MINISTERSTVO
HOSPODÁRSTVA
SLOVENSKEJ REPUBLIKY

Draft update of the Integrated National energy and climate plan for 2021-2030

processed pursuant to 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	Euro
AO	Action Measure
AP	Action plan
BOE	Oil equivalent barrel (5.7 GJ)
BSK	Bratislava Self-Governing Region
CEF	Connecting Europe Facility
CESEC	Central and South Eastern Europe Energy Connectivity
CNG	Compressed natural gas
CO	Carbon monoxide
CO_2	Carbon dioxide
CPS	Compact-PRIMES model for Slovakia
CZ	Czechia
CZT	Central heating
CEPS	Czech energy přenosová soustava
DS	Distribution system
8TH EAP	7th Environment Action Programme
EDEPI	European Indoor Energy Poverty Index
EED	Energy Efficiency Directive
EEX	European Energy Exchange
EC	European commission
EMO	Mochovce power plant
ENO	Nováky power plant
ENTSO-E	European Network of Transmission System Operators
EP	European parliament
EP SR	Energy policy of the Slovak Republic (material approved by the Slovak Government in 2014)
ECJ	Effort Sharing Decision
ECJ	Effort Sharing Decision
ESR	Regulation on effort sharing
Est	Electrical Station
ETS	Emissions Trade Scheme
EU	European Union
EU ETS	European scheme for greenhouse gas emission allowance trading
EUCO scenarios	Scenarios developed by the European Commission
EUR	Euro
EURATOM	European Atomic Energy Community
FCR	Primary power control
aFRR	Frequency with automatic activation
mFRR	Frequency with manual activation
GES	Guaranteed energy service
GG	Gigagram
GWh	Gigawatt hour
H_2	Hydrogen
GDP	Gross domestic product

HU	Hungary
CH_4	Methane
IAD	Individual car transportation
IEA	International Energy Agency
IMS	Smart metering systems
IROP	Integrated Regional Operational Programme
IS	Smart grids
IT	Information technology
KES	Final energy consumption
KO	Municipal waste
PIECE	Compressor station
ktoe	Thousand tonnes of oil equivalent (41.868 TJ)
CHP	Combined heat and power
kW	Kilowatt
LCA	Life Cycle Analysis
LPG	liquefied petroleum gas
LNG	liquefied natural gas
LULUCF	Land use-Land use change and forestry
m^2	Square metre
m^3	Cubic metre
Ministry of the Interior of the Slovak Republic	Ministry of Transport and Construction of the Slovak Republic
MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC	Ministry of Economic Affairs of the Slovak Republic
MPaRV SR	Ministry of Agriculture and Rural Development of the Slovak Republic
SMES	Small and medium enterprises
MSR	Market Stability Reserve
MŠVVaŠ SR	Ministry of Education, Science, Research and Sport of the Slovak Republic
Mtoe	Million tonnes of oil equivalent (1000 ktoe)
MW	Megawatt
MINISTRY OF THE ENVIRONMENT OF THE SLOVAK REPUBLIC	Ministry of Environment of the Slovak Republic
N_2O	Nitrous oxide
NBS	National Bank of Slovakia
NECP	Integrated National Energy and Climate Plan
NES	National emission ceilings
NFP	Non-repayable financial contribution
NH3	Ammonia
NJZ	New nuclear source
NLC	National Forest Centre
NMVOC	Non-methane volatile organic substances
NOx	Nitrogen oxides

NRPS	national Reform Programme
NATIONAL COUNCIL OF THE SLOVAK REPUBLIC	National Council of the Slovak Republic
NS TUR	National Sustainable Development Strategy
NUS SR	Low-carbon strategy of the Slovak Republic
O_3	Ozone
OECD	Organisation for Economic Cooperation and Development
OH	Circulareconomy
OP EQU	Operational programme Quality of Environment
OPII	Operational programme Integrated Infrastructure
UN	United Nations Organisation
RES	Renewable sources of energy
PCI	Projects of common interest
DSOS	Distribution system operator
PES	Primary energy consumption
PM	Particular matter – Particulate matter
POPs	Persistent organic polutants
PPC	CCG cycle
TSOs	Support services
WG	Transmission network
PVE	Pumped hydropower plants
R&D	Research & Development (Research &Development)
SAV	Slovak Academy of Sciences
SAŽP	Slovak Environmental Agency
SEA	Strategic Environmental Assessement – Environmental Impact Assessment of Strategy Papers
SET-Plan	Strategic Energy Technology Plan
SHMÚ	Slovak hydrometeorological institute
SIEA	Slovak Innovation and Energy Agency
SK	Slovakia
SO_2	Sulphur dioxide
STI	Slovak Commercial Inspection
SR	Slovak Republic
SRV	Secondary power control
R & D SO	State Science and Research Plan
STATISTICAL OFFICE OF THE SLOVAK REPUBLIC	Statistical Office of the Slovak Republic
T	Tonne
TEN-E	Trans-European Networks for Energy
TEN-T	Trans-European Transport Networks
TJ	Terrajoul
TRV	Tertiary power control
TUR	Sustainable Development
TYNDP	Ten-year gas and electricity transmission network development plan
UA	Ukraine

UNFCCC	United Nations Framework Convention on Climate Change
ÚRSO	Regulatory Office for Network Industries
V4	Visegrad Group countries (Slovakia, Czechia, Hungary, Poland)
VN	High voltage
NN	Low voltage
H.E.	College
IWT	Very high voltage
WAM	Scenario with additional measures
WEM	Scenario with existing measures
WOM	A scenario without measures
RU	Environment

Part 1 General framework

SECTION A: NATIONAL PLAN

1. OVERVIEW AND PROCEDURE FOR ESTABLISHING THE PLAN

1.1. Summary

I. 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 State of the European Union (EU) since May 2004 and has been a member of the International Energy Agency (IEA) since 2007. In January 2009, the Slovak Republic adopted 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 is updated by the Ministry of the Economy. The approval of the update of this plan in 2024 will also ensure compliance with the legislative requirement, which gives the Ministry of Economic Affairs the responsibility to draw up an energy policy for a period of at least 20 years and to update it in a five-year cycle.

The energy policy, which set objectives and priorities for the energy sector by 2035 with a 2050 perspective, was approved by the government in 2014. At the end of 2019, by its Resolution No 606/2019, the Government of the Slovak Republic approved the Integrated National Energy and Climate Plan, which was drawn up pursuant to Article 9 of Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action and constitutes an update of the approved energy policy of 2014.

The strategic objective of the EP is to achieve competitive low-carbon energy, ensuring a secure, reliable and efficient supply of all forms of energy at affordable prices, taking into account consumer protection and sustainable development. The 'value for money' principle applies to the setting of milestones and measures necessary to achieve them. In line with this principle, the modelling of objectives and measures to ensure the fulfilment of the triangle of 'security', 'sustainable development' and 'energy affordability' objectives should be optimised with the requirement of minimising the costs of achieving them.

The update of the plan is based on the requirement of Article 14 of the above-mentioned Regulation that a Member State shall submit to the Commission a draft update of the plan by 30 June 2023 or inform the Commission of the reasons why it does not consider it necessary to update the plan.

The period from 2020 to 2023 can be considered as non-standard due to the COVID-19 pandemic and the war in Ukraine. This was also evident 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, after the opening up of economies and difficulties in obtaining natural gas for storage, energy prices in the EU recorded record high levels.

The Union-wide headline quantified energy and climate targets for 2030 are to achieve at least a 55 % reduction in greenhouse gas emissions compared to 1990 (individual Member States have defined shares according to local conditions), a binding Union-wide target of at least 32 % of energy from renewable sources (RES) in gross final consumption of energy, with a share of RES in transport of at least 14 % in each Member State, a national energy efficiency contribution of at least 32.5 % and electricity interconnection of at least 15 %.

The main quantified NECP targets in Slovakia for 2030 are a 22.7 % reduction in greenhouse gas emissions for non-ETS sectors. The use of RES in final energy consumption is set at 23 % in 2030. The measures prepared to achieve Slovakia's national contribution in the field of energy efficiency show values slightly lower (30.3 %) than the European target of 32.5 %. The industrial and building sectors will be key to achieving the objectives. Long-term electricity interconnectivity is above 50 %, so the target of at least 15 % will be met.

Table 1 Pan-European and national targets

EU and Slovak objectives	***EU 2030***	***SR 2030***
Greenhouse gas emissions (as at 1990)	**55 %**	No targets are set for individual Member States
Emissions in the ETS sector (as at 2005)	**62 %**	
Non-ETS greenhouse gas emissions (as at 2005)	**40 %**	**— 22.7 %**
Total share of renewable energy sources (RES)	**32 %**	**23 %**
Share of RES in transport	**14 %**	**14 %**
Energy efficiency	**32.5 %**	**30.3 %**
Electricity interconnection	**15 %**	**15 %**

Source: EC, MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

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

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

Slovakia attaches great importance to air quality, reduction of greenhouse gas emissions, mitigation of climate change, security of supply of all types of energy and affordability. In 2019, Slovakia signed up to the commitment to achieve carbon neutrality by 2050.

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

Slovakia’s energy development aims at optimising the energy mix so as to reduce as much as possible greenhouse gas and pollutant emissions while maintaining or increasing energy security and affordability of the various types of energy.

In summer 2022, while securing energy for the winter months and the following year, energy commodity prices in Europe reached historic peaks and Slovakia had to react to high prices with various measures.

The year 2022 showed vulnerability in the area of energy security and showed a problem of reliability in ensuring the necessary amount of energy at affordable prices. This situation also affected the safety perspective when updating the plan. A key safety requirement is to ensure that demand is met in the winter months. Addressing sufficient energy is essential in the form of seasonal storage and sufficient stable power for the production of electricity in winter. The continuation of the safe use of nuclear energy and its further development is therefore a key prerequisite and a fundamental safety concern of the Slovak Republic. It is to be expected that differences in energy prices and availability will increase in winter and summer.

Seasonal price volatility is also a key challenge for Slovakia, linked to the increasing share of renewables in electricity generation. Maintaining a competitive industry requires stable, predictable and competitive prices for low-emission electricity and energy raw materials or carriers. Ensuring sufficient low-emission electricity output (nuclear power plants and not variable RES) in winter months will help reduce dependence on fossil fuel imports and decarbonise heat generation through heat pumps. Installations producing low-emission electricity and waste recovery installations are fully in line with energy policy. If the need to secure 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 prefer their use in high-efficiency cogeneration or that they will also be ready for the combustion of hydrogen at the time of commissioning.

The long-term priority of Slovakia’s energy policy is to build a competitive low-carbon economy towards carbon neutrality. The transition to a low-carbon economy entails additional costs to be paid by consumers or taxpayers. For this reason, measures will need to be taken that respect the energy efficiency first principle, whereby RES should not be a primary objective, but only one of the tools for such a transformation. Maximising the use of financial support mechanisms in 2021-2030 (in particular the Modernisation Fund, the Recovery and Resilience Plan, 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 when priority projects are properly calibrated at domestic level.

The energy policy of the Slovak Republic (EP SR) was originally based on four basic pillars – energy security; energy efficiency; competitiveness and sustainable energy. Science, research and innovation were also part of the EP. This plan updates the current energy policy, extending it to the decarbonisation dimension.

The priorities of Slovakia’s energy policy are:

- an optimal energy mix;
- enhancing security of energy supply;

- development of energy infrastructure;
- diversification of energy sources and transport routes;
- maximum use of transmission networks and transit systems through the territory of the Slovak Republic;
- the application of the energy efficiency first principle;
- reducing energy intensity;
- a functioning energy market with a competitive environment;
- quality of energy supply at affordable prices;
- the protection of vulnerable customers;
- tackling energy poverty;
- adequate pro-export balance in electricity;
- promotion of high-efficiency cogeneration;
- promoting the use of efficient district heating systems (CZTs);
- promoting the use of RES for electricity, hydrogen, biomethane, heating and cooling;
- 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 nuclear power plants.

In addition to these priorities in the original energy policy, new priorities are

- promoting smart energy systems;
- promoting energy storage;
- increasing the energy recovery of waste that cannot be recycled (in particular through the production of high-quality solid fuel and secondary fuel).

The new measures needed to deliver on the objectives and priorities are:

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

Sustainable development must meet the current needs of the population without limiting the ability of future generations to meet their own needs. It is therefore necessary to change technologies, processes and habits, both on the production and on the demand side.

Measures to ensure environmental sustainability:

- provide financial mechanisms and use the proceeds of the auctioning of allowances under the Emissions Trading System to support the energy and industrial sectors, focusing on priority areas in line with the principles of sustainable development as set out above;
- step up action on reducing CO2 emissions, in particular in the transport sector;
- use of natural gas
- promoting decarbonised gases, including hydrogen;
- ensure the development of a hydrogen ecosystem aimed at decarbonising industry, transport and energy by implementing the actions of the action plan for the successful implementation of the national hydrogen strategy;
- setting up incentives and tax policies that ensure economic growth based on a low-carbon, circular and less energy- and material-intensive economy.

Decarbonisation dimension

In the Paris Agreement, the Slovak Republic, together with other parties, has subscribed to the objective of keeping the increase in the global average temperature 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 so-called 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 in 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), ('European Climate Law'). The content 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 requires States 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, as well as the obligation to prepare and implement mitigation and adaptation strategies and plans 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 for the Slovak Republic is set to achieve climate neutrality of the Slovak Republic as soon as possible by 2050. Climate and energy policies are among the main areas where the potential for synergies in achieving common objectives can be identified. Measures to achieve the objectives of those policies provide considerable scope for integrating air protection requirements. At the same time, they also include potential risk areas such as the use of biomass as a renewable energy source. Building a competitive low-carbon economy is a long-term priority of Slovakia's energy policy. The optimal use of renewable energy sources, nuclear energy, decarbonised gases and innovative technologies that will contribute to the efficient use of energy resources 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 supply and diversification efforts, it is now important for Slovakia to consider and prepare for new innovative technologies. Small Modular Reactors (SMRs) have potential in their ability to meet the need for flexible energy supply in the form of electricity, hydrogen and heat for heating and industrial purposes. On the basis of SMR project proposals, manufacturers declare the implementation of safety features in order 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 which will be carried out once the first types of SMRs are constructed. The SMR is one of the appropriate solutions to ensure security of supply and stability of the electricity transmission system in the east of Slovakia after the closure of TE Vojany.

Achieving Slovakia's objectives for the next period, following an increase in the share of RES, will entail significant financial costs. Slovakia will therefore put in place support mechanisms which, on the one hand, meet the objectives of increasing the share of RES and, on the other, contribute to meeting the targets for reducing greenhouse gas emissions while maintaining the value for money principle. This principle will be applied both in the context of the sustainability of supported solutions and in setting up appropriate forms of funding for these support mechanisms.

Given the high share of nuclear sources in electricity production and the high share of natural gas in the heat sector, Slovakia has one of the least emitting energy sources in the EU. The closure of coal mining in Bani Nováky at the end of 2023 and the subsequent projected shutdown of the Nováky coal power plant mark a significant milestone for the end of coal use in the energy sector.

In the heating sector, the phasing out of coal and the transition to renewable energy sources are ongoing. The high degree of centralisation of the heat supply creates good technical preconditions for the use of biomass, biomethane and geothermal energy. The appropriateness of involving heat pumps in district heating systems is also shown. One way to reduce the dependence on natural gas in heating is to increase the use of heat from the Bohunice nuclear power plant and to start using heat from the Mochovcev nuclear power plant in the surrounding sites and, after 2030, heat from small modular reactors. Suitable geothermal conditions, particularly for heat production, allow Košice, Prešova and other cities to be heated.

After replacing solid fossil fuels with renewable energy sources, Slovakia will have one of the least emitting energy across the EU (about the seventh least carbon intensive energy across the EU in terms of $CO2_{intensity}$ of electricity and heat production) and therefore the potential for greater implementation of RES needs to be sought in countries where solid fossil fuels are used to a greater extent and where the implementation of RES and the decarbonisation of the electricity sector are much more cost-effective.

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 mix, the challenge is the gradual electrification of transport, in particular public passenger transport. The decarbonisation of industry needs to make use of all available innovative technologies and all decarbonised fuels and energy carriers.

.In order to ensure decarbonisation objectives and a competitive economy, it is essential to reconcile the need for stable low-carbon electricity generation with targets for those forms of RES from which variable electricity generation originates.

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, last but not least, saving primary energy sources contributes to mitigating the environmental impact of energy. Energy efficiency is cross-cutting across all dimensions of energy policy.

Slovakia’s energy intensity has been on a downward trend in recent years. Significant progress in reducing energy intensity is evidenced by its development in 2000-2015, when, according to Eurostat data, Slovakia reduced energy intensity by 50.8 %. These positive developments are the result, inter alia, of successful industrial restructuring, the introduction of low-energy production processes in industry, improvements in the thermal performance of buildings and the conversion of appliances to more cost-effective ones. Nevertheless, the Slovak Republic has the seventh highest energy intensity based on constant prices in the EU-28. This is mainly due to the structure of industry in Slovakia, where there is a large share of energy intensive industries, so energy efficiency measures, including sources of financing, will in future also be more strongly targeted at 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.

The Energy Efficiency Action Plans, which evaluate energy efficiency measures, as well as setting up new measures to meet the energy savings targets, were essential implementing instruments up to 2020 for energy efficiency. This task is transferred to the NECPs and the biennial progress reports on the energy sector after 2020.

Energy security dimension

In terms of energy security, an efficient energy architecture will be supported, creating the conditions for increased energy security by using indigenous energy resources, a favourable environment for the construction of low-carbon sources of heat and electricity, with the possibility of exporting electricity, and an optimal energy mix with low-carbon technologies in each sector, for the benefit and protection of the customer. In the medium term, the production of synthetic fuels based on renewable hydrogen will be supported, thus reducing dependence on imports of the primary energy carrier.

Key areas are diversifying transport routes and sources of energy, enhancing nuclear safety and 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 is considered to be very important in this context.

Research, innovation and competitiveness dimension:

In March 2023, the national R & D & I strategy 2030 was approved by the government with an action plan, which also covers actions 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 objectives, a system of policies and measures in the field of research, innovation and human resources, which will help stimulate structural change in 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 funds for Policy Objective 1 a more competitive and smarter Europe, by promoting innovative and smart economic transformation[1] and regional ICT connectivity, conditional on 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 Slovak Programme ('PSK').

Horizon Europe has a budget of EUR 95.5 billion for the period 2021-2027. Of the total budget, EUR 15.1 billion is allocated to climate, energy and mobility. EUR 8.9 billion is allocated to 'Food, Bioeconomy, Natural Resources, Agriculture and Environment'. Research and innovation exploiting synergies in the fields of climate, energy and mobility addresses the environmental and economic sustainability of our way of life. The main objectives of the Climate, Energy and Mobility cluster are combating climate change, improving the competitiveness of the energy and transport industries and the quality of the services they provide to society.

In Slovakia, there is potential to use knowledge and domestic expertise in Big Data (BIG DATA) in the area of processing, analysis, prediction and visualisation of large volumes of data in real time, as well as the use of artificial intelligence based on historical data extraction, to support further decisions, for example in the field of environmental protection, climate, etc. Using these methods, already tested prediction models can be improved, modern technologies and algorithms developed for distributed and parallel data processing can be used. This allows, inter alia, the processing of analyses of various 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.

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

[1] For policy objective 1, as set out in Article 3(1)(a) of Regulation 2021/1058, compliance with SK RIS3 2021+ is a pre-condition for operations corresponding to the specific objectives set out in points (i) and (iv) of that point (a). Under OP SK, this condition applies to Specific Objectives 1.1 (Development and Extension of Research and Innovation Capabilities and Utilisation 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 the plan's key objectives, policies and measures

Table 2 Key Objectives, Policies and Measures

Strategy/Policy	Key objectives	Measures
Economic Policy Strategy of the Slovak Republic until 2030 (Government Resolution No 300/2018)	Define the strategic orientation of Slovakia's economic policy with a view to 2030. Better predictability and stability of public decisions.	The economic policy strategy is of a cross-ministerial nature and its defined scope requires cooperation in its preparation, including, in addition to the relevant departments, the Office of the Government of the Slovak Republic and the Office of the Deputy Prime Minister of the Slovak Republic for investment and computerisation. The draft measures were drawn up in cooperation with the departments and institutions concerned. The measures set out in the document will be implemented in the form of action plans in three-year cycles. At the mid-term of the period covered by the document, it is foreseen to review the strategy and to adjust it, if necessary, on the basis of current needs.
Strategic Transport Development Plan of the Slovak Republic until 2030 (Government Resolution No 13/2017)	Reduction of negative environmental and negative socio-economic impacts of transport (including climate change) as a result of environmental monitoring, efficient infrastructure planning/realisation and reduction of conventionally powered means of transport or the use of alternative fuels	Promoting the use of alternative fuels and the construction of related infrastructure for road transport and waterborne transport, the remotorisation of obsolete propulsion units of ships, including low-emission auxiliary aggregates, will ensure the protection of waters against pollution caused by discharges from vessels on the Slovak section of the Danube, replacement of the fleet by new vehicles by encouraging citizens through direct financial support from the State; where applicable, tax instruments or, in the case of alternatively fuelled trucks, exemption from payment of tolls
Climate Change Adaptation Strategy of the Slovak Republic – Update (Government Resolution No 478/2018)	The main objective of the updated Slovak Strategy for Adaptation to the Adverse Impacts of Climate Change is to	General guidance on adaptation and examples of concrete adaptation measures in the transport, energy, industry and some other business areas.

	improve Slovakia's preparedness to deal with the adverse effects of climate change, to provide the widest possible information on current adaptation processes in Slovakia and, on the basis of their analysis, to establish an institutional framework and coordination mechanism to ensure the effective implementation of adaptation measures at all levels and in all areas, as well as to raise overall awareness of this issue.	
Slovak Environment Policy Strategy 2030 (Envirostratégia 2030) (Government Resolution No 87/2019)	Nature conservation Air protection Green economy	It will improve biodiversity protection and avoid the deterioration of species and habitats. Slovakia will achieve good water status and the green measures taken will ensure increased flood protection. By retaining water, better planning in the country and more responsible water management, we will contribute to reducing droughts and water scarcity. In the area of air protection, the main measures focus on reducing coal combustion, clean transport and more efficient and cleaner heating systems. The polluter pays principle will also be applied more consistently and environmentally harmful subsidies to coal or biomass from unsustainable sources should also be eliminated. Air quality will improve in 2030 and will not have a significant negative impact on human health and the environment. In the area of climate change, Slovakia will reduce greenhouse gas emissions in the emissions trading sectors by

		43 % and outside these sectors by at least 20 % compared to 2005. Criteria for the sustainable use of all renewables will be developed by 2020. Circular economy principles will be phased in in Slovakia. The recycling rate of municipal waste shall be increased to at least 60 % by 2030 and the landfilling rate shall be reduced to less than 25 % by 2035. At the same time, the use of preventive measures to prevent black landfills will be increased. Slovakia will reduce food waste generation by 2030. Restaurants and supermarkets will be obliged to make further use of food, either to donate unsafe food to charity, or to make food compost or energy valorised after a guarantee. Green public procurement will cover at least 70 % of the total value of all public procurements and support for green innovation, science and research will be significantly increased. The energy intensity of Slovakia's industry will come closer to the EU average. In the area of energy production, the production of energy from renewable sources, which by its very nature does not weigh on the environment, will be favoured.
National indicative energy efficiency targets and contributions to the European energy efficiency target	Primary energy consumption in 2020 16.38 Mtoe, 686 PJ, 20 % Final energy consumption in 2020 (Eurostat) 10.39 Mtoe, 435 PJ, 23 % National indicative contributions of the EU target of 32.5 % in 2030	energy efficiency measures, in particular buildings and industry, Chapter 2.2 Energy efficiency dimension
Low-carbon development strategy of the Slovak Republic (Government	Objectives of the strategy:	The strategy identifies key policies and measures that will deliver on the Paris Agreement headline target of limiting global temperature growth to no more than 2 °C by

Resolution No 104/2020 of 5 March 2020)	• Provide a coherent long-term (30-year) strategic outlook for the transition to a low-carbon economy • Ensure coherence with other strategic documents and action plans within the national economy (energy, industry, transport, land and forestry, waste) • Introduce binding and indicative area-specific targets • Ensure consistency with the objectives of the Paris Agreement, in particular as regards the objective of carbon neutrality • Offer a list of actions and funding opportunities • Assess the impact of the strategy and its measures on macroeconomic indicators	the end of the century and pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels. In line with the Paris Agreement objective, the EU and Slovakia have committed to achieving climate neutrality by 2050, meaning that only as many greenhouse gas emissions as we can capture them should be released.
National policy framework for the development of the market for alternative fuels (Government Resolution No 504/2016)	• support, through defined measures, the development of an alternative fuel market in the transport sector and the development of relevant infrastructure;	The document defines measures to meet the national targets and objectives of the national policy framework, measures to support the deployment of alternative fuels infrastructure in public transport services, as well as an assessment of the location of LNG refuelling points in ports not covered by the TEN-T core network and an assessment of the need to install electricity supply facilities at airports for aircraft on stand sites. Fuels included in the national policy framework shall be eligible for Union and national support measures for alternative fuels infrastructure in order to support

		focus publically on the coordinated development of the internal market towards mobility; using alternative fuels means of transport, as well as a range of regulatory and non-regulatory incentives, in close cooperation with private sector actors that could play a leading role in supporting the development of alternative fuels infrastructure.
Action plan for the implementation of the Slovak Climate Change Adaptation Strategy (Government Resolution No 476 of 31 August 2021).	• increase Slovakia's preparedness for the adverse effects of climate change	The structure of the NAPs is based on the definition of the main objective, which is based on the implementation of the strategic priorities. 5 cross-cutting actions are identified to meet the objective and aim to improve the implementation framework, support science and research on adaptation to climate change, develop an efficient crisis management system and address extreme events such as floods and fires, promote green infrastructure, as well as support education and awareness. These actions are followed up by 18 tasks. 7 specific areas are at the core of the NAPs: water protection, management and use, sustainable agriculture, adapted forestry, natural environment and biodiversity, health and healthy population, settlement environment and technical, economic and social measures. Each of these 7 areas has its specific objective, each of which has its basic principles and specific measures defining tasks in that segment. In total, 45 specific actions have been identified and 169 assignments have been identified for the period of validity of the NAPs until 2027. These measures and their follow-up tasks are based on the Slovak Climate Change Adaptation Strategy – update.
Air Protection Strategy of the Slovak Republic until 2030	• the aim is to develop a coherent approach to air quality management.	The objective of this strategy is to draw up a comprehensive approach to air quality management for the Slovak Republic and to achieve good air quality throughout Slovakia,

		i.e. in order to comply with limit values and target values for human health, ecosystems and vegetation, including limit values for PM2,5 set for the urban population. The main output of the strategy to improve air quality will be tailor-made air quality improvement programmes for specific air quality management areas. The strategy will include two key documents, a national emission reduction programme and a strategy to improve air quality.
National Emission Reduction Programme (Government Resolution 103/2020 on 05. 3. 2020)	• it addresses potential air emission reduction measures to meet the emission reduction commitments (national ceilings) established by 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 for 2030. National emission ceilings are set for SO2 (sulphur dioxide), NOx (nitrogen oxides), VOC (volatile organic compounds), NH3 (ammonia) and PM2,5.	In order to reach the above ceilings, the programme in question has been drawn up, which proposes policies and measures to achieve the above national commitments in two stages: the period from 2020 to 2029 and the period from 2030 onwards. 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 established in other relevant policy areas, including climate, energy, agriculture, industry and transport. It will also support the transfer of investments to clean and efficient technologies.
National Hydrogen Strategy of the Slovak Republic[2] (Government Resolution No 356 of 23. 6. 2021	• boosting the hydrogen economy	The document defines the Slovak Republic's strategy in promoting the introduction of hydrogen technologies in the Slovak economy with a view to producing, distributing and using zero- and low-emission hydrogen. The overarching document is the Action Plan for

[2] Slovak Government Resolution No 356 of 23. 06. 2021, https://rokovania.gov.sk/RVL/Resolution/19331/1

		the Development of Hydrogen, which defines the specific instruments and actions to achieve the objectives of the National Hydrogen Strategy of the Slovak Republic.
Action plan for the successful implementation of the National Hydrogen Strategy of the Slovak Republic until 2026[3] (Government Resolution No 307 of 12. 6. 2023)	• boosting the hydrogen economy	The Action Plan for the successful implementation of the National Hydrogen Strategy by 2026 will pave the way for the implementation of hydrogen technologies in line with the National Hydrogen Strategy "Preparing for the Future" The action plan is drawn up for the period 2023-2026. It contains measures defined to be met by 2026 and their financing for a total amount of EUR 59.6 million has been identified as potentially available sources of funding. Following the evaluation of the implementation of the Action Plan between 2023 and 2026, an update of the Action Plan with implementation between 2027 and 2030 will be prepared.
Action plan for the development of electromobility in the Slovak Republic (Government Resolution No 306 of 12.6.2023)	• promoting low-emission mobility	The measures are in the nature of financial measures to support charging infrastructure, legislative measures to facilitate permits and advantages for electric vehicles

Related national legislation:

Act No 414/2012 on emission allowance trading and amending certain acts

This Act governs greenhouse gas emission allowance trading in the Slovak Republic, between persons registered in the Slovak Republic and in the European Union and persons registered in countries listed in Annex B to the Kyoto Protocol to the United Nations Framework Convention on Climate Change, which promotes the reduction of greenhouse gas emissions in an economically efficient manner, the rights and obligations of those who operate or manage stationary operations, aircraft operators and other participants in the trading scheme, and the powers of State administrative authorities.
Online: https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2012/414/

[3] https://rokovania.gov.sk/RVL/Material/28497/1

Act No 146/2023 on air protection and amending certain acts and decrees following that Act

This law sets air protection objectives to achieve and maintain air quality that does not have a significant negative impact on human health and does not pose a risk to the environment and ecosystems. The Act regulates the monitoring and assessment of air quality and the impacts of air pollution on ecosystems, public information on air quality, the effects of air pollution on public health and ecosystems, permissible levels of air pollution and air quality management tools, national emission reduction commitments for certain pollutants entering the air and requirements for the establishment of a national emission reduction programme, permissible levels of air pollution, monitoring and demonstration of compliance, instruments for reducing and detecting emissions from stationary air pollution sources, requirements for the quality of fuels and regulated products; rights and obligations of persons in air protection, competence of State air protection authorities, State supervision, administrative and air protection offences, activities in support of the performance of the State air protection administration requiring competence in air protection and information systems on stationary sources of air pollution and their emissions.
Online: https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2023/146/20230701

Act No 190/2023 on air pollution charges

The Act provides for an air pollution charge to be paid, under the conditions laid down in the Act, by a legal person and a natural person entrepreneur operating a stationary source of air pollution for the discharge into the air of the pollutants listed in Annex 1 from a large source, medium source or small source, if the municipality so provides in a generally binding regulation.
Online: https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2023/190/20240101

Act No 79/2015 on waste and amending certain acts, as amended

This Act places emphasis on the sorting of packaging and recyclable materials. The scheme for financing separate collection from the State Recycling Fund to the Producer Responsibility Organisation is also amended. Disposal of waste is permitted only in authorised managed landfills. This law prohibits the disposal of garden waste, biodegradable waste through landfilling and incineration, and requires separate collection of kitchen waste. The law aims, in particular, to reduce the amount of waste that is disposed of through landfilling, to treat and focus on waste prevention, to minimise the negative impacts of the generation and management of waste on the environment and human health, to introduce and implement extended responsibility for producers and importers in the normal way in other Member States of the European Union and to translate it into municipal level.
Online: https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2015/79/20220630

Waste Management Plan of the Slovak Republic 2021-2025

The main objective of waste management in the Slovak Republic for the period 2021-2025 is to divert waste away from landfilling, in particular for municipal waste, to increase recycling together with improved separate collection and to introduce and increase reuse.
it includes a number of key objectives related to climate change mitigation: Increase the separate collection of municipal waste to 60 % by 2025 and the preparing for re-use and recycling rates for municipal waste to 55 %; reduce the share of biodegradable municipal waste in mixed municipal waste to 25 % by 2025, divert landfilling of municipal waste to 10 % by 2035. In the area of textile collection, the main objective is to establish a functional system for textiles in the Waste Act with effect from 1. 1. 2025.
online: https://www.minzp.sk/files/sekcia-enviromentalneho-hodnotenia-riadenia/odpady-a-obaly/registre-a-zoznamy/poh_sr_2021_2025_vestnik.pdf

The concept of water policy of the Slovak Republic up to 2030 with a 2050 perspective

The main objective of the concept is to ensure the gradual restoration of damaged water bodies, the cessation of water pollution and the reduction of groundwater, as well as the provision of sufficient drinking water in the regions. It defines ten priority areas, one of the main objectives being to increase the proportion of the population connected to sewerage to reach 85 % coverage in 2050.
Online: https://www.minzp.sk/files/sekcia-vod/koncepcia-vodnej-politiky/koncepcia-vodnej-politiky.pdf Tax Office

Act No 302/2019 on the deposit of non-reusable beverage packaging and amending certain acts

That law triggered the operation of a deposit on non-reusable beverage packaging. This Act applies to non-reusable beverage packaging placed on the market in the Slovak Republic and to waste from such packaging. The law governs, inter alia, the powers of the State authorities in the field of deposit of non-reusable drinks packaging and packaging waste, State supervision and the conduct of the State supervisory authorities in its execution, administrative offences and the procedure for the imposition of fines.
Online: https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2019/302/20230101

Act No 543/2002 Coll. on nature and landscape protection, as amended – Expansion of areas under strict protection

This measure results from the adopted amendment to Act No 356/2019 of 11 September 2019 amending Act No 543/2002 on nature and landscape protection, as amended, and amending certain acts – online: https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2019/356/vyhlasene_znenie.html. Extension without intervention regime to 75 % of national parks by 2030, i.e. an increase of around 130 thousand ha compared to the current situation. A temporary increase in sinks in these forests is expected. However, the effect of this measure will decrease over time. At the same time, the modelled quantification does not include the effects of natural disturbances in these forests, where active management will not be carried out to protect them against biotic and abiotic disturbances, which can significantly affect the stability of the carbon sinks thus achieved before and after 2030 in those forests.

FINANCIAL TOOLS:

ENVIRONMENTAL FUND

State aid scheme – Compensations for indirect costs

To cover the direct costs of CO2 emissions, 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.

A State aid scheme for the heating sector (EUR 149,5 million for 2022), which aims at improving energy efficiency, modernising energy systems, including district heating or cooling (CZT), energy storage and smart heat distribution solutions, increasing the share of electricity and heat produced by high-efficiency cogeneration plants (HHP) ('the 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 published. More details on the call are available on the website of the Environmental Fund on the following link: https://envirofond.sk/modernizacny-fond/.

