plan), including relevant Union policies and measures.*

The effects of planned policies and measures described in Chapter 3 on the energy system and on greenhouse gas emissions and removals, including a comparison with projections based on existing policies and measures (as described in Chapter 4 above).

This chapter fully follows, by sector of the national economy, Chapter 4 which provides descriptions of the models, methodologies and implemented Pams used in the preparation of greenhouse gas emission projections, including a description of the sectors (parameters, activity data, data sources, etc.).

The Slovak marginal abatement cost curve – MACC (Figure 6), modelled by the Value for Money Unit, Boston Consulting Group and the Environmental Policy Institute consists of 58 measures. Through these, Slovakia can reduce emissions by more than 20 MtCO2e by 2030, representing a 76 % reduction in emissions compared to 1990 levels.

The curve outlined three possible objectives:

The first is a reduction of 6.3 MtCO2e by 2030, i.e. a 55 % reduction compared to 1990, and corresponds to the EU 2030 target.

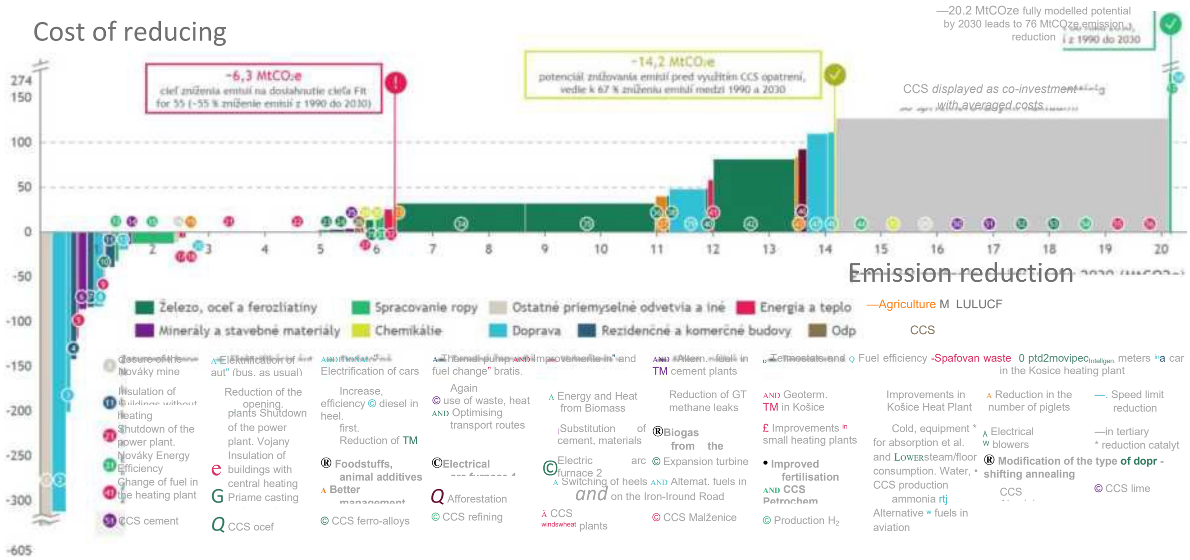
The second target is 14.2 MtCO2e, which includes measures cheaper than CCS (carbon capture and storage) and would achieve a 67 % reduction in emissions compared to 1990.

The last target represents the full 2030 modelling potential of 20.2 MtCO2e, covering all available measures, including CCS. This results in a 76 % reduction in emissions compared to 1990 levels.

More ambitious targets have been modelled to show the high cost of measures to move closer to carbon neutrality.

99Planned policies and measures are options under discussion and having a realistic chance of being adopted and implemented after the date of submission of the national plan. The resulting projections under section 5.1.i shall therefore include not only implemented and adopted policies and measures (projections with existing policies and measures), but also planned policies and measures.

Figure 6: Emission reduction costs (EUR/tCO2e)
https://www.minzp.sk/files/iep/decarbonization_of_the_slovak_economy_by_2030_study_0620



Note: CCS = Carbon Capture and Storage
1. NPV costs of emission reduction by 2030/NCE of the amount of emission reductions up to 2030. CAPEX includes only annualised costs until 2030
Source: Analysis of the team

The price in euro for reducing one tonne of CO2 equivalent is shown on the Y axis. This figure can also be minus if the measure brings economic savings while reducing emissions. A typical example is the closure measure of the Nováky mine, the operation of which requires a subsidy by means of a system operating tariff at the final electricity prices. The closure of the mine will reduce societal costs – the tariff will decrease, while emissions will decrease due to the reduction of mining activity. The price on the Y axis is presented as a social cost and thus includes the costs and benefits not only of the State, but also of other actors – households, firms, etc.

In addition to price, what matters is the amount of reduction we can achieve by a given measure. The closure of the Nováky mine will have a negative price (thus the public will save money), but there is a limit on how much CO2 this measure removes – the emissions these mines produce annually. The reduction potential is shown in the X-axis (Figure 6).

Thus, through the X and Y axes, we can define the different measures that take the form of rectangles for the MACC. They are ranked upwards from the cheapest to the most expensive. The MACC principle is that the measures shown on the curve can be implemented together, no two measures being mutually exclusive. This makes it realistic to achieve the overall potential of the MACC (sum of the values of all measures).

a) Description of the scenario with further measures

The WAM scenarios include ways to achieve different combinations of ambitious targets for energy efficiency, renewables and 2030 emission reduction targets. The WAM scenario analyses the possibility of achieving the EU's 2050 emission reduction targets (carbon neutrality). The scenario involves Slovakia's participation in the EU ETS with targets for renewables and energy efficiency, construction of new nuclear power generation capacities, maintaining its key role in the production mix.