Aid scheme for the decarbonisation of industry

In autumn 2022, two State aid schemes for the decarbonisation of industry were 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 lead to primary energy savings, reduce final energy consumption and introduce the use of advanced environmental technologies into industrial production, thereby directly supporting the achievement of national, European and global climate targets under the Paris Agreement.

The aim of the schemes is 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 RRP scheme (component 4) will provide aid amounting to EUR 357 343 413,00.

The Modernisation Fund has an estimated budget of EUR 750000000 for the period 2022-2030.

The text of schemes to decarbonise industry is available at:
1.
https://obchodnyvestnik.justice.gov.sk/ObchodnyVestnik/Formular/FormularDetailHtml.aspx?IdFormular=3550458&csrt=2384708614519771708
2.
https://obchodnyvestnik.justice.gov.sk/ObchodnyVestnik/Formular/FormularDetailHtml.aspx?IdFormular=3550458&csrt=2384708614519771708

The State aid scheme for the promotion of electricity from RES aims to support investments in the construction, renovation and modernisation of installations 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 grantor of aid under the scheme is the Ministry of the Environment of the Slovak Republic and the implementing body of the scheme is the Ministry of the Economy of the Slovak Republic. The indicative amount of expenditure planned under this scheme for the period 2024-2030 is EUR 400 million.
https://www.justice.gov.sk/PortalApp/ObchodnyVestnik/Formular/FormularDetailHtml.aspx?IdFormular=2892958

RECOVERY AND RESILIENCE PLAN

Recovery and resilience plan – 'House recovery' project

It represents a long-term renovation programme for single-family houses financed through the Recovery Plan. This long-term renovation programme for single-family houses will help rebuild Slovakia's countryside, protect against the adverse effects of climate change. The programme aims to rebuild at least 30000 single-family houses by June 2026. Support through this project focuses on the already implemented renovations of single-family houses built before 2013. The investment is aimed at owners of older single-family houses, allowing the financing of traditional energy saving measures (e.g. thermal insulation, replacement of windows, replacement of inefficient heat sources or installation of new installations using RES) and measures to promote adaptation to climate change (e.g. green roofs). The applicant shall prove that the energy savings of at least 30 % have been met. In order to mobilise a comprehensive and green recovery, the scheme includes a combination of

mandatory and optional parts. Energy savings achieved in the renovation of single-family houses will be verified mainly through energy performance certificates.
(as at 5.1.2023 1975 applications were submitted)

Available online: www.obnovdom.sk

REPowerEU

REPowerEU is the European Union's ('EU') response to Russia's military aggression against Ukraine and the resulting disruption of the global energy market. The most important objectives of REPowerEU are therefore to put an end to the EU's dependence on fossil fuel imports from Russia as soon as possible, while fighting the climate crisis, through energy saving measures, diversification of energy supply and accelerating the deployment of renewable energy sources in both industry and households, including electricity generation.

JUST TRANSITION FUND

The Just Transition Mechanism is a key tool to ensure that the transition to a climate-neutral economy takes place in a fair way. The Just Transition Mechanism addresses the social and economic consequences of the transition, focusing on the regions, industries and workers that will face the greatest challenges.

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 creation 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.

I. National and Union energy system and 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.

Slovakia's priority in the energy sector is to ensure synergy between sub-policies, cost-effectiveness, the promotion of the principles of sovereignty in the energy mix, the preservation of competitiveness and energy security. In this context, we consider the replacement of high-emission energy sources as low-emissions as well as the development of renewable energy sources (RES) and energy efficiency measures as a means of achieving the emission targets. In Slovakia, as well 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 sources is an effective tool for achieving climate objectives (with a minimum impact on electricity end-prices).

Industrial competitiveness is also very closely linked to energy, with increased attention given to sharp international competition and the emergence of the technologically revolutionary concept of Industry

4.0. We have committed to finding options for lowering the final price of electricity for industrial consumers.
The Slovak Republic has consistently put emphasis on strengthening energy security and security of energy supply, as evidenced by the continuation of work on individual projects of common interest (PCIs).

In the field of renewable energy sources (RES), efforts are made to promote forms that can replace fossil fuels so as to ensure the reliability of the production and supply of electricity and heat without significant additional costs. Conditions will be created for the optimal use of renewable energy sources in the energy mix so as to secure Slovakia's objectives under EU legislation.

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

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 the mechanisms for monitoring, evaluating and streamlining 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 being strengthened to meet the 2030 targets as agreed in the Fit for 55 package. This includes legislation in place 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.

Policy context at EU level

Non-legislative/legislative act	*Type of act*	*Main objective*
The European Green Deal	*Non-legislative act*	*— the European Commission's plan for the green transition of the European Union's economy* *— a climate-neutral continent by 2050 at EU level* *— decoupling economic growth from resource use and ensuring that upcoming changes are fair and inclusive, leaving no individual or region behind.*
Fit for 55 package	*Non-legislative act*	*— a set of proposals to revise and update EU legislation and to 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 longer lifetimes and making full use of circular economy principles.*
EU Biodiversity Strategy for 2030	*Non-legislative act*	*— protecting at least 30 % of the EU's land and 30 % of marine areas and integrating ecological corridors within a genuine Trans-European Nature Network;* *—the strict protection of at least a third of the EU's protected areas, including all remaining primary and old-growth forests in the EU;* *— the efficient management of all protected areas, with the definition of clear conservation objectives and measures and their proper monitoring.* *— sets out an EU Nature Restoration Plan – a set of concrete commitments and actions to restore degraded ecosystems across the EU by 2030 and sustainably manage them;*
Forging a climate-resilient Europe – the new EU Strategy on Adaptation to Climate Change	*Non-legislative act*	— a 2050 vision for a climate-resilient Union by making adaptation smarter, more systemic and faster, as well as stepping up international action. —exploit better knowledge and data, support policy development and climate risk management at all levels and accelerate adaptation across the board. —increase awareness of adaptation and planning would be extended to every local authority, society and household, adaptation implementation would be fully rolled out for those most affected, and increased climate resilience would also be achieved using nature-based solutions.
EU Soil Strategy for 2030 — Reaping the benefits of healthy soils for people, food, nature and climate	*Non-legislative act*	—emphasis on soil protection, sustainable soil management and restoration of degraded soil to achieve the Green Deal objectives, as well as land degradation neutrality by 2030. — prevent further soil degradation; —introduce sustainable soil management as a new standard; — take action to restore ecosystems.
New EU Forest strategy for 2030	*Non-legislative act*	— ensure healthy, diverse and resilient forests in the EU, which contribute significantly to enhancing biodiversity and climate ambition. —forests are important in carbon capture and their protection is essential to achieve EU climate neutrality by 2050.
Pathway to a healthy planet for all — EU action plan: 'Towards	*Non-legislative act*	— the zero pollution ambition https://eur-lex.europa.eu/legal-content/SK/TXT/HTML/?uri=CELEX:52021DC0400&from=ENis a cross-cutting objective that contributes to the UN 2030 Agenda for

Zero Pollution for Air, Water and Soil'		SustainableDevelopment https://eur-lex.europa.eu/legal-content/SK/TXT/HTML/?uri=CELEX:52021DC0400&from=EN and complements the objective of climate neutrality by 2050, in synergy with the green and circular economy and biodiversity restoration objectives. —it is an integral part of many European Green Deal and other initiatives. — sets key targets for 2030 to accelerate pollution reduction to steer the EU towards a vision of a healthy planet for all by 2050. The Zero Pollution Action Plan for 2030 aims to reduce the health impact of air pollution by 55 % and to reduce the number of EU ecosystems at risk of air pollution by 25 % compared to 2005.
EU strategy to reduce methane emissions	*Non-legislative act*	— sets out measures to reduce methane emissions in Europe and internationally. It represents legislative and non-legislative measures in the energy sector, agriculture (monitoring methane emissions at farm level, valorising agricultural waste and residues flows through anaerobic digestion, improving the quality of animal feed (innovating compound feed), feed additives and feeding techniques) and waste management, which account for around 95 % of human-related methane emissions worldwide.
Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system	*Non-legislative act*	—reduce the use of pesticides, fertilisers and antibiotics in agriculture. This strategy was developed in synergy with the European Green Deal, which set itself the objective of mitigating the environmental and climate footprint of the European food system. A European target for reducing inorganic nitrogen fertilisers by 20 % compared to 2030.
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*	—introduces the objective set out in the European Green Deal to make Europe's economy and society climate neutral by 2050. —set an intermediate target of reducing net greenhouse gas emissions by at least 55 % by 2030 compared to 1990 levels. —The aim of the regulation is to ensure that all EU policies contribute to this objective 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	*Legislative act*	—set out the necessary legislative foundations for a robust, inclusive, cost-effective, transparent and predictable governance of the Energy Union and climate action that ensures the achievement of the 2030 objectives and targets of the Energy Union and the long-term objectives and targets of the Energy Union in line with the 2015 Paris Agreement on Climate Change following the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change through complementary, coherent and ambitious efforts by the Union and its Member States, while limiting administrative complexity.

715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council		
Regulation (EU) 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*	The sectors covered by Regulation (EU) 2018/842 have been revised with a view to reaching the Union's new target of reducing their greenhouse gas emissions gradually until they reach a 40 % reduction in 2030 compared to 2005 levels. This Regulation applies to greenhouse gas emissions from the IPCC categories relating to 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 amending Regulation (EU) 2019/631 as regards strengthening the CO2 emission performance standards for new passenger cars and new light commercial vehicles in line with the Union's	*Legislative act*	The Regulation contains a CO2 reduction target for passenger cars and light commercial vehicles. The limit for emission reductions is 15 % from 1.1.2025 and 55 % for cars and 50 % for light commercial vehicles from 1.1.2030. At the same time, from 1.1.2035 this value is a 100 % reduction.

increased climate ambition		
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 Regulations (EU) 2018/841 as regards the scope, simplifying the reporting and compliance rules and setting the targets of the Member States for 2030 and Regulation (EU) 2018/1999 as regards improving monitoring, reporting, tracking of progress and review	*Legislative act*	—sets a LULUCF skeleton target for the Union's 2030 greenhouse gas emission reduction target of 55 % compared to 1990. Slovakia has a target of reducing emissions in 2030 (i.e. increasing sinks, as net emissions in LULUCF are negative) by -504 kt CO2 eq.
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)	*Legislative acts*	— the Directives adapt the EU Emissions Trading System (EU ETS) to the overall 2030 emission reduction ambition of the sectors covered by the EU ETS to 62 % compared to 2005 levels. —include emissions from shipping within the scope of the EU ETS. —a new separate emissions trading system is established for buildings, road transport and other sectors (especially small industry). The new system will apply to distributors supplying fuels to buildings, road transport and other sectors from 2027. Free emission allowances for the aviation sector will be phased out and full auctioning will be introduced from 2026 onwards. From 1 January 2024, emission monitoring and reporting shall also be extended to the combustion of

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.		fuels in municipal waste incineration installations with a total rated thermal input exceeding 20 MW in order to assess their inclusion in the EU ETS from 2028 onwards.
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*	—the above-mentioned fodna will provide specific funding to Member States to support in particular 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*	— the mechanism will phase out free allowances to the sectors covered by the mechanism and thereby replace 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	*Legislative act*	The adoption of these regulations would represent an important step towards limiting global temperature rises in line with the Paris Agreement. The proposal to reduce F-gases will also contribute to reducing emissions by at least 55 % by 2030 and to making Europe climate neutral by 2050. Together, both proposals could deliver an overall reduction in EU greenhouse gas (GHG) emissions of 490 Mt (CO_2 equivalent) by 2050.

European Parliament and of the Council on substances that deplete the ozone layer and repealing Regulation (EU) No 1005/2009		
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 temporary EU air quality standards by 2030, more closely aligned with World Health Organisation guidelines —to move the EU towards a zero-pollution trajectory by 2050 at the latest, in synergy with climate. — striving for neutrality.
Proposal for a Directive of the European Parliament and of the Council concerning urban waste water treatment (recast)	*Legislative act*	—increase in the possibility of reuse of sludge and treated waste water —focus on the energy neutrality of the sector by 2040 and improve the quality of sludge to enable more reuse, thus contributing to a more circular economy.
Proposal for a Regulation of the EP and of the Council concerning batteries and waste batteries, repealing Directive 2006/66/EC and amending Regulation (EU) 2019/1020	*Legislative act*	The measures will lead to further harmonisation of: (I) product requirements for batteries placed on the Union market and (ii) levels of waste management services provided by businesses. The proposal will also set requirements for ensuring a well-functioning market for secondary raw materials while preventing and reducing the environmental impacts from the production and use of batteries (as well as their treatment – including recycling – at the battery's end of life). This will support a circular battery industry across Europe and avoid fragmentation that different national approaches can induce.
Proposal for a Regulation of the EP and of the Council on nature restoration	*Legislative act*	—set restoration targets and obligations across a wide range of ecosystems on land and at sea; —one of the main priorities will be the ecosystems with the greatest potential for carbon removal and storage and the prevention or reduction of the impact of natural disasters, such as floods. Restoring EU wetlands, rivers, forests, grasslands, marine ecosystems, urban environments and the species they host is a crucial and cost-effective investment: into our food security, climate resilience, health, and well-being.

Proposal for a Directive of the EP and of the Council amending Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) and Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste	*Legislative act*	—improve the effectiveness of the IED in preventing or, where this is not possible, minimising pollutant emissions from agro-industrial installations at source; —support the uptake of innovative technologies and techniques during the ongoing industrial transformation, by revising without delay the BAT Reference Documents (BREFs) where there is evidence that better performing innovative techniques are available, and by ensuring permits that support frontrunners; support the transition towards the use of safer and less toxic chemicals, improved resource efficiency (energy, water and waste prevention) and greater circularity; promote decarbonisation by promoting synergies in the use of techniques that prevent or reduce pollution and carbon emissions.
Proposal for a Regulation of the EP and of the Council establishing a Union certification framework for carbon sinks	*Legislative act*	—ensure high quality carbon sinks in the EU and establish an EU certification management system to avoid greenwashing by correctly applying and enforcing EU quality framework criteria in a reliable and harmonised way across the Union; —launch measures for the introduction of carbon sinks to develop any future policy in this area, given the need to eliminate hundreds of millions of tonnes of CO2 per year. This will support the achievement of the 2050 climate neutrality objective set out in the European Climate Law, as well as other environmental objectives outlined in the European Green Deal.
Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a General Union Environment Action Programme to 2030	Legislative act	—to accelerate the green transition equitably and inclusively, in line with the long-term 2050 goal of 'Tree well within planetary boundaries', and guide the adoption and implementation of environmental policy measures by 2030. 8. The 8th EAP has six interlinked thematic priority objectives for the period until 31 December 2030: —fast and predictable reduction of greenhouse gas emissions while enhancing removals by natural sinks in the Union with a view to achieving the 2030 greenhouse gas emission reduction target set out in Regulation (EU) 2021/1119, in line with the Union's climate and environmental objectives; —constant progress in enhancing and mainstreaming adaptive capacity, including on the basis of ecosystem-based approaches, strengthening resilience and adaptation, and reducing environmental vulnerability;

		—progress towards a wellbeing economy that returns to the planet more than it takes, and accelerating the transition to a non-toxic circular economy where growth is regenerative, resources are used efficiently and sustainably and a waste hierarchy is applied; —promoting zero pollution, including in relation to harmful chemicals, with a view to achieving a toxic-free environment, including air, water and soil; —preserving, conserving and restoring marine, terrestrial and inland water biodiversity within and outside protected areas, inter alia by halting and reversing loss; —promoting environmental sustainability aspects and significantly reducing key environmental and climate pressures related to the production and consumption of the Union, in particular in the areas of energy, industry, buildings and infrastructure, mobility, tourism, international trade and the food system.

Policy context at national level

(a) Energy policy of the Slovak Republic

Energy policy was adopted by Slovak Government Resolution No 548/2014. The energy policy of the Slovak Republic (energy policy) is a strategy document which defines the primary objectives and priorities of the energy sector for the period up to 2035 with a 2050 perspective. Energy policy is part of the Slovak Republic’s national economic strategy, since ensuring sustainable economic growth is conditional on the reliable supply of affordable energy. The objective of energy policy 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. Ensuring the reliability and stability of energy supply, efficient use of energy at optimal costs and ensuring environmental protection is a priority in this respect. Energy policy was updated with the approval of the draft document Integrated National Energy and Climate Plan in 2019.

(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. Its aim is to provide a comprehensive overview of the measures implemented and planned in 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 to communicate the implementation of the Sustainable Development Goals and the European Pillar of Social Rights.

(C) Slovakia's vision and development strategy for 2030 – long-term sustainable development strategy of the Slovak Republic – Slovakia 2030

In terms of content, Slovakia's 2030 draft document is based on four key principles:

- sustainability, i.e. the balance between available resources and their use;
- the strengths of quality of life over economic growth;
- efficiency based on synergies; 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) Climate Change Adaptation Strategy of the Slovak Republic

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 the issue.

1(e) Environmental Policy Strategy of the Slovak Republic "Greener Slovakia"

The 2030 Environmental Policy Strategy of the Slovak Republic (Envirostratégia 2030), which was approved by the Slovak Government in February 2019 by Resolution No 87/2019, defines a vision for 2030 taking into account possible, probable and desired future developments, identifies underlying systemic problems, sets targets for 2030, proposes framework measures to improve the current situation and also contains basic result indicators that will make it possible to verify the results achieved. The underlying vision of the Envirostratégie 2030 is to achieve a better environmental quality and a sustainable circular economy based on consistent protection of environmental components, using the least non-renewable natural resources and hazardous substances that will lead to improved public health.

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

(F) Low-carbon development strategy for the Slovak Republic up to 2030, with a 2050 perspective (NUS SR)

In 2019, the Ministry of the Environment completed a cooperation project with the World Bank. The main output of the project is the "Low Carbon Growth Study for Slovakia Implementing the EU's 2030 climate and energy policy framework". This study is the main background document in the preparation of the NUSSR. The Nus SR will include effective and cost-effective measures in the industrial, energy, energy efficiency, transport, agriculture and forestry and waste management sectors. Representatives of the professional and lay public (competent ministries, sectoral organisations, and other interest organisations and institutions) are involved in the preparation process of the NUSSR. The Nus SR was approved by Slovak Government Resolution No 104/2020 on 5 March 2020. The Nus SR presents a cross-cutting document across all sectors of the economy and identifies all measures, including additional measures, that will lead to climate neutrality in Slovakia by 2050. This ambitious target was only formally defined at the final stage of the preparation of this strategy (after modelling of possible emission scenarios) and therefore other less ambitious emission reduction scenarios (and increasing sinks) are analysed in detail: scenario with existing WEM measures and WAM additional measures scenario. However, as the Strategy itself shows, these are unlikely to lead Slovakia without additional efforts towards climate neutrality. Possible additional measures are proposed at the end of each sectoral chapter, labelled NEUTRAL, and should be modelled for subsequent updates of the strategy.

(g) European scheme for greenhouse gas emission allowance trading (EU ETS)

The EU ETS was established by Directive 2003/87/EC and has undergone a number of revisions to strengthen implementation during its three trading periods (2005-2007, 2008-2012 and the current period 2013-2020).

The first phase (2005-2007) was a three-year pilot period of learning in practical situations to prepare for the second phase, when the EU ETS was to operate efficiently to help ensure that the EU and its Member States meet their Kyoto Protocol emission targets.

Before the start of the first phase, the Slovak Republic had to decide on the quantity of allowances it will allocate to each EU ETS operation on its territory. The allocation was made through the first National Allocation Plan drawn up and published by the Slovak Republic on 1 May 2004. The European Commission’s decision on Phase I of the National Allocation Plan of the Slovak Republic was approved on 20 October 2004.

The statistics from the first phase of the EU ETS are as follows:

- 175 installations;
- 38 installations have closed their accounts;
- the permit was revoked for 1 installation.

Table 3 Statistics from Phase I of the National Allocation Plan (tonnes)

Year	2005	2006	2007
Allocation(2004 – 2006)	30 299 021	30 357 450	30 357 404
Verified emissions	24 892 813	25 200 029	24 153 151

Source: MINISTRY OF THE ENVIRONMENT OF THE SLOVAK REPUBLIC

The second phase of the EU ETS was the five-year period 2008-2012 and corresponded to the first commitment period of the Kyoto Protocol. The European Commission’s decision on the second phase of the National Allocation Plan of the Slovak Republic was approved on 29 November 2006 and amended by the decision of 7 December 2007. The statistics from the second phase of the EU ETS are as follows:

- 193 installations;
- 30 establishments have closed their accounts;
- the permit was revoked for 1 installation.

Table 4 Statistics from Phase II of the National Allocation Plan (tonnes)

Year	2008	2009	2010	2011	2012

Allocation(2004	32 166 094	32 140 581	32 356 123	32 617 164	33 432 258
Verified	25 336 706	21 595 209	21 698 625	22 222 534	20 932 903

Source: MINISTRY OF THE ENVIRONMENT OF THE SLOVAK REPUBLIC

The third phase of the EU ETS started on 1 January 2013 and introduced a number of changes. It has brought harmonised rules for free allocation of emission allowances, introduced auctions as the main tool to meet the emission reduction target, added other sectors to the scope (i.e. civil aviation, aluminium) and set an annual emission reduction target of 1.74 %. The Slovak Republic notified the Commission on 17 August 2012 of the list of installations covered by the Directive on its territory.

Table 5 Statistics from Phase III of the National Allocation Plan

Year	**2013**	**2014**	**2015**	**2016**	**2017**
Allocation(2004 – 2006)	16 466 336	15 821 315	15 029 434	14 526 743	13 849 714
Verified emissions	21 829 374	20 918 069	21 181 280	21 264 045	22 063 225
Year	**2018**	**2019**	**2020**	**2021**	
Allocation(2004 – 2006)	13 746 320	13 414 163	13 048 220	11 597 175	
Verified emissions	22 193 396	19 903 840	18 169 997	20 898 870	

Source: The Ministry of Environment

As of January 2021, the Emissions Trading System entered its 4th phase, which will run until 31 December 2030. The emission cap shall decrease by a linear factor of 2.2 % starting in 2021. A completely new feature of the trading system is the Modernisation Fund.

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 2030 emission reduction ambition of the sectors covered by the EU ETS to 62 % compared to 2005 levels. The scope of the EU ETS includes emissions from shipping 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. Preliminary auctioning started in 2012 with an auction of 120 million EUA, of which the Slovak Republic accounted for 1.8 million EUA emission allowances. Auctions are held on the single auction platform, the European Energy Exchange (EEX), every Monday, Tuesday and Thursday (on Wednesdays separately for Poland and Friday separately for Germany). The entire auction proceeds have been the revenue of the Environment Fund of the Slovak Republic since 2015.

Table 6 Revenue of the Slovak Republic from the 2012-2021 auction

Period of time.	**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 of time.	**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: The Ministry of Environment

- MSR

The Market Stability Reserve (Market Stability Reserve) was 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 on the market. If there is a need for additional allowances, 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 the effort-sharing of Member States in reducing greenhouse gas emissions is spread over the period from 2013 to 2020 and the period 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 (ECD). 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 (ESR). The relevant legislation sets annual targets for Member States' greenhouse gas emissions, which are legally binding and cover only greenhouse gas emissions that are not part of the scope of the EU ETS, i.e. small energy and industry outside the EU ETS, transport (excluding 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 the promotion of public transport, energy performance standards for buildings, more efficient agricultural practices, the conversion of animal waste into biogas and waste management measures. The emission limit values for the Slovak Republic are + 13 % by 2020 compared to 2005 levels. Through its policies and measures, the Slovak Republic has achieved the national target set in the ECJ for 2020. The 2030 target is set at – 22.7 % under the revised ESR.

Table 7 Compliance by ECJ

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		

Table 8 Progress made towards meeting the ESD targets of the 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 = 23 137,11 GgCO 2ₑ

Road transport and heating in residential buildings are among the largest contributors of greenhouse gas emissions under the ESD sectors. Transport currently contributes 19.1 % of total greenhouse gas emissions (eq. CO_2) and its share of total emissions since 1990 has been on an increasing trend. Effective policies and measures to reduce emissions from road transport in the Slovak Republic therefore need to be continuously addressed and implemented.

Table 9 Assessment of ETS and ESD greenhouse gas emissions in 2020

Category	Unit	Total GHG emissions	ETS emissions	ESD emissions	ETS/ESD ratio in %
GHG emissions	equid. Co_2 Gg	37 002,71	18 170,00	18 887,70	49/51

Source: MŽP SR, SHMÚ

(J) Biofuel policy

The basic frameworks for the use of biofuels are Directive (EU) 2018/2001 of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (recast).

The authority responsible for implementing the Directive is the Ministry of the Economy of the Slovak Republic. The Ministry of the Environment is responsible for the fulfilment of the sustainability criteria for biofuels and bioliquids, for the calculations for determining the greenhouse gas 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 laying down 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) Hydrogen policy

In June 2021, the Slovak Government approved 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 is 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 for the successful implementation of the National Hydrogen Strategy up to 2026, which already specifically addresses issues of legislative setting, subsidising hydrogen technologies and supporting start-ups. Around EUR 60 million of funding is foreseen for the 10 actions in the Action Plan and potential sources are identified for each action.

(L) Taxation of energy products and electricity

The most important tax in relation to the generation of tax revenue is the mineral oil tax. Electricity, coal and natural gas revenues are relatively low. Slovakia generates relatively low revenue from environmental taxes and the implicit energy tax rate is low. Heating and energy use$_{in}$ industrial processes account for the largest share of total energy use and CO2 emissions in the Slovak Republic. 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. Excise duties payable on a unit basis could also be indexed in the event of inflation in order to avoid a fall in environmental tax revenue in real terms over time. It is also possible to consider closing the tax gap between petrol and diesel.

(m) National emission ceilings (NES)

The original NEC 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 reducing by more than half the number of premature deaths annually due to air pollution. This revised Directive contains national emission reduction commitments for each Member State for the period up to 2030 (with intermediate targets set for the period up to 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 plan

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 PM2.5 dust 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 for the period after 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 established in other relevant policy areas, including climate, energy, agriculture, industry and transport. It will also support the transfer of investments to clean and efficient technologies.

The low-carbon study described above analyses and describes the reference scenario as well as four possible emission reduction scenarios by 2050. In the reference scenario developed on the basis of current policies, the share of natural gas in CHP is significantly increasing, both before and after 2030. In the reference scenario, investments in electricity will concentrate on combined heat and power (CHP) and solar energy. CHP primarily uses natural gas as a fuel. This also applies to the four decarbonisation scenarios before 2030. At a later stage, however, gas is replaced by biomass, wind and solar energy. The electricity sector will be dominated by nuclear energy by 2050. Apart from the increase in biomass combustion, almost all of the proposed measures also provide synergies in terms of air quality. The concrete figures will be the result of modelling that is currently carried out in cooperation with the World Bank, including the same scenarios.

The Slovak Republic’s strategy for adapting to the adverse effects of climate change, as 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 relating, inter alia, to the maintenance of good air quality. These measures have not yet been quantified in terms of air protection.

On 3 July 2019, the Slovak Government adopted Resolution No 336/2019 on the Action Plan for the Transformation of the Coal Region of Upper Nitra.

The present document proposes a solution to the situation linked to the shortening of the general economic interest in the production of electricity in the Nováky power plant and the subsequent development of the decline in coal production in the context of the planned downsizing of mining activity and its impact on employment in the Upper Nitra region.

The purpose of the material is also to prevent the decline of the region concerned and to address its development through a conceptual approach of structural change in the functioning of the economy and related impacts, similarly to addressing and addressing the reduction of coal mining in developed countries in the context of the European Union’s policies on social cohesion, regional development and economic growth.

In the context of the transformation of the Upper Nitra region and maintaining continuity of heat supply in that region, it is appropriate to make use of the 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.

In 2018, the Slovak Government adopted the Slovak Economic Policy Strategy 2030 which defines measure ‘O 2.10 Increasing R & D expenditure so that Slovakia gradually reaches the level of the first five EU countries by 2030 in terms of R & D expenditure in GDP’.

In the past, R & D incentives have been provided to address material and energy projects – Development of a technology complex for the treatment of municipal waste for material and energy purposes and in the field of nuclear energy, namely the decommissioning of nuclear installations “Continguted Release of Materials from Nuclear Decommissioning”

The EURATOM (European Atomic Energy Community) Treaty was established in order to establish the European Atomic Energy Community, inter alia, to coordinate the research programmes of Member States in the 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.

Since its main objective is also to bring together the nuclear industry of the Member States, it falls within its competence in one of the fields covered by the Treaty (Member States, public and private bodies, undertakings and natural persons) which carry out their activities or a part thereof. The areas of special fissile materials, raw materials and ores from which these raw materials are sourced. The competences of the EURATOM Treaty are exclusively limited to the use of civil and peaceful nuclear energy.

EURATOM's specific missions include:

- R toconduct research and ensure the dissemination of technical knowledge;
- Developing and ensuring the use of uniform safety standards for the protection of workers and the population;
- Facilitating access to investment and ensuring the construction of essential facilities necessary for the development of nuclear energy in the EU;
- Oversee the regularity and uniformity of the supply of users of ores and nuclear fuels in the EU;
- Guarantee that nuclear material is not diverted to other purposes, in particular military purposes;
- The exercise of the right of ownership of specific fissile materials attributed to him;
- Contribute to the advancement of the peaceful uses of nuclear energy in cooperation with third countries and international organisations;
- Setting up joint ventures.

Euratom is a complementary research and training programme for nuclear research and training under the European Horizon Europe Framework Programme. 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 nuclear safety and radiation protection, spent fuel and radioactive waste management and decommissioning
- Maintaining and developing capacities and knowledge in the field of nuclear energy within the European Community.
- Supporting the development of fusion as potential future energy
- Supporting EU and Member State policies.

The Euratom programme is structured around two basic pillars, namely:

- Nuclear fusion (Fusion)

- Nuclear fission (Fission)

The activities and calls for projects are implemented on the basis of the Strategic Agenda 2021-2025 (with a budget of EUR 1382 billion) and the current Work Programme 2023-2025.

The Programme should also include the creation of new European Research and Innovation Partnerships

III. Key issues of cross-border relevance

The Slovak Republic is highly dependent on imports of primary energy sources. It is therefore necessary to reduce the high dependence on fossil fuel imports through systematic energy efficiency and RES measures meeting sustainability criteria. In view of Slovakia's location in Central Europe, diversification of transport routes is becoming more important.

Following gas supply problems in 2009, facilities enabling reverse gas flow from the Czech Republic and Austria were put into operation. Following the launch of the commercial operation of the gas interconnection between Poland and Slovakia in November 2022, there is interconnection at transmission system level with all neighbouring states. Electricity is strengthening interconnection with Hungary and building smart interconnection with Czechia (ACON). The Danube InGrid (Danube Intelligent Grid) project in Slovakia 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 for 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 primarily responsible for the energy sector, and the Ministry of the Environment is primarily responsible for the air protection and climate change sector.

Slovakia has a systematised mechanism for managing, planning, monitoring and evaluating energy efficiency, resulting from the requirements of European and national strategy documents and legislation. The Ministry of the Economy is the general coordinator of the energy efficiency agenda, focusing primarily on energy savings in all sectors of the national economy, and has set up an interdepartmental working group with the participation of all relevant central government bodies to this end.

The Ministry of Economy assesses the compliance of the application for a certificate for the construction of an energy installation with the Integrated National Energy and Climate Plan, which replaces the energy policy, pursuant to Section 88 of Act No 251/2012 on energy and amending certain acts, as amended. An intention may be assessed only upon submission of an application containing all the elements laid down in the Energy Act. The Ministry of Economic Affairs will assess whether the application is in line with the EP's priorities.

If the legal requirements and compliance with the above-mentioned priorities are met, the Ministry of the Economy will issue a certificate on the compliance of the investment plan with the energy policy of the Slovak Republic.

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.

In 2021, the Slovak Government Council for the European Green Deal (EGD) was created. The ESDC serves as an expert, advisory, coordination and initiative body of the Slovak Government on matters relating to the European Green Deal as a vision for achieving the Sustainable Development Goals (i.e. national priorities for the implementation of the 2030 Agenda for Sustainable Development) and the transition to a carbon-neutral economy by 2050 and the related implementation of key policies and measures aimed at achieving climate and environmental objectives.
The EWC is chaired by the Minister for the Environment; other members are the relevant ministers and representatives of state authorities and the National Council of the Slovak Republic, municipal authorities, municipalities and representatives of the Academy.

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

I. Involvement of the national parliament

The Slovak Republic's regular preliminary opinions on individual legislative proposals were sent to the Parliament after their preparation and public consultation.

II. Involving local and regional authorities

Local and regional authorities have the possibility to contribute to the development of strategic documents in accordance with the procedures set out in section 1.3.(iii).

It is customary for individual regional projects to involve regional and local authorities already in the preparatory phase. For example, the Action Plan for the Development of Upper Nitra, one of the three pilot regions of the new Platform for Coal Regions in Transition launched by the European Commission, was approved by the Slovak Government in July 2019. It was prepared by the Office of the Deputy Prime Minister of the Slovak Republic for Investment and Informatisation in cooperation with the Trenčín Self-Governing Region, the Association of Cities and Municipalities of Upper Nitra and stakeholders from the region concerned.

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

In accordance with the rules governing the preparation of material for discussion by the Government of the Slovak Republic, the preparation includes consultations with all the departments and entities concerned, as well as with the public. As part of a standardised process on the material submitted for discussion by the Government, inter-ministerial comments are made, followed by an inter-ministerial consultation procedure (MPK). The material is published in the MPK via the publicly accessible Slov-Lex web portal, which is operated by the Ministry of Justice of the Slovak Republic. It is possible to consult the proposed documents on the portal and, via the electronic form, are entitled to comment on the material submitted not only by representatives of the State and public authorities, but also by natural or legal persons from the public. After a specified period of publication (minimum 15 days, non-legislative material may be reduced to 5 days), the submitter of the material must evaluate the comments made and, if necessary, incorporate them. If the submission relates to an activity for which a government advisory body has been set up, it must be considered in that advisory body before being submitted for discussion by the government. Accepted comments from the Government's advisory body shall be incorporated by the submitter in the material; any non-acceptance of comments must be justified.

Under the legislation in force, the approval of strategic materials is also subject to the assessment process pursuant to Act No 24/2006 on environmental impact assessment and amending certain acts. Where a strategic environmental assessment is needed, the material shall only be submitted for discussion by the government after the strategy paper and the report on the evaluation of the strategy document have been publicly discussed and the final opinion on the assessment of the strategy document has been drawn up. The documents referred to in Chapter 1.2.ii have been discussed by the Government of the Slovak Republic.

As part of the process of assessing the proposal for a Regulation on the Governance of the Energy Union, other departments were also consulted on the content and preparation of the NECPs and an interdepartmental working group was set up which, in addition to considering the draft Regulation, mapped the data sources needed to prepare the NECPs within the different departments.

The Ministry of the Economy has already cooperated with key undertakings and professional associations in the energy sector when negotiating the content of the Regulation on the Governance of the Energy Union. Input from experts from these firms and associations has also been used in the negotiations on the final form of the regulation and thus on the content of the integrated national energy and climate plan. Organisations involved in the production, transmission and supply of electricity, petroleum products, distribution companies, heating companies and employers' associations were contacted.

IV. Consultation of other Member States

The assessment process pursuant to Act No 24/2006 (the Environmental Impact Assessment Act and amending certain acts) also includes the assessment of transboundary impacts. All cross-border links shall be implemented in accordance with the conventions with the relevant neighbouring Member States.

v. Iterative process with the Commission

To be completed after the iterative process with the EC.

1.4. Regional cooperation in preparing the plan

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

In April 2023, a joint meeting of experts from V4 countries (Czechia, Hungary, Poland and Slovakia) took place in Bratislava to discuss 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, internal market and security of supply.

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 process of their preparation, it reflects the requests and views of the countries concerned.

2. NATIONAL OBJECTIVES AND TARGETS

2.1. Dimension: decarbonisation

2.1.1. GHG emissions and removals

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

Binding targets for greenhouse gas emissions at EU level

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

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

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

GHG emissions from non-EU ETS sectors are covered by the Effort Sharing Regulation (ESR). The ESR covers emissions from all sectors outside the EU ETS, excluding emissions from international maritime transport, domestic and international aviation (which was 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 in connection with heating), services, small industrial installations, fugitive emissions from the energy sector, emissions of fluorinated gases from installations and other sources, agriculture and waste. These sources account for around 55 % of the EU's total greenhouse gas emissions.4

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

The Ministry of the Environment preliminarily proposes to achieve the 22.7 % target by setting sectoral targets falling under the ESR as follows:

- The road transport sector has the objective of no more than a 29 % increase in emissions by 2030 compared to the reference year 2005;
- The buildings sector, excluding emissions covered by the EU ETS, aims to reduce carbon dioxide emissions by 12 % by 2030;
- The agricultural sector aims to reduce emissions by 10 % by 2030 compared to the reference year 2005;
- The waste sector aims to reduce emissions by 24 % by 2030 compared to with reference year 2005;

[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

- The industrial processes and solvent use sector, including fluorinated greenhouse gases, excluding emissions covered by the emissions trading system, has the objective not to exceed an emissions increase of 40 % by 2030 compared to the reference year 2005.

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 Regulations (EU) 2018/841 as regards the scope, simplifying the reporting and compliance rules and setting the targets of the Member States for 2030 and (EU) 2018/1999 as regards improving monitoring, reporting, tracking of progress and review sets for the Slovak Republic the amount of net removals in the land use, land use change and forestry sector higher by 504000 tonnes of CO2 equivalent in 2030 compared to the average of the 2016-2018 net removals in that inventory.

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

Tackling climate change as a global but also national challenge requires the implementation of mitigation and adaptation measures. Avoiding or at least minimising the risks and negative impacts of climate change can be achieved by combining measures aimed at reducing greenhouse gas emissions with measures that reduce vulnerability and increase the adaptive capacity of natural and man-made systems to current or expected negative impacts of climate change.

The first more comprehensive document providing basic strategic guidance on 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 Climate Change Adaptation Strategy of the Slovak Republic was approved on 17 October 2018 by Slovak Government Resolution No 478/2018. The strategy assesses the state of play of adaptation and planned activities in critical areas and sectors, defines a broad vision for the 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 the issue.

The achievement of the adaptation headline target should contribute to the achievement of the sub-objectives of: ensuring active national adaptation policy development, implementing adaptation measures and monitoring their effectiveness, strengthening the translation of adaptation strategy objectives and recommendations within multi-level governance and business promotion, raising public awareness of climate change issues, promoting synergies between adaptation and mitigation actions and using the ecosystem-based approach in the implementation of adaptation actions, and supporting the translation of the 2030 Agenda for Sustainable Development, the UN Framework Convention on Climate Change and the Paris Agreement objectives and recommendations.

Based on the latest scientific knowledge, the national adaptation strategy shall link scenarios and potential impacts of climate change with proposals for appropriate adaptation measures in the broadest possible range of areas and sectors. Effective implementation and monitoring of adaptation measures, fostering synergies between adaptation and mitigation actions, as well as raising public awareness and building the knowledge base are necessary to ensure the achievement of these objectives. The updated ISA applies a proactive adaptation principle and seeks to link scenarios and potential impacts of climate change with proposals for appropriate adaptation measures to the widest possible range of areas and sectors, aims at assessing the current state of adaptation and planned activities in critical areas and sectors, defining a broad vision for adaptation in selected areas and updating the set of adaptation measures and the framework for their implementation. In implementing adaptation measures, the ISA supports the use of the ecosystem approach and proposes a set of adaptation measures in the following areas: rock and geology, soil environment, natural environment and biodiversity, landscape and water management, settlement environment, population health, agriculture, forestry, transport, energy, industry and some other business areas, recreation and tourism.

Adaptation actions will be further assessed and prioritised in the National Adaptation Action Plan. The "Action Plan for the implementation of the Slovak Climate Change Adaptation Strategy" (hereinafter "NAPs" or "Action Plan") aims to increase Slovakia's preparedness for the adverse effects of climate change through the implementation of cross-cutting and specific adaptation measures and tasks. At the same time, an 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 the main objective, which is based on the implementation of the strategic priorities. 5 cross-cutting actions are identified to meet the objective and aim to improve the implementation framework, support science and research on adaptation to climate change, develop an efficient crisis management system and address extreme events such as floods and fires, promote green infrastructure, as well as support education and awareness. These actions are followed up by 18 tasks. 7 specific areas are at the core of the NAPs: water protection, management and use, sustainable agriculture, adapted forestry, natural environment and biodiversity, health and healthy population, settlement environment and technical, economic and social measures. Each of these 7 areas has its specific objective, each of which has its basic principles and specific measures defining tasks in that segment. In total, 45 specific actions have been identified and 169 assignments have been identified for the period of validity of the NAPs until 2027. These measures and their follow-up tasks are based on the Slovak Climate Change Adaptation Strategy – update.

The action plan was approved by Slovak Government Resolution No 476 of 31 August 2021.

Circulareconomy

The linear economy model generates a large amount of greenhouse gas emissions, mainly due to energy-intensive production processes but also at the end of the life cycle of products. The circular economy (circular economy) seeks to minimise and optimise energy materials and flows. The following sectors have the greatest GHG 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 (material replacement, modular design, smart shredders, space sharing, improved lifetime)
- Waste management sector
- Automotive industry (sharing vehicles, durability, improved durability)

Around 80 % of Europe's greenhouse gas emissions come from energy production and use, climate change mitigation efforts mostly focus on increasing energy efficiency and shifting to low-carbon energy sources. Circular economy measures such as optimising resource use, optimising the use of products 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. Too often, OH is understood as improving waste management and increasing recycling rates, but the concept of circular economy goes far beyond this.

The circular economy affects not only the use of material resources but also the use of energy resources. Our economy is highly dependent on the energy system, as it consumes electricity and fuels during the production and use of materials and products. The transition to a regenerative economy therefore includes a transition to an energy system based on renewable energy sources (RES).

Climate change mitigation and circular economy measures overlap. However, circular economy measures can reduce greenhouse gas emissions other than through energy efficiency and renewable energy measures. For example, reducing the amount of raw materials needed to produce a product indirectly reduces emissions from production by reducing the demand for raw materials.

Our growing welfare has led to a continued increase in consumption, resulting in increased pressure on the environment. This is reflected in air, water and soil pollution, increased greenhouse gas emissions and the degradation of natural capital and biodiversity. Much of the potential of the circular economy lies in the consumption phase. There is considerable potential for changing consumer behaviour and the way products are used.

It is important to note that the production of materials and products is responsible for a significant part of our total energy consumption. Therefore, measures aimed at optimising these production processes in order to minimise the demand for energy and materials can also have a major impact on greenhouse gas emissions.

Action 3.1. The 2030 Economic Policy Strategy requires 'Adopting a document for the implementation of the circular economy, followed by its implementation, with the aim of 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 energies

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 shall be at least **32 % in 2030.** In order to reach this binding target, Member States’ contributions for 2030 to this target from 2021 onwards shall be in line with the indicative trajectory for that contribution. The indicative trajectory shall reach a reference point of at least

(a) 18 % by 2022;

(b) 43 % by 2025;

(C) 65 % by 2027

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

The Slovak Republic proposes a target of 23 % for 2030. This represents an increase of 3.8 percentage points compared to the target set in the applicable plan of 19.2 %. The binding target for 2020 was 14 %. The indicative trajectory for Slovakia starts at 17.4 % and is growing, thus fulfilling the baseline requirement.

For the 23 % target, as required by Article 4(2) of the Regulation, the reference points in the indicative trajectory for 2022, 2025 and 2027 are set at 15.62 %, 17.87 % and 19.85 %.

The total investment costs for reaching the RES targets are estimated at EUR 5.3 billion for 2023-2030. These investment costs include the electricity and heating sector. They are based on the estimated increase in installed capacity for electricity/heat from RES and the investment intensity per unit of power.

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

Table 10 Estimated RES trajectories

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
RES – Heat and cold production in (%)	19,5	20,4	20,9	21,7	22,8	23,8	24,8	25,7	27,0	28,3

RES – electricity generation (%)	22,4	24,3	24,3	25,2	25,4	26,3	26,9	27,3	28,0	29,5
RES – Transport including multiplication (%)	8,9	9,2	9,5	9,6	10,2	10,7	11,4	12,1	13,2	14,7
Total RES (%)	**17,4**	**18,2**	**18,3**	**18,9**	**19,5**	**20,2**	**20,9**	**21,5**	**22,1**	**23,0**

Source of the Ministry of Economic Affairs of the Slovak Republic

III. *Estimated trajectories per renewable energy technology that the Member State plans to use to achieve the overall renewable energy trajectory and sector-specific trajectories from 2021 to 2030, including expected total gross final energy consumption per technology and sector in Mtoe and total planned installed capacity divided by new capacity and repowering)] per technology and sector in MW*

Table 11 Sectorial contribution of renewable energy to final energy consumption (ktoe)

	2023	2024	2025	2026	2027	2028	2029	2030
(A) Expected gross final consumption of RES for heating and cooling	1188	1211	1246	1271	1302	1323	1345	1368
(B) Expected gross final consumption of electricity from RES	607	642	663	705	739	769	808	873
(C) Expected final consumption of energy from RES in transport	175	195	200	210	218	237	250	278
(D) Expected total renewable energy consumption	**1 969**	**2 048**	**2 109**	**2 186**	**2 259**	**2 329**	**2 403**	**2 519**

Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

Table 12 Estimation of the total expected contribution (installed capacity, gross amount of electricity produced) of individual renewable energy technologies in Slovakia for electricity generation in the period 2023-2030

	2023		2024		2025	
	MW	GWh	MW	GWh	MW	GWh
Pumped Hydroelectric Power Plants (PVE)	*916*	*420*	*916*	*450*	*916*	*450*
Hydroelectric plants	1 629	4 473	1 630	4 476	1 641	4 507
&1 MW	38	110	39	113	40	116
1 MW – 10 MW	60	168	60	168	70	196

> 10 MW	1 531	4 195	1 531	4 195	1 531	4 195
Geothermal energy	0	0	4	28	4	28
Solar – *Photovoltaics*	850	893	930	977	1 000	1 050
Wind – Onshore	3	6	100	200	150	300
Biomass:*solid*	200	1 100	200	1 100	200	1 100
biogas/Biomethane	95	684	110	792	120	864
TOGETHER, (excluding HP)	**2 777**	**7 156**	**2 974**	**7 573**	**3 115**	**7 849**

	2026		2027		2028		2029		2030	
	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh
Pumped Hydroelectric Power Plants (PVE)	*916*	*450*	*916*	*450*	*916*	*450*	*916*	*500*	*916*	*500*
Hydro:	1 731	4 754	1 742	4 785	1 753	4 816	1 754	4 819	1 755	4 822
&1 MW	41	119	42	122	43	125	44	128	45	131
1 MW – 10 MW	80	224	90	252	100	280	100	280	100	280
> 10 MW	1 610	4 411	1 610	4 411	1 610	4 411	1 610	4 411	1 610	4 411
Geothermal	4	28	4	28	4	28	4	29	4	30
Solar – *PV*	1 080	1 134	1 160	1 218	1 240	1 302	1 320	1 386	1 400	1 470
Wind (onshore)	200	400	300	600	400	800	500	1 000	750	1 500
Biomass:*solid*	200	1 100	200	1 100	200	1 100	200	1 100	200	1 100
biogas/Biomethane	135	972	150	1 080	160	1 152	180	1 296	200	1 440
TOGETHER, (excluding HP)	**3 350**	**8 388**	**3 556**	**8 811**	**3 757**	**9 198**	**3 958**	**9 630**	**4 309**	**10362**

Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

Table 13 Estimation of the total expected contribution (final energy consumption) of individual renewable technologies in Slovakia for heating and cooling production in the period 2023-2030 (ktoe)

	2023	2024	2025	2026	2027	2028	2029	2030
Geothermal energy excluding use in heat pumps	12	15	30	35	46	47	48	50
Solar energy	20	23	26	29	32	35	39	43
Biomass:								

fixed	1000	1000	1000	1000	1000	1000	1000	1000
biogas/Biomethane	65	70	75	80	85	90	95	100
Renewable energy from heat pumps of which								
aerothermal	82	91	100	109	118	127	136	145
geothermal	4	5	6	7	8	9	10	11
hydrothermal	5	7	9	11	13	15	17	19
TOGETHER,	**1188**	**1211**	**1246**	**1271**	**1302**	**1323**	**1345**	**1368**

Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

Table 14 Estimation of the total expected contribution of individual renewable technologies in Slovakia in the transport sector (ktoe)

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Bioethanol/bio-ETBE	50,0	50,0	50,0	60,0	62,0	64,0	67,0	70,0	74,0	80,0
of which advanced biofuels according to Annex IX.A	3,0	6,0	10,0	4,5	8,0	8,0	8,0	8,0	9,5	10,0
Biodiesel	125,0	125,0	125,0	135,4	137,3	144,8	149,0	161,7	161,5	170,0
of which advanced biofuels according to Annex IX.A	0,0	0,0	0,0	16,0	25,5	26,0	37,0	37,0	47,5	60,0
of which biofuels listed in Annex IX.B	35,0	35,0	35,0	53,0	53,8	53,8	54,0	54,0	55,0	55,0
Hydrogen from renewables	0,0	0,0	0,0	0	0	0	0,1	0,5	4,0	10,0
Electricity from renewable sources	12,3	13,2	13,8	14,6	15,4	16,8	17,9	19,2	20,2	22,0
of which road transport	0,7	0,8	1,0	1,2	1,5	1,8	2,4	2,9	3,8	5,0
of which rail transport	10,3	11,0	11,4	12,0	12,4	13,2	13,7	14,1	14,6	15,0
Biomethane/RCF *	0,0	0,0	0,0	0,0	0,5	1,0	2,0	5,0	10,0	18,0
Together,	**187,3**	**188,2**	**188,8**	**210,0**	**215,2**	**226,6**	**236,0**	**256,4**	**269,7**	**300,0**

Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

*RCF (recycled carbon fuels) – Recycled carbon fuels

The RES Directive also sets an indicative target of 1.3 percentage points as an annual average over the period from 2021 to 2025 and 2026 to 2030. That indicative value shall be reduced to 1.1 percentage points if waste heat and cold is not used. The following table shows the fulfilment of the indicative target for heating and cooling, using heat from RES in the numerator and an estimate of the heat demand for heating and cooling in the denominator. The indicative values amount to an annual average of 1.3 % and 1.4 %. We consider achieving higher growth or calculating total heat consumption in industrial processes to be very problematic for the annual installation and replacement of RES equipment.

Table 15 Estimation of the total expected contribution of individual renewable technologies in Slovakia in the heating and cooling sector

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
RES for heat generation (ktoe)	685	721	768	788	810	844	868	898	913	924	936
Estimate of heat needs for heating and cooling (ktoe)	3 344	3 284	3 224	3 164	3 104	3 044	2 984	2 924	2 864	2 804	2 744
Share of RES in heating	20.5 %	22.0 %	23.8 %	24.9 %	26.1 %	27.7 %	29.1 %	30.7 %	31.9 %	33.0 %	34.1 %
Annual increase		1.5 %	1.9 %	1.1 %	1.2 %	1.6 %	1.4 %	1.6 %	1.2 %	1.1 %	1.2 %
Average 5 years				**1.4 %**					**1.3 %**		

Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

IV. ***Estimated*** *trajectories on bioenergy demand, disaggregated between heat, electricity and transport, and on biomass supply by feedstocks and origin (distinguishing between domestic production and imports). For forest biomass, an assessment of its source and impact on the LULUCF sink*

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

Forest plots increased from 2.006 to 2.019 million ha between 2000 and 2017.5 Over this period, the stock of wood with a thickness of over 7 cm without bark increased from 40,0 to 480.3 million m^3, with the annual increment of that dimension increasing from 11.2 to 12.0 million m^3. The actual annual logging ranged from 6.2 to 9.8 million m^3 m. The share of salvage mining in total mining was 35 to 65 %.
The carbon stock of live above-ground tree biomass increased from 166.3 to 187.3 million t and live underground biomass from 36.1 to 40.5 million t. Carbon stocks in dead biomass increased from 35.7 to 39.4 million t.

Due to the effects of climate change and the subsequent growth of salvage logging, the share of conifers in the total recorded timber stock decreased from 41.0 % to 37.2 % between 2000 and 2017, while the proportion of leaf leaves rose from 59.0 to 62.8 %. Changes in the species composition of forests result in a deterioration of the quality structure of the stock. The proportion of round ranges in the total production of conifers is 54 % on average and 37 % for foliars. The above changes in wood quality structure and stock developments affect the possibilities of producing forest fuel biomass. Between 2020 and 2030, the planned annual logging will be between 8.9 and 9.0 m^3 thick wood than 7 cm, representing 11.2 to 11.4 million t of 6 above ground tree biomass (including bark and wood of less than 7 cm thickness). A forecast of the evolution of the usable potential of wood-based fuel

[5] 2018 Green Report, Report on Forestry in the Slovak Republic 2017.
http://www.mpsr.sk/index.php?nav/D=123
[6] Draft criteria for sustainable use of biomass in Slovakia's regions for 2014-2020 programmes co-financed by ESIF, NLC Zvolen, 2017.

biomass on forest land, taking into account biological constraints and current legislation by 2030, is provided in Table 16.

Table 16 Projection of the evolution of the annual usable potential of wood-based fuel biomass on forest land by 2030 (000 t)

Year	2020	2025	2030
Conifers fuel biomass	754	718	693
Fuel biomass of leafers	2 020	2 108	2 182
Together,	2 774	2 826	2 875

Source: NLC Zvolen

The evolution of the supply of forest woody biomass between 2009 and 2018 is shown in Table 17.

Table 17 Annual supply of forest fuel woody biomass from 2009 to 2018 (000 t)

Year	Forest chips	Fuel wood and other	Together,
2009	220	695	915
2010	250	695	945
2011	270	700	970
2012	530	750	1 280
2013	620	820	1 440
2014	620	830	1 450
2015	615	835	1 450
2016	610	830	1 440
2017	580	845	1 425
2018	560	850	1 410

Source: NLC Zvolen

In 2017, of the total recorded logging, 9,36 million m^3 supplies of woody fuel biomass amounted to 0.66 million m^3, i.e. 7 % of total logging, the rest of the supplies were thing of wood, logging residues and bark. The current utilisation rate of available forest fuel biomass resources amounts to 51 % of the usable potential *(by comparing the supply in Table 16 and the forecast in the table. 17).*

The balances of annual greenhouse gas emissions and removals on forest land between 2010 and 2017 by LULUCF categories are presented in Table 18.

Table 18 Emissions of annual emissions and removals of greenhouse gases from 2010 to 2017 on forest land (Gg)

Year	2010	2011	2012	2013	2014	2015	2016	2017
Balances of emissions	— 3756,0	— 4255,9	— 5842,9	— 6686,9	— 4466,3	— 4786,7	— 4573,2	— 4448,8

and removals								

Source: NLC Zvolen

Even a possible increase in the supply of forest fuel biomass should not have a significant negative impact on emission balances and removals by 2030. The forecast of the evolution of the usable supply potential up to 2030 assumes a substantial increase in the share of leafwood harvesting, which accounts for a larger proportion of lower quality wood, tree finish and harvest residues. The large scale of calamities affecting, in particular, coniferous stands has the effect of postponing the harvesting of broadleaved trees for a later period and thus of deterioration in the quality of the wood. However, the total annual volume of planned mining is not expected to increase.

Forest tree stands on long-term non-managed forest plots increased from 273 to 288 ha between 2006 and 2016 and from 38 to 46 million m^3 thick wood with a thickness of over 7 cm excluding bark. The average annual wood increment of that dimension was 2.07 million m^3 and annual harvesting 0.5 million m^3. The supply of above-ground tree biomass amounted to 61.5 million m^3 m in 2016.

The evolution of the exploitable potential, taking into account biological constraints and current legislation with a 2030 perspective, is presented in Table 19.

Table 19 Estimated evolution of the annual usable potential of wood-based fuel biomass on non-forest land by 2030 (000 t)

Year	2006	2020	2025	2030
Fuel biomass	704	852	942	1 031

Source: NLC Zvolen

The size of the annual supply of woody fuel biomass, mainly in the form of chips, currently stands at around 0.45-0.5 million t.

The carbon stock in live above-ground tree biomass was assessed in 2016 to 15.1 million t and live underground biomass to 4.4 million t. The supply of dead wood was 1.2 million t. The annual production of solid wood residues in the wood processing industries used for energy purposes is 1.694 million t. The producers' own energy consumption was 669 thousand t and supply to the market of 1025 thousand t. The pulp and paper industry companies produce approximately 520 thousand t annually of the so-called black liquors used for their own energy use. The production of wood residues used for energy purposes by 2030 will be influenced by:

- development of domestic processing capacities;
- cascading rate of wood;
- the competitiveness of wood vis-à-vis other raw materials;
- fuel and energy market developments.

For the period 2020-2030, the annual production of solid residues from wood treatment is assumed to be 1,6-1.7 mM. For the determination of the trajectories for the supply of wood fuel biomass, estimates of the contribution trajectories for electricity generation (Table 9), heating and cooling (Table 10) part of solid biomass are based on estimates of the contribution trajectories for electricity generation (Table 9), heating and cooling (Table 10) part of solid biomass. The trajectory for supply needs for woody biomass in 2020-2030 is valid provided that all solid biomass consumption is covered by woody biomass (Table 20).

Table 20 Fuel wood biomass supply trajectories 2020-2030 broken down into cogeneration and heating and cooling (000 t)

Year	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Production of electricity and heat in cogeneration	1630	1630	1800	1800	1800	1800	1800	1800	1800	1800	1800
Heat and cold generation	1530	1630	1660	1600	1650	1700	1740	1740	1740	1740	1740
Together,	3160	3260	3400	3400	3450	3500	3540	3540	3540	3540	3540

Source: NLC Zvolen

Note: Electricity generation on the condensing principle is not foreseen.

The annual usable potential of wood-based fuel biomass on forest and non-forest land and solid residues after wood treatment will be between 5.1 and 5.5 million t by 2030.

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 who are also consumers, energy recovered from sludge obtained from waste water treatment)

The national trajectories and intentions for this point are not yet approved.

2.2. Dimension: energy efficiency

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

The indicative national energy efficiency contribution to the achievement of 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 primary or final energy consumption, primary or final energy savings, or energy intensity.

In relation to the indicative national contribution on energy efficiency to the achievement of the Union's energy efficiency targets, the Slovak Republic has developed two scenarios – realistic and ambitious. In developing these scenarios, the starting point was the Low Carbon Growth Study for Slovakia: Implementation of the EU 2030 Climate and Energy Policy Framework. The main characteristics of the scenarios are:

- In the context of slowing growth, some sectors and sub-sectors will expand, while others will shrink. Export-oriented sectors in manufacturing, such as the motor vehicle sub-sector, are undergoing a sustained expansion driven by external demand. Other sectors are slowing down.
- Continuous improvement in energy efficiency is taken into account.
- The ETS will remain the main impact on the choice of energy by 2050. In the reference scenario, the carbon price pushes the energy consumption of industry with lower carbon content. The ETS also delivers energy savings that should be accounted for.
- Industry's energy needs are projected to decrease in parallel with the use of new efficient technologies in manufacturing investments in industry
- Over the outlook period, electricity needs are rising.
- Nuclear energy plays a key role in the electricity generation mix of the Slovak Republic.
- In the reference scenario, CCG cycles replace coal-fired power plants in order to fulfil an important role in ensuring flexibility and safety.
- This includes the construction of new nuclear energy generation capacity in Slovakia, maintaining the importance of nuclear energy in the energy mix.
- Energy consumption for the production of heat and steam is decreasing thanks to the ever-increasing energy efficiency.

Table 21 National indicative energy efficiency targets for 2020 and national indicative contributions to the EU energy efficiency target in 2030

National indicative energy efficiency targets and contributions to the European energy efficiency target	[ktoe]	[%]
Realistic PES scenario in 2030	16 153	28.36 %
A realistic KES scenario in 2030; F_CE	10 443	
An ambitious PES scenario in 2030	15 703	30.32 %
An ambitious KES scenario in 2030; F_CE	10 271	

Source of the Ministry of Economic Affairs of the Slovak Republic

Based on Article 4 of the proposal for a new Energy Efficiency Directive issued as part of the Fit for 55 package, Member States collectively ensure a reduction in energy consumption of at least 11.7 % in

2030 compared to the projections of the reference scenario for 2020[7]. Based on the algorithm for calculating the 2030 KEC target set out in Annex I of the proposal for a new Energy Efficiency Directive, **the Slovak contribution is 8463 ktoe (-12 %). Accounting for the deviation of ± 2.50 %, the contribution is in the range of 8252-8675 ktoe, representing a reduction of 9.8 to 14.2 % of final energy consumption in 2030 compared to the 2020 reference scenario for Slovakia.**

A 12 % reduction in final energy consumption in 2030 compared to the 2020 Reference Scenario means that the State should take such measures to ensure a 22 % decrease in final energy consumption by 2030 compared to 2021 consumption.

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

The cumulative amount of end-use energy savings from 2021 to 2030 is 49535 **GWh according to the FC_E**methodology**.** On an annual basis, the value of the contribution **is 900.6 GWh**. According to the FEC2020-2030 methodology, the target for the cumulative amount of end-use energy savings is **55 680.3 GWh,** which amounts to 1012.37 **GWh** on an annual basis. This target is calculated in accordance with Article 7(1)(b) EED, which states that Member States shall achieve cumulative end-use energy savings that correspond at least to new savings each year from 1 January 2021 to 31 December 2030 of 0.8 % of annual final energy consumption, averaged over the three most recent years prior to 1 January 2019. Eurostat data from 'Energy balance sheets 2022 DATA' were used for the calculation of the target value:

Table 22 Energy balance sheets 2021 DATA

Eurostat methodology	KES 2016 (GWh)	KES 2017 (GWh)	KES 2018 (GWh)	Diameter (GWh)	0.8 % of average (GWh)
FC_E	107 295,34	115 172,2	115 270,92	112 579,49	**900,636**
FEC2020-2030	120 987,78	129 406,78	129 244,49	126 546,35	**1012,37**

Source: EUROSTAT

Table 23 Accumulation of energy savings in 2021-2030 (ktoe); current version of Directive 2012/27/EU on energy efficiency

Methodology	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	TOGETHER,
FC_E	774	697	620	542	465	387	310	232	155	77	**4 259**
FEC2020-2030	870	783	696	609	522	435	348	261	174	87	**4 788**

Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

Under the current proposal for an amendment to the Energy Efficiency Directive 'Fit for 55' package, targets for the cumulative amount of end-use energy savings are set in accordance with Article 8 (formerly Article 7). The target values are as follows: The cumulative target for 2021-2030 is 6 899 ktoe

[7] 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

according to the **Eurostat methodology FC_E 6137 ktoe and** according to FEC2020-2030 methodology 6 899 ktoe.

Table 24 Accumulation of energy savings in 2021-2030 (ktoe); proposal for a Directive 2012/27/EU on energy efficiency

Methodology	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	TOGETHER,
	0.8 %	0.8 %	0.8 %	1.3 %	1.3 %	1.5 %	1.5 %	1.9 %	1.9 %	1.9 %	
FC_E	774	697	620	881	755	726	581	552	368	184	**6 137**
FEC2020-2030	870	783	696	990	849	816	653	620	413	207	**6 899**

Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

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

The text to the chapter is part of the Long-term strategy for the renovation of the stock of residential and non-residential buildings in the Slovak Republic.

The total floor area to be renovated or the corresponding annual energy savings to be achieved between 2021 and 2030 pursuant to Article 5 of Directive 2012/27/EU on the exemplary role of public bodies' buildings;

When calculating the target, the Slovak Republic applied the so-called alternative approach within the meaning of Article 5(6) of the Energy Efficiency Directive. The calculated target is **52.17 GWh/year**. This energy saving is equivalent to the 3 % renovation rate under Article 5(1) of the EED.

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

The text to the chapter is part of the Long-term strategy for the renovation of the stock of residential and non-residential buildings in the Slovak Republic.

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

Table 25 Other national objectives

Other national objectives	Key Objectives/Measures
National traffic information system	Use of a single system environment for the collection, processing, sharing, distribution and use of traffic information in specific information, management and telematic applications to create the conditions for reducing negative environmental impacts and reducing energy difficulty of transport

Transgeer Project	Planning large-scale infrastructure projects as well as nature protection. An integrated approach to developing a safe and environmentally friendly transport system in the Carpathians region
Methodological Guide to the Assessment of the Impacts of Climate Change on Large Projects in the Transport Sector	Analysis of climate change scenarios, possible impacts on the different areas covered presented in the present strategy
Working Group on Low-Carbon Development Strategy of the Slovak Republic	Emissions Design (ENVISAGE, CGE, TREMOVE and COPERT model)
Climate Change Adaptation Strategy of the Slovak Republic – Update	General adaptation guidance and examples of specific adaptation measures in the construction, transport, energy, industry and some other business areas, increasing the resilience of these sectors
Interdepartmental Commission for the Implementation of the Framework Convention on the Protection and Sustainable Development of the Carpathians (Carpathian Convention)	Implementation of the Carpathian Convention in Slovakia, implementation of the Protocol on the conservation and sustainable use of biological and landscape diversity
Working Group on Low Emission Zones	Preparation of legislation for the delimitation of Low-Emission Zones in cities
Informal interdepartmental working group on circular economy	Creating the conditions for the functioning of the circular economy, addressing cross-cutting issues in the preparation of Slovakia's strategic documents and opinions for EU negotiations
Membership – EIONET (European Environment Information and Observation Network)	Providing input for the preparation of European environmental reports, updating information and commenting on material
Membership – IPBES (Inter-Governmental Science and Policy Platform on Biodiversity and Ecosystem Services)	Comment on regional assessments of biodiversity and ecosystem services
Material provider of scientific – research tasks	Processing environmental monitoring and analysis in transport; the transition from the Kyoto Protocol to the Paris Agreement and its specificities for the transport sector in the Slovak Republic

Source of the Ministry of the Slovak Republic

2.3. Dimension: energy security

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 handling of electricity or gas emergency situations, are laid down in Act No 251/2012 (the Energy Act and amending certain acts).

Electricity

The main state authority for the security of electricity supply policy for preventing and dealing with electricity emergencies is the Slovak Ministry of the Economy. In accordance with Section 88 of the Energy Act, the Ministry of Economy shall monitor compliance with the security of electricity supply, determine the application of measures to ensure security of electricity supply if the security and reliability of the electricity system is compromised. The elements within the meaning of Article 4(c) relating to ensuring a basic level of security of electricity supply are necessary to ensure a sufficient number of sources of electricity generation (resource adequacy, see Chapter. 2.4.iv National objectives for ensuring the adequacy of the electricity system as well as the flexibility of the energy system). Elements within the meaning of Article 4(c) concerning system flexibility by ensuring the sufficiency of ancillary services (see Chapter National objectives with regard to increasing the flexibility of the national energy system).

The current legislation on security of electricity supply builds on the 'Clean Energy for All Europeans' package, in particular 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 on security of electricity supply and ensuring uninterrupted electricity supply to end-users, which is consulted with stakeholders to ensure a common approach to crisis prevention and management and regularly updated.

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

Annex 5, Policy on Emergency and Restoration of the SAFA (Synchronous Area Framework Agreement for Regional Group Continental Europe) lays down the reference rules for system operation by the national transmission system operator SEPS in emergency situations and recovery processes following large-scale system failures or 'black-out' failures.

Gas

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

Several possibilities to import pipeline gas are available, but LNG supply is also becoming important in the context of the significant development of the necessary regasification infrastructure in coastal states.

Another factor for significant diversification is the fact that the transit treaty between Ukraine and Russia is valid only until the end of 2024 and it cannot be expected that it will be renewed or prolonged.

Technically, Slovakia is ready to supply gas from other producers thanks to the projects carried out which have connected 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 dependencies, especially in the area of natural gas imports. Slovak suppliers succeeded in replacing a significant amount of Russian natural gas. However, further steps need to be taken.

While Russian natural gas imports continue, nominations are decreasing and flows are unpredictable. Ensuring the supply of natural gas for the future winter and beyond is therefore a challenge for the EU as a whole.

The Slovak gas industry, a.s. (hereafter CAP), with a market share of around 60 %, is actively discussing other possible sources of supply and is involved in the aggregation of demand in the EU under the relevant European legislation. Various forms of possible participation in different LNG projects (FSRUs) in the EU are currently being considered as an additional contribution to security of supply.

The CAP has signed Memoranda of Understanding with a number of companies from Italy, Poland and Germany, which could provide access to regaining capacity at LNG terminals and possible gas supplies to Slovakia. The above steps were taken to ensure the strengthening of Slovakia's energy independence. In parallel, negotiations are also taking place with LNG producers from the USA, Qatar, Asia and Africa.

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

Reducing dependence on imports can also be achieved through the use of biomethane, the potential of which is estimated at around 8 % of the current consumption of the natural body. At the same time, gas companies are carrying out projects that explore technical possibilities for the use of hydrogen blending into natural gas.