To shape the possible contributions of the Slovak Republic to the achievement of the EU 2030 targets, an overview of possible contributions has been prepared using several variant scenarios that have been quantified for Slovakia using the Compact Primes Slovakia (CPS) model.

Table 66: Targets achieved in each scenario

	Base year	Target value	WEM Scenario	Scenario WAM
Total emissions (excluding LULUCF)	1990	—55 %	—51.9 %	—64.3 %
Total emissions under ESR	2005	—22.7 %	—19.9 %	—31.5 %
LULUCF	Average of - 2017 2019	—504 kt	+ 2 962 kt	+ 1 335 kt
Total RES share (%)	—	35 %	19.6 %	25 %

Source: IEP under CPS

b) Description of the different models – Compact Primes Slovakia (CPS) linked to the macroeconomic model GEM-E3-SK

CPS linked to the macroeconomic model GEM-E3-SK. The CPS model is an energy system model for Slovakia. It builds on the well-known PRIMES model used for European Reference Scenarios (EUREF 2020) as well as in the European Commission's impact clauses. CPS models the energy system and captures technological and engineering details, along with micro and macro interactions and dynamics across all energy sectors and markets. It includes energy demand, energy sector planning and allows for an impact assessment of climate and energy measures with a horizon to 2070. The structure of the model makes it possible to link with external (non-state) markets in order to obtain international fuel prices. All exogenous assumptions, including fossil fuel prices, price elasticities, technological or policy constraints, are presented in a transparent manner and can be tested in a sensitivity analysis. The details are described in Chapter 4.

c) Emission projections (WAM scenario) in the sectors under review industry, transport, households, services, agriculture and LULUCF)

The modelling of emission projections was done on the basis of the results of the new CPS model. The CPS model is still not fully calibrated for the CRF GHG emissions categorisation, therefore the model's results had to be adjusted to the current GHG emission inventory. The projections of greenhouse gas emissions in the WAM scenario in the sectors under review are further described in Chapter 4.2.1 Greenhouse gas emissions and removals. A list of the policies used in modelling the outputs of the NECPs is given in Chapter 3. Policies and measures, 3.1. Dimension Decarbonisation.

ii. *An assessment of the interaction between policies (between existing and planned policies; and measures within a certain policy dimension and between existing and planned policies and measures of different dimensions) at least until the last year of the period covered by the plan, in particular for the proper understanding of the impact of energy efficiency/energy savings policies on the size of the energy system and to reduce the risk of stranded investments in energy supply;*

Slovakia's intention is to minimise the risk of stranded costs in existing energy installations. For this reason, the completion of under construction electricity sources, the gradual replacement of fossil fuel pollutants by reducing consumption and constructing renewables-based sources remain a priority.

In the field of heat supply, the priority is to maximise the use of existing CZT systems and to gradually transform them into efficient DHC, with the possibility of changing the fuel base towards RES, taking into account decreasing heat consumption and due to insulation.

In order to optimise the decision-making and authorisation process, it is therefore necessary to take into account the interplay of ETS policy, pricing, taxation, regulatory policy as well as environmental burden reduction requirements. Aligning individual policies with investment intentions is a challenge for better regulation. Predictability and transparency of the decision-making process play a significant role in this. That procedure minimises the possibility of frustrating the investment and stranding of costs.

iii. Assessment of interactions between existing policies and measures and planned policies and measures and between those of the Union on climate and energy;

Slovakia is a leader in electricity generation using low-carbon technologies. Nuclear energy is the largest contributor, which contributes not only to decarbonisation but also to the security of electricity supply, and therefore the safe use of nuclear energy is an essential safety interest of the Slovak Republic. Slovakia's intention is to use existing resources for as long as possible with regard to nuclear safety, to prepare new resources and to continue to use such technology. Such an approach may appear to be restrictive in terms of meeting the EU's RES targets, but achieves better results in terms of meeting decarbonisation objectives.

Natural gas is widely used for heat production, where Slovakia is steaming towards the countries with the largest supply coverage. Gradually increasing the share of biomethane is in synergy with EU action.

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

This chapter, in full according to the analysed sectors of the national economy (energy, industry, energy efficiency, transport, households and services), follows on from Chapter 4, which provides descriptions of the energy and macroeconomic model (CPS, GEM-E3-SK Slovakia), which have been prepared for Slovakia to address issues on EU climate change and energy policies. These analytical models differ essentially in terms of coverage and approach. On the other hand, together they represent a powerful tool for evaluating climate policies and displaying the impact of different policy packages. Both models draw on multiple data sources and are based on the information used by the EU to develop scenarios (described in more detail in Chapter 4).

In addition to the energy and climate indicators, each activity in the model also has its capital, fuel, emission and other costs (mainly operating and maintenance costs). The output of the model is therefore also the overall system costs of each sector that can assess the economic side of the additional measures. (see Table 67)

Table 67: Comparison of costs in the household sector (EUR million 2015)

Scenario	Costs	2019	2025	2030	2035	2040	2045	2050
WEM	Overall	2976	4539	4448	4538	4552	4674	46682
	Equity*	661	1437	1472	1770	1788	1873	2023
	Operational	337	360	373	362	360	356	339
	Fuel	1979	2741	2640	2407	2405	2445	2320
	Emission	0	0	0	0	0	0	0
WAM	Overall	2976	4533	4414	4358	4220	4250	3953
	Equity*	661	1437	1678	2077	2151	2235	2241
	Operational	337	360	368	304	249	209	194
	Fuel	1979	2736	2274	1885	1769	1781	1518
	Emission	0	0	93	91	51	25	0

***annual cost of capital equivalent**

In addition to the above, in the field of electricity generation and supply, the costs of the transmission and distribution system and the other items are also calculated, one of the outputs being the final price of electricity. This is further used as part of fuel costs.