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

Oil

Oil deliveries to and transit through Slovakia are relatively reliable and relatively smooth 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 by the European Parliament and the Council. The supply of crude oil is so far ensured 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 crude 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 relatively large transport capacity on the Druzhba pipeline to meet the needs of Slovakia, the Czech Republic and part 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 is not favourable in terms of access to such pipelines with sufficient capacity.

In Šahy, the Druzhba oil pipeline connects the Adria pipeline, which begins at the Croatian port of Omišalj and ends in Slovakia at a pumping station at Tupá. Part of the Adria pipeline – the interconnection between Slovakia and Hungary – was put into operation in 2015 after refurbishment. The Adria pipeline is bidirectional in this section. However, in the near future, it is foreseen 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. This depends on the oil blend being transported and whether it is a continuous transport of crude oil as supplied from the Russian Federation. In Hungary, the Croatian border-Száhalombatta route currently has a transport capacity of approximately 11.0 million tonnes per year, while the capacity of 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 above mentioned available transport capacity of the Adria pipeline is sufficient to fully supply the refinery in Hungary and to cover Slovakia's domestic consumption.

For the above reasons (diversification, affordable oil, capacity utilisation of the refinery in Slovakia) and also in view of the existing robust infrastructure of the Druzhba pipeline in the territory of Slovakia, negotiations are ongoing with the Ukrainian side to ensure that the Druzhba pipeline is further used to transport oil other than oil supplied from the Russian Federation.

Due to the need to meet the logistical, technological needs of the oil transporter in Slovakia and possible changes in the storage of emergency oil stocks, including their replacement, Transpetrol, a.s. is preparing the construction of new large-scale oil storage facilities at the Tupá and Bučany storage stations. These storage facilities 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 Russian export blends. For this project, TRANSPETROL, a.s. will look for different ways of co-financing through different funds (e.g. EU funds).

In the past, consideration has been given to an international project to ensure the connection of the Druzhba pipeline to the Schwechat refinery so that oil can be supplied bidirectionally, i.e. both to the Austrian refinery via the Druzhba pipeline and to the refinery in Slovakia via the TAL and AWP pipelines.

The project, which in the past has been given common importance in the EU's economic area (the project was also included in the EU list of projects of common interest (PCI)), is not continued for a number of reasons:

The programme statement of the current government includes the cancellation of this project as it crosses Žitný Island;

The creation of a territorial reserve in the planning documents was rejected by the local government;

The project was removed from the EU list of projects of common interest (PCI) in 2021.

Natural gas

Slovakia is an important transit country for natural gas in the East-West and West-East direction. It is also necessary to complete the interconnections in the north-south direction in order to maintain Slovakia's position in gas transmission through the transmission network.

In order to secure gas supply, steps are being taken both by the State and by the gas companies to make the Slovak Republic better prepared for any gas supply problems in order to avoid a repetition of the situation which meant limiting the gas supply to Slovak customers during the 2009 gas crisis. These measures aim at the possibility of transporting emergency gas supplies from other routes/States, including securing auxiliary gas supplies through reverse flows from the Czech Republic and Austria. In particular, medium- and long-term measures aim at building interconnections of transmission networks providing opportunities for diversification of gas supply and building/expansion of gas storage facilities in Slovakia in suitable geological structures currently available.

Since 2009, the Slovak Republic has clearly declared support for specific projects with an impact on increasing the level of security of gas supply or efforts to find a solution to interconnect Slovakia's networks with neighbouring countries' networks where such interconnection does not yet exist. Negotiations also took place to maximise the use of EU funds.

Slovakia supported interconnection projects with Poland, Hungary, as well as reverse flow projects from the Czech Republic and Austria (these were implemented 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 the technical adjustment project to allow reverse flow in the Slovak transmission network operated by eustream, a.s. and the project of NAFTA a.s., which will allow for an increase in the volume of gas supply from storage to the transmission network in times of crisis.

As part of the Slovakia-Hungary interconnection project, the gas pipeline was put into standard commercial operation on 1 July 2015, following the successful completion of construction and testing operations. Following the 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.

Diversification of natural gas routes and sources

Increase of fixed transport capacity at the Veľké Zlievce interconnection point

Due to expected changes in natural gas flows within Europe, an investment project for increasing fixed transmission capacity at the Veľké Zlievce interconnection point is under preparation. The implementation and commissioning of the project will depend on the market demand for the capacity in question, based on the evolution of the situation in the Black Sea Basin linked to the natural gas project.

The implementation of the project will contribute to:

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

Solidarity Ring

The aim of the project is to provide an import route for gas supplies from Azerbaijan at an expected volume of 5-20 bcm^3/year with a minimal adjustment of the transmission network. The project would connect the existing key infrastructure in Slovakia, connected to the Western gas hubs, with gas infrastructure in the territory of Hungary, Romania, Bulgaria, Türkiye and gas resources in the Caspian region. This solution would effectively help 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 possible shortfall. 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 to fulfil the Memorandum of Understanding on a Strategic Energy Partnership signed on 18 July 2022 between the European Commission and Azerbaijan to increase gas imports into Europe. The project is at an early stage of preparation. Ring solidarity is a quicker solution in time for ensuring the security of gas supply, especially for the Central European region, compared to the Eastring project, as it is the use of already existing infrastructure and not the realisation of a new line.

In Sofia, a Memorandum of Understanding was signed 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) and the Azerbaijani energy company SOCAR. The Memorandum concerns their joint initiative, supported by the European Commission, "Solidarity Ring", which aims to increase the security of supply of natural gas 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.

Increase in reverse flow of natural gas in the direction of Ukraine

Since the construction of the pipeline connection and the gas metering station in the Veľké Kapušany compressor station site in 2014, Eustream is ready to provide, through the exit point of Budince, a natural gas flow in the direction of Ukraine of 14.6 bcm/year (of which 9.9 bcm/year fixed and the rest interruptible).

In the context of a possible increase in gas transmission in the direction of SK-UA, Eustream completed the preparatory and engineering activities of the project 'North flow of natural gas in the direction of Ukraine'. Currently, due to the ongoing conflict in Ukraine, linked to a drop in demand for capacity, there is no presumption of interest for this project. For the reasons set out above, the project is temporarily suspended.

Energy transformation of the transport system, in particular 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 the capture and storage of carbon dioxide. These technologies can potentially represent not only an important decarbonisation contribution but also an opportunity for further use of 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 plans to implement a series of projects for the energy transformation of the transmission network in the coming years, which can be summarised in the following categories:

- Reduction of methane emissions;
- Improving the energy efficiency of the transmission system;
- Transport of natural gas with hydrogen admixture
- Transport of blue hydrogen
- H2I-T project
- Repurpose of one line on H2

Transport of natural gas with hydrogen admixture

Eustream pays significant attention to the European strategy on hydrogen use, production and transport. The company's analysis of options for the future transport of hydrogen in the transmission network is ongoing. The 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 to ensure infrastructure readiness to transport a 5 % blend of hydrogen with natural gas by the end of 2024. The above measures are and will continue to focus mainly on commercial, measuring, security and safety equipment. The analyses will be gradually complemented by new information that can change the blending strategy of hydrogen into natural gas in order to increase efficiently and safely the content of transported hydrogen in natural gas in future periods. The implementation of the projects included 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. Transport of natural gas with hydrogen admixture will make it possible to reduce the negative environmental impact of fossil fuels and to meet the European Union's energy and environmental objectives.

Transport of blue hydrogen

In September 2021, Eustream, EP Infrastructure, NAFTA and RWE Supply & Trading signed a Memorandum of Common Practice on exploring the possibility of developing state-of-the-art blue hydrogen production facilities in eastern Slovakia. RWE Supply & Trading intends to source and import produced hydrogen to Germany and other key RWE markets in Western Europe. Hydrogen should be transported to Germany via the adapted 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 of the hydrogen economy and to make a significant contribution to Europe’s decarbonisation objectives.

H2I-T project

In order to achieve the European Union’s objectives and to have a significant impact on economic growth, sustainability or value creation across the EU for the transformation of the economy leading to a reduction in greenhouse gas emissions, Eustream has been involved in the process of acquiring IPCEI for research on the impact of hydrogen on the transmission network components used so far for the transport of natural gas, through the development of a testing polygon, including laboratory and practical research.

The European Commission is currently assessing the documentation submitted for the proposed H2I-T project.

If the European Commission considers the proposed H2I-T project to be sufficiently innovative, Eustream can obtain access to co-funding sources from the Slovak state budget for this project.

Repurpose of one line on H2

Eustream has become part of a number of hydrogen initiatives in Central Europe and the company’s transport system should form an integral part of Hydrogen Backbone. The first step is the upcoming retrofit project for a single line of the transmission network of a company that would serve for the transport of hydrogen. Ukraine is expected to play an important role in the different stages of the transition, where large-scale construction of renewable energy sources with green hydrogen production is expected. This hydrogen would enter the territory of Slovakia in Veľký Kapušany and continue to the national borders with the Czech Republic and Austria. The network will be bidirectional and will also be linked to resources from North Africa and the rest of the EU. The transition will entail significant investment costs, mainly for the replacement or retrofit of unsuitable components of the system and the construction of new hydrogen-ready compressor stations. The capacity of this transmission system will depend on supply and demand for hydrogen. Currently under consideration at 10 GWh at the entry point from Ukraine.

As part of the creation process 1. PCI list, the candidate projects in the field of hydrogen transport are the following projects:

- New SK- HU connection to hydrogen from 2030 and Modification of the existing SK-HU interconnection (hyd-N-661) from 2040;
- Repurposing hydrogen transport infrastructure in Slovakia (hyd-N-772) corridor from the border with Ukraine to the border with Austria from 2030 onwards
- Central European Hydrogen Corridor – SK part (hyd-N-1264) – corridor from the border with Ukraine to the border with the Czech Republic from 2030 onwards

Preparing a transport system for blending (RET-N-916) from 2025 onwards.

Hydrogen projects at distribution network level

The largest gas distribution network operator SPP – distribution, a.s. is ready to upgrade existing and build new H2-ready infrastructure, i.e. to ensure the transformation of existing natural gas infrastructure into hydrogen. The Slovak molecular energy demand is almost 1.5 times higher than the electricity demand. There is therefore a potential for need in Slovakia after significant volumes of sustainable hydrogen, which is much higher than the national H2 production capacity. Significant volumes will therefore need to be imported from abroad via the international H2-backbone corridor. The projects aim to build H2 infrastructure from H2-backbone to the largest Slovak industrial customers and major Slovak cities, allowing the gradual transformation of the distribution network from natural gas to hydrogen.

Picture 1: Hydrogen projects SPP-distribution, a.s. (hydrogen)

Source: CAP – Distribution, a.s.

❶ H2 – Fuel:
The new high-pressure gas pipeline DN350 PN40, using the existing methane pipeline route DN300 PN25, which is currently planned to be reconstructed (initially built in the 1950s). The length of the main route is 150 km and the length of the connecting pipes is at least 50 km.

❷ H2 – Šaľa-Bratislava:
New high-pressure gas pipeline DN700/DN500 PN40 using the existing 84 km methane pipeline route DN500 PN40:

Consumer	Industrial sector	Length of H2 gas pipeline DN500-700 PN40 (from the H2-backbone line) in km
Duslo Šaľa	Fertilisers	16
Slovnaft MOL Group Bratislava*	Oil refinery	68 (extension of the Duslo pipeline)

*connecting Bratislava capital to H2-backbone

❸ H2 – Košice-Prešov:

A new high-pressure gas pipeline DN500 PN40 using the current route of the existing methane pipeline DN500 PN40 to US Steel and further to Košice with a length of 32 km and the subsequent use of the existing (currently reconstructed) methane pipeline DN500 PN40 in Prešov.

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

Transport routes and their diversification are described in point (ii).

Domestic gas extraction

There is domestic gas extraction in Slovakia. It accounts for up to 2 % of total gas consumption. In the long term, the continued production of natural gas from current sources can be expected, with a downward 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. operates several exploration wells in different parts of the country.

In Slovakia, despite today's low gas production, there is considerable potential and it is therefore efficient to take measures to promote gas production.

If mining is carried out, Slovakia's annual consumption potential is assumed to be up to 10 %.

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.

It is the underground storage facilities that are considered to be the most important tool for ensuring the security of gas supply and therefore 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 of storage facilities on the territory of the Slovak Republic is 37 137 GWh (operators' data 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), a maximum daily fixed injection capacity of more than 410 GWh (38 million m^3).

The underground storage facility of Dolní Bojanovice (in the territory of the Czech Republic) operated by SPP Storage s.r.o., Prague with a capacity of 6 944 GWh (0.65 billion m^3), with a maximum daily extraction capacity of approximately 95 GWh (8.8 million m^3) is also used for Slovakia's needs. 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. It also has a high degree of flexibility and it is possible to change the gas injection regime into a production regime in a relatively short period of time and vice versa.

Projects to convert other suitable geological structures into underground gas storage facilities or other energy-related applications (CCS) are also at different stages of development.

The gas infrastructure projects are followed up by the project to build an underground natural gas storage facility Veľké Kapušany by NAFTA a.s., the underground natural gas storage facility Veľké Kapušany aims to promote the security of natural gas supply in the region and to step up the integration of the EU Member States' markets – Poland, Slovakia and Hungary – also including Ukraine's neighbouring market. In terms of technical characteristics, the project envisages the creation of 340 mcm of new storage capacity with an estimated production capacity of 3.75 million m³/day and injection of 3.75 million m³/day.

The project will support the European Union's Priority Energy Gas Corridor (NSI East Gas) and will have a significant cross-border impact on the surrounding countries. It is strategic to locate the project on the eastern border of the European Union, in close proximity to one of the natural gas entry gates to the EU, the Veľké Kapušany compressor station, where the 3 existing and 2 planned pipeline routes meet. There is currently no storage capacity in this area of Slovakia. The construction of an underground storage facility with a direct connection to the Veľké Kapušany compressor station will strengthen the position of the Veľké Kapušany gas node, with the expected intensification of business activities and the gradual transformation of the hub into HUB gas.

The possible use of waste heat from the Veľké Kapušany station's existing compressors (provided that the direction of gas transit from east to west or sufficient waste heat capacity at the Veľké Kapušany compressor station) is also considered for propulsion of storage compressors, which would have a positive environmental impact and would not lead to an additional increase in greenhouse gas emissions.

In addition, the project envisages the possibility of storing energy in the form of a mixture of natural gas and hydrogen. Storage of hydrogen blended with natural gas has the potential to increase the development of renewable energy sources, since such storage eliminates the disadvantages of these energy sources (volatility of the amount of energy generated from renewable sources) and allows for long-term storage of renewable energy.

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

Electricity

One of the objectives of the Slovak Republic in relation to increasing the **flexibility of the energy system** is **to ensure sufficient flexibility in the electricity** market for market participants, primarily for operators with variable generation resources such as renewable energy sources. The basis for this flexibility is trading as close as possible to the time of physical electricity supply, as variable generation cannot be precisely planned in the longer term. Attention will therefore be paid to the development of trading opportunities and rules, in particular through intraday and balancing markets. This was achieved on 1 October 2022, when Slovakia joined the international XBID platform, which allows electricity to be traded on day D. This connection allows trading in 15 min or 1 hour trade derivatives, which appears to be highly liquid for the needs of electricity traders from the Slovak Regulatory Area.

In the context of increasing the flexibility of the electricity system, the Slovak Republic's intention was to create, in accordance with European legislation, conditions for the provision of ancillary services which, on the basis of clearly defined rules, allowthe **aggregation** of demand facilities, energy storage facilities, power-to-X facilities and power generation facilities for the purpose of offering balancing services. In addition, the task was to establish rules and appropriate conditions allowing demand facility owners, third parties and owners of power generation facilities from conventional and renewable energy sources, as well as owners of energy storage units, to become balancing service providers.

These objectives were met through the TSO of the Slovak Republic (SEPS), which is responsible, inter alia, for maintaining a balanced power balance. Since the beginning of 2023, the harmonisation of types and requirements for ancillary services has allowed the provision of ancillary services with a control capacity of 1 MW or more and, by means of aggregation, installations with a regulatory contribution of 0.01 MW may participate within the control unit. From a technology perspective, it is possible to provide flexibility on all types (production, abstraction, accumulation) and their combinations. It is also possible to provide PCPs out of a closed state or operational state, which has increased the possibilities and opportunities for all market participants. The aim was to ensure full and equal access to balancing markets for all technologies and providers, including renewables.

The Slovak Republic's difficulty in providing flexibility in electricity generation is the installed capacity of power plants that are able to respond flexibly to current system requirements. Together with the increasing share of volatile renewables in electricity generation, as well as diverging imbalance pricing rules in neighbouring countries, difficulties for the transmission system operator in managing the electricity system are created due to the non-fulfilment of the required volume of PSPs in some months of the year. In these months, there are also difficulties in activating a high volume of PS due to the occurrence of positive or negative balance sheet incidents. A possible rapid uncoordinated expansion of the connection of photovoltaic and wind power plants will entail increased demand for support services and its further development will need to ensure the operation of resources with adequate regulatory capabilities or link the operation of photovoltaic and wind power plants to the operation of power storage and/or power-to-X facilities in order to eliminate unpredictability of supply to the grid.

The main obstacle to increasing national ambition in solar and wind power generation is their variability in generation and the existing electricity generation structure, where 55 % of electricity is generated from nuclear energy. For 2030, the share of RES in electricity consumption was set at 29.5 %. Variable sources with high fluctuations in electricity generation have a significant impact on ensuring a sufficient amount of ancillary services.

Flexibility in the electricity system can be achieved in several ways:
—Building new flexible production resources and modernising existing resources providing flexibility
— Interaction with other energy vectors (power to X, heat)
- By limiting the production of RES in case of overproduction
— Development of electricity storage sites (batteries, PHP)
— By transmission line
— Offering customer demand flexibility (industry, aggregation)

For Slovakia, there is no reference study setting out the need for flexibility in different time horizons (daily, weekly, monthly) nor a reference study setting out optimal flexibility contributions from different sources. It can be partly supported by studies that have been carried out for the whole of the EU. 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 it would be sufficient for the Slovak PVEs to be used more intensively by 2030, in line with ENTSOE and SEPS simulations.
The increased use of the Slovak PHP means that, in order to further develop flexibility in the Slovak electricity system, it is appropriate to consider modernising the existing HPUs – increasing overall efficiency also increases the total amount of flexibility that TEs can provide.

Another source of new flexibility could be to solve sedimentation in water tanks, which could significantly increase their supply 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 facilities to existing CZTs.

Slovakia's recovery and resilience plan sets out a coherent package of reforms and investments implemented until 2026 and supported by the Recovery and Resilience Facility. Within the framework of the Slovak Republic's recovery and resilience plan, Komponent 1 (POO SR K1 – Renewable energy sources and energy infrastructure) includes investments in new sources of electricity generation from RES, modernisation of existing hydroelectric power plants and biogas stations, *conversion of biogas stations into biomethane stations, and* **support for** *installations increasing the flexibility of the Slovak electricity system* (battery storage sites, hydrogen production facilities through electrolysis and the modernisation of pumped hydropower plants). The structure of POO SR K1 consists of a series of reforms and investments. This is a total investment of more than EUR 202 million for the construction of:

- 120 MW of new RES sources (K1, Investment 1),
- 83 MW of upgraded RES installations (K1, Investment 2) and
- **52 MW installations increasing grid flexibility (K1, Investment 3)**.

As part of Reform 1 **and Investment 1, the new REPowerEU chapter of the Slovak Republic's recovery and resilience** plan aims to ensure the technical capacity of the electricity system for the connection of RES, which is essential to achieve carbon neutrality by 2050. **The development and modernisation of the electricity system** and subsequent investments in distribution grids are crucial for further integration of RES and the achievement of the green transition objectives. The objective of the investment to further develop and modernise the electricity transmission system, and for this to be the follow-up investments within the different regional distribution networks, is to increase the technical capacity to further integrate and accelerate RES. 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 further developing RES, including increasing energy security and diversification, measures in this area will ultimately contribute to reducing Slovakia's dependence on fossil fuel imports from Russia and meeting the targets of a 55 % reduction in EU greenhouse gas emissions by 2030 and EU carbon neutrality by 2050.

InJuly 2022, Slovakia transposed into law the requirements of the 'Clean Energy for All Europeans' package in the field of **electricity market design**, including provisions on aggregation and 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). Slovakia is currently in the process of adopting secondary and tertiary legislation (in particular amendments to the Decree on the rules for the functioning of the electricity market, the Decree on price regulation in the electricity sector, the technical conditions for access and connection to the system and the rules on the operation of the system of transmission and distribution system operators), which, together with the implementation of the new model for the provision and exchange of data in the electricity market, should enable new active elements and activities in the electricity market to function effectively.

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 realised and operated without centrally **adjusting data flows** (sharing of electricity from RES, storage, formation of energy communities, active customers). Investment 1 of the Slovak Recovery and Resilience Plan (REPowerEU chapter) responds to this need in its last part by supporting the creation of an **Energy Data Centre** ('EDC'), which aims to streamline and speed up access to the electricity market for new entrants. The EDC project, which implements the new model for data provision and exchange in the electricity market, is currently in the process of implementing a baseline version of the solution (following the effectiveness of the amendment of the related Ordinance on rules for the functioning of the electricity market and the modification of the operating rules of the operator of the short-term electricity market operator OKTE, the operator of the central electronic system for managing and collecting measured data in the electricity market).

Gas

It is necessary to create an appropriate environment for flexibility for storage operators and storage. Maximum use should be made of the benefits of underground storage facilities in Slovakia and the district heating system.

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

NAFTA a.s. has two storage development projects in place. One is the new storage facility in the east of Slovakia – the geological structure of Ptrukša (expected technical parameters: a work volume of 0.34 billion m^3, a production and injection capacity of 3.75 m^3/day) for Veľké Kapušany. Another project is the extension of the existing Lab complex (expected technical parameters: a work volume of 0.55 bcm, an increase in production output of 10 m^3/d and an 8 mcm/d injection capacity). However, the implementation of these projects will depend on the situation on the gas storage market as well as on the possibility of receiving financial support from the European Union.

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 generated energy and to consume it depending on the need. The integration of local energy storage in storage appliances, energy storage 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 grid mapping and analysis, so that electricity at the generation site does not need to be transformed to a higher voltage level and then back to lower voltage levels at the remote point of consumption. Ensuring a flexible, low-carbon and sustainable structure of the source base of electricity generation requires, first and foremost, maintaining and supporting existing hydro-pumping capacity and operation, for example through appropriate upgrades, while improving the stock volume of existing water reservoirs currently under sediment load. Another option, taking into account the resource base needs of all V4 countries, is necessary to reconsider the possible increase in storage capacity by building a new pumped hydropower plant.

Heating

The heat sector will support efficient CZT systems with the supply of heat from RES, waste heat from industrial processes to economically cost use of RES, in particular locally available biomass/biomethane and wastes, including the promotion of multi-fuel systems, as well as heat pumps, which, as a form of RES, allow significant savings in the cost of heat production. Options for creating conditions for the use of heat plants in the supply of electricity in emergency and emergency situations will be assessed. Preference will be given to CZTs with CHP over non-heat-free fossil fuel electricity generation. They must be operated in such a way that they can be used to the maximum extent in the provision of balancing electricity. It is necessary to use the infrastructure of heating plants and the siting of existing high-efficiency cogeneration plants for the integration of RES in CZT in the form of electricity and heat generation from biogas and biomethane (mainly from waste from plant and animal production, the biodegradable fraction of municipal waste, biodegradable kitchen and restaurant waste and waste from waste water treatment plants), energy recovery of municipal waste in the circular economy and energy efficient RES facilities meeting sustainability criteria.

2.4. Dimension: internal Energy Market

2.4.1. Electricity interconnectivity

I. *The level of electricity interconnectivity that Member States aim to achieve in 2030 with a view to the 2030 electricity interconnectivity target of at least 15 %, with a strategy where the level from 2021 onwards will be set in close cooperation with the Member States concerned, taking into account the 10 % interconnection indicator by 2020 and the following indicators ranked by urgency*

Slovakia is currently meeting the target of 10 % of the level of interconnection of the transmission systems of the Member States of the European Union by 2020 adopted by the Council of the EU in 2002 and the 15 % interconnection level target for 2030 set by the EU Council in 2014 as a share of net import transmission capacity in the total installed capacity of the Member State's electricity generation facilities. The level of connectivity is increasing by building new cross-border interconnections, but is decreasing with the construction of new generation capacities. Slovakia's current connectivity has long been above the 15 % target set for 2030 and is not expected to fall below 15 % even in the case of the extreme connection of new RES.

Slovakia also meets the indicative indicators of the EU Member States' 2030 target of interconnectivity, according to the Commission report8 of November 2017, according to which nominal transmission capacity, i.e. thermal capacity of cross-border interconnections of a Member State should amount to 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 difference of the 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 projects for the reinforcement of the European interconnected system are implemented by 2030, the average annual marginal price difference should be less than EUR 2/MWh for the neighbouring commercial zones CZ, HU and UA, between EUR 5 and EUR 10/MWh for the PL trading zone and more than EUR 10/MWh for the AT trade zone9.

The average annual marginal price in trading areas is the level of variable costs, thus depending on the variable costs of the Member State's source mix. The price differential in neighbouring areas indicates the degree of market distortion by limiting transmission. In case there is sufficient capacity on all profiles, the average annual marginal price difference should not exceed EUR 2/MWh.

2.4.2. Energy transmission infrastructure

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

Electricity transmission infrastructure

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13 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*

14 *2050*, Publications Office, 2021, https://data.europa.eu/doi/10.2833/35750

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

In the field of electricity transmission infrastructure, the Slovak operator PS (SEPS) in cooperation with the Czech operator PS (ČEPS) is continuing the preparation of the planned interconnection of 1x400kV Ladce (SK) – Otrokovice (CZ) as well as efforts to include this project on the PCI list. This is an interconnection that would replace the successively shut down 220 kV transmission system (PS) on both sides of the SK/CZ border. This profile enhancement includes the planned upgrade of the transmission capability of the V404 Varín (SK)-Nošovice (CZ) line as part of the forthcoming SEPS renovation. SEPS is preparing an investment measure to remove a bottleneck within the transmission system of the Slovak Republic (hereinafter also referred to as the TSG) on the 400 kV Veľký Ďur – Levice (V490 and V491) lines, resulting in a failure to comply with SEPS's 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 PSOs line for electricity transmission. The solution chosen was to connect V492 Veľký Ďur – Horná Ždana to R400kV in ESt Levice and to connect the lines V490 Veľký Ďur – Levice and V449 Veľký Ďur – št.hr. SR/HU (Göd) including modifications to secondary equipment in related electrical stations (ESt) SEPS.

The decarbonisation of steel production in the east of Slovakia and the development of the strategic territory of Valalika (VOLVO Automobile) and other strategic territories in the same nodal area of the Slovak electricity system will lead to an increase and change in 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-Hungarian interconnection and the Slovak-Polish interconnection). The transmission network of Eustream, a.s. is connected to all the transmission networks of neighbouring countries and the possibility of reverse flow on these connections is ensured.

Various possibilities to use existing transmission infrastructures to secure gas supply from other sources are currently being assessed. Eustream and other subversions are exploring possibilities to import gas from Azerbaijan.

Solidarity Ring

The aim of the project is to provide an import route for gas supplies from Azerbaijan at an expected volume of 5-20 bcm^3/year with a minimal adjustment of the transmission network. The project would connect the existing key infrastructure in Slovakia, connected to the Western gas hubs, with gas infrastructure in the territory of Hungary, Romania, Bulgaria, Türkiye and gas resources in the Caspian region. This solution would effectively help 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 possible shortfall. 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 to fulfil the Memorandum of Understanding on a Strategic Energy Partnership signed on 18 July 2022 between the European Commission and Azerbaijan to increase gas imports into Europe. The project is at an early stage of preparation. Ring solidarity is a quicker solution in time for ensuring the security of gas supply, especially for the Central European region, compared to the Eastring project, as it is the use of already existing infrastructure and not the realisation of a new line.

In Sofia, a Memorandum of Understanding was signed 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) and the Azerbaijani energy company SOCAR. The Memorandum concerns their joint initiative, supported by the European Commission, "Solidarity Ring", which aims to increase the security of supply of natural gas 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.

Central European Hydrogen Corridor

The initiative brought together natural gas transmission system operators from Ukraine (Gas TSO of Ukraine), Slovakia (eustream), the 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, Slovak, Czech and German gas pipelines may be adapted for the transport of hydrogen. Germany is expected to be an important area of hydrogen demand within Europe. In order to cover this expected demand, imports of hydrogen in large quantities will be unavoidable.

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.

The project partners have already started exploring the technical feasibility of establishing a Central European Hydrogen Corridor for the transport of clean hydrogen from Ukraine to Germany of up to 120 GWh per day, amounting to 1.3 million tonnes of hydrogen per year from 2030.

II. Where applicable, main infrastructure projects envisaged other than Projects of Common Interest (PCIs)10

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 PS SR, taking into account the potential development of electricity in the Slovak Republic, in accordance with the available Slovak strategic documents, as well as the requirements for the renewal of existing PS infrastructure due to the achievement of the projected lifetimes of the installations and the assessment of their current state of affairs as non-compliant. The need for an extension of the PS SR can also be based on the input of PS users.

Slovakia's investment needs for the transition to a green economy include investments to increase the ability of the electricity system to connect renewable installations, including increasing grid flexibility for solar (FVE) and wind (VTE) power plants. The development of the electricity grid needs to be stepped up in order to increase energy security and promote electrification based on RES. Otherwise, security of electricity supply as well as a reduction in the quality of system operation may be at risk, which can ultimately have a major negative impact on the economy and industry in Slovakia. From the point of view of PBS, the objective is to create conditions so that the growth of demand from users of

[10] In 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).

DS for electricity supply is not accompanied by a decline in quality. In order to ensure the energy security and resilience of the Slovak Republic, it is crucial to have a robust PB with sufficient regulatory performance and adequate DS.

SEPS invests in the redesign of its ESt in remote control with unserviced operation. This significantly modernises, digitises and adapts the ESt to new operational, security and reliability requirements, but also to high energy efficiency requirements for transmission. Energy efficiency is essential for long-term sustainability. In response to the expected challenges of integrating RES into the grid, there will be increased demands on the transmission system. The priorities of the SEPS include investment intentions that will ensure:

• replacement of essential parts of 220 kV of the transmission system, phased-out, 400 kV installations;

• transfer of power stations from local and remote control to remote control, including complex upgrades;

• strengthening the PS infrastructure for fulfilling Slovakia's obligations and obligations under national and international legislation (e.g. INECP objectives, FitFor55, REPowerEU);

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

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

When renovating existing and constructing new electricity stations within the PS SR, the long-term objective of the PS operator (SEPS) is to use state-of-the-art equipment and equipment that meets the strict requirements for the safe and reliable operation of the PS SR, as well as the requirements for their sufficiently long, smooth operation, with minimum requirements for carrying out revision and maintenance activities. The same applies to the construction or reconstruction of power lines, but also to all secondary installations necessary for the operation, management and control of the PS SR.

The Ministry's intention is to ensure efficient administrative processing of applications for **permits for energy infrastructure structures**, so that those applications are dealt with as quickly as possible in accordance with Union and national law. All dispute settlement procedures, litigation, appeals, successions and remedies relating to energy infrastructure projects before any national courts, tribunals, special courts, including mediation or arbitration, where they exist under national law, should be considered urgent.

Gas

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

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

(b) enable and enhance diversification of routes and sources, thereby enhancing the security of natural gas supply through increased flexibility of the gas network;

(C) contribute to improving sustainable development in Europe, as natural gas plays a key role in the European Union’s energy mix, in particular with regard to economic development and environmental protection.

As regards interconnections with neighbouring states at transmission system level, once the interconnection of Slovakia and Poland becomes operational, there is an interconnection with each neighbouring State. Through these interconnections it is possible to transport gas from different producers and from different directions.

2.4.3. Market integration

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

<u>Electricity market</u>

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 the Slovak electricity system for greater integration of RES. National flexibilities and targets should be based on the assessment and quantification of flexibility needs following the transposition and implementation of new EU legislation on electricity market design reform (flexibility provisions of the proposal for a Regulation (EU) 2019/943 and Regulation (EU) 2019/942 of the European Parliament and of the Council, as well as Directive (EU) 2018/2001 and Directive (EU) 2019/944 to improve the design of the electricity market in the Union, taking into account the potential and measures to increase the share of RES in electricity generation resulting from the Fit for 55 package (revisions of Directive (EU) 2018/2000 on the promotion of the use of renewable energy sources in the Union).

In 2022, Slovakia transposed into Slovak law the requirements of the **‘Clean Energy for All Europeans’ package** in the area of internal electricity, including (the so-called new electricity market design, 2019), in particular the recast EP and Council Directive (EU) 2019/944 and the recast Regulation (EU) 2019/943 of the European Parliament and of the Council on the internal market for electricity, including the provisions on **aggregation and the provision of flexibility**. Slovakia is currently in the process of adopting secondary and tertiary legislation (in particular amending the Decree on the rules for the functioning of the electricity market, the Decree on price regulation in the electricity sector, the technical conditions for access and connection to the grid and the rules on the operation of the system of transmission and distribution system operators), which, together with the implementation of the new model for the provision and exchange of data in the electricity market (operated by OKTE by the metered data controller), should enable new active elements and activities on the electricity market to function effectively.

At the same time, the requirements of Directive (EU) 2019/944 on electricity **contracts with dynamic electricity prices (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 transposing the Electricity Directive, regulates the rules for the negotiation of contracts for the (joint) supply of electricity with dynamic price or other means of determining or calculating the price of electricity derived from changes in electricity prices in organised electricity markets.

The new regulatory **policy for the 6th regulatory period from 1.1.2023 to 31.12.2027** adopted on 29 March 2023 by the Office for Regulation in Network Industries ('ÚRSO' or 'the Regulatory Authority') envisages the development of new innovative supply products supported by **dynamic tariffs** and new types of distribution tariffs, in order to stimulate the use of new technologies or 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 introduction 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 system loads, either by using **flexibility** or by developing the **concept** of **dynamic tarification** (including dynamic valuation of reserved capacity), with a view to making more efficient use of existing distribution system capacity, reducing system deviation over time and supporting the needs of new electricity market participants.

The contribution to improving the safety of operations in the Slovak Republic and, in particular, to reducing the need to activate regulatory power in the SRV and the number of TRV activations was to participate in the **project for the cross-border exchange of balancing electricity in the Grid Control Cooperation (e-GCC) system in** early 2012. The e-GCC was shut down in 2020 due to its participation in a common system called International Grid Control Cooperation (IGCC). Participation in the IGCC also confirmed the expected lower number of TRV/mFRR activations compared to previous years, as well as reduced volumes of RE from domestic electricity generation facilities providing the SRV/aFRR support service.

Next year, through SEPS, Slovakia joins the **international platforms for the exchange of balancing energy** (PICASSO and MARI) 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 to succeed in providing flexibility and balancing electricity also to flexibility providers from Slovakia. Once the platforms are connected, there will be a change in the pricing of balancing electricity from pay-as-bid to marginal pricing. At the same time, balancing electricity prices will be deregulated as an incentive for new PSP providers to enter the market.

Through SEPS, Slovakia became an observer in the FCR cooperation project, which uses the 'Regelleistung' platform for cross-border sharing of FCR-type PpS availability. The connection to the platform will ensure SEPS access to a liquid market for the purchase of an FCR service from abroad.

Market integration and coupling

Electricity market

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

Forward-looking objectives and targets for market integration are mainly conditioned by Commission Regulation (EU) 2015/1222 establishing a guideline on capacity allocation and congestion management (CACM), 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 particular, **day-ahead and intraday market** timeframes involve full integration of the Slovak Republic within a single solution based on the principles of the implicit allocation of cross-zonal capacities of the Single Day Ahead Coupling (SDAC) and single intraday coupling based on the principle of continuous allocation of cross-zonal capacity (SIDC).

For the day-ahead electricity market timeframe, a project for the timely implementation of the merger of Slovakia, the Czech Republic, Hungary and Romania (4M MC) with the connected Western European MRC (DE-AT-PL-4MMC project) was launched at the turn of 2018/2019 on the basis of the Net Transmission Capacity (NTC) method[11]. 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, have confirmed their commitment to implement the targeted European solution and methodologies stemming from legally binding EU legislation based on the principle of coordinated flow-based capacity calculation within the region for co-ordinated capacity calculation, the Core CCR. The Core Flow-based Day Ahead Market Coupling project was successfully launched on 8.6.2022.

The objective solution for the integration of the intraday electricity market would be based on the XBID project, where integration is implemented through a comprehensive accession process involving the Slovak Republic. Slovak stakeholders became a fully-fledged part of the XBID project (currently replaced by the SIDC structure) in early 2020, the operational connection of the bidding zone Slovak Republic to the XBID project was successfully implemented through a local implementation project ('Local Implementation Project 17' or 'LIP17') in November 2022.

With regard to **balancing markets**, Slovakia is expected to become an integral part of single centralised European performance balancing platforms in the course of 2024. The involvement of the Slovak Republic in these platforms, which arises from the European legislation currently in force, responds to the need for increased flexibility in the management of the interconnected electricity system, increased liquidity in the balancing market and transparent pricing for performance balancing services.

On the basis of the appropriate conditions laid down by the relevant legislation, an increase in the liquidity of European platforms can be envisaged through the promotion of new technologies and performance balancing services.

As regards the integration of wholesale markets and the **increase of marketable capacity**, Slovakia and the Slovak parties 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 list of Projects of Common Interest (PCI, Chapter 2.4.2) has been an important contribution to the integration of wholesale electricity markets in terms of reducing the price differential between market areas (Chapter 2.4.1 in relation to interconnection** indicators). The new

[11] http://www.urso.gov.sk/?q=node/598

Slovak-Hungarian interconnections 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, thus increasing the tradable electricity capacity on the SK-HU profile.

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 the transmission of electricity, the SEPS operator plans and implements the national investment plans of the PS operator.

By increasing the available transmission capacities on the SK-HU profile in April 2021, it contributed to removing the bottleneck in the PS SR from the point of view of system permeability, and the 'stop-state' was completed in order to remove the bottleneck in the PS SR from the point of view of system permeability, and the 'stop-state' for connecting new resources to the Slovak Republic and increasing the installed capacity of existing resources in the Slovak Republic was completed. Also from a broader regional perspective, this bottleneck was an obstacle to RES flows from North to South.

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 the development of current and emerging trends (aggregation, flexibility, dynamic prices) is the introduction of intelligent metering systems (IMS). The implementation of the IMS is a key element for the development of 'smart grids'.

Slovakia is at the stage of initial development of basic smart grid infrastructure within the scope of selective deployment of smart metering systems as required by EU legislation (Articles 19 to 21 and Annex II to Directive 2019/944) and Slovak transposition legislation pursuant to Act No 251/2012 on energy and Decree No 358/2013 of the Ministry of the Economy on the implementation of the IMS (see point (iii) of this chapter).

In the area of the development of **smart grids**, Slovakia aims to implement projects of common interest (PCIs) 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** in view of the future development of distributed and renewable energy sources is the implementation of the cross-border **smart grid project ACON** between Slovakia and the Czech Republic, which is included in the list of Projects of Common Interest and received Union support from the Connecting Europe Facility (CEF Energy). The project will increase the efficiency and safety of the distribution system and preparedness for the integration of distributed renewable resources, in particular in the common border areas of Czechia and Slovakia. The project is expected to be implemented by 2024. At the same time, the **Danube InGrid joint Slovak-Hungarian smart-grid project** is being prepared and is also included in the list of Projects of Common Interest.

Smart grid ACON project

The main objective of the ACON (Again COnnected Networks) cross-border smart grid between Slovakia and the Czech Republic is to strengthen the integration of the Czech and Slovak electricity markets and to efficiently unify 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 2021, the project was included on the fifth list of EU Projects of Common Interest (PCI). On the part of the Slovak Republic, the project implementer is Západoslovenská distribučná a.s. (ZSD) and, on the part of the Czech Republic, EG.D, a.s.. The expected implementation date is 2018-2024.

It is the first ever project in Slovakia, with the massive deployment of state-of-the-art smart technologies to enable the emergence of 'new energy' based on local renewable sources.

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

The ACON project is implemented in the border areas of Western Slovakia, but the benefits of 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 the 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 remedy them. It will thus provide the customer with a more stable distribution system with a minimum of outages and a high quality of supply.

The possibility to co-finance the development of the distribution system from EU resources is an opportunity to make a significant contribution to the digitalisation of the Slovak distribution system and to offer new technological solutions to network users. The total value of the supported ACON project amounts to 182 million euro, with European co-financing amounting to 91,2 million euro, i.e. 50 % of the value of the project and the cost of each of the project partners being 50 %.

Projects of common interest are key cross-border EU energy infrastructure projects that are essential to create a single energy market and achieve affordable, secure and renewable energy.

The ACON project, which is one of the most important joint Slovak-Czech energy projects while supporting European energy objectives, was supported by the Slovak Minister of Economy and the Minister for Industry and Trade of the Czech Republic. The two sectoral ministers, together with the project partners, signed 24. 6. 2019 in Bratislava A statement of support for the ACON project to ensure the smooth implementation of the project's different objectives.

ACON has several smart and innovative features and is one of the first smart grid projects on the PCI list. Smart technologies will complement new communication elements as well as intelligent load management with automatic algorithms, raising awareness, ensuring better interconnection and allowing for future use of distribution grids for a wider deployment of renewables as well as access to digital infrastructure.

The work on ACON will include a number of activities, namely: new cross-border 22 kV interconnection between Holich and Hodonine; new electric traphost and upgrade of existing traphosphates; cabling; and the installation of IT equipment and smart solutions.

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 the Danube InGrid (Danube Intelligent Grid) project is the wider integration of renewables into the distribution grid through the use of smart technologies at transmission and distribution level, including their smart management.

While the ACON PCI project is mainly implemented in the territory of the Trenčian and Trnava regions, the PCI project Danube InGrid should mainly cover the territory of the Nitra region and part of the Trnava region.

The purpose of the Danube InGrid PCI is to enhance the interaction and integration between the Slovak and Hungarian electricity markets. The project introduces smart technologies at the internal level of system operators and also 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 generators, in order to integrate large amounts of electricity from renewable sources and/or distributed energy sources. The Danube InGrid project presents a number of areas for the deployment of smart elements that are essential for achieving the project’s final objectives. These are intelligent elements focusing on security of operation, their implementation at electricity stations (sensors, IT devices, applications) network upgrades due to RES integration, e-mobility, smart metering, communication devices.

To better distinguish the project’s activities, the Danube InGrid project is subdivided into the first and second waves due to territorial and temporal differences. The implementation of the first wave of the project – Action No 10.7-008-SKHU-W-M-20 (‘the Action’), for which the European Commission was awarded EUR 102 million for a smart grid project under the Connecting Europe Facility (CEF) is currently ongoing. The implementers of the Actions are Západoslovenská distribučná, a.s., Észak-dunántúli Áramhálózti Zrt. and Slovenská Electricá Transmission Systema, a.s., the supporter is MAVIR. The project’s activities implement the construction of a new ESt Vajnory transforming 400/110 kV, including the modernisation and expansion of ESt Podunajské Biskupice and ESt Stupava, which will lead to a more robust system in the Bratislava area, with more capacity, which is essential for greater 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 PCI (Danube InGrid 2.0) relates to activities in eastern Slovakia and north-eastern Hungary and concerns the deployment of smart grid elements related to the design of smart substations, data exchange, data flow and smart metering and managing interactions between TSOs and DSOs for the secure and efficient operation of future energy systems. The second wave of the Danube InGrid project aims to improve cross-border cooperation at TSO and DSO level in the coordination of electricity system management, with a focus on smart data collections and their exchange, in order to enable more renewable energy producers to connect 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-eastern and central Hungary. The promoters of the second wave of the project are the companies Východoslovenská distribučná a.s., Slovenská elektrárneátransová sústava, a.s. Elmű Hálózti Kft. and MVM Émász Áramhálostti Kft.

The main objective of the project is to develop a smart electricity grid in the Central and Eastern Europe region with a view to integrating more RES into the distribution system while maintaining a high quality and security of electricity supply to consumers. The project will create more capacity for the development and connection of distributed generation and the right conditions for the possible connection of new distribution system users in the region. The project will promote the connection of several new producers of electricity from renewable sources, improve the quality and security of electricity supply, increase the possibility of 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 arising from the 'Clean Energy for All Europeans' package in the field of **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 (under the directly applicable Regulation (EU) 2019/943 of the European Parliament and of the Council on the internal market for electricity).

The draft amendment to the Energy Act includes:

- the regulation of **new entrants to the** electricity market (and the gas market);
- legislation on the **storage of electricity**;
- **adjustment of data flows** linked to new processes.

New **market entrants** include an active customer, an energy community, an electricity storage facility operator and an aggregator. In addition to the rights and obligations of these new entrants, it is also proposed how they can enter the market, while maintaining the current concept of granting or certifying compliance with the notification requirement for energy activities.

Several of these new activities cannot be efficiently realised and operated without centrally **adjusting data flows** (sharing of electricity from RES, storage, formation of energy communities, active customers). **Investment 1 of the REPowerEU chapter of the Slovakrecovery and resilience**planresponds to this need 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 EDC project, which implements the new model for data provision and exchange in the electricity market, is currently in the process of implementing a baseline version of the solution (following the effectiveness of the amendment of the related Ordinance on rules for the functioning of the electricity market and the modification of the operating rules of the operator of the short-term electricity market operator OKTE, the operator of the central electronic system for managing and collecting measured data in the electricity market).

The**electricity market reform** is a milestone in the Slovak recovery and resilience plan (Micle C1-1 Electricity Market Reform). A milestone in the electricity market reform is contained in the Annex to the draft COUNCIL IMPLEMENTING DECISION on the approval of the assessment of the recovery and resilience plan of Slovakia ("The legal framework will be amended by amending Act 251/2012 on energy and Act No 250/2012 on regulation in network industries for the purpose of transposing Directive 2019/944". The updated legal framework will also facilitate new activities and access for operators to the electricity market (energy producing communities, aggregators, self-consumers, electricity storage), while increasing the overall flexibility of the electricity system and improving the possibilities for connecting new renewable sources to the Slovak grid.).

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

Gas market

In addition to supporting the implementation of infrastructure projects, the Slovak Republic's national objectives for the development of a single gas market will focus on supporting the proper and timely implementation of network codes in the field of gas transmission. For example, the transmission system operator is currently able to sell transmission capacity at cross-border transmission points through all existing platforms (PRISMA, RBP, GSA). Looking forward to 2030, it will be necessary to focus on the expected package for the internal gas market, which, in addition to the integration of gas markets, should also significantly strengthen the sustainability aspect.

II. *Where applicable, national objectives for non-discriminatory participation in renewable energy, demand response and storage through aggregation in all energy markets, including a timetable for when the objectives shall be met;*

The**Slovak Republic**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 in the 'Clean Energy for All Europeans' package for the internal electricity market under the recast Directive (EU) 2019/944 and the recast Regulation (EU) 2019/943 on the internal market for electricity (see previous point (i) of this chapter – Agregation,** 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 entrants and new active elements and activities in the electricity market (and in the gas market):

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

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

The promotion of RES, including in the field of access and connection of RES, is regulated 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 amending the Decree on the rules for the functioning of the electricity market, the Decree on price regulation in the electricity sector, the technical conditions for access and connection to the grid and the rules on the operation of the system of transmission and distribution system operators) and the implementation of a new model for data provision and exchange in the electricity market (through the Energy Data Centre (EDC) project), which aims to streamline and speed up access to the electricity market for new entrants.

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 objectives 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 into Slovak law of Directive (EU) 2019/944 of the European Parliament and of the Council, in particular the provisions concerning the active participation of consumers in the market in Chapter III (Dynamic Pricing Treaty – Article 11, Active consumers – Article 15, Citizens' Energy** Communities – Article 16, Delivery 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 Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources.

Slovakia has implemented legislation promoting self-generation by introducing a **'local source' institute**. The concept of a local resource has been introduced since the beginning of 2019 in Act No 309/2009 Coll. on the promotion of renewable energy sources. The production of electricity from these sources more significantly fulfils the objective of developing RES in electricity generation. In March 2022, the local resource provisions were amended. The aim of this amendment was to immediately promote the large-scale but controlled development of local renewable energy sources installed by final customers up to the maximum reserved capacity of their demand points and used 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 assessment carried out in 2012, Slovakia decided to proceed with the selective introduction of smart metering systems for demand points with an annual consumption of over 4 MWh, which accounted for approximately 23 % of all forecasted demand points in 2020, representing approximately 53 % of total annual consumption (around 3.2 TWh) at low voltage (NN). The roadmap for the roll-out of the IMS for 2013 and 2020 has been extended until the end of 2021 due to COVID-19 restrictions. The economic assessment resulted in a negative net present value of large (national) deployment. By the target date of 31 December 2021, 431433 smart meters had been installed under regional distribution system operators (DSOs) out of the final planned number of 414388 smart meters (a further several thousand smart meters had been installed by local DSOs).

The recently adopted amendment to Act No 251/2012 on energy transposed the provisions of Directive (EU) 2019/944 on electricity in the field of IMS (Articles 19-21, Annex II). The Ministry of the Economy, in cooperation with the Office for the Regulation of Network Industries, is currently preparing, on the basis of Article 19(5) of the Directive, an update of the economic assessment of the long-term costs and benefits of the roll-out of smart metering systems (CBA), including the related amendment to Decree No 358/2013 on the implementation of the IMS in order to determine the criteria and timetable for the further deployment of the IMS (until the already implemented selective deployment of the IMS).

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

The 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 source mix**, both in terms of sufficient generation capacity (quantity), but also from the point of view of generation technology (quality) of electricity, is an important prerequisite for ensuring the adequacy** of the electricity system and ensuring the secure and reliable operation of the system of each Member State. **Slovakia intends to create the conditions for ensuring the adequacy of the electricity system in meeting the climate and energy targets and respecting the conditions of the single European market**.

By 2030, Slovakia expects a system export balance of around 20 % of the projected electricity consumption,12 assuming the start of Mochovce's 4th unit of the nuclear power plant, the operation of the Malženice CCG plant (PPC Malženice) and considering the cessation of operation of the Nováky and Vojany thermal power plant. In this scenario, Slovakia will have no problem with covering the expected load.

Under the Regulation of the Parliament and of the Council on the internal market in electricity, each Member State13 must have a **reliability standard** in place when applying the capacity mechanism, indicating in a transparent manner the required level of security of electricity supply. For the purpose of setting the reliability standard, national regulatory authorities should establish an estimate of the Value of Lost Load **(** VoLL) in EUR/MWh on the basis of a single ENTSO-E methodology approved by ACER. The reliability standard is to be **expressed as Energy** Not Supply (ENS) in MWh/year, which should be taken into account, inter alia, in the resource adequacy assessment.

According to 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 preparation of the ten-year European network development plan (TYNDP ENTSO-E) includes an adequacy assessment based on a probabilistic approach. The European resource adequacy assessment (ERAA) shall be carried out over an annual cycle on the basis of input from ENTSO-E Member States' transmission system operators, focusing on sensitivity analyses of the impact of sudden changes in fluctuated RES production, climatic conditions, market conditions (commodities and emissions), etc.

The probabilistic treatment of the Pan-European Adequacy Outlook14 also includes indicatively calculated indicators of the Energy Not Supply (ENS) reliability standard in MWh/year and Loss of Load

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

Expectation (LOLE) in h/year. Non-zero values 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 does not apply a capacity mechanism to ensure resource adequacy. In order to establish these parameters, account must be taken of the socio-economic and economic interest of energy self-sufficiency, i.e. the price of energy foregone, on the basis of the projected source mix in line with the climate and energy objectives and the technical limits of the interconnections of the national and pan-European grids.

In the event of the establishment of a national standard of reliability of supply (following the application of the capacity mechanism) in accordance with the European legislation in force, Slovakia may in the future establish or update the strategic objectives of ensuring the adequacy of the electricity system and the flexibility of the energy system in relation to RES production in accordance with the climate and energy objectives or ensuring that the system has sufficient import capacity (in this case, account must be taken of the risk of underperformance in the surrounding systems and of the interest in ensuring an adequate level of security of supply in its own territory).

The measures taken by the PS operator to ensure the adequacy of the electricity system in terms of increasing PSP availability in recent years have tended to search for reserves that can be activated by adjusting the rules for the provision of PSPs (enabling aggregation, enabling the provision of FCR from battery systems, lowering the minimum value for TRV3MIN± service providers). The modification of the rules is perceived from a number of perspectives by the PSO operator. One of these is the economically efficient provision of the PSF volumes targeted by the "Strategy for ensuring sufficient 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, the risk-sharing by procuring the availability of PSP in multi-day tenders (annual and monthly tenders) is complemented by the daily purchase of the IPs. The result is to ensure a high level of security and reliability of the system while achieving economic benefits. The review of the Strategy is carried out at a frequency of one year.

Another aspect is the introduction of important changes resulting from European legislation, namely Regulation (EU) 2019/943 of the European Parliament and of the Council on the internal market for electricity, as part of the harmonisation of the rules for organising daily tendering procedures for the procurement of ancillary services.

As of 1 January 2022, SEPS proceeded to modify the parameters of the balancing electricity products and the balancing capacity of PSPs and to harmonise the RDP product nomenclature on FCR, SRV+/SRV- on aFRR+/aFRR- and TRV+/TRV- to mFRR+/mFRR-. The amendment was applied based on the requirements of Commission Regulation (EU) 2017/2195 establishing a guideline on electricity balancing ('the EBGL Regulation') and the resulting implementation frameworks for the implementation of 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 balancing capacity' published on SEPS's website.

Product standardisation is linked to SEPS's preparation to connect to frequency restoration reserve exchange platforms:

- 1 June 2024 – to PICASSO (exchange of reserves aFRR)
- 24 July 2024 – to MARI (exchange of mFRR reserves)

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

Another important step that should contribute to the introduction of a competitive environment in the PSP market is also the planned entry of decentral sources of flexibility into the market for PSPs, so-called aggregators. The issue of aggregation is addressed in the PIAF (Pilot of Flexibility for Support Services) project, which has as its main objective:

- test the concept of aggregation of the flexibility of decentralised facilities for the provision of ancillary services to the transmission system operator;
- identify legislative barriers to the development of this concept;
- propose possible modifications to energy legislation.

In the area of support services in development years after joining international platforms, there will be an increasing focus on the **flexibility of the resource base**, in particular in relation to the achievement of the F55 and REpowerEU decarbonisation targets. Among other things, the connection of sources of electricity in the form of photovoltaic and wind power sources with varying climate-dependent operation, which, in the case of higher installed capacities, may cause deviations between the planned and actual Slovakia's balance sheets, which will need to be regulated, fall within the scope of these objectives.

Until next generation nuclear sources (new nuclear source in Jaslovské Bohunice and SMR) are integrated into the energy system, CCGs will play an important role in ensuring:

(a) electricity system flexibility (fast start-up capability);
(b) security of supply (no wind and sunshine);
(C) secure system operation (switch sources ensuring sufficient inertia).

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

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

v. Where applicable, national objectives to protect energy consumers and improve the competitiveness of the retail 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 electricity market, including **provisions relating to consumer protection** (Articles 4, 10, 11, 12, 14, 18 and Annex I to the recast EP and Council Directive (EU) 2019/944) and provisions relating to the application of state intervention in the price setting of supply on the retail electricity market (Article 5 of the recast EP and Council Directive (EU) 2019/944).

The amendment to Act No 250/2012 on the regulation of 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 electricity (and gas) retail prices;
- consumer protection for electricity (and gas).

Changes to consumer protection legislation by amending Act No 251/2012 on energy by Act No 256/2022 Coll. of 22 June 2022 also relate to the new rules on the regulation of retail prices for the supply of electricity and gas (which was the subject of a separate amendment to Act No 250/2022 on the regulation of network industries by Act No 85/2022 Coll.), with an emphasis on the free choice of supplier/aggregator, the right to change supplier/aggregator and rules on fees associated with it, rights for collective switching of suppliers, legal enactment of a dynamic comparison tool for suppliers' offers, rules on the content and formalities of invoices and billing information, the right to change supplier/aggregator and rules on out-of-court settlement.

Changes in retail price regulation in the electricity (and gas) market **responded to the surge in prices on wholesale electricity/gas markets in late 2021 and early 2022,** while the initial proposal for new legislation 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 proposed, allowing for the coexistence of regulated and unregulated (market) prices/products (applicable from 1 January 2023) with equal access to electricity and gas supply.

2.4.4. Energy poverty

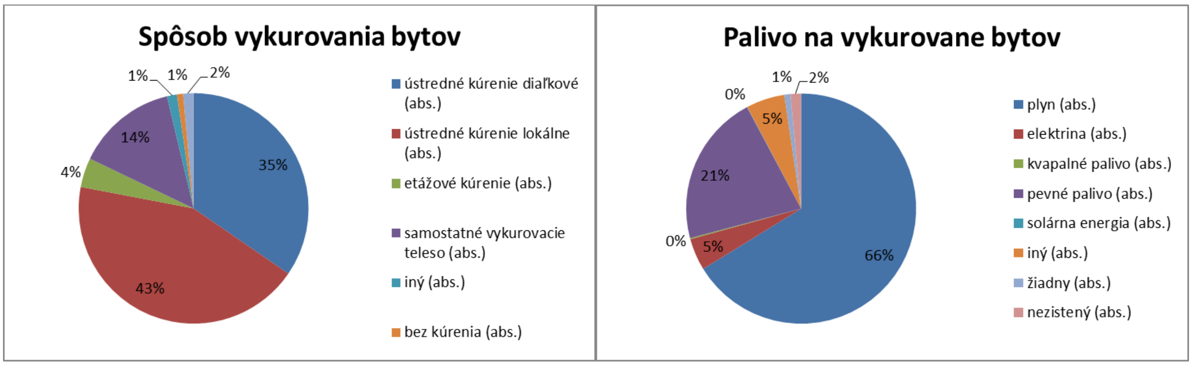
The foundations for addressing energy poverty from the point of view of the energy sector are laid down in the legal acts relating to the internal electricity and gas market, in which the European Union has imposed an obligation on Member States to take measures to protect final customers and, in particular, to ensure that there are sufficient safeguards to protect vulnerable customers.

In this context, each Member State, including the Slovak Republic, has to develop a concept for the protection of customers who can be considered at risk of energy poverty.

Energy poverty goes well beyond the energy sector and inter-ministerial cooperation is essential to effectively tackle it. The same conclusions were also adopted by the European Commission in its Recommendation (EU) 2020/1563 of 14 October 2020 on energy poverty (the 'Recommendation on Energy Poverty'), where in point 4 it specifically recommended EU Member States to "develop integrated policy solutions as part of energy and social policy, in line with the rationale of the recast Electricity Directive. These could include social policy measures and energy efficiency improvements that reinforce each other, especially in the area of housing."

There is a close, causal link between energy and income poverty. Energy poverty is often a consequence and part of income poverty, as in Slovakia the availability of the necessary quantities of energy and water is primarily a matter of household finances and not of physical lack of energy and water. Over 99 % of households are connected to electricity, more than 66 % consume natural gas, and both are also used for heating and hot water production. More than a third of households heat their homes with heat taken from district heating systems. A larger proportion of households feed wood and solid fuels. Public water systems are connected in the order of 90 % of households and two thirds of them have access to public sewerage facilities.

Figure 1 Housing heating 2021



Source: JOBD 2021

Source: JOBD 2021

Individuals' income plays a key role in defining the criteria for the definition of energy poverty, as well as in addressing energy poverty and reducing the number of energy and water customers at risk of energy poverty. When addressing energy poverty, it is also necessary to address the reasons for energy poverty, which can be several, not only low income, but also housing costs, wasteful use of energy resources, poor housing quality and, ultimately, energy inaccessibility for a certain part of the population due to illegal housing or the unavailability of energy sources. Standard settings also play an important role, for example when it comes to household consumption thresholds.

There are different perspectives and views on the topics of targeting and advocacy for low-income groups. Support for households at risk of energy poverty is intended to be a complementary, not dominant, instrument of the State's social policy. It is therefore necessary to address possible distressed social assistance needs, at least through existing instruments, while at the same time building a system of support for energy poor households based on relevant data and expert analysis. In particular, the effect of the State's instruments to protect against energy poverty is to prevent situations where households are at risk of energy poverty at all.

The Slovak Republic has adopted national programmes and strategies which also address the challenges of energy poverty, even though they do not yet define directly the criteria for assessing the risk of energy poverty, nor do they contain targeted instruments specifically applied to categories of households meeting such a definition.

These include, in particular:

- National Reform Programme (NRP) – a document providing a comprehensive overview of the measures implemented and planned in which Slovakia responds to the specific recommendations of the Council of the European Union to Slovakia (CSR) and also serves as a communication tool for the achievement of the objectives of the 2030 Agenda for Sustainable Development (2030 Agenda) and the European Pillar of Social Rights (EPSR), thus replacing the Europe 2020 flagship strategy in the past decade.
- National Employment Strategy of the Slovak Republic until 2020 – a cross-departmental document which, with the contribution of social partners, local governments and civil society, identified mechanisms supporting employment development,
- 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 Europe 2020 objectives and in relation to the European Pillar of Social Rights

- Networking and development of public employment services.

However, in order to tackle energy poverty effectively, it is necessary to properly define energy poverty, to set appropriate indicators for monitoring and evaluating it and to select instruments to mitigate it. These instruments do not only concern the energy sector, but are a complex area including, in particular, the social policy of the State and other public policies in the fields of education, economy, housing and the environment. Given that there is no standard definition of energy poverty at European level, it is up to the Member States to develop their own criteria on the basis of their individual national context.

The issue of protecting consumers against energy poverty is a topic that has not been comprehensively embraced by national administrations in the past. For example, while the Office for the Regulation of Network Industries (ÚRSO) drew up a draft concept in 2019-2020 to protect customers meeting the conditions of energy poverty and submitted it to the Government of the Slovak Republic, the material was not discussed.

At the end of 2022, the ÚRSO drafted a new draft concept for the protection of customers meeting the conditions of energy poverty, which was subsequently discussed and adopted by the Slovak Government. The Blueprint includes a proposal for a future definition methodology. At the same time, the Government recommended that ÚRSO's energy regulator set up a cross-ministerial working group with the task of drawing up a proposal for a specific definition and drawing up a proposal for the implementation of measures suitable for implementation. In March 2023, ÚRSO created a cross-ministerial group composed of relevant central government bodies, including social and family affairs, finance, the economy, and the environment.

The concept aims at defining a draft methodology for the definition of energy poverty, including a proposal for qualification criteria, as well as a proposal for a recommended framework of possible measures to protect and reduce the number of energy consumers (electricity, gas, water and heat) at risk of energy poverty and a proposal for instruments to protect these household energy consumers from energy poverty in the Slovak Republic.

Proposed methodology for future definition:

A household is at risk of energy poverty if, after subtracting its total energy and water costs from the total disposable household income, the financial resources of the household remain available at a specified level, for example against the universally accepted minimum subsistence value. In addition, a baseline energy standard (threshold energy and water consumption) may also be taken into account in the future when assessing the total cost of a household, and the future setting of this value should act as an incentive to adjust consumption habits in order to incentivise households to use energy and water more economically.

The proposed definition takes into account the level of monthly income and the level of monthly energy and water costs, in accordance with the definition of energy poverty in Section 2(n) of the Regulation Act No 250/2012. Taking into account the level of minimum subsistence income is recommended under Act No 601/2003 on minimum living wages and amending certain acts, according to which in the Slovak Republic the level of the minimum subsistence income is set as a socially recognised minimum income threshold of a natural person below which a material need exists. The recommended definition also reflects the conclusions of the STEP (Solutions to tackle energy poverty) project implemented in selected EU countries to identify appropriate approaches to defining and addressing energy poverty.

A definition of energy poverty and some specific measures are also being prepared in the framework of the proposal for an Energy Efficiency Directive as part of the Fit for 55 package.

Therefore, the development of the definition should take into account the requirements of the definition in the proposed Energy Efficiency Directive. The likely wording of this definition is as follows:

'energy poverty' means a household's lack of access to essential energy services that provide basic levels and decent standards of life and health, including adequate heating, hot water, cooling, lighting and electricity 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 financial unavailability, insufficient disposable income, high energy expenditure and low energy efficiency in houses**.

2.5. Dimension: research, innovation and competitiveness

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

In the context of the EU energy system and the gradual increase in the share of renewables, research on increasing the performance flexibility of nuclear installations currently in operation, on the possibilities of using spent nuclear fuel, on the safe storage of spent nuclear fuel and on the analysis of advanced nuclear fuel types are required. It is necessary 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 energy supply in changing conditions for the operation of energy systems, integrating RES into distribution networks and involving active customers, help achieve this strategic objective in line with the 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 energy R & D are in line with the document "Research and Innovation Strategy for Smart Specialisation of the Slovak Republic"(2013).

R & D in this area will focus on new and renewable, environmentally friendly energy sources, 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 RES electricity and heat recovery technologies (water, sun, wind, biomass and geothermal energy);
- development of energy storage and energy conversion technologies (POWER to X) for sector coupling;
- research in nuclear energy with a focus on safety and spent fuel disposal;
- research on fourth generation reactors and nuclear fusion issues (participation of the Slovak Republic in the global ITER and DEMO projects);
- development of new energy transmission systems (power cables without dispersed electric and magnetic fields);
- development of technologies to increase energy efficiency and reduce energy intensity.

One of the key objectives of the strategy is that vocational training responds to the needs of the economy.
and to produce more workforce with the skills needed to address scientific and economic challenges. It is therefore proposed to adopt a specific set of actions targeting human resources across this ecosystem. In nuclear energy, the implementation of the project of a new nuclear source and small modular reactors (SMRs) will require strong engineering support and expertise for their construction, so it would be appropriate to create the conditions for increasing the number of expertise through cooperation with Slovak universities and in close coordination with the corporate sector.

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

The promotion of clean technologies by 2050 is undergoing processing.

III. Where applicable, national objectives with regard to competitiveness

The aim is to reduce the costs of highly energy-intensive businesses in relation to payments in the electricity price used to finance support for the production of electricity from renewable sources.

The aim of the compensation is to reduce the costs of electricity-intensive undertakings due to high payments at the price of electricity.

Under Section 6a(1)(a) of Act No 309/2009 and Annex 1 to the Ministry's Decree, compensation may be granted to an authorised legal person or a natural person who is an entrepreneur who meets the criteria laid down in that legislative framework.

Undertakings meeting the legal criteria and falling within the list of eligible industries may apply to the Ministry of the Economy for compensation for the tariff for operating the system (TPS).

The granting of compensation for the tariff for the operation of the system to eligible energy-intensive undertakings is subject to the notification process and the aid itself, the grant of funding, takes place after the European Commission has issued a decision confirming the compliance of the measure with the relevant State aid rules.

By reimbursing part of the charges, the Ministry of Economic Affairs seeks to reduce the costs of electricity-intensive businesses because of high payments at the price of electricity. Compensation has been requested from undertakings active, for example, in the steel and steel sectors, various metals, paper mills, cement plants, plastics, dyes, refined petroleum products, etc.

The amount available to the Ministry of Economic Affairs for this purpose is divided into the total amount of supported electricity found after the aggregation of all applications from undertakings that meet the criteria laid down. These include, in particular, annual electricity consumption above 1 GWh, a share of gross value added from eligible activities of at least 50 % of the total value of the undertaking, proper payment of TPS, etc.

3. POLICIES AND MEASURES

3.1. Dimension: decarbonisation

3.1.1. GHG emissions and removals

*I. Policies and measures to achieve the target set out in Regulation **(EU) 2018/842, as** referred to in point 2.1.1, and policies and measures to comply with Regulation **(EU) 2018/841, covering** all key emitting sectors and sectors to scale up removals, towards a long-term vision and goal 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 base year 2016. It describes existing and planned measures.

Cross-sectoral policies and measures:

Policies and measures	**script**	**Gas/Category**	**measure**
The European Emissions Trading System (EU ETS) established by Directive 2003/87/EC, as amended and transposed by Act No 414/2012 on emission allowance trading and amending certain acts	WEM/WAM	Co_2, $CH_{4,}$ N_2O, HFC, PFC and$_{SF}$ 6/Regulatory measure	The EU ETS is an essential tool for cost-effective reduction of greenhouse gas emissions in industry, energy and aviation. The EU ETS is a market-based instrument based on the principle of cap and trading with a continuously reduced annual cap on the volume of emissions allowed. Within this limit, participants in the scheme may buy and sell allowances through the auctioning system as appropriate. The EU ETS is an economic and regulatory measure with a high positive impact on greenhouse gas emission reductions and stimulates the use of biomass in the fuel mix and drives technological innovation.
Effort-sharing legislation as laid down in Regulation (EU) 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	WEM/WAM	Co_2, $CH_{4,}$ N_2O and Perfluorocarbons (PFCs)/regulatory measure	The Effort Sharing Decision sets annual greenhouse gas emission limits for Member States for the period 2013-2020, which are legally binding and cover only greenhouse gas emissions that are not part of the scope of the EU ETS, i.e. small energy and industry outside the EU ETS, transport (excluding aviation), buildings, agriculture and waste. Each Member State must define and implement national policies and measures to reduce emissions in these sectors, such as the promotion of public transport, energy performance standards for buildings, and

Paris Agreement and the forthcoming Climate Law implementing Slovakia's commitment			biogas, measures in agricultural waste management.
Integrated National Energy and Climate Plan 2021-2030 (NECP) adopted by Government Resolution 606/2019	WEM/WAM	Co_2, CH_4 and N_2O/regulatory measure	based on existing or being prepared strategic multi-sectorial materials, conceptual material sets the framework for the implementation of legislative and non-legislative measures aimed at climate protection and sustainable energy in the long term.
Policy on the use of biofuels as amended by Directive 2009/28/EC of the European Parliament and of the Council and Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources as transposed by Act No 309/2009 on the promotion of renewable energy sources and high-efficiency cogeneration and amending certain acts, as amended	WEM/WAM	Co_2, CH_4 and N_2O/regulatory measure	—establishes a regulatory framework for the promotion of the use of energy from renewable sources
Taxation of energy products and electricity	WEM/WAM	Co_2, CH_4 and N_2O/regulatory measure	The most important in relation to the generation of tax revenue is the tax on mineral oils. Electricity, coal and natural gas revenues are relatively low.