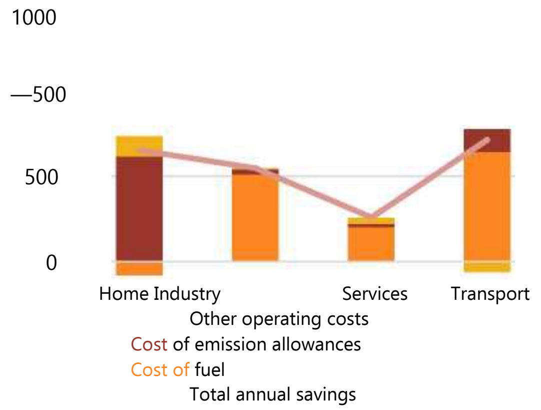
5.2.1 Macroeconomic analysis – Additional costs of the WAM scenario

The energy system requires regular investment in equipment and technology. These investments relate to the lifetime of equipment, the availability of new or improved technologies, but also the need to meet technological and legislative standards. The amount of investments depends mainly on their return (i.e. covering capital costs through reductions in operating costs), as well as on the legislative framework, e.g. tightening standards (such as emissions standards in transport) or introducing new financial obligations (such as the introduction of emissions trading).

The efforts made to achieve the results of the WAM scenario will require additional investment (capital) costs compared to the WEM scenario. In addition to improving energy and climate indicators, much of these investments will generate operational savings. Increased energy efficiency leads to a reduction in fuel consumption, which is linked to a reduction in fuel costs. Reducing greenhouse gas emissions will also lower the cost of purchasing emission allowances. Other operating costs (mainly maintenance and servicing costs) are also slightly decreasing in the context of higher renewal rates and higher quality of equipment.

To achieve the results of the WAM scenario, around EUR 11.8 billion will need to be invested over the period 2021-2030, i.e. EUR 1.18 billion per year, equivalent to around 0.97 % of GDP in 2023. As a result of these investments, annual operating costs will fall by around EUR 2.2 billion by 2030 compared to the WEM scenario, of which EUR 1.3 billion are fuel cost savings, nearly EUR 800 million are savings on the purchase of emission allowances and around EUR 100 million are savings on other operating costs.

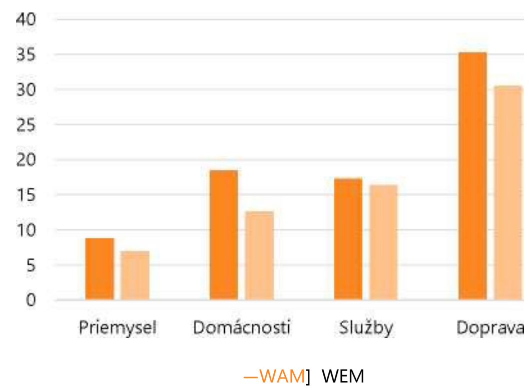
Figure 129: Amount of total annual savings of the WAM scenario in 2030100 101 (EUR million)



Source: IEP under CPS

Source: IEP under CPS

Graph 130: Comparison of WAM investments by 2030 (EUR billion)



Source: IEP under CPS

Figure 131: Amount of total annual savings of the WAM scenario (EUR billion 2023)

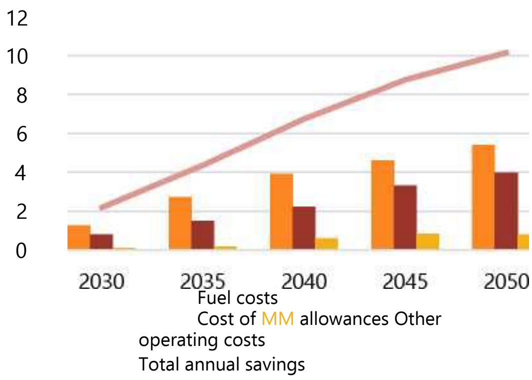
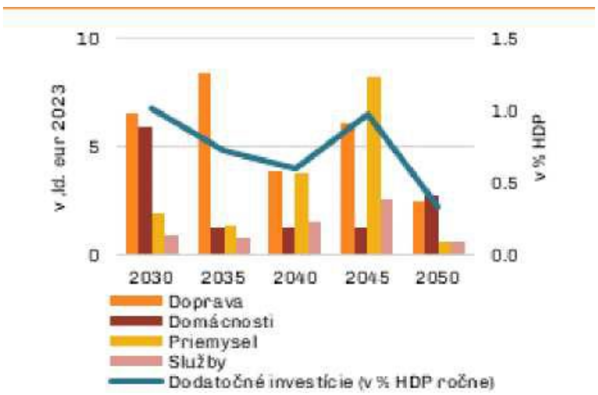


Figure 132: Amount of additional investments of the



Source: IEP under

100Compared to the WEM scenario, where the setting of allowances is the same for the WEM and WAM scenarios, i.e. no free allowances are available and the allowance price is determined by the price for the WAM scenario

Source: IEP under CPS

5.3. Overview of investment needs

I. Existing investment flows and forward investment projections taking into account planned policies and measures

Industry

In order to achieve energy efficiency savings and to reduce greenhouse gas emissions in industry, an additional EUR 1.9 billion compared to the WEM scenario is needed in the WAM scenario over the period 2021-2030. Most (approximately EUR 1.3 billion) is directed to the steel industry to replace blast furnaces with electric arc furnaces. Another important sector is the construction industry, where additional investments, leading to higher uptake of solid alternative fuels combined with energy efficiency gains, amount to around EUR 260 million. The resources of the Modernisation Fund and the Recovery and Resilience Plan are planned to support these investments.

These investments will reduce the annual cost of fuels, emission allowances and operation of installations by up to EUR 650 million in 2030, which means investments with a short payback period, but requiring a large initial investment.