The national emission ceilings laid down in Directive 2001/81/EC on national emission ceilings and the revised Directive 2016/2284 are transposed by Act No 146/2023 Coll. on air protection and amending certain acts and Decrees, which are further to that Act and supplemented by Act No 190/2023 Coll. on air pollution charges	WEM/WAM	air pollutants: NOx, SO2, NMVOC, NH3, PM2,5 and CH4/regulatory measure	Its main objective is to reduce the adverse health impacts of air pollution, including reducing the number of premature deaths caused by air pollution by more than half per year.
National emission reduction programme following Directive 2016/2284	WEM/WAM	air pollutants: NOx, SO2, NMVOC, NH3, PM2,5/regulatory measure	it contains policies and measures to achieve the national commitments in two stages, between 2020 and 2029 and for the post-2030 period. 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 established in other relevant policy areas, including climate, energy, agriculture, industry and transport. It will also support the transfer of investments to clean and efficient technologies.

(a) Sectoral policies and measures in the field of energy – In addition to legislative instruments on greenhouse gas emission allowance trading, Act No 146/2023 Coll. 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 a significant role. This Act is supplemented by Act No 190/2023 on air pollution charges, which serves as an economic tool for reducing emissions.

The policies and measures used in the energy sector were taken from the low-carbon strategy of the Slovak Republic (NUS SR)15, the National Pollutant Emission Reduction Programme16 and the Slovak Recovery Plan17. The Wem scenario includes the following policies and measures at EU level and related national measures.

[15] https://www.minzp.sk/klima/nizkouhlikova-strategia

[16]https://www.minzp.sk/ovzdusie/ochrana-ovzdusia/narodne-zavazky-znizovania-emisii/narodny-program-znizovania-emisii/.

[17] https://www.planobnovy.sk/kompletny-plan-obnovy/zelena-ekonomika

Policies and measures	script	Gas/Category	measure
The Ecodesign Framework Directive transposed by Act 529/2010 on the environmental design and use of products (Ecodesign Act)	WEM	CO2/regulatory and economical in force since 2005	It lays down ecodesign requirements for energy-using products governed by Framework Directive 2009/125/EC recasting Directive 2005/32/EC, as amended by Directive 2008/28/EC. Implementing regulations cover a wide range of products, including heaters, vacuum cleaners, computers, air conditioners, dishwashers, lighting products, refrigerators and freezers, televisions and electric motors.
Energy Labelling Directive (Directive 2010/30/EU) transposed by Act No 182/2011 on the labelling of energy-related products and amending certain acts	WEM	CO2/regulatory and economical validity since 2011	It provides a framework for the harmonisation of national measures concerning end-user information, in particular by means of labelling and standard product information, on the consumption of energy and, where appropriate, other essential resources during use, as well as supplementary information relating to energy-related products, thereby enabling end-users to choose more efficient products. The Directive applies to energy-related products which have a so-called 'significant direct or indirect impact on energy consumption'. It shall also apply, as appropriate, to other essential resources during use.
Directive on the energy performance of buildings (2010/31/EU) transposed by Act No 300/2012 amending Act No 555/2005 on the energy performance of buildings and amending certain acts, as amended, and amending Act No 50/1976 on spatial planning and building codes.	WEM	CO2/regulatory applicable from 2012	This Directive promotes the improvement of the energy performance of buildings, taking into account outdoor climatic and local conditions, as well as indoor environmental requirements and cost-effectiveness.

energy Efficiency Directive (Directive 2012/27/EU) transposed by Act No 321/2014 on energy efficiency and amending certain acts	WEM	CO2/regulatory applicable from 2012	Energy efficiency is a key area of action, without which the full decarbonisation of the Union economy cannot be achieved. The Energy Efficiency Directive has led to the Union's current energy efficiency policy to capture the cost-effective energy saving opportunities. In December 2018, the Energy Efficiency Directive was amended as part of the 'Clean Energy for All Europeans package', in particular to include a new headline 2030 Union energy efficiency target of at least 32.5 % (compared to projected energy use in 2030), and to extend and strengthen the energy savings obligation beyond 2020.
Directive 2009/73/EC, Directive 2009/72/EC, Regulation (EC) 715/2009, Regulation (EC) 714/2009	WEM	CO2/regulatory applicable from 2009	European legislation covers in particular the establishment of the internal energy market, including the provisions of the 3 rd package for the EU internal market, consisting of Directive 2009/72/EC (Article 4) and Directive 2005/89/EC (Article 7). In the gas sector, a number of measures are expected to be implemented in the context of strengthening the internal gas market, such as: enable and facilitate a liquid and competitive internal gas market environment, enable and enhance diversification of routes and sources, thereby enhancing the security of natural gas supply through increased flexibility of the gas network, contribute to improving sustainable development in Europe, as natural gas plays a key role in the European Union's energy mix, in particular with regard to economic development and environmental protection.

Directive on the promotion of the use of energy from renewable sources, Renewable Energy Directive – including the ILUC amendment (Directive 2009/28 EC as amended by Directive (EU) 2015/1513) transposed by Act No 309/2009 on the promotion of renewable energy sources and high-efficiency cogeneration, as amended	WEM	CO2/regulatory applicable from 2009	It addresses the use of renewable energy.
“Clean energy for all Europeans”	WEM	CO2/regulatory and economical validity since 2016	Implementation by the Commission of an EU target of 27 % share of renewable energy sources (RES) in total consumption by 2030, based on the proposal for the Clean Energy for All Europeans package presented by the European Commission in November 2016. Modelling did not take into account the fact that a substantially more ambitious EU target was finally adopted in December 2018 (32 %).
National Renewable Energy Action Plan, Slovak Government Resolution No 677/2010	WEM	CO2/regulatory and economical validity since 2011	The impact of renewable energy sources in heat and electricity generation. Increasing the share of electricity production from renewable energy sources in the energy system. Increase in biomass consumption for electricity and heat production.
Increasing energy efficiency with a number of measures in force since 2014 on the energy consumption side, according to which energy savings translate into a reduction in final energy consumption	WEM	CO2/regulatory and economical in force since 2014	These measures are broken down by sector (buildings, industry, public sector, transport and appliances). In the buildings sector, this is mainly about improving the thermal performance of buildings by implementing cost-effective deep renovations. Legislation and amendments to national technical standards after 2012 introduced conditions for a gradual tightening of energy performance requirements for new and substantially renovated buildings, which are regularly reviewed. Measures in the buildings sector represent the most important source of potential energy savings by 2030.

Optimisation of district heating systems	WEM	CO2/regulatory and economical in force since 2015	Switch from fossil fuels to biomass and natural gas and installation of cogeneration units with combined heat and power (CHP) into district heating systems. Industrial cogeneration plants produce industrial steam, which can also be used for district heating and is a secondary use of industrial steam. Other measures (e.g. improving the efficiency of district heating systems (CZT), installation of innovative technologies for district heating, improving heat supply from combined heat and power plants) are also taken into account.
Closure of solid fuel heating plants	WEM	CO2/regulatory and economical in force since 2015	Phasing out solid fuel heating plants from 2025

The specification of the NUS SR WAM scenario depends on the design logic of the EU scenarios and, in particular[18], on the EUCO3030 scenario, which sets the EU 2030 energy efficiency target of 30 %.

The WAM scenario includes all the measures from the WEM scenario named in the NUSSR, and also contains measures and more ambitious targets for RES and EE, ambitious plans for the new Commission under the Green Deal[19].

Policies and measures	**script**	**Gas/Category**	**measure**
Slovakia's low-carbon development strategy for 2030 with a 2050 perspective (NUS)	WAM	Co_2, CH_4 and N_2O/regulatory and economic measure in force since 2020	Through modelling, the Nus SR sets a national RES target of 18.91 %, the national target for ESR is -20 % and the national target for primary energy efficiency savings has been set at -28.36 % in the model.
Increase in carbon prices in the EU ETS after 2020	WAM	Co_2/economically valid from 2020	The carbon price of the EU ETS affects the energy sector as well as energy-intensive industries and is the main driver of emission reductions. Electricity producers will have to respond to the pressure from rising emission allowances prices to facilitate their own transition from coal to other low-emission to non-emission sources.

[18]http://www.e3mlab.eu/e3mlab/index.php?option=com_content&view=article&id=532%3Aeuco-scenarios&catid=1%3Alatest-news&Itemid=82&lang=en

[19] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal#documents.

Early decommissioning of solid fuel power plants	WAM	Co2/Economic Estimated after 2023	The decommissioning of Vojany and Nováky is foreseen in 2025 and 2023 respectively.
Decarbonisation of electricity generation after 2020 thanks to RES and the development of nuclear energy	WAM	Co2/Economic Estimated after 2022	The decarbonisation of electricity generation is achieved through renewables. Eligible renewable energy technologies include photovoltaic, solar, wind turbine and biomass.
Support scheme for renewable energy sources	WAM	Co2/Economic Estimated after 2022	They are RES support schemes for electricity generation with foreseen RES technologies such as solar photovoltaics, onshore wind turbines, biogas/biomethane and biomass. The scenarios foresee 50 MW support in the period 2021-2025, followed by an additional 500 MW based on auctions.
Increasing the share of nuclear energy in the Slovak energy mix	WAM	CO_2/Regulatory and Economic Estimated after 2023-2035	This increase in the medium term (2020-2025) will be mainly due to the operationalisation of two new nuclear reactors at the Atomic power plants Mochovce. One new Mochovce unit will be 471 MWe (up to 535 MW in the future) and one reactor will thus cover 13 % of electricity consumption in Slovakia. The new units will replace the capacity shortfall of the new lignite-fired power plant, which will only be operational until the end of 2023, as well as the negative balance of Slovakia in the import/export of electricity. Slovakia will thus become once again self-sufficient in the country's electricity supply and will also be prepared for increased electricity consumption in the future, which will come with the development of electro-mobility.
Continued reduction in final energy consumption in all sectors after 2020	WAM	Co2/Regulatory and Economic Estimated after 2022	The measure puts emphasis on policies supporting accelerating the renovation of the building stock (both residential and non-residential, public and private), with a focus on delivering cost-effective deep renovations and applying minimum energy

			performance requirements for nearly zero-energy buildings after 2020 for new buildings. Most of the above measures were applied at the level of the Compact Primes for Slovakia[20] (CPS) model, from which energy consumption trends or other parameters for emission modelling in the TIMES model were taken over[21].
Assessment of the future structure of appliances used for domestic heating on the basis of statistical survey data	WAM	$Co_{2/Regulatory}$and Economic Estimated after 2022	The SHMÚ, in cooperation with the Statistical Office of the Slovak Republic, carries out a statistical survey aimed at producing quantitative data on sources, the use of thermal energy in households (family houses) with individual heating, as well as equipment used for heating and heating, such as boilers, fires, stoves, stoves and stoves, as well as information on the consumption of, in particular, solid fuels.
Green Households II	WAM	$Co_{2/Regulatory}$and Economic Estimated after 2015	National Green Households projects are prepared under the Operational Programme Quality of the Environment, managed by the Ministry of the Environment of the Slovak Republic. This is the second stage of support for the use of small renewable resources in family and multi-apartment buildings with a budget of EUR 48 million. The project aims to increase the share of RES use in households and the related reduction of greenhouse gas emissions. The project supports the promotion of the replacement of old solid fuel heating appliances (boilers) in households with low-emission systems. The project should help to revitalise the market environment for domestic renewable energy installations. It should also contribute to improving the information and practice of installers of RES equipment and to increasing interest in studying related fields.

[20] https://www.minzp.sk/klima/nizkouhlikova-strategia; Integrated National Energy and Climate Plan for 2021 to 2030 for Slovakia,' 2019. [Online]: https://ec.europa.eu/energy/sites/ener/files/sk_final_necp_main_en.pdf.

[21] https://iea-etsap.org/index.php/etsap-tools/model-generators/times

Recovery and resilience plan – 'House recovery' project	WAM	CO_2, CO, NO, NO_2, PM_{10}, $PM_{2,5}$, CO, NMVOC/regulatory and economic validity as of 2022	It represents a long-term renovation programme for single-family houses financed through the Recovery Plan. The programme aims to rebuild at least 30000 single-family houses by June 2026. Support through this project focuses on the already implemented renovations of single-family houses built before, 2013. The investment is aimed at owners of older single-family houses, allowing the financing of traditional energy saving measures (e.g. thermal insulation, replacement of windows, replacement of inefficient heat sources or installation of new installations using RES) and measures to promote adaptation to climate change (e.g. green roofs). The applicant shall prove that the energy savings of at least 30 % have been met. In order to mobilise a comprehensive and green recovery, the scheme includes a combination of mandatory and optional parts. Energy savings achieved in the renovation of single-family houses will be verified mainly through energy performance certificates.
Awareness raising and education on good practices in coal and biomass combustion – LIFE IP – Improving air quality (Populair)	WAM	CO_2, CO, NO, NO_2, PM_{10}, $PM_{2,5}$, CO, NMVOC/regulatory and economic validity as of 2020	The aim of this activity is to develop and implement training programmes and information activities which, on the one hand, raise awareness among local officials and the public about the issue of air pollution, its causes and impacts; on the other hand, they will support air quality initiatives, involve the public and provide information on the support tools offered. Information activities will reach a wide audience through communication campaigns and project web platforms. In particular, educational programmes will be aimed at representatives of municipal authorities, teachers, students and pupils.

(b) Sectoral policies and measures in transport

Policies and measures	script	Gas/Category	measure
Law 277/2020 on the promotion of the use of energy from renewable sources 22	WEM	CO2/regulatory and economical validity since 2007	The Renewable Energy Act transposes Directive (EU) 2018/2001 of the European Parliament and of the Council on the promotion and use of energy from renewable sources and sets targets for minimum RES shares.
Regulation (EU) 2019/631 of the European Parliament and of the Council of 17 April 2019 setting CO2 emission performance standards for new passenger cars and for new light commercial vehicles23	WEM	CO2,CH4, N2O/regulatory valid from 2019	The Regulation contains a CO2 reduction target for passenger cars and light commercial vehicles. The emission reduction limit is 15 % by 2025 and 55 % for cars and 50 % for light commercial vehicles by 2030.
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 vehicles24	WEM	CO2,CH4, N2O/regulatory valid from 2019	The Regulation includes a CO2 reduction target for trucks of 15 % by 2025 and 31 % by 2030 compared to the reference period/July 2019-June 2020).

[22] https://www.slov-lex.sk/static/pdf/2009/309/ZZ_2009_309_20220901.pdf

[23] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019R0631

[24] https://eur-lex.europa.eu/eli/reg/2019/1242/oj

Energy efficiency 25	WEM	CO_2,CH_4, N_2O/regulatory valid from 2019	Increasing the energy efficiency of internal combustion engines and other types of propulsion is expected in the context of Regulations 2019/631 and 2019/1242 of the European Parliament.
Promotion of the sale of low-emission and emission-free vehicles26	WAM	CO_2,CH_4, N_2O/regulatory and economical as of 2023	Significant support for the sale of electric vehicles is foreseen. The support will be implemented on the basis of the Action Plan for the development of electric vehicles in the Slovak Republic.
Long-term financial mechanism to support the development of charging infrastructure for electro-mobility27	WAM	CO_2,CH_4, N_2O/regulatory and economical as of 2023	According to the Action Plan for the development of electric vehicles in the Slovak Republic and the EU proposal, recharging points along the main transport arteries are to be constructed approximately every 60 km.
Setting stricter requirements for periodic technical inspections of vehicles28	WAM	CO_2,CH_4, N_2O/Regulatory as of 2023	Stricter technical and emission checks should result in the capture and removal from transport of the oldest and non-compliant vehicles. Strict rules for technical and emission control centres are already in place, but despite these measures, circumvention of the rules is still taking place. It is envisaged to gradually reduce the effect of this

[25] https://www.minzp.sk/klima/nizkouhlikova-strategia; https://ec.europa.eu/energy/sites/ener/files/sk_final_necp_main_en.pdf

[26] https://www.mhsr.sk/uploads/files/5wuw3LIe.pdf

[27] https://www.minzp.sk/klima/nizkouhlikova-strategia

[28] https://environment.ec.europa.eu/topics/air_en.

			measure by 2050 as a result of a change in vehicle owners' behaviour and good technical maintenance and the elimination of older vehicles.
Vehicle registration fee based on emissions g CO2/km	WAM	CO2,CH4, N2O/regulatory and economical as of 2023	The introduction of a new registration fee, or a so-called 'environmental tax', takes into account the production of CO2 emissions by passenger cars.
Modal shift to public transport – Strategic Transport Development Plan 2030[29]	WAM	CO2,CH4, N2O/regulatory and economical as of 2023	The aim of the measure is to make public passenger transport (VOD) both within and between cities more attractive. There should be a preference for rail transport between cities, with the possibility of using the Park and Ride system.
Modal shift in goods transport 72	WAM	CO2,CH4, N2O/regulatory and economical as of 2025	Rail transport of goods over longer distances is to be favoured thanks to the construction of the Žilina railway terminal.
Introduction and promotion of hydrogen-powered vehicles (FCEVs) 30	WAM	CO2,CH4, N2O/regulatory and economical as of 2023	Launching support for the purchase of hydrogen-powered vehicles across all categories, but mainly in freight transport and for buses. The action is built on the EU hydrogen strategy.
Blending of biomethane with CNG and LNG 65	WAM	CO2,/regulatory and economical as of 2023	In Slovakia, this obligation will be introduced by amending Act No 309/2009 on the promotion of renewable energy sources and high-efficiency cogeneration. On the basis of the amendment, the share of biomethane will grow from 2 % to 14 % in 2030

[29]https://www.minzp.sk/klima/nizkouhlikova-strategia;
https://www.mindop.sk/index/open_file.php?file=doprava/dopinfra/program/Dokumenty/fondyeu20142020/StrategickyPlan2030/Strategicky_plan_2030.pdf

[30] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0301

(C) Sectoral policies and measures in agriculture

Policies and measures	script	Gas/Category	measure
Strategic plan Common Agricultural Policy 2023-2027 31	WAM	N2O. CH4,/regulatory and economical valid from 2023	The strategic plan sets out the rules for spending agri-subsidies between 2023 and 2027. The strategy implements measures in the form of on-farm strategy investments to reduce greenhouse gas and ammonia emissions.
Decree on the new Air Act No 146/2023 Coll.	WEM	CH3, N2O/regulatory and economical in force since 2012	Obligation to comply with measures to reduce ammonia emissions from large sources of air pollution. The measure is primarily designed to reduce ammonia but also has an impact on the reduction of N2O emissions. The projections assume compliance with insulation of slurry and manure on farms (sources of air pollution).
National emission reduction plan 32	WAM	CH4, N2O/regulatory and economic – new sources of pollution 2021, existing sources 2030	Obligation to comply with measures to reduce ammonia emissions also on medium sources of air pollution. The measure is primarily designed to reduce ammonia but also has an impact on the reduction of N2O emissions. The measure will also be implemented in the amendment to the Air Act No 146/2023 Coll. and the subsequent Decree of the Ministry of the Environment of

[31] https://www.mpsr.sk/spolocna-polnohospodarska-politika-2023-2027/462

[32] https://www.minzp.sk/files/oblasti/ovzdusie/ochrana-ovzdusia/dokumenty/strategia-ochrany-ovzdusia/vlastny-material-narodny-program-znizovania-emisii-sr_final.pdf.

			the Slovak Republic. The projections assume compliance with the insulation of slurry and manure from the surroundings at medium and large farms (air pollution sources).
Methane strategy33	WAM	CH4, N2O/regulatory and economical validity since 2015	This strategy sets out actions to reduce methane emissions in Europe and internationally. Presents legislative and non-legislative measures in the energy sector, agriculture (monitoring methane emissions at farm level, valorising agricultural waste and residues flows through anaerobic digestion, improving the quality of animal feed (innovating compound feed), feed additives and feeding techniques) and waste management, which accounts for around 95 % of human-related methane emissions worldwide.
Farm to Fork Strategy34	WAM	N2O/regulatory and economic – valid as of 2025	The strategy aims to reduce the use of pesticides, fertilisers and antibiotics in agriculture. This strategy was developed in synergy with the European Green Deal, which set itself the objective of mitigating the environmental and climate footprint of the European food system. A European target for reducing inorganic nitrogen fertilisers by 20 % compared to 2030.

[33] https://ec.europa.eu/energy/sites/ener/files/eu_methane_strategy.pdf
[34] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0381.

Code of Good Agricultural Practice[35]	WEM, WAM	CH_4, N_2O/regulatory and economical in force since 2020	The current framework code was issued on the basis of an addendum to the Gothenburg Protocol with the aim of providing recommendations on good agricultural practice in livestock farming and manure application to soil, thereby reducing ammonia emissions. This is an update of the 2001 document, reflecting new opportunities and insights. This document is intended to serve as a basis for drawing up national codes.
Low-carbon strategy[36]	WAM	CH_4, N_2O/regulatory and economical as of 2025	Efficient storage of animal waste, namely storage of liquids in insulated tanks from the surroundings or oxygen-access tanks, and storage of livestock manure in plastic films without or with minimum addition of water. Interventions in animal feeding to reduce emissions. Efficiently process animal waste and use biogas, in particular as a local energy source. Increasing the use of nitrogen fertilisers with stabilised nitrogen to the detriment of urea use.
Fit for 55[37]	WAM	CH_4, N_2O/regulatory and economical as of 2025	Reducing greenhouse gases under the Green Deal, the package also implies a Farm to Fork Strategy. Regulating and setting ambitious emission reduction targets for agriculture and related land use,

[35]https://www.minzp.sk/files/oblasti/ovzdusie/ochrana-ovzdusia/metodicke-postupy-prirucky/kodex_spravnej_polnohosp_praxe_final.pdf.

[36] https://www.minzp.sk/klima/nizkouhlikova-strategia

[37]https://www.minzp.sk/files/oblasti/politika-zmeny-klimy/oznamenie_celex-52021dc0550-sk-txt.pdf., https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

			which should include strict criteria for producing renewable energy based on biomass, reducing the consumption of inorganic fertilisers, reducing the consumption of chemical pesticides, increasing the agricultural area under organic farming system and meeting the EU's 2030 climate targets

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

2021 saw relatively numerous changes in sectoral policies and measures related to the LULUCF sector itself or policies and measures that have a more significant impact on its functioning. At EU level, this was mainly the publication of the EU Forest Strategy, as well as the revision of Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework. Progress has been made at national level in the preparation of the Slovak National Forestry Programme 2022-2030; Preparing the CAP Strategic Plan 2023-2027 or adopting an amendment to the Nature and Landscape Protection Act.

Policies and measures	**script**	**Gas/Category**	**measure**
EU Forest Strategy 2030[38]	Bau without direct mitigation potential	CO2/strategic valid from 2021-2030	It sets out a policy framework for forests for 2030 at EU level, which aims to ensure healthy and resilient forests and their multifunctional role for the benefit of European society. The strategy, which is part of the European Green Deal, proposes options for introducing different regulatory, financial and voluntary instruments that should enable the forest sector and its downstream sectors to contribute to a successful transition towards a climate-neutral economy. While primarily focusing

[38] https://data.consilium.europa.eu/doc/document/ST-13537-2021-INIT/sk/pdf.

			on the EU's forests, the Strategy recognises that forest-related challenges are inherently global and therefore also aims to strengthen the EU's contribution to global efforts to protect and restore the world's forests.
Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework 39 and revision of the Regulation	BAU	CO2/regulatory valid from 2020	The Regulation lays down EU targets for greenhouse gas emissions and removals in the LULUCF sector, as well as accounting rules for emissions and removals for the purposes of this target and the conditions and control of compliance with those targets. This Regulation is part of the implementation of the Union's commitments under the Paris Agreement on Climate Change. The Regulation is currently in the process of being revised in order to increase the contribution of the LULUCF sector at the level of the EU and its Member States to the Union's 2030 greenhouse gas emission reduction target of 55 % compared to 1990.
Rural Development Programme 2014-2020 extended to 2022 40	WEM	CO2/economically valid from 2022	The measures of the Rural Development Plan of the Slovak Republic for the period 2014-2020 provide financial support for the measures included in the WEM scenario, such as: • afforestation of non-agricultural land; • the establishment of fast-growing tree stands on agricultural land; • grassing of agricultural land; • fire abatement measures;

[39] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.156.01.0001.01.ENG

[40] https://agriculture.ec.europa.eu/common-agricultural-policy/rural-development_sk

			sustainable forest management, including restoration of forest ecosystems after natural disturbances. The duration of the programme has been extended to 2022 with the implementation of projects until 2025. Some of these measures are also included in the National Forestry Programme and Slovakia's low carbon strategy.
Rural Development Programme of the Slovak Republic 2023-2027 41	WAM	CO2/economic in preparation	A substantial part of the support to the Rural Development Plan of the Slovak Republic for the period 2023-2027 is dedicated to adaptation to climate change. The measures envisaged are intended to contribute to the CAP specific objective S04: SO4 "Contribution to climate change mitigation and adaptation, including reduction of greenhouse gas emissions and improved carbon storage as well as promotion of sustainable energies". In particular, the following measures are concerned: - protection and maintenance within an established agroforestry system; - establishment of an agroforestry system; - afforestation of agricultural land; - investments to increase the water retention function of the forest; - integrated projects for good practice of close-to-nature

[41] https://agriculture.ec.europa.eu/common-agricultural-policy/rural-development_sk

			forest management (part — non-productive investments), • integrated projects for good practice of close-to-nature forest management (part — productive investment), • projects for recovery measures in forests.
National Forestry Programme of the Slovak Republic 2022-2030[42]	WAM	CO_2/regulatory in preparation	It is a basic document of the State's forest policy and a strategic and policy instrument for the State to steer sustainable forest management. One of the strategic objectives of the National Forestry Programme is to implement adaptation measures in forests threatened by climate change. It is followed by a specific objective and measures aimed at improving the effectiveness of the implementation of forest protection measures against biotic and abiotic disturbances (in particular insect and wind bark) in the most vulnerable stands. The measures aim at slowing down the decay of Slovakia's currently most vulnerable forests (spruce and pine forests, unstable forest cover). The expected output of the measures is a steady annual volume of calamity harvesting in forests 30 % lower than the 2030 forecast for the zero variant (without action) or a reduction from a balanced culmination of 5,5 million m^3 in 2020 to 4.4 million m^3 in 2030. However, the expected reduction in the volume of calamity mining depends on the future support and timely implementation of these

[42] https://www.mpsr.sk/aktualne/sme-o-krok-blizsie-k-finalnej-verzii-narodneho-lesnickeho-programu-na-roky-2022-2030/16990/

			measures. In case of insufficient support or other obstacles to the timely implementation of the measures, there is a high expectation that these results will not be achieved.
Incentivising forest managers to bring the target plants of the future climate into crops where natural restoration cannot be expected	WAM	CO2/regulatory in preparation	The measure is part of the objective of adjusting the tree composition in order to make crops more resilient to drought and reduce vulnerability to biotic and abiotic agents. It should be targeted to promote (1) the introduction of beech and food into endangered and decaying spruceres, (2) the introduction of summer oak and winter oak into pine stands, play, agata, Cera and other plants in lowland and submounting levels, and (3) the introduction of an appropriate admixture of suitable valuable leaf leaves. The objective also includes the creation of conditions for the preservation of the forest tree gene pool and its use in assisted migration, the integration of Slovakia's forest adaptation models to climate change (NLC, 2019), alternative forest management models – outputs of the ALTERFOR project (TUZVO) and other available knowledge on the role and usability of pre-plant plants (breed, seed, crayfish, partridge) in calamity shavings. Maintaining vital forests by limiting the negative impacts of climate change on forests through forest adaptation measures (promote the use of alternative management models for the purpose of adjusting woodland composition, using appropriate provenances) is also included in the National Forestry

			Programme and Slovakia's low-carbon strategy.
Motivating forest managers to start a process of transition to close-to-nature forms of forest management	WAM	CO2/regulatory in preparation	The measures stem from another NLP strategic objective, such as the introduction of close-to-nature forms of forest management (Strategic Goal II), which can also be expected to have higher crop reserves of biomass and hence of carbon embedded in forests. The measure is intended to encourage forest managers to initiate a relatively complex and long-term process of forest transition to close-to-nature forests, at least ¼ of Slovakia's forest areas, for which a transitional increase in both operational and overhead costs is foreseen, especially at the outset.
Expansion of areas under strict protection	WAM	CO2/regulatory in preparation	This is a measure resulting from the adopted amendment to Act No 356/2019 of 11 September 2019 amending Act No 543/2002 on nature and landscape protection, as amended, and amending certain acts[43]. Extension without intervention regime to 75 % of national parks by 2030, i.e. an increase of around 130 thousand ha compared to the current situation. A temporary increase in sinks in these forests is expected. However, the effect of this measure will decrease over time. At the same time, the modelled quantification does not include the effects of natural disturbances in these forests, where active management will not be

[43] https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2019/356/vyhlasene_znenie.html

			carried out to protect them against biotic and abiotic disturbances, which can significantly affect the stability of the carbon sinks thus achieved before and after 2030 in those forests.
Transfers of unused agricultural land to forest land	WAM	CO2/regulatory in preparation	Increase forest area by clearing and including ‘white’ areas in forest plots in the range of 100 ha by 2030. It is apparent from a number of strategic documents – both the National Forestry Programme and the 2030 Environmental Policy Strategy of the Slovak Republic[44]
Increasing the share of long-lived timber products (HWPs), including for construction purposes	WAM	CO2/regulatory in preparation	The measure stems from the Slovak Republic’s low-carbon development strategy[45]. The more efficient use of products based on circular bio-economy principles is also part of the forthcoming National Forestry Programme of the Slovak Republic 2022.
Implementation of measures aimed at increasing carbon sequestration in agricultural soils and maintaining high levels of organic carbon in carbon-rich soils.	WAM	CO2/regulatory in preparation	The measure stems from the Slovak Republic’s low-carbon development strategy.
Maintenance and restoration of grassland.	WAM	CO2/regulatory in preparation	The measure stems from the Slovak Republic’s low-carbon development strategy.

[44] https://www.minzp.sk/files/iep/03_vlastny_material_envirostrategia2030_def.pdf.

[45] https://www.minzp.sk/klima/nizkouhlikova-strategia/

(e) Sectoral policies and measures in waste management

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

The waste management sector consists of the following categories:

- 5.A Storage of solid wastes
- 5.B Biological treatment of solid wastes
- 5.C Combustion of waste in incineration plants and non-controlled incineration of waste
- 5.D Wastewater treatment

The most common disposal methods are landfills and, to a lesser extent, incineration. When waste from landfills is broken down, 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 method of waste management in the Slovak Republic. This energy was often not used in the past and waste was only disposed of. Modern waste energy installations (ZEVOs) currently use waste as a fuel to generate energy, and heat and waste are thus recovered. In this case, emissions resulting from combustion are classified in the energy sector. Waste incineration at us makes a minimal contribution to the amount of dioxins and furans (PCDD/PCDFs) discharged into the atmosphere. Waste incineration also generates high emissions of heavy metals. Modern waste incineration plants (ZEVO) effectively capture these substances.

Recycling of waste is not the only sustainable way to recover waste. One of these is the composting of any organic waste, such as food and garden waste. Organic waste decomposes within a few weeks into mulch, which can be used as a fertiliser for the soil. Many households practise small-scale composting and large-scale composting systems are also being developed to collect organic waste from parks and civic amenities. Similar types of organic waste can also be treated in biogas stations. Unlike composting, waste decomposes anaerobically (without air access) and generates biogas that can be further incinerated to generate energy that can be further used for heating.

This sector also includes cremation of human and animal remains, which are also a source of air pollution by emissions of heavy metals and POPs.

The management of waste water also results in the release of pollutants and greenhouse gases (CH_4 and N_2O). In general, POPs as well as NMVOC, CO and NH_3 emissions occur in waste water treatment plants, but in most cases these are negligible amounts.