After 2030, the investment rate in industry will temporarily decrease. However, there will be significant investments before 2050, mainly due to the need to reduce greenhouse gas emissions. Further emission reductions will only be possible by shifting to zero-emission fuels. This means in particular replacing solid fossil fuels and natural gas with a blend of synthetic gases, biogas and hydrogen, which requires significant investments in new technologies.

Figure 133: Amount of annual savings in industry (EUR billion 2023)

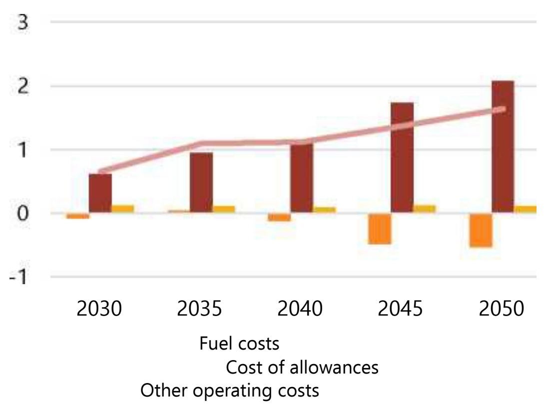
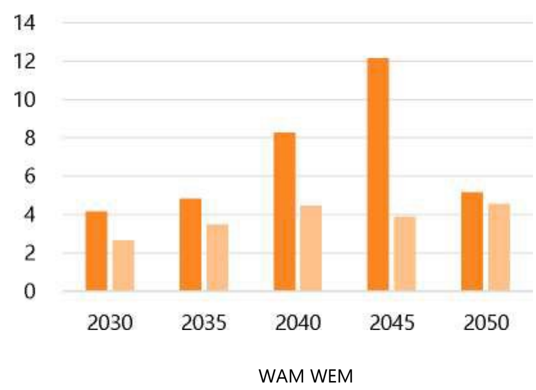
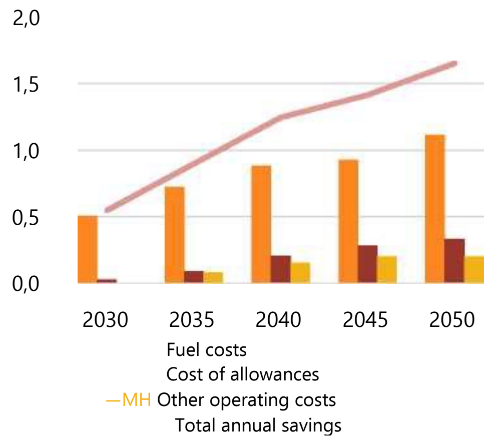


Figure 134: Amount of investment in industry (EUR



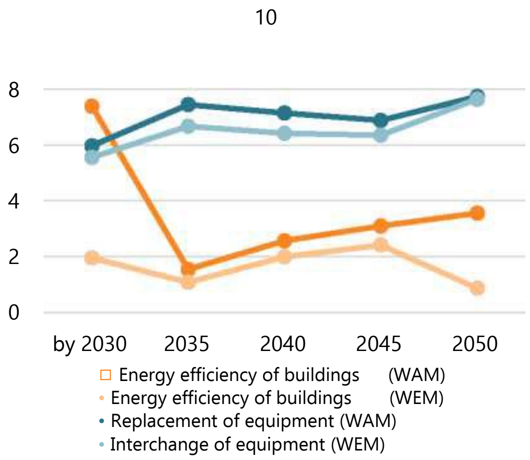
After 2030, the expected level of investment in the thermal characteristics of buildings will decrease significantly. On the contrary, investments in more efficient equipment – in particular heat pumps used in heating – will increase. For this reason, by 2050, fuel costs in the WAM scenario should be up to 34.4 % lower than the WEM scenario, resulting in savings of EUR 1.1 billion.

Figure 135: Amount of annual savings in households (EUR billion 2023)



Source: IEP under CPS

Figure 136: Amount of additional investment in households (EUR billion 2023)



Source: IEP under CPS

Services

In the services sector, an additional EUR 900 million need to be invested in order to achieve the results of the WAM scenario over the period 2021-2030. Approximately EUR 700 million will be the cost of increasing the energy efficiency of buildings, a smaller part to replace heating and electrical equipment.

Investments will lead to a reduction in fuel costs of EUR 200 million per year. Improved energy efficiency and fuel mix adjustments will also generate savings on the purchase of emission allowances (ETS2) of EUR 21 million per year.

Between 2030 and 2040, investment in more efficient equipment, in particular heat pumps (EUR 100-120 million per year) is expected to increase significantly. Further investment in the thermal characteristics of buildings will also be significantly increased after 2040 (EUR 400 million per year). Overall cost growth in the sector is also expected, mainly due to an increase in the sector's share of the country's GDP.

Figure 137: Amount of annual savings in services (EUR billion 2023)

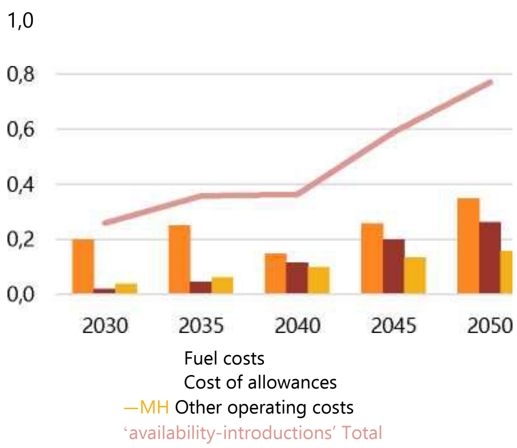
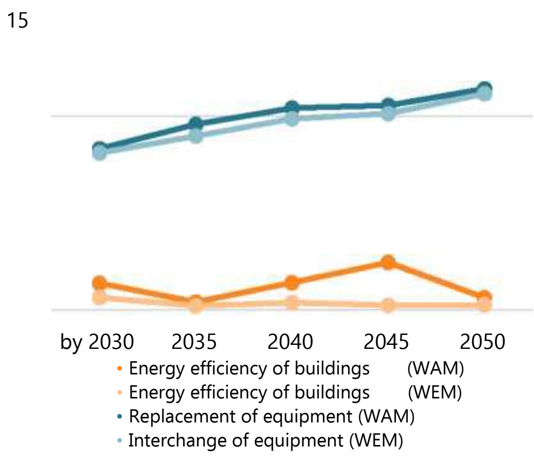


Figure 138: Additional investment in services (EUR billion 2023)



Source: IEP under CPS

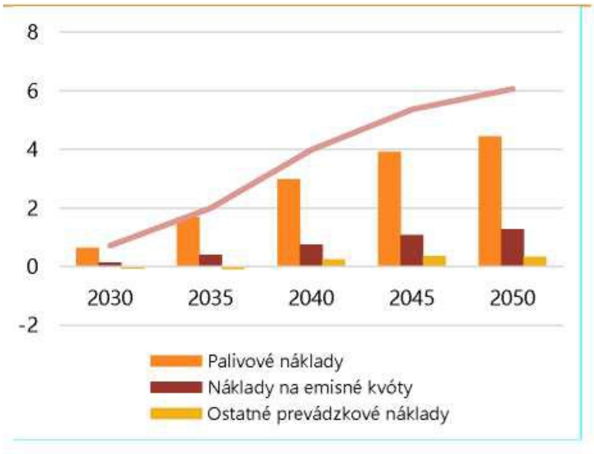
Transport

Electrification is a key measure in the transport sector. Electric vehicles have a higher investment cost, so an additional EUR 6.6 billion need to be invested in new vehicles by 2030, with investments in passenger cars amounting to around EUR 3.1 billion, a further EUR 1.9 billion in the purchase of commercial vehicles. The remaining costs will be mainly for public road and rail transport.

Investments will have a significant impact on reducing annual fuel costs (EUR 640 million) and, once ETS2 has been introduced, the cost of emission allowances (EUR 130 million). On the contrary, there will be a slight increase in other operating costs (EUR 60 million) due to the expected slightly higher costs of servicing and repairing electric vehicles, which are due to the temporarily lower availability of specialised service works.

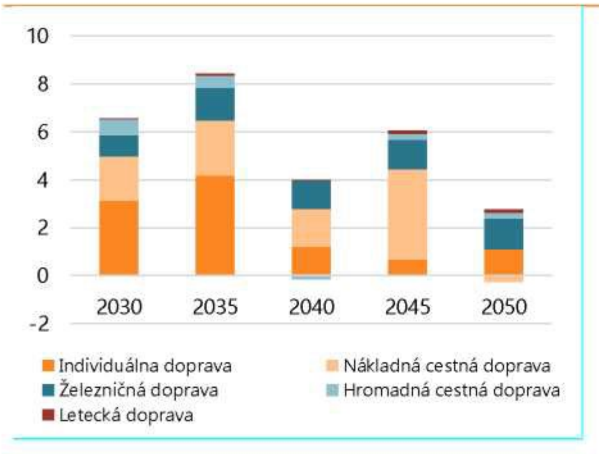
After 2030, electrification will result in significant savings. Due to the long-term fall in the price of electric vehicles, the rate of additional investment per vehicle will also decrease. In 2050, the expected total annual costs of the system are up to EUR 4.2 billion102 lower, i.e. by around EUR 1100 per average vehicle. Shifting part of individual transport to public transport will also help to optimise transport costs.

Graf 139: Výška ročných úspor v doprave (v mld. eur 2023)



Zdroj: IEP podľa CPS

Figure 140: Amount of additional investment in transport (EUR billion 2023)



Zdroj: IEP podľa CPS

Table 68: Total investment needed to implement the proposed measures

2030	Industry	Household	Services	Transport	Together
WAM	8 802	18 482	17 288	35 263	79 836
WEM	6 906	12 635	16 361	30 539	66 441

Source: IEP, figures in million euros

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

The high level of energy intensity of industry, as well as the share of industry in the country’s GDP, represents a key challenge for the decarbonisation of industry in the future, linked to the digital transformation and innovative technologies.

In the field of R & I, the problem is fragmented and especially thinly capitalised manufacturing. Expenditure on business R & D is only low in Slovakia. In innovation, university cooperation with businesses in R & D is poorly valued. The problem is the low incentive for researchers to stay in Slovakia.

102After taking into account the annual equivalent of investment costs

The creation of specific conditions for the procurement of these objectives is necessary for further progress in this area.

Slovakia's ambition in the area of competitiveness is to promote value-added investments, with a focus on business research and innovation. The low share of public investment in addition to European funds is limited.

III. Analysis of additional public financial support or resources to remove identified shortcomings under point (ii)

As an EU Member State, Slovakia accepts the strengthening of the strategic approach in cohesion policy to further develop the coordinated and harmonised implementation of Union funds, which will be implemented under so-called 'general – shared management', namely for the European Regional Development Fund, the European Social Fund Plus, the Cohesion Fund, the Just Transition Fund, the European Maritime, Fisheries and Aquaculture Fund, the Asylum, Migration and Integration Fund, the Internal Security Fund and the Instrument for Financial Support for Border Management and Visa Policy, simplifying and defining five clear cohesion policy objectives for the 2021-2027 period:

1) a more competitive and smarter Europe by promoting innovative and smart economic transformation and regional ICT connectivity;
2) greener, low-carbon with the transition to a net zero carbon economy and resilient Europe by promoting clean and fair energy transition, green and blue investment, circular economy;
climate change mitigation and adaptation, risk prevention and management, and sustainable urban mobility;
3) a more connected Europe by enhancing mobility;
4) a more social and inclusive Europe implementing the European Pillar of Social Rights;
5) A Europe closer to citizens by fostering the sustainable and integrated development of all types of territories and local initiatives.