Policies and measures	**script**	**Gas/Category**	**measure**
Act No 79/2015 on waste and amending	WEM, WAM	CO_2,CH_4, N_2O/regulatory	This Act places emphasis on the sorting of packaging and recyclable

certain acts, as amended46		and economical validity since 2015	materials. The scheme for financing separate collection from the State Recycling Fund to the Producer Responsibility Organisation is also amended. Waste disposal is allowed only in authorised managed landfills). This law prohibits the disposal of garden waste, biodegradable waste through landfilling and incineration, and requires separate collection of kitchen waste. The law aims, in particular, to reduce the amount of waste that is disposed of through landfilling, to treat and focus on waste prevention, to minimise the negative impacts of the generation and management of waste on the environment and human health, to introduce and implement extended responsibility for producers and importers in the normal way in other Member States of the European Union and to translate it into municipal level.
Waste Management Plan of the Slovak Republic 2021-202547	WEM, WAM	CO2,CH4, N2O/regulatory and economical as of 2021	The main objective of waste management in the Slovak Republic for the period 2021-2025 is to divert waste away from landfilling, in particular for municipal waste, to increase recycling together with improved separate collection and to introduce and increase reuse. it includes a number of key objectives related to climate change mitigation: Increase the separate collection of municipal waste to 60 % by 2025 and the preparing for re-use and recycling rates for municipal

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

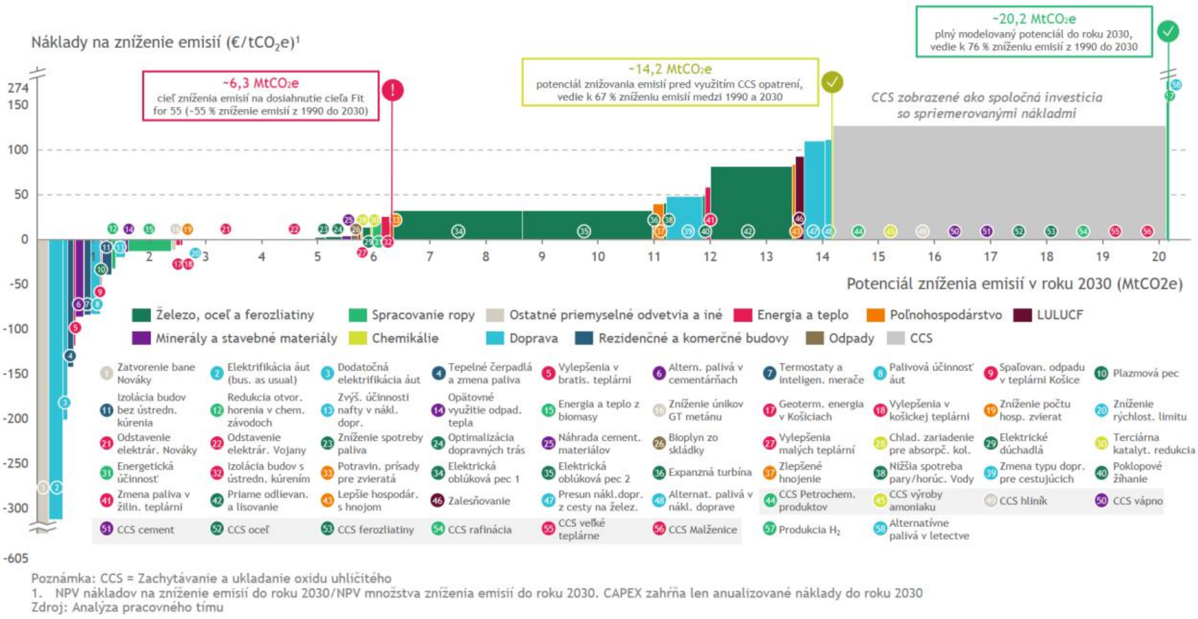
[47]https://www.minzp.sk/files/sekcia-enviromentalneho-hodnotenia-riadenia/odpady-a-obaly/registre-a-zoznamy/poh_sr_2021_2025_vestnik.pdf

			waste to 55 %; reduce the share of biodegradable municipal waste in mixed municipal waste to 25 % by 2025, divert landfilling of municipal waste to 10 % by 2035. In the area of textile collection, the main objective is to establish a functional system for textiles in the Waste Act with effect from 1. 1. 2025.
The concept of water policy of the Slovak Republic up to 2030 with a 2050 perspective	WEM, WAM	CH4, N2O/regulatory valid from 2022	The main objective of the concept is to ensure the gradual restoration of damaged water bodies, the cessation of water pollution and the reduction of groundwater, as well as the provision of sufficient drinking water in the regions. It defines ten priority areas, one of the main objectives being to increase the proportion of the population connected to sewerage to reach 85 % coverage in 2050.
Act No 302/2019 on the deposit of non-reusable beverage packaging and amending certain acts	WEM, WAM	CH4/regulatory and economically valid since 2019	That law triggered the operation of a deposit on non-reusable beverage packaging. This Act applies to non-reusable beverage packaging placed on the market in the Slovak Republic and to waste from such packaging.The Act governs, inter alia, the powers of the state administrative authorities in the field of deposit of non-reusable drinks packaging and waste from such packaging, State supervision and the procedure of State supervisory authorities in its execution, administrative offences and the procedure for imposing fines.

The Slovak marginal abatement cost curve – MACC (Figure 2) modelled by the Value for Money Unit, Boston Consulting Group and the Institute for Environmental Policy consists of 58 measures. Through these, Slovakia can reduce emissions by more than 20 MtCO2e by 2030, representing 48 % of gross emissions and 57 % of net emissions. The best way to read the MACC is from left to right. In this way, we can start with the most cost-effective measures and stand by any measure that achieves the desired potential.

Three possible targets have been outlined within the curve. The first of these is to reduce emissions by 6.3 MtCO2e by 2030, a 55 % reduction compared to 1990, and corresponds to the EU 2030 target. The second target is 14.2 MtCO2e, which includes measures that are cheaper than CCS (carbon capture and storage) and would achieve a 67 % reduction in emissions compared to 1990. The final target represents a full modelled potential of 20.2 MtCO2e by 2030, covering all available measures, including CCS. It results in emission reductions of 76 % compared to 1990 levels. More ambitious targets have been modelled to show the high cost of measures approaching carbon neutrality.

Figure 2: Emission reduction costs (EUR/tCO2e)
https://www.minzp.sk/files/iep/decarbonization_of_the_slovak_economy_by_2030_study_062022.pdf



The price in euro for the reduction of one tonne of CO2 equivalent is shown on the Y axis. This number may also be negative if the measure delivers economic savings while reducing emissions. A typical example is the closure of the Nováky mine, the operation of which requires subsidising by means of a tariff for operating the system at final electricity prices. The closure of the mine will reduce societal costs – the tariff will decrease while emissions will decrease due to the dampening of mining activity. The Y-axis price is reported as a social cost and thus includes costs and benefits not only to the State but also to other actors – households, firms, etc.

In addition to price, the amount of reduction that can be achieved by the measure is important. The closure of the Nováky mine will have a negative price (i.e. the public will save money), but there is a limit on how much CO2 will be depleted by this measure – emissions produced annually by these mines. The reduction potential is shown on the X axis (Figure 2).

The X and Y axes are thus able to define the various measures that take the form of quadriangles on the MACC. They are ranked in ascending order 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 are mutually exclusive. This makes it realistic to achieve the overall potential of MACC (the sum of the values of all X-axis measures).

II. Where relevant, regional cooperation in this area

According to 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 surplus emission allocations.

III. Without prejudice to the applicability of state aid rules, financing measures, including Union support and the use of Union funds, in this area at national level, where applicable

Financial measures:

(a) Financial actions from EU sources:

Improving the energy efficiency of public buildings – Activity L

This subsidy programme is financed through the Environmental Fund from the proceeds of the auctioning of emission allowances, which are one of the sources of revenue of the Environmental Fund. In the forthcoming amendment to Act No 414/2012 on emission allowance trading and amending certain acts, as amended, the Ministry of the Environment proposes to increase the usable share of the proceeds from the sale of emission allowances (currently 30 % of the annual proceeds from the sale of emission allowances). This change will allow for better predictability of investments and better planning of the management of the Environmental Fund. The revenues of the Environmental Fund will be used retroactively for investments that will contribute to reducing greenhouse gas emissions. This provision also pursues the fulfilment of the ETS Directive's provision that at least 50 % of revenues should be used to reduce emissions and mitigate the consequences of climate change, whether at national level or through assistance to developing countries.
The Environmental Fund launched the latest call in January 2023 and will be open for two months. The amount of the subsidy per project may amount to a maximum of EUR 400000. and shall cover a maximum of 95 % of the eligible costs. The applicant must therefore co-finance from its own resources at least 5 % of the costs. As part of the project, it is possible to carry out one or more 'core activities' (weatten walls and building envelopes, insulation or replacement of roof, replacement of opening pads such as windows or doors, insulation of the lowest and highest floor of the building). Only in case of implementation of the main activities, sub-activities can be implemented (e.g.: modernisation/replacement of heat source (including using renewable energy sources, excluding biomass in air quality management areas) and associated heat and/or hot water distribution; application of innovative technologies for the use of waste heat, cooling and circulation of air; measures to avoid overheating of buildings; elements to capture rainwater and use it to cool the outside of the building on land owned by the applicant; planting trees in the vicinity of the building on land owned by the applicant, which, after growing up, will shield the façade of the building and thus reduce energy consumption for cooling.

The Environment Fund budget supported projects in the area of insulation of public buildings over the last 3 financial years, amounting to an average of EUR 19 million per year. The final allocation for the financial year 2022 is based on the financing decision for other areas of support and on other requirements related to the new areas of support (such as the financing of national parks) and will be known in the near term.

Financial instruments for the business sector:

Environmental Fund

State aid scheme – Compensations for indirect costs

To cover the direct costs of CO2 emissions, 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.

Compensations for indirect CO2 costs 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.

A State aid scheme for the heating sector (EUR149,5 million for 2022), which aims at improving energy efficiency, modernising energy systems including district heating or cooling (CZT), energy storage and smart heat distribution solutions, increasing the share of electricity and heat produced by high-efficiency cogeneration plants (HHP) ('the 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 Tax Office

On 27 July 2022, a Call for Heating prepared under the Heat Scheme was published. More details on the call are available on the website of the Environmental Fund on the following link: https://envirofond.sk/modernizacny-fond/

Aid scheme for the decarbonisation of industry

In autumn 2022, two State aid schemes for the decarbonisation of industry were 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 lead to primary energy savings, reduce final energy consumption and introduce the use of advanced environmental technologies into industrial production, thereby directly supporting the achievement of national, European and global climate targets under the Paris Agreement.

The aim of the schemes is 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 RRP scheme (component 4) will provide aid amounting to EUR 357 343 413,00.

The Modernisation Fund has an estimated budget of EUR 750000000 for the period 2022-2030.

The text of schemes to decarbonise industry is available at:

1.
https://obchodnyvestnik.justice.gov.sk/ObchodnyVestnik/Formular/FormularDetailHtml.aspx?IdFormular=3550458&csrt=2384708614519771708
2.
https://obchodnyvestnik.justice.gov.sk/ObchodnyVestnik/Formular/FormularDetailHtml.aspx?IdFormular=3550458&csrt=2384708614519771708

<u>The State aid scheme for support for the production of electricity from RES</u> (EUR 20 million for 2022) aims to support investments in the construction, renovation and modernisation of installations for the production of electricity from renewable energy sources (RES) with a view to increasing the share of RES in gross final energy consumption in Slovakia. The grantor of aid under the scheme is the Ministry of the Environment of the Slovak Republic and the implementing body of the scheme is the Ministry of the Economy of the Slovak Republic. The estimated average annual amount of funding from the MoF for the implementation of this scheme is EUR 40 million. The indicative amount of expenditure planned under this scheme for the period 2021-2030 is EUR 400 million.
https://www.justice.gov.sk/PortalApp/ObchodnyVestnik/Formular/FormularDetailHtml.aspx?IdFormular=2892958

<u>Other financial instruments (support mechanisms):</u>

Multiannual Financial Framework 2021-2027

The 2020 European Green Deal Investment Plan calls for EUR 1 trillion of green investments (public and private) by 2030. The 2021-2027 MFF and NextGenerationEU will mobilise EUR 2,018 trillion (in current prices) to support the recovery from the COVID-19 pandemic and the EU's long-term priorities, including environmental protection. Based on the 'do no harm' sworn in the European Green Deal and the Interinstitutional Agreement on the MFF 2021-2027, 30 % of the EU budget will support climate efforts and 7.5 % (from 2024) and 10 % (from 2026) will be dedicated to promoting biodiversity. Achieving these targets requires increased programming of financial resources in the area of biodiversity, namely under the 2021-2027 cohesion policy and the common agricultural policy (CAP) 2023-2027.

Sustainable finance significantly increases transparency of environmental sustainability (a goal supported by the EU Taxonomy) and strengthens non-financial reporting requirements, facilitates the issuance of green bonds (based on the EU Green Bond Standard). With the renewed Sustainable Finance Strategy (2020), investment flows in climate and environment will increase. In the case of support for climate adaptation finance, the new strategy on adaptation to climate change can facilitate the resolution of insurance protection gaps for uninsured climate-related events. By 2025, the EIB will align 50 % of its lending to climate and environment with a contribution of EUR 250 billion to the European Green Deal Investment Plan by 2027.

The table below provides an overview of the EU funds specifically allocated to Slovakia for the period 2021-2027. These funds are complemented by other EU funding programmes available to all Member States.

Table 26: Key EU funds allocated to Slovakia (current prices), 2021-2027

Instrument	Country allocation (EUR million)

Cohesion policy ERDF CF ESF+ ETC (ERDF)	**Total: 12 358,1** 8 117,4 1 613,0 2 404,4 223,3
Just Transition Fund	**458,9**
EAFRD/Rural development under the CAP Strategic Plans 2023-2027	**1 295,4**
European Maritime, Fisheries and Aquaculture Fund (EMFAF)	**15,2**
Recovery and Resilience Facility 2021-2026	**6 328,6 (** grants)

Slovakia's national recovery and resilience plan responds to the urgent need to support a strong recovery and prepare the country for the future. 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. To this end, the plan consists of five key policy areas (green economy, education, research and innovation, health and public administration and digitalisation) with 18 components. Support of EUR 6.3 billion in grants will be allocated to the measures. Around 43 % of the plan will support climate objectives of EUR 2.73 billion. This goes beyond the 37 % climate target of the Recovery and Resilience Facility. As regards the green economy, the plan reflects the climate commitment and makes important contributions to the green transition and the ambitious 55 % greenhouse gas emission reduction target by 2030 and to the overall objective of achieving EU carbon neutrality by 2050.
Key actions for the green economy, to which EUR 2.301 billion are allocated. The EUR shall be:

- **EUR 232 million for renewable energy sources and energy infrastructure.**
- EUR**741 million** for **building renovation**.
- **EUR 1368 million to** decarbonise **industry to** improve energy efficiency and deploy innovative technologies.
- **EUR 801 million** in **sustainable transport** to support the deployment of around 3000 recharging points for alternative fuels, the modernisation of railways and 200 km of new cycling infrastructure. These investments will be further strengthened by a comprehensive reform that will create integrated public transport systems in six regions.
- **EUR 159 million** for **climate change adaptation measures** related to nature conservation reform, water management and landscape planning to preserve biodiversity. Investments will lead to the renaturation of 90 km of watercourses and the promotion of a more sustainable local economy.

The plan is to be implemented under several conditions to ensure the application of the DNSH principle. For example, no investment in biomass boilers and the construction of new small hydropower plants is eligible, while the modernisation of existing hydropower plants is linked to a detailed control of compliance with environmental legislation.

Programming period 2021-2027

As regards the allocation per policy objective during the 2021-2027 programming period, Slovakia, in accordance with the approved Partnership Agreement and the Commission Implementing Decision of 18.7.2022 approving the Partnership Agreement with the Slovak Republic, states that the indicative climate contribution target for Slovakia is set at 31 % of its total ERDF allocation and 43 % of its total Cohesion Fund allocation.

For policy objective 2 – a greener low-carbon Europe, the aim is to support the achievement of the national energy and climate targets set out in the integrated national energy and climate plan (hereinafter referred to as “the INECP”) as well as the more ambitious targets 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 represent the highest potential for energy savings. Where relevant and feasible, restoration will also 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.

The following results are expected to promote energy efficiency and reduce greenhouse gas emissions:

- contributing to reducing primary energy consumption by approximately 230 GWh and meeting the energy efficiency targets set out in the INECP and contributing to reducing greenhouse gas emissions by approximately 50600 tonnes towards meeting the targets set out in the Slovakia’s low-carbon development 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 in the field of energy efficiency;
- reducing energy intensity in enterprises, as a priority in SMEs, by implementing energy-efficient measures in the areas of consumption: buildings, technology and transport;
- the expansion of a highly energy efficient building stock by 2030 and its gradual decarbonisation;
- reducing final energy consumption in buildings by applying the energy efficiency first principle, thus contributing to the reduction of greenhouse gas emissions;
- improving the thermal performance of buildings, leading to improved indoor climate conditions, higher levels of well-being and comfort, and improved user health.

For the promotion of energy from renewable sources in accordance with Directive (EU) 2018/2001, including the sustainability criteria set out therein, the expected results:

- the total contribution to increasing the share of RES in Slovakia by approximately 300 MW;

- increased use of RES by enterprises 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 green 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 the 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 105000 tonnes/year and improving air quality.

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 linked to the system;
- greater integration of renewables into distribution grids, improved demand and supply planning at local level;
- reducing losses in the distribution of electricity;
- deployment of standardised solutions for smart distribution grids and storage.

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

- increasing the accessibility and attractiveness of public passenger transport to increase the share of public passenger transport in the division of transport work and reducing the share of individual car transport;
- reducing negative environmental impacts in large agglomerations (reduction of noise load, vibration, dust and the production of pollutant and greenhouse gas emissions);
- improving the quality of services provided by public rail transport (MHD);
- improving transport infrastructure and creating the preconditions for introducing complex changes in the organisation of public transport in settlements;
- ensuring safe and high-quality cycling infrastructure, including its integration with public passenger transport;
- increased share of cycling and other non-motorised transport in the overall division of transport work.

The largest allocation (EUR 4.2 billion) was allocated to policy objective 2 ‘A 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 proposal covers all relevant environmental sectors, in particular under Policy Objective 2, which includes three policy priorities: energy efficiency and decarbonisation; environment and sustainable urban mobility.

Under NextGenerationEU, the Commission will issue up to EUR 250 billion of EU green bonds (one third of the total NextGenerationEU) by 2026, which are in line with the general spirit of the 'do no significant harm' principle, but will not be subject to the currently being developed delegated acts on the EU Taxonomy or be fully in line with the proposed EU Green Bond Standard.

In addition to the EU funds specifically earmarked 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 the funds to be mobilised under InvestEU. They will also support the green transition, including research and innovation activities in the fields of environmental protection (Horizon Europe), clean transport and energy (CEF) or sustainable infrastructure (InvestEU).
The new Social Climate Fund (SPF) will also be able to compensate for social impacts.
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 the impacts on vulnerable households and vulnerable transport users following the introduction of a sub-scheme for emissions trading for buildings and road transport (ETS 2). Member States may use the allocation for investments in increasing energy efficiency of buildings, decarbonisation of heating and cooling systems of buildings, including the integration of renewable energy sources, as well as providing improved 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 trading system – ETS+ETS2) for the period 2027-2032 (note 2026 will be refinancing, the official fund will be operational as of 2027). These EU resources will be increased by 25 % through mandatory national co-financing to be provided primarily by additional national revenues from emission allowances. The total investment from the Fund for Slovakia will thus be EUR 1.875 billion. For Slovakia, it is important to maintain the favourable allocation key for Slovakia at 2.36 % (as opposed to 0.9 %), thanks to the European redistribution of resources, Slovakia will receive much more from the fund than it will pay from its ETS revenues, maintain the eligibility of technical assistance directly from the Fund at 2.5 % and that the annual amount of support will remain unchanged even if the total duration of the Fund has been reduced by one year compared to the Commission proposal.

Table 27: Support under the Slovakia programme with *SIEA*

Focus of RES support	**Possible involvement of enterprises from the heating sector**	**Indicative allocation (EUR million)**	**Indicative power (MW)**	**Remarks**

Promoting the use of RES in enterprises based on active electricity customers, RES self-consumers and renewable energy communities	No	134 508 846,00	81	Measure 2.2.1 Use of RES by enterprises; self-consumers and communities
SIEA, SMEs (SIEA as a government organisation provides SME voucher contributions)	No	55 930 017,00	62	Measure 2.2.1 Green business activity
Promoting the use of RES in enterprises (without sector limitation), public sector, communities	yes	24 132 512,00	19	Measure 2.2.1 Demand-driven challenge
Promoting the use of RES in enterprises	yes	EUR 15 000 000,00	15	Measure 2.2.1 Financial instruments
Promoting the use of RES in energy supply systems	No	31 160 875,00	72	Action 2.2.2 Public sector
Promoting the use of RES in energy supply systems	yes	223 428 618,00	72	Action 2.2.2 Business enterprise sector
Promoting the use of RES in energy supply systems	No	23 235 280,00	22	Action 2.2.2 ITI, UMR
Support for household use of RESs	No	142 605 649,00	219	Measure 2.2.3 Green Households

Promoting the prospection and exploration of geothermal energy sources with a view to making them available for energy purposes	yes	13 096 436,00	0	Action 2.2.4 Exploration and exploration of geothermal energy resources
Together,		EUR 663 098 233,00	562	

Within the framework of existing financial resources for households and the population themselves, the following support schemes are identified:

National programme "Green Households"

In the case of NP Green Households, the extension of its support to the Bratislava Self-Governing Region is limited by the EU resources made up of the European Regional Development Fund (ERDF), through which only the less developed regions of Slovakia can be supported.

However, wider NP innovation support to Green Households is taking place in the new 2021-2027 programming period from Slovakia. The Slovakia programme, currently under preparation, allocates more than EUR 100 million to renewable energy installations. Households from the Bratislava Self-Governing Region will also be able to use part of the funds. In both cases (both in the current NP Green Households and in the pipeline), support for the installation of RES is conditional on the energy efficiency requirements of the house.

In April this year, SIEA launched the third follow-up of the Green Households project. In May this year, households could apply for vouchers for the installation of heat pumps and biomass boilers from the Green Households project, while extending them until the end of 2022, so that contractors have sufficient time to install the equipment and send the SIEA claim for reimbursement.

According to the publication of voucher information from the Green Households project as of 17.1.2023, the total number of supported installation since 2015 has been supported by 44526 installation in single-family houses in the form of reimbursement of the voucher (Photovoltaic panel(9955), solar collector (13492), Biomass Cotol (6412), Heat pump (14667).

"Home Restoration" project

The Ministry of the Environment supports a long-term renovation programme for single-family houses financed through the Recovery Plan. This long-term renovation programme for single-family houses will help rebuild Slovakia's countryside, protect against the adverse effects of climate change. We are also convinced that implementing measures to improve the energy efficiency of single-family houses will reduce energy consumption in single-family houses.

This project is part of the recovery and resilience plan (component 2) and is implemented by the Slovak Environment Agency (SAŽP), which is under the Ministry of the Environment of the Slovak Republic. The programme aims to rebuild at least 30000 single-family houses by June 2026.

Support through this project focuses on the already implemented renovations of single-family houses built before 2013. The investment is aimed at owners of older single-family houses, allowing the financing of traditional energy saving measures (e.g. thermal insulation, replacement of windows, replacement of inefficient heat sources or installation of new installations using RES) and measures to promote adaptation to climate change (e.g. green roofs). The applicant shall prove that the energy savings of at least 30 % have been met. In order to mobilise a comprehensive and green recovery, the scheme includes a combination of mandatory and optional parts. Energy savings achieved in the renovation of single-family houses will be verified mainly through energy performance certificates. Investment measures related to building renovation shall comply with DNSH requirements, including the prevention and recycling of construction and demolition waste. Specific requirements also apply to the boiler replacement system. Replacement with a gas condensing boiler is only possible if it is part of a complex renovation, represents a small part of the total renovation and meets the highest energy efficiency criteria (class A). Available online: www.obnovdom.sk

The Operational Programme Quality of the Environment (OP Quality of the Environment) – OP KŽP is the Slovak programme document for the use of assistance from the EU Structural Funds and the Cohesion Fund in the 2014-2020 programming period in the field of sustainable and efficient use of natural resources, ensuring environmental protection, active adaptation to climate change and promoting an energy-efficient low-carbon economy.

The overall objective of the OPKP is to promote sustainable and efficient use of natural resources, ensuring environmental protection, active adaptation to climate change and promoting an energy-efficient low-carbon economy.

In order to achieve this global objective, three basic thematic objectives were included in the investment strategy of the OP Environment, namely:

- Supporting the shift towards a low-carbon economy in all sectors (TC4);
- Promoting climate change adaptation, risk prevention and management (TC5);
- Preserving and protecting the environment and promoting resource efficiency (TC6).

Of the five priority axes, three are dedicated to climate change and energy:

- <u>Priority axis 2:</u> Adaptation to the adverse impacts of climate change with a focus on flood protection (EUR 419.3 million from the Cohesion Fund, 13.36 % of the OP HOP allocation). Supporting investments for adaptation to climate change, including ecosystem-based approaches.
- <u>Priority axis 3:</u> Support for risk management, emergency management and resilience to incidents affected by climate change (260,9 million euro from the European Regional Development Fund, 8.31 % of the allocation from OP EQS). Promoting investment to address specific risks, ensuring disaster prevention and developing disaster management systems.
- <u>Priority axis 4:</u> An energy-efficient low-carbon economy in all sectors (EUR 938,88 million from the European Regional Development Fund, 29.92 % of the allocation from OP EQS). Promoting the production and distribution of energy from renewable sources. Promoting energy efficiency and renewable energy use in enterprises. Promoting energy efficiency, smart energy

management and renewable energy use in public infrastructures, including public buildings and the housing sector. Promoting low-carbon strategies for all types of territories, in particular urban areas, including the promotion of sustainable multimodal urban mobility and adaptation measures aimed at mitigating climate change. Promoting the use of high-efficiency cogeneration based on useful heat demand.

Slovak Investment Holding (SIH) is the national development institution responsible for the implementation of EU financial instruments in the current and previous programming period. Financial instruments are repayable forms of EU funding, which are also used in the field of energy efficiency. SIh, among other areas, provides financial instruments to increase energy efficiency in multi-apartment buildings in the current programming period, while developing financial instruments for energy efficiency improvements in public buildings and small and medium-sized enterprises. The financial instruments in question are financed by both the OP HOP and the Integrated Regional Operational Programme (IROP). Given the economic efficiency of financial instruments compared to non-repayable financial assistance, the use of financial instruments through SIH is expected to continue in the next programming period.

(b)Financial actions from other sources:

SLOVSEFF III – SlovSEFF III is a credit line to support the development of energy efficiency and renewable energy sources in Slovakia. The programme aims to support projects:

- which include the purchase and installation of equipment, systems and processes for the use of renewable energy sources to produce electricity and/or heat and/or cooling and/or any other form of energy substituting fossil fuel sources;
- which include equipment, systems and processes enabling the reduction of primary energy consumption, final consumption of electricity, fuels or other forms of energy for the production of goods and/or the provision of energy services incidental to the production of goods or services related to the industry;
- measures in complex residential buildings, large projects to renovate the thermal ratios of multi-apartment buildings consisting of thermal insulation of the envelope (circuit walls, roofs, cellars), together with other measures.

The programme consists of a combination of loans provided by the European Bank for Reconstruction and Development with a grant component co-financed by funds obtained from the sale of awarded units (AAUs) to Spain.

State aid scheme for environmental protection for the reduction of greenhouse gas and pollutant emissions in the industrial production sectors ('industrial scheme') – State aid scheme was prepared in accordance with Commission Regulation (EU) 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. The purpose of the aid is to encourage undertakings to increase the level of environmental protection in the context of their activities, in accordance with Article 36(2)(a) of the Block Exemption Regulation, by going beyond the applicable Union standards, by supporting projects aimed at reducing emissions of greenhouse gases and pollutants into the air by introducing the best available technologies.

The scheme was approved by the Antimonopoly Office of the Slovak Republic by letter 104/2017/OŠP-3471/2017 of 7 July 2017 and published in Official Journal 135/2017 under number G000019 on 17 July 2017. On 11 August 2017, the scheme was also registered in SANI2 under number SA.48924. The scheme is valid until 2020, the implementation of the projects is possible until the end of 2023. The scheme may be financed by funds obtained from the sale of emission allowances in auctions, no call for tenders has been issued until November 2019.

State 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 (‘compensation scheme’) – The State aid scheme is prepared in accordance with the Communication from the Commission ‘Guidelines on certain State aid measures in the context of the scheme for greenhouse gas emission allowance trading post-2012’. The purpose of this aid is to prevent a significant risk of carbon leakage due to the passing-on of the costs of greenhouse gas emission allowances in electricity prices borne by the aid beneficiary, where its competitors from third countries do not have to include similar CO_2 costs in their electricity prices and the beneficiary is not able to pass on those costs to product prices without losing a significant market share.

The purpose of this aid is to prevent a significant risk of carbon leakage due to the passing-on of the costs of greenhouse gas emission allowances in electricity prices borne by the aid beneficiary, where its competitors from third countries do not have to include similar CO_2 costs in their electricity prices and the beneficiary is not able to pass on those costs to product prices without losing a significant market share. The aid will be revised on the basis of the profitability of these undertakings and a realistic assessment of the risk of departure to third countries. Priority shall be given to financing projects to reduce greenhouse gas emissions and pollution overall.”

The aid is intended to compensate for the increase in electricity prices resulting from the inclusion of the costs of greenhouse gas emissions in electricity prices as a result of the introduction of the EU ETS. The scheme was approved by European Commission Decision C(2015) 9479 final of 14.12.2015 (SA.43509 (2015/N) – Compensation for indirect costs linked to CO_2 in Slovakia).

The scheme was published in the European Trade Journal on 22 April 2016, as well as in Commercial Gazette of the Slovak Republic 74/2016, published on 19 April 2016 under G000007. The scheme is valid until 2021, compensations can still be granted in 2021 (for 2020). The scheme is financed by funds obtained from the sale of emission allowances in auctions.

Amendment 1 to the compensation scheme has been drawn up due to the update of the national State aid legislation and the extension of the duration of the scheme from 22.4.2016-31.12.2020 to 22.4.2016-31.12.2021. The modifications in Appendix 1 to the compensation scheme did not need to be notified to the European Commission, as neither the substance nor the conditions for granting aid under the scheme had changed. The scheme as amended by Addendum 1 was published on 6 August 2018 in Commercial Gazette No 150/2018 with ID: 1933496 – State aid and other support schemes under number G000027.

3.1.2. Renewable energies

I. Policies and measures to achieve the national contribution to the Union-level binding 2030 target for renewable energy and trajectories as referred to in point (a)(2) of Article 4 and, where applicable or available, the elements referred to in point 2.1.2, including sector-specific and technology-specific measures48

Existing policies and measures

The RES policy and the measures based on it follow up on previous strategic documents approved by the Slovak Government (Energy Security Strategy (2008), National Renewable Energy Action Plan (2010) and Slovak Energy Policy (2014)).These documents supported increasing the share of renewables 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 5 Existing Policies and Measures

Cor. number	Title and reference of the measure	Type of action	Expected outcome	Target group and/or activity	Start and end dates of the measure
1.	Mandatory blending of biocomponents into transport fuels	regulatory	Keeping up to 7 % food crop biofuels after 2020	motor fuel manufacturers	2006 →
2.	Mandatory blending of advanced biofuels into transport fuels	regulatory	Reaching 3.5 % of advanced biofuels in 2030	motor fuel manufacturers	2019 →
3.	Promotion of electricity generation through feed-in tariffs (up to 500 kW)	legislative, regulatory	New Sources – Power generation 0.5 TWh 2020-2030	investors	2009-2030
4.	Promotion of electricity generation through the auction system	legislative, financial	Support for electricity generation 1.5 TWh 2020-2030	investors	2019-2030
5.	Support for decentralised electricity generation	legislative	New sources – electricity generation 0.5 TWh 2020-2030	investors	2019 → –

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

6.	Support for the use of RESs in the business sector	financial	electricity and heat generation from RES	investors	2014 →
7.	Support for household use of RESs	financial	Increasing the use of RES	households	2015 →
8.	Support for the renovation of heat distribution pipes	financial	energy saving, promotion of district heating	investors	2014 →

Some of the existing electricity generation measures included in the expected result the estimated contributions from individual technologies to electricity generation from Chapter 2.1.2.

Policies and proposed measures for achieving the national contribution

The principle set out in the Energy Policy of the Slovak Republic, which took into account the principle of minimising costs in the integrated approach to the use of RES and reducing greenhouse gas emissions in the projection of the use of RES, remains valid for the next period. Maintaining this principle will result in the setting-up of RES support ensuring the achievement of the targets set in a cost-effective manner and avoiding a significant negative impact on electricity prices. In order to achieve the RES targets, it is essential to use all the options available, with one of the greatest potentials in developing waste recovery in the production of biomethane and the energy recovery of waste that cannot be recycled and thus ends up in landfills. In particular, the energy potential of geothermal and solar energy, biomass and biomethane will be exploited in CZT systems.

The policy for increased use of RES will be directed towards the following areas:

Support for small-scale electricity and heat generation installations in single and multi-apartment buildings

A sustainable approach is to support the installation of small-scale electricity generation facilities, where beneficiaries have an incentive 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 the installation of heat generators using RES will continue as part of support for small-scale resources. The reduction of local emissions will not only be achieved by promoting proven technologies, but it is also appropriate to support new fuel cell technologies with a reduced carbon footprint for the use of natural gas or with a zero carbon footprint when using biomethane or pure hydrogen.

Development of the use of second generation 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 called 2nd generation biofuels) from feedstocks under Annex IX, Part A, and biofuels from feedstocks under Annex IX, Part B, to the RES Directive. At the same time, given the existing production capacity of food and feed crop biofuels, this policy will maintain as much as possible the share of these biofuels counted towards the transport targets.

Continuation of support for electricity generation from RES

Support for electricity generation from RES will continue mainly on the basis of operating aid as it was set after the support reform effective in early 2019. Support through a surcharge will remain the basic form of support for installations with installed capacity above 500 kW, while the electricity generator is responsible for selling electricity on the market and for the imbalance caused. Success in the auction is a prerequisite for providing support in the form of a surcharge. This scheme is complemented by a pre-fixed feed-in tariff support scheme (FIT support scheme) which applies to new producers with an installed capacity of up to 500 kW. Installations with up to 250 kW installed capacity have the possibility to support in the FIT system by purchasing electricity and assuming responsibility for imbalance. This form of support for installations of up to 250 kW will be provided until 2033, when the activities of the purchaser carrying out those activities will also cease. Existing aid for electricity production is in line 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.

Creation of a support mechanism for increasing the share of RES in the heating sector and in CZT systems, including through RES production in high-efficiency cogeneration

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

- at the level of each building separately, or
- at the level of existing district heating and cooling systems supplying several buildings at the same time.

All the analyses comparing the two alternatives prefer the other, given the lower costs and economies of scale.

The existing CZT infrastructure is the ideal basis for building a city’s smart energy system and is well placed to play the role of integrator of individual RES solutions in its territory. Already today, CZT systems play an important role in maintaining favourable air quality in cities, as these systems can deliver clean heat meeting the highest legal standards and emission limits. Individual heat generators are virtually uncontrolled from the point of view of emissions and do not have to meet such high standards and therefore pose a higher risk to the population from the point of view 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 solutions or also ‘smart’ solutions.

Developed CET infrastructure, which is already largely upgraded today, is gradually integrating new smart solutions. For future Smart Cities, CZT systems will be indispensable. The deployment of these modern smart solutions is on track to build the so-called 4-generation CZT, creating an efficient and smart system in cities. Such a system can flexibly connect production and consumption, store energy in times of surplus, integrate the various forms of energy generated in the city, including renewable sources, exploit waste heat from industrial processes or tertiary domains (e.g. from data centers or hospitals) that otherwise escape air emissions and contribute to global warming. It is more acceptable to 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 combined heat and cooling, use renewable energy sources, use emission-reducing technologies, build energy storage facilities, etc. CZT is already today not only heat generation, but also CHP, which consumes about 20 % less fuel than the separate production of the same amount of electricity or heat. CZT allows the provision of ancillary services in electricity systems and the storage of energy in the form of heat. Last but not least, by reducing the purchase of fossil fuels, which are largely imported from abroad, the funds for purchasing them in the region remain, thus supporting the development of the local economy.