This simplification will allow synergies and flexibility between the different components within a given objective and close the artificial differences between different policies contributing to the same objective, while setting the basis for thematic concentration for the ERDF and ESF+. At the same time, synergies between different EU instruments will be promoted through a strategic planning process that identifies common objectives and common areas for activities under different programmes, such as the Common Agricultural Policy (CAP), Horizon Europe (Horizon Europe), the Connecting Europe Facility (CEF), the Digital Europe Programme, Erasmus+, InvestEU Fund, LIFE, Erasmus+, the Slovak Recovery and Resilience Plan, the Modernisation Fund.

Existing funding for the green transition is EUR 4.1 billion from the existing Modernisation Fund, EUR 4.2 billion from the Slovakia programme and EUR 2.2 billion from the Recovery Plan, securing at least EUR 12.6 billion for the period 2021-2032 for Slovakia. It is important to carefully calibrate the different challenges within existing financial instruments, in such a way as to accelerate not only absorption but also the efficiency of all related processes. From the point of view of the Ministry of the Environment, it is important to increase Slovakia's ability to use the funds for the green transition as well as other EU resources to the greatest extent possible, while at the same time setting the conditions for support, the rules to be as targeted as possible, providing long-term structural solutions (see Table 69).

Table 69: Financial instruments for the green transition

Financial mechanism	Program Slovakia	Recovery and Resilience Plan (new REPowerEU component)	Common Agricultural Policy 2023-2027	Just Transition Fund	Modernisation Fund (by 2030)
Share (%) of climate (green) investments from the Facility	*35 %*	*43 % (85 %)*	*40 %*	*100 %*	*100 %*
Climate financial allocation (EUR billion)	*4,4*	*2,1 (0,4)*	*2,0*	*0,4*	*5,0**

**) a rough estimate that will depend on the price of the ETS allowance*

Source: MOE

ENVIRONMENTAL FUND

State aid scheme – Indirect cost compensation

To cover indirect CO2 costs, EU Member Statesmay grant State aid to certain electricity-intensive industries as compensation for indirect CO_2 costs, i.e. costs resulting from increased electricity prices because electricity producers pass on the cost of purchasing emission allowances to customers.

HeatingState aid scheme (EUR 149.5 million for 2022), which aims at improving energy efficiency, modernising energy systems, including district heating or cooling (CZT) distributions, as well as repowering fossil-based heat distribution facilities for small-scale CZT systems for energy storage and smart solutions for heat distribution, increasing the share of electricity and heat produced from high-efficiency cogeneration (CHP), including switching from separate heat production to high-efficiency cogeneration and replacing solid fossil fuel power generation with natural gas ('heat scheme'). The indicative amount of expenditure planned under this scheme for the period 2021-2030 is EUR 1 billion.

Text of the scheme:
https://www.justice.gov.sk/PortalApp/ObchodnyVestnik/Formular/FormularDetailHtml.aspx?IdFormular =2892954

On 27 July 2022, a call for heating prepared under the Heat Scheme was launched. More details on the call are available on the Environmental Fund website at the following link: https://envirofond.sk/modernizacny-fond/.

The State aid scheme for the support of electricity production from RES [103]aims to support investments in the construction, renovation and modernisation of plants for the production of electricity from renewable energy sources (RES) in order to increase the share of RES in gross final energy consumption in Slovakia. The aid provider under the scheme is the Ministry of the Environment and the beneficiary of the scheme is the Ministry of the Economy. The indicative amount of expenditure planned under this scheme for the period 2024-2030 is EUR 400 million.

The TRANSFORM TRANSFORMATION Fund is a key tool to ensure that the transition to a climate-neutral economy takes place in a just manner. The Just Transition Mechanism addresses the social, economic and environmental consequences of the transition, focusing on the regions, industries and workers that will face the greatest challenges.

- Slovakia has **EUR 459** million available from the Just Transition Fund (or EUR 441 million if the

103*https://www.justice.gov.sk/PortalApp/ObchodnyVestnik/Formular/ FormularDetailHtml.aspx?IdFormular=2892958* allocation for technical assistance is not included).

- The implementation of the JTF is conditional on the preparation **of the Territorial Just Transition Plan (TJTP)** and its approval by the European Commission. The Slovak PST was approved by the Commission on 22.11.2022. The Pst was prepared in a participatory manner, with the involvement of relevant municipalities and other socio-economic partners, and with a focus on identified needs and priorities in the territory.
- The JTF is **part of the Slovakia 2021-2027** programme, which sets the basic support framework for almost the entire envelope of EU cohesion policy funds available to Slovakia for the 2021-2027 period (totalling EUR 12.6 billion). The MIRRI SR is responsible for the overall setting up and preparation of the JTF and PST, the implementation of which is ensured by the MIRRI SR in the role of the Managing Authority of the Slovakia Programme and other relevant departments (MH SR, MPSVaR SR, SIEA and MŽP SR) in the role of intermediate bodies.
- In Slovakia, the following **eligible territories**have been defined for the JTF:
  1. **Trenčín Region** - Upper Nitra (districts of Prievidza and Partizán) – This is a key region from a JTF perspective and the last coal region of Slovakia (in 2023, lignite mining and combustion at the Nováky power plant was discontinued).
  2. **Košice region** (Kice I-IV districts, Košice surroundings and Michalovce).
  3. **Banská Bystrica region** (Brezno districts, Revúca, Rimavská Sobota, Zvolen, Žiar nad Hronom, Žarnovica and Banská Štiavnica)
- In Slovakia, the **core areas of JTF support**are:
  - **Economic diversification (allocation > 130 MEUR)**: Developing new pillars of local economies and creating jobs by supporting forward-looking projects by key employers and small and medium-sized enterprises, as well as by investing in research, development and innovation
  - **Clean energy transition and revitalisation of territories (allocation > 215 MEUR)**: Development of renewable energy sources (with a focus on developing geothermal and solar energy), increasing the energy efficiency of public buildings, promoting the circular economy, revitalising former industrial sites (brownfields) and sustainable local transport
  - **Human capital and skills development for a just transition (allocation > 95.5 MEUR)**: Supporting the reskilling of workers who have lost their jobs as a result of the transition, supporting education and matching the needs of the transformed labour market, and supporting young people in transition

Modernisation Fund – Decarbonising Industry

In the case of a State aid scheme aimed at decarbonising industry from the RRP, one of the main conditions for granting support is the condition that **fossil104 fuels cannot be supported.**

In particular, increasing energy efficiency, electrification and completing the transition to low-emission energy sources are needed for efficient decarbonisation. Measures have been modelled across all areas of the economy, in the short and medium term mainly energy efficiency gains and electrification (transport, industry). At the same time, the transition to a low-emission energy mix

104Solid fossil fuels cannot be supported. Projects using natural gas as the main raw material/energy source cannot be supported. For projects where natural gas is used in small quantities, the share of natural gas in the final consumption of the aided technology shall not exceed 20 %.

(nuclear energy, renewables) and the introduction of measures in agriculture or forests should be completed. In the long term, more costly or unaffordable technologies such as storage of electricity in hydrogen, artificial emission sinks in industry and energy will become available.

The price of ETS allowances is the main driver for reducing emissions intensity. Today, it is a driving factor, especially in industry and energy, and, following the introduction of ETS2, transport and households. The proceeds of permits are used to support investment and innovation through the Modernisation Fund. The future Social Climate Fund from ETS2 revenues will finance measures to address energy and transport poverty.

Decarbonising industry in a targeted way (e.g. in relation to economic operators, etc.) can be done by decarbonising the Slovak industry from the resources of the Modernisation Fund, of which the Slovak Republic has allocated more than EUR 2 billion until 2030 to decarbonise the industry and the heating sector under approved State aid schemes. EUR 1.35 billion and EUR 750 million are allocated to the heating programme. In order to ensure the effective use of these funds, the Ministry of the Environment of the Slovak Republic, together with the Ministry of Economy of the Slovak Republic, carried out a collection of information from economic operators on their planned investments (with project investment costs above EUR 1 million) in the area of industrial and heat decarbonisation in the summer of 2023. Projects thus identified may be supported under State aid schemes already approved or included in the indicative list of investments that the Slovak Republic intends to support from the Modernisation Fund in the future.

Recovery and Resilience Plan (component 4)

The objective of the measures under Component 4 is to reduce the greenhouse gas emissions (in CO2 equivalent units, weighted average) emitted by undertakings supported by the decarbonisation scheme by at least 30 % compared to the counterfactual scenario. The achievement of the target of reducing emissions by at least 1 232 926 tonnes of CO2 equivalent, beyond the counterfactual scenario submitted to the Commission, out of the overall GHG emission reduction target of 1 369 917 tonnes CO2 equivalent, is to be demonstrated to the European Commission ("the Commission") either by data on projects implemented under the decarbonisation scheme or on the basis of the parameters of the supported technologies.

On 25 November 2022, the Slovak Ministry of the Environment launched a call for industry companies participating in the EU ETS, aimed at decarbonising industry with a total allocation of more than EUR 357 million. 2 decarbonisation projects of industrial enterprises are currently being implemented from the Recovery and Resilience Plan. These are two projects with a total investment of EUR 16.8 million.

On 30 May 2024, the Ministry of the Environment launched Call No 2 for the decarbonisation of industry from the resources of the Recovery and Resilience Plan, addressed to Slovak industrial undertakings participating in the EU ETS. After evaluation of the applications received, it is assumed that the Ministry of the Environment will support another 4 decarbonisation projects with a total value of EUR 52.6 million.

Social Climate Fund

Social Climate Fund, part of the Fit-for-55 package of legislative proposals. SKF is proposed for the period 2027-2032. It aims to mitigate impacts on vulnerable households and vulnerable transport users following the introduction of the emissions trading sub-scheme for buildings and road transport (ETS 2). Member States may use the allocation for investments in increasing the energy efficiency of buildings, decarbonising building heating and cooling systems, including the integration of renewable energy sources, as well as providing better access to zero- and low-emission mobility and transport, e.g. through the deployment of alternative propulsions (e.g. LPG, CNG, hydrogen, biofuels) or for direct financial support.

The allocation for Slovakia amounts to **EUR 1.5 billion** (to be filled from both the old and the new ETS+ETS2) for the period 2027-2032 (NB 2026 will be refinancing, official fund will become operational as of 2027). These EU resources will be increased by 25 % through mandatory national co-financing to be secured primarily from additional national revenues from emission allowances. The total amount of investment from the Fund for Slovakia will thus be EUR 1.875 billion. It is important for Slovakia to maintain the favourable allocation key for SK at 2.36 % (as opposed to the 0.9 % levy), thanks to the European redistribution of resources, to benefit Slovakia from the fund much more than it will out of its ETS revenues, to maintain the eligibility of technical assistance directly from the Fund at 2.5 % and that the annual amount of support will not change even if the total length of the fund has been reduced by one year compared to the EC proposal.

To support the transition towards climate neutrality and mitigate the related negative socio-economic consequences, a Just Transition Mechanism (JTM) has been established at European Union level, the first pillar of which is the new EU fund, the Just Transition Fund (JTF), with a total budget of EUR 19.2 billion (in current prices). During the 2021-2027 programming period, EU Member States can provide financial support from the JTF in regions further affected by the transition. This is particularly the case for coal regions and regions with a strong presence of greenhouse gas-intensive industries.

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. Effects on the energy system in neighbouring and other Member States in the region in to the extent possible

The links below contribute to increasing energy security and reliable supply in all States concerned.

In particular, bilateral cooperation at the level of the concerned PSO operators shall take place to support the preparation and implementation of cross-border investment plans in the field of electricity infrastructure. Wider regional cooperation to support cross-border transmission projects and other key electricity infrastructure projects is currently not shown to be necessary. Discussions on future cross-border interconnections are ongoing within ENTSO-E in the System Development Committee.

In the area of electricity transmission infrastructure, Slovakia’s priority was to complete the construction of new Slovak-Hungarian cross-border connections (2x400 kV Gabčíkovo (SK) – Gönyű (HU) – Veľký Ďur (SK) and 400 kV R. Sobota (SK) – Sajóivánka (HU)). Both lines were operational in 2021 and building permits were issued for both projects.

In cooperation with the Czech Post Operator (ČEPS), the PS Operator (SEPS) requested the inclusion of the planned connection 1x400kV Ladce (SK) – Otrokovice (CZ) on the PCI list. This is an interconnection that would replace the gradually shutdown 220 kV transmission system (PS) on both sides of the SK/CZ border. The EC adopted the 6th PCI list 28. 11. In 2023, this project, together with the electricity storage project by upgrading the Montenegrin Váh ‘SE Integrator’ submitted by Slovenské elektrárne, a.s., is included in the Priorit Corridor ‘North South electricity interconnections in Central Eastern and South Eastern Europe’ (NSI East Electricity).

Steps are being taken, both on the part of the State and on the part of the gas companies, in order to secure gas supplies, so that the Slovak Republic will be better prepared for possible gas supply problems. The Slovak Republic supported interconnection projects with Poland, Hungary, as well as reverse flow projects from the Czech Republic and Austria.

The Slovak-Polish gas interconnection project is part of the north-south gas corridor and forms an important element in the chain of transit pipelines connecting Eastern Europe from the Polish LNG terminal Świnoujście to the planned Croatian LNG terminal on the island of Krk.

The Druzhba – Adria project deals with the transport of crude oil by pipeline from the Russian Federation through the territory of Belarus, Ukraine, Slovakia, Hungary and Croatia. In 2015, the extension of the section of the Adria-Friendship 1 pipeline between the Slovak city of Šahy and the Hungarian city of Százhalombatta was completed and put into operation. That expansion and reconstruction means increasing the initial transmission capacity to almost double. This project was included in the original so-called first list of PCIs.

II. Effects on energy prices, grid industries and integration of energy markets

Binding European Community legislation is the decisive basis for regulatory policy. This translates into the setting of reasonable energy prices for consumers, while maintaining transparent and non-discriminatory regulatory principles. Energy prices are expected to rise due to higher demand, network costs, deregulation, implementation of European measures as well as increased costs of environmental protection. Recent geopolitical developments also have an impact on energy prices.

The activities of the Agency for the Cooperation of Energy Regulators (ACER) in developing a coordinated governance system for building a functioning single European gas and electricity market in terms of energy security and reliability in individual EU Member States, and the framework guidelines that serve as a basis for the development of network codes are also reflected in cooperation with the Office for the Regulation of Network Industries (ÚRSO). The cooperation of the national regulator with ACER is also embedded in the regulatory policy developed by the Regulatory Board (ÚRSO), which defines regulatory policy priorities for the relevant regulatory period, with the ambition to apply regulatory tools and methods that ensure transparent and non-discriminatory performance of activities in network industries, including control mechanisms to monitor compliance with competition rules, to monitor compliance with transparency obligations, possible abuses of market dominance and, not least, the protection of consumer rights, with a focus on the most vulnerable customer groups.

The current regulatory policy for the period 2023-2027 aims to create a transparent and predictable regulatory environment that incentivises investment while creating the conditions for effective implementation of EU policies stemming primarily from the ‘Clean Energy for all Europeans’ legislative package (4th Energy Package), but also from the ‘Fit for 55’ and ‘Gas Package’ packages.

III. Where relevant, effects on regional cooperation

The transmission system operator eustream, a.s., also monitors long-term trends and estimates of gas consumption across the EU when forecasting future developments. Thus, when considering the suitability of projects for implementation, it takes into account security of supply needs not only for the Slovak Republic but also for regions at risk, such as in particular South-East Europe and Ukraine.

Part 2

List of parameters and variables to be reported in Section B of the national plan

The list of parameters and variables to be reported in Section B of the NECPs are set out in the Annexes:

Annex No. 1

Table of data used for WEM and WAM modelling

Annex 2

Methodological tables for energy efficiency measures

Annex 3

Description of the methodologies for calculating the energy efficiency targets of Directive 2023/1791 on cumulative energy savings ropes and complementary information to energy efficiency measures

[101] The values shown in the graph are (with the exception for 2030) reported for the five-year period preceding that year, the level of GDP being determined in the final year of the period

Source: IEP under CPS **Source: IEP under CPS**

Household

Additional investment in the household sector is expected to amount to around EUR 5.8 billion over the period 2021-2030, most of which (EUR 5.4 billion) should be used to improve the thermal performance of buildings, the remainder for the replacement of heating, lighting and water heating equipment. Part of these investments are to be covered by the challenges of the Recovery and Resilience Plan, the Slovakia Programme and the Social Climate Fund.

Investments in this sector should lead to a reduction in fuel costs of EUR 510 million per year. Further savings of around EUR 30 million per year will result in reduced entitlements to purchase allowances following the introduction of ETS2.