For the time being, in existing buildings (in classic panel houses), the supply of cold from CZT systems is a music of the future. But in new buildings, this solution is starting to be successfully implemented. Absorption cooling production projects are successfully implemented in Bratislava and for industrial consumers in Žilina and Levice, and more are under preparation.

In developed countries, CZT systems are considered to be 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 for heating. Slovakia has all the preconditions for building and developing 4-generation CZT systems. CZT systems are suitable for the integration of RES in the form of biomethane, mainly from waste from plant and animal production, the biodegradable fraction of municipal waste, biodegradable kitchen and restaurant waste and waste from waste water treatment plants.

Table 6 Individual waste types in relation to biomethane

<table>
<tr><td>Type of waste</td><td>Annual production in tonnes</td><td>Amount of biomethane</td><td>Quantity ktoe</td></tr>
<tr><td>Livestock excrements</td><td>10.1 million tonnes*</td><td>155 million m^3 – 205 million m^3
(methane content in biogas 55 %)</td><td>141-187, ktoe</td></tr>
<tr><td>Biodegradable fraction of municipal waste (BRKO)</td><td>1 million tonnes
(50 % of total volume of AA*)</td><td>65 million m^3</td><td>60 ktoe</td></tr>
<tr><td rowspan="2">Biodegradable fraction of catering and restaurant waste (one, cantons, hotels, school canteens, etc.)</td><td>0,35 million tonnes</td><td>42 million m^3</td><td>38 ktoe</td></tr>
<tr><td colspan="3">Energy potential of agricultural biomass = 115.2 PJ (2750 ktoe)
The waste component (grassy and straw phytomass) accounts for approximately 40 % of that volume (1100 ktoe)*</td></tr>
</table>

* SIEA – National Road Map for the Development of Biomethane Production and Use in Slovakia”

In addition to increasing the use of RES, the aim of heating and cooling policy is to actively participate in 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 the current global challenges and challenges of modern, fast-growing cities, where clean air is a key indicator of quality of life.

Promoting biomethane production

Biomethane is a very promising fuel for energy storage. Biomethane will be used as a priority in transport and high-efficiency cogeneration. Over 300 million m^3/year biomethane is realistic to obtain by 2030.

Biomethane can be extracted from

- transition from biogas to biomethane
- recovery of wastes from the biodegradable fraction of municipal waste (BRKO), kitchen and restaurant waste
- recovery of plant and animal waste for the production of biomethane

Promoting renewable and low-carbon hydrogen and the construction of RES for its production

The policy on the promotion of hydrogen in the Slovak Republic will be based on the approved National Hydrogen Strategy (UV No 356/2021) and its Action Plan (UV No 307/2023), as well as any future updates of these documents. On the basis of existing hydrogen use, it can be assumed that 200 kilotonnes of hydrogen per year are consumed in Slovakia by 2030. This consumption of hydrogen currently produced from fossil fuel will gradually be replaced by renewable and low-carbon hydrogen according to agreed European legislation. Hydrogen policy aims to cover as much as possible of the need for substitution of hydrogen from indigenous sources, in particular through the construction of electrolysers and other low-emission hydrogen production pathways. Given the energy requirements related to hydrogen production and its forecasted 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 additionality principle described in the European RED II and its possible future revisions.

Proposed legislative and regulatory measures:

In order to implement measures aimed at increasing the share of RES in the heating and cooling sector, the following necessary legislative and regulatory measures will need to be taken. In addition to the transposition of Directive (EU) 2018/2001 and Directive (EU) 2018/2002, they will cover regulatory action. The aim will also be to introduce incentive mechanisms for district heating and cooling system operators 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 other economically justified costs and the level of maximum heat price, increasing the relevance of energy efficiency indicators in the calculation of fuel costs if RES is used to produce heat).

Public support will be made possible for projects in CZT where cost and environmental efficiency is demonstrated. CZT systems are suitable for the integration of RES also in the form of biomethane, mainly from waste from plant and animal production, the biodegradable fraction of municipal waste, biodegradable kitchen and restaurant waste and waste from waste water treatment plants. The potential of geothermal energy for heat generation is sufficient, but its use must be adequately supported, which will require an overall increase in aid. An example of significant potential is Geoterm Košice, where the RES Action Plan 2011-2020, drawn up in 2009, already envisaged a higher use of geothermal energy in heat generation.

The conditions of the post-2022 thermal energy regulatory periods 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 renewables self-consumers/energy communities to the CZT system.

Table 30 Overview of heating and cooling measures

Name of action	Type of measure/short description of the measure	Expected outcome	Target public	Start and end dates of the measure
1. Mandatory amount of RES or waste heat in centralised heating systems	regulatory/ obligation for district heating and cooling systems to contribute to increasing the share of RES or waste heat in district heating and through connection of RES suppliers or integration of waste heat into district heating systems	increase of RES or waste heat by one percentage point per year[49]	CZT	2022 →
2. Mandatory connection to efficient district heating from RES	regulatory/ physical integration of RES energy for heating and cooling through the use of district heating and cooling systems	more efficient use of heat from RES	CZT and new or reconstructed buildings	2022
3. Information obligation	regulatory/ an obligation for heat suppliers to regularly inform their customers about the share of RES in the heat supply through the district heating and cooling system;	increase acceptance of customers	CZT	2022 →
4. Support for heat self-consumers	legislative/ enabling the installation of RES heat generators for their own needs of RES self-consumers and RES heat communities for self-heating purposes, storage of RES energy in connection to district heating and cooling systems (with the possibility of selling excess production to the CZT system)	Integration of decentra-lised heat generators to CZT	CZT and customers	2022 →
The right to disconnect a self-consumer of heat from RES	legislative/ right of a self-consumer of heat from RES connected to CZT systems to install a heat generator from RES if the CZT system does not fulfil the condition of efficient district heating	Installation of own RES heat generator	self-consumer or community producing heat from RES	2026

[49] within the meaning of Article 24(4)(a) of Directive (EU) 2018/2001

Use of waste and waste heat; and waste energy recovery and use of waste heat in CZT systems	favouring the construction of biomethane plants (mainly from plant and animal waste, the biodegradable fraction of municipal waste, biodegradable catering and waste water treatment plants) and promoting the use of waste heat from industrial, tertiary, waste water and energy processes in CZT systems	reducing fossil fuel consumption	waste recovery sector, nuclear power plants, industry	2023
Support for district heating systems	Enabling support for the installation of RES for CZT equipment and systems that are technically fit for RES installation	reducing fossil fuel consumption and pollutant emissions	CZT	2023

Broader description of the measures

Action 1: Mandatory quantity of RES in district heating systems

A binding target of at least one percentage point will be set for the district heating and cooling sector, expressed as an annual average for the periods 2021 to 2025 and 2026 to 2030. This binding target will not be set for individual district heating and cooling operators, but for the entire district heating sector in such a way as to allow the operators' contributions to be accounted for at their real level. Operators of district heating and cooling systems will be able to contribute to the achievement of that binding target by changing their own fuel base, by connecting RES heat suppliers pursuant to Article 24(4)(b) of Directive (EU) 2018/2001 or by connecting self-consumers and renewable energy communities.

The connection of RES heat suppliers will be ensured through a mandatory heat demand mechanism based on non-discriminatory criteria and in order to meet the demand of new customers, by replacing existing heat and cooling capacity or by extending existing capacity under the conditions under Article 24(5) of Directive (EU) 2018/2001. The connection of renewable energy suppliers to district heating and cooling systems shall be subject to non-discriminatory conditions and proportionate charges ensuring that an appropriate part of the fixed costs associated with operating the district heating system and holding the necessary capacity by the operator of the district heating system is met to meet the heat demand due to insufficient capacity of the installation of the RES heat supplier.

Action 2: Mandatory connection to efficient RES-using CZT

A measure to increase the share of RES in the heating and cooling sector will also be a measure in the form of connecting new buildings and existing buildings undergoing major renovation to district heating and cooling systems fulfilling the condition of efficient district heating and using RES, where such a district heating and cooling system is present on the site concerned and has sufficient capacity to connect and supply heating or cooling to the building. For existing buildings that have not been connected to a district heating and cooling system prior to major renovation, connection will only be required if this leads to a higher degree of compliance with the energy performance requirements of the buildings compared to the operation of the individual installation of RES self-consumers or energy communities producing heat from RES.

Action 3: Information obligation

Suppliers of district heating and cooling systems will be required to inform at regular intervals (at least once a year) the share of RES in the heat supply in the district heating and cooling system, as well as whether the system fulfils the condition of efficient district heating or is in the process of transition to an efficient district heating system.

Action 4: Support for self-consumers of heat

In accordance with Article 21 and 22 of Directive (EU) 2018/2001, renewable energy consumers themselves and energy communities producing heat from RES will be entitled to install their own RES heat generator to provide self-consumption heat, allow heat produced from RES to be stored and to sell excess production. In locations where a district heating and cooling system is present, it will be possible to install heat generators for self-consumers and renewable heat communities only by connecting to district heating and cooling systems (with the possibility of providing and selling excess production to the CZT system), except for RES self-consumers or energy communities generating heat from RES in existing buildings that are not connected to the district heating and cooling system, nor do they have an obligation to connect in the context of major renovation of an existing building.

Only non-discriminatory charges and charges will be applied to self-consumers and communities producing heat from RES, ensuring that an appropriate part of the fixed costs associated with operating the district heating system and holding the necessary capacity is held by the district heating system operator to meet the heat demand due to insufficient capacity of the installation of the self-consumer or the RES heating community.

The right of self-consumers and energy communities to set up a heat generator in a building to cover their own heat consumption, energy storage and sale of excess heat production will only be possible at the level of the whole building and for single-family houses with apartments and multi-apartment buildings only at the level of the entire single-family house with apartments or multi-apartment buildings (Article 24(7) of Directive (EU) 2018/2001).

Action 5: Right to disconnect

A final consumer of heat from a district heating and cooling system that does not become efficient district heating and cooling by 31 December 2025 shall be entitled to disconnect from that system if he or she installs a heat generator exclusively from RES, under the conditions resulting from Article 24(2) and (3) of Directive (EU) 2018/2001. To this end, the competent national authority will approve a plan for the transition to efficient district heating and cooling for individual operators of district heating and cooling systems. With the exception of significant deficiencies in the fulfilment of contractual obligations which the district heating and cooling operator has not remedied even within a reasonable period of time after receiving the customer's warning, customers from efficient district heating systems shall not be allowed to disconnect otherwise than through an agreement with the efficient district heating operator. This will not exclude the right of the final customer to install his own heat generator as a self-consumer or a community producing heat from RES under conditions applicable to self-consumers and energy communities.

Action 6: Waste and waste heat utilisation

The measure will support the integration of RES (advantaging the construction of biomethane plants mainly from plant and animal waste, the biodegradable fraction of municipal waste, biodegradable kitchen and restoration waste and waste from waste water treatment plants) as well as the involvement and utilisation of waste heat in CZT systems, including waste heat from industrial processes, tertiary, waste water and energy processesgenerated as a by-product in industrial and energy installations. The measure will also target the use of waste heat from the Mochovce nuclear power plant to heat surrounding sites.

Action 7: Support for district heating systems

The measure will allow the installation of RES for CZT equipment and systems that have the technical capability to install RES but do not yet fulfil the condition of an effective CZT. The measure will contribute to:

— to meet the 2030 targets for the share of RES to which the Slovak Republic has committed itself
— on reducing pollutant emissions
— on reducing fossil fuel consumption
— at least partial use of RES in certain built-up areas where the possibilities of using RES are limited and thus limited possibilities for moving to an efficient CZT.

<u>Proposed legislative and regulatory measures in the field of hydrogen and heating</u>

Hydrogen:

In line with the approved National Hydrogen Strategy Action Plan and building on EU requirements, the legislative and regulatory environment for hydrogen in the Slovak Republic 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 area of individual hydrogen technology permitting processes (e.g. EIA, IPPC, land-use procedure, construction procedure, etc.) with a view to proposing legislative measures that will significantly simplify permitting processes for hydrogen technologies. It will also be necessary to continuously adopt European standards in the Slovak Technical Standards (STN) system and, if necessary, to ensure the development of original STNs on the basis of the identification and input of stakeholders.

Heating:

Slovakia's regulatory policy should reflect the evolution of EU legislation and the new situation in the heating sector resulting from the implementation of Directive 2018/2001 on the promotion of the use of energy from renewable sources, in particular by introducing incentive instruments for the swift transition to efficient district heating and the implementation of renewable energy sources into existing district heating systems, where this is technically possible and economically efficient and by promoting the construction and connection to new CZT systems.

II. Where relevant, specific regional cooperation measures, as well as on a voluntary basis, the estimated excess production of renewable energy that can be transferred to other Member States to reach the national contribution and trajectories referred to in point 2.1.2.

The use of a voluntary statistical transfer of RES to another Member State is not foreseen. The Slovak Republic will primarily seek to contribute to the European objective set out in Chapter 2.1.2. This contribution shall be designed in such a way that it can be fulfilled. If Slovakia overachieves its target, it will consider using a statistical transfer.

For suitable projects, Slovakia will participate in RES projects of common interest (PCIs) or projects supported by the Connecting Europe Facility (CEF). Slovakia welcomes the creation of an EU financial mechanism for RES and will consider participating in this mechanism on the basis of conditions.

III. Specific measures on financial support, where applicable, including Union support and the use of Union funds, for the promotion of the production and use of energy from renewable sources in electricity, heating and cooling, and transport

Financial support measures to achieve the objectives – operating support:

1. **Operating support for the production of heat from RES**

Operating support for RES is coupled to electricity generation, with the heat sector only having access to CHP 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 heat generators from biomass, biogas, biomethane, geothermal and solar energy and aerothermal, geothermal and hydrothermal 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 sites with impaired air quality) or which will have an approved plan to switch to efficient district heating (Article 24(2) of Directive (EU) 2018/2001) and which, precisely on the basis of the installation of the aided installation, fulfil the conditions for efficient district heating. Funding for this form of operating support will also be provided from the proceeds of auctioning of emission allowances.

2. **Operating support for electricity generation in combined heat and power plants using RES technology with an installed capacity below 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 less than 1 MW_e, of which at least 60 % of the heat produced is used for the supply of heat through district heating and the primary energy saving is at least 10 %.

In order to increase the incentive for investors in RES electricity and heat technologies, this form of support will need to be modified to cover new cogeneration plants installed together with RES heat generators. Support should be provided in the form of a guaranteed feed-in tariff in accordance with the rules resulting from Article 43 of Regulation (EU) 651/2014 and Chapter 3.3.2.2 of the Guidelines for State aid for environmental protection and energy 2014-2020 (2014/C 200/01) (or its future amendments), for as long as investments in cogeneration technology and RES are fully depreciated according to normal accounting principles. The aid will be limited to the construction of installations whose operators build a new district heating and cooling system (with a preference for sites with impaired air quality) or that have an approved plan to switch to efficient district heating by the competent national authority (Article 24(2) of Directive (EU) 2018/2001) and which, precisely on the basis of the installation of the aided installation, fulfil the conditions for efficient district heating.

3. **Operating support for electricity generation in modernised combined heat and power plants using RES technology**

Act No 309/2009 on the promotion of renewable energy sources and high-efficiency cogeneration currently allows support for the production of electricity in modernised combined heat and power plants (regardless of the use of RES) with installed capacity up to 125 MW_e, provided that the overall cogeneration efficiency achieved is at least 80 % for combined cycle combustion turbines and condensing steam turbines or 75 % for other cogeneration plants, at least 60 % of the heat produced in the cogeneration plant is supplied through district heating and at least 60 % of the total district heating supply is the supply of heat 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 technologies, this form of support would need to be modified so that, under the current conditions, only cogeneration plants that will be upgraded if the upgrade includes the installation of a heat generator from RES or the CZT operator will conclude a long-term contract for the supply of biomethane.

4. **Operating support for maintaining cogeneration of electricity and heat from biomass**

Operating support will be granted to cogeneration plants using biomass in order to compensate for differences between the plant's operating costs and the market price of electricity and heat. Support will be provided through a feed-in tariff for a period of three years, with the possibility of extending the period of support in the event that after the expiry of the previous period of support the differences have not been compensated. 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 combined heat and power plants using renewable energy sources with installed capacity above 1 MW**

The existing system of support for electricity generation in CHP plants using renewable energy sources through transparent tendering procedures (auctions) will continue to be maintained, while increasing the focus on supporting those installations that place the bulk of the thermal output in district heating and cooling systems. If it is to be supported, installation from renewable energy sources that technologically allows the use of useful heat, the heat output will have to be located in district heating and cooling systems.

<u>Financial support measures to achieve objectives – investment support</u>

In order to implement measures aimed at increasing the share of RES, it is proposed to also use investment support instruments:
1.EU funds
2. The Modernisation Fund consisting of the sale of emission allowances and other instruments linked to the EU ETS
3. Environmental Fund
4. De minimis.

EU financial support for the use of RES is mainly aimed at:

- supporting the fulfilment of RES targets and increasing the share of RES in district heating and cooling systems, including increasing efficiency of heat production and distribution in district heating system distribution and the use of RES in energy carriers for heating and cooling;

- supporting the fulfilment of RES targets and increasing the share of RES in district heating and cooling systems that do not yet meet the condition of an efficient CZT, including increasing the efficiency of heat generation and distribution in district heating system distribution;
- support for RES installations, distribution and storage facilities (including intelligent management systems) to increase the efficiency of existing installations and the installation of new equipment for the use of RES (entrepreneurial sector, public sector and households)
- the use of geothermal energy and support for the development of local heating systems;
- supporting transport infrastructure for charging electric vehicles and for refuelling hydrogen to vehicles, as well as for the electrification of public passenger transport (electrification of railway lines, construction of new tram and trolleybus lines instead of bus transport);
- solutions to ensure the needs of flexibility and ancillary services for the electricity system;
- construction of renewable hydrogen production facilities using RES and biomethane.

The Environmental Fund shall accumulate the funds obtained from the auctioning of emission allowances and at least 35 % of the revenues will also be used for projects in the power generation sector supported by efficient and sustainable district heating, cogeneration of electricity and heat and the development of renewable energy sources. The objective will be to support projects by district heating and cooling system operators to switch to efficient district heating and cooling through the construction of new or upgraded existing heat generation and combined heat and power plants using renewable energy sources.

Continuation of support to households beyond 2023

For the development of domestic equipment, it is proposed to continue support through subsidies for the purchase and installation of RES equipment. The positive experience so far is based on the current set-up of the Green Households II subsidy programme. This is a nativeprojectofthe Slovak Innovation and Energy Agency (SIEA) in which family and residential buildings can apply for support in the form of a voucher for the installation of small equipment for the use of renewable energy sources from 2019 onwards. The projectis funded by Operanéby its QualityofEnvironmentProgramme. The support isdesigned in such a way that the Housesof Excellencearemotivatedto havea goodqualitysysté for mewiththe messagingatthe end,witha longchequeou, and you’ re eagertoinspireenergy conversion and not tohavea tradeunion inanothertalácii. The aid shallnotexceed 50 % ofthesnowinthecrowd.

Inaprogrammewith supportfacilities:

- smallinstallations for the explosionofelectricity with a horseofless than 10 kW
  - photovoltaic panels
  - vetern é TURBíny (there isnosupport forthese facilities)
- heat-extinguishinginstallations thatcover theenergy needsofasingle -family house or apartment building
  - salinesn.e.c.
  - biomass boilers
  - temperate erpadl
- micro-cogeneration plants based on fuel cells.

Overlapping of investment and operating support

In order to reduce operating support, the possibility of overlapping 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 investments in the calculation of the average cost of energy production (LCOE).

Other measures with similar effect to investment and operating support

Fiscal measures may also be introduced to implement measures aimed at increasing the share of RES in the heating and cooling sector, e.g. a reduced VAT rate on heat from district heating and cooling using RES.

Measures in the transport sector

Table 31 Measures in the transport sector

Name of action	Type of measure/short description of the measure	Expected outcome	Target public	Start and end dates of the measure
Increasing the minimum share for fuel suppliers	regulatory/ in line with the indicative trajectory, achieve a 14 % share of RES in fuels in 2030	Achievement of the 14 % target for RES in transport	fuel suppliers	2022-2030
Increase of the contribution of advanced biofuels	regulatory/ increase of the share of advanced biofuels according to Annex IX, Part A as a share of final energy consumption in transport	Share of advanced BP: 2022: 0.2 % 2025: 1.0 % 2030: 3.5 %	fuel suppliers	2022-2030
Increasing the share of biofuels in transport	analysis of the need to introduce fuels with higher biofuel content for the purpose of meeting RES targets in transport	Achievement of the 14 % target for RES in transport	fuel suppliers biofuel suppliers MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC	until 2022

			MINISTRY OF THE ENVIRONMENT OF THE SLOVAK REPUBLIC	
Construction of hydrogen infrastructure in transport	Ensure the construction of hydrogen fuel refuelling infrastructure along TEN-T corridors and at defined urban nodes, in line with the upcoming EU Alternative Fuel Infrastructure Regulation (AFIR)	Achievement of the 14 % target for RES in transport/updated targets in the light of future updates of RED I		2024-2030

Measures in the biomethane and hydrogen sector

Table 32 Measures in the biomethane and hydrogen sector

Name of action	Type of measure/short description of the measure	Expected outcome	Target public	Starting date of the action
Introduction of guarantees of origin for biomethane	legislative/ introduction of guarantees of origin for biomethane in order to develop the market for biomethane tradable in the EU	biomethane Guarantee Market	biomethane producers	2022
Support the transition from biogas to biomethane	regulatory/ support the transition from biogas to biomethane to be used in transport or high-efficiency cogeneration	production of 250 million m³ (200 ktoe) biomethane	biomethane producers	2022
Support for the recovery of waste from crop and animal production	regulatory/ promoting the recovery of plant and animal waste for the production of biomethane	the production 60 million m³ (50 ktoe) of biomethane	biomethane producers	2022
Promoting the recovery of waste from the biodegradable fraction of municipal	regulatory/ promotion of waste recovery	the production 30 m³ (25 ktoe) biomethane	processors of BROKs, industrial, kitchen and restaurant waste	2022

(BRKO), industrial kitchen and restaurant waste		landfilling of less than 10 % of municipal waste generated		
Support for the production of renewable or low-carbon hydrogen *	support for hydrogen production to be used for transport, industry or high-efficiency cogeneration	100 % coverage of hydrogen refuelling stations and partial substitution of fossil-based hydrogen	hydrogen producers	2022

*low carbon hydrogen for this measure is hydrogen with a 70 % lower carbon footprint (e.g. with carbon sink or utilisation or CO_2) compared to hydrogen production in the natural gas reforming process

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

Every five years, and no later than the end of 2024, the Slovak Republic shall assess the efficiency of its support schemes for electricity from renewable sources and their significant distributional impacts on different consumer groups and investments. That assessment shall take into account the effect of possible changes to the support schemes. The results of this assessment shall be taken into account in the indicative long-term planning governing the decisions on support and proposals for new support. This assessment will be included in the progress reports in accordance with Regulation (EU) 2018/1999.

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

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

The contact point referred to in Article 16(1) shall be the Slovak Innovation and Energy Agency (SIEA). As its organisation, the Ministry of the Economy will authorise the SIEA to set up one or more sites within its four branches to guide applicants throughout the administrative process of applying for a permit and issuing a permit for the construction, modernisation and operation of renewable energy installations and the equipment necessary to connect to the grid. The Ministry of the Economy will promote more efficient administrative procedures by optimising the boundary settings for environmental impact assessments so that plants using renewable energy sources have a significantly lower administrative burden compared to fossil fuels.

Information on RES is already provided by the SIEA. The training of installers of RES equipment is provided by accredited training to certify the installer. 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, perform quality work and comply with all relevant regulations. The training course ends with an examination granting a certificate issued free of charge by the Ministry of the Economy. The validity of the certificate shall be 5 years and shall be automatically renewed once for a period of 5 years if the holder of the certificate takes part in the updating training.

The preparation of this plan assessed the existing unjustified barriers and potential for RES self-consumption. As a result of the assessment, there are no regulatory or other legislative barriers to 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 a supplementary or substitute heat generator in relation to the return on investment generates a low degree of interest in these sources. The situation changes in the case of a subsidy for equipment. An example is the Green Households programme, which supports equipment to match the pay-back period of the investment. The interest in installing equipment has increased several times. Therefore, in the post-2021 period, it is proposed to continue subsidies to households in the strengths of the existing Green Households programme. A measure under Article 22(6) of the RES Directive is a financial subsidy for households and multi-apartment buildings.

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

The construction of new district heating and cooling systems based on renewable heat generators (in particular geothermal energy, biomass, biogas, biomethane, solar energy and aerothermal, geothermal and hydrothermal energy used in heat pumps), possibly combined with high-efficiency cogeneration plants, appears necessary for the implementation of measures aimed at increasing the share of RES in the heating and cooling sector and in order to improve air quality in locations with an increased emission load (mainly due to emissions of fine particulate matter). In the event of insufficient interest on the part of participants in the heating and cooling market to build a new district heating and cooling system under market conditions, the competent authority will launch a tender for new district heating and cooling capacities with the possibility of participating in any of the above investment or operating support programmes.

Building infrastructure for the production and supply of cooling using new or existing district heating infrastructure, absorption cooling technology as well as heat pumps is also a challenge. Projects implementing such infrastructure will be able to participate in investment and operating support programmes, provided that they use renewable energy sources, possibly in combination with high-efficiency cogeneration technology.

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

Specific measures within the remit of the Ministry of Agriculture and Rural Development are foreseen to increase the availability of biomass resources, in particular for the cultivation of fast-growing trees.

3.1.3. *Other elements of the dimension*

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

Table 32 below presents the effects of mitigation measures. The overall impact of the policies and measures was established as the difference between the scenarios after the definition of the impact of a specific measure.

Table 33 Effects of mitigation measures and policies

Name of the mitigation measure	Policy impact on EU ETS or ESD emissions	Greenhouse gas emission reductions in 2020 (GG CO_2 eq.)			Greenhouse gas emission reductions for 2025 (GG CO_2 eq.)		
		EU ETS	ECJ	Together,	EU ETS	ECJ	Together,
Environmental design and use of products	ECJ		21,99	**21,99**		47,33	**47,33**
Energy efficiency gains	EU ETS ECJ	257,36	109,16	**366,52**	489,32	207,54	**696,85**
Implementation of the EU Winter Package	EU ETS ECJ	225,80	51,97	**277,78**	238,83	54,97	**293,81**
Optimisation of district heating CZT	EU ETS ECJ				337,40	56,10	
Decommissioning of a fossil fuel power plant	EU ETS ECJ				494,15	82,17	
Decarbonisation of electricity generation	EU ETS ECJ	277,71	63,92	**341,64**	286,38	65,92	**352,30**
Continued reduction of final energy consumption in all sectors	EU ETS ECJ	447,07	89,62	**636,68**	675,3	286,42	**961,72**
Environmental design and use of products	ECJ		55,23	**55,23**		69,85	**69,85**
Energy efficiency gains	EU ETS ESD	879,37	372,98	**1 252,35**	995,73	422,33	**1 418,07**
Implementation of the EU Winter Package	EU ETS ESD	256,1	58,95	**315,05**	301,73	69,45	**371,18**
Optimisation of district heating CZT	EU ETS ESD	389,17	64,71	**453,88**	634,26	105,47	**739,72**
Decommissioning of a fossil fuel power plant	EU ETS ESD	768,59	127,8	**896,39**	631,88	105,07	**736,95**
Decarbonisation of electricity generation	EU ETS ESD	559,13	128,69	**687,82**	611,79	140,81	**752,6**

Continued reduction of final energy consumption in all sectors	EU ETS ESD	1 405,55	596,15	**2 001,70**	1 507,13	639,24	**2 146,36**

Source: https://cdr.eionet.europa.eu/Converters/run_conversion?file=sk/eu/mmr/art04-13-14_lcds_pams_projections/pams/pams/envxrmnra/SK_mmr-pam_report_2019_ETC_NEW.xml&conv=565&source=remote

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 the Adaptation of the Slovak Republic to Climate Change. The main objective of the updated adaptation strategy is to increase resilience and improve the 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 adaptation headline target should contribute to the achievement of the sub-objectives of: ensuring active national adaptation policy development, implementing adaptation measures and monitoring their effectiveness, strengthening the translation of adaptation strategy objectives and recommendations in multi-level governance and promotion of entrepreneurship, raising public awareness of climate change, promoting synergies between adaptation and mitigation actions and using the ecosystem-based approach in the implementation of adaptation actions, 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 potential impacts of climate change with proposals for appropriate adaptation measures to the widest possible range of areas and sectors. In terms of adaptation to the adverse impacts of climate change, the following are considered to be key areas and sectors: rock and geology, soil environment, natural environment and biodiversity, landscape and water management, settlement environment, population health, agriculture, forestry, transport, tourism, industry, energy and other business and risk management.

The “Action Plan for the implementation of the Slovak Climate Change Adaptation Strategy” (hereinafter “NAPs” or “Action Plan”) aims to increase Slovakia’s preparedness for the adverse effects of climate change through the implementation of cross-cutting and specific adaptation measures and tasks. At the same time, an 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 the main objective, which is based on the implementation of the strategic priorities. 5 cross-cutting actions are identified to meet the objective and aim to improve the implementation framework, support science and research on adaptation to climate change, develop an efficient crisis management system and address extreme events such as floods and fires, promote green infrastructure, as well as support education and awareness. These actions are followed up by 18 tasks. 7 specific areas are at the core of the NAPs: water protection, management and use, sustainable agriculture, adapted forestry, natural environment and biodiversity, health and healthy population, settlement environment and technical, economic and social measures. Each of these 7 areas has its specific objective, each of which has its basic principles and specific measures defining tasks in that segment. In total, 45 specific actions have been identified and 169 assignments have been identified for the period of validity of the NAPs until 2027. These measures and their follow-up tasks are based on the Slovak Climate Change Adaptation Strategy – update. The action plan was approved by Slovak Government Resolution No 476 of 31 August 2021.

On 23 June 2021, by Resolution No 356/2021, the Slovak Government 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 the deployment of 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 developed in the form of the Action Plan for the successful implementation of the National Hydrogen Strategy up to 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 with implementation between 2027 and 2030 will be prepared.

The national hydrogen strategy defines the objectives for the use of hydrogen in the various economic areas of the Slovak Republic in order to contribute to the energy transition of the Slovak Republic and the achievement of the decarbonisation objectives. The measures to meet these objectives, as defined in the Action Plan, will create the conditions for investments in an economically sustainable value chain for renewable and low-carbon hydrogen, i.e. its production, transport and distribution, storage as well as use primarily in industry, energy and transport, especially in cases where direct electrification is not possible or is not cost-effective. Together with them, conditions will be created for research and development, international cooperation and marketing.

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

The Ministry of the Economy has drawn up a 'Proposal for an Action Plan for the Development of Electromobility in the Slovak Republic', which follows 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 adopted Clean Mobility Package. The Action Plan contains 15 measures that are 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 incentive support. The current incentives to purchase vehicles are supported by advantages such as distinguishable vehicle markings, the possibility of using public transport lanes, admission to low-emission zones or the use of parking areas for a narrower group of users.

In July 2019, the Ministry of the Economy issued the first ever call for the construction of AC charging points for municipalities and municipalities (planned volume of EUR 500 000). At the end of 2019, the Ministry of Economy issued a call for the purchase of battery and plug-in hybrid electric vehicles (EUR 5 million).

Support to the Ministry of the Economy is carried out on the basis of Section 2(h) – the construction of alternative fuels infrastructure and point (i) – the use of new vehicles powered by alternative fuels of Act No 71/2013 on the granting of subsidies under the competence of the Ministry of the 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 context of the organisation and efficient use of buildings, also aim at gradually renewing the fleet and conscientiously meet all the requirements arising from the transposed European Union legislation. As these technologies are more costly, they are significantly more difficult to procure for some companies. In addition, problems relating to the implementation of the adopted Act No 343/2015 on public procurement and amending certain acts have also been 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 in the case of above-threshold contracts. These problems relate in particular to the consequent competitive disadvantage (increasing the price of services) as well as the narrower market supply of electric vehicles and the current state of the charging infrastructure.

In line with the upcoming EU Alternative Fuels Infrastructure Regulation (AFIR), a network of hydrogen refuelling stations needs to be considered by 2030 along every 200 km along the TEN-T corridors and also in designated urban nodes within the meaning of Regulation (EU) No 1315/2013 of the European Parliament and of the Council of 11 December 2013 on Union guidelines for the development of the trans-European transport network and repealing Decision No 661/2010/EU and its possible future updates.

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

On 3 July 2019, the Slovak Government adopted Resolution No 336/2019 on the Action Plan for the Transformation of the Coal Region of Upper Nitra. For more details on the Action Plan, see section 1.2. Overview of the current political situation, point (ii) (g).

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 and to be prepared in accordance with Annex III to this Regulation

The Slovak Republic will continue to achieve energy savings for meeting the target under Article 7 of the Energy Efficiency Directive through policy measures.

Between 2014 and 2021, savings achieved by the renovation of private buildings (40 %) and reducing industry's energy intensity (35 %) were the most important contributors to the achievement of the target under Article 7 of the EED. The contributions of the transport sector and the public sector (buildings + lighting) were in line with 8 %.

Table 34: Overview of the most important policy measures and financial mechanisms for achieving the objective of Article 7 of Directive 2012/27/EU

	Measure – Support Mechanism	Share of energy savings per sector (%)
Private buildings	Multi-apartment buildings/renewal – ECB	46 %
	Single-family houses/restoration – ECB	9 %
	Retail and wholesale trade – ECB	7 %
	Monitoring of building consumption – MSEE SIEA	7 %
	Multi-apartment buildings/restoration – SFRB	6 %
	Hotels and restaurants/renewal – ECB	4 %
	Multi-apartment and single-family houses/construction – ECB	4 %
	Administrative buildings/Renovation – ECB	4 %
	Retail and wholesale/construction – ECB	3 %
Industry	Energy savings agreement – legislative action	73 %
	Mandatory energy audits in large enterprises – legislative measure	13 %
	Ministry of the Economy's investment incentives for industrial enterprises	5 %
	Improving the energy efficiency of industrial production – OP CEAEC 2007-2013	5 %
Transport	E-mobility in passenger transport by road	25 %
	Fleet modernisation/freight transport – Own resources	19 %
	Building and modernising transport infrastructure – EU funds	19 %
	Renewal and modernisation of the fleet – OPD 2007-2013	16 %
	Efficiency gains in road and rail freight transport – Own resources	13 %
Public sector	Administrative buildings/Renovation – ECB	20 %
	Schools/Renewal – ECB	16 %
	Multi-Category Buildings/Renovation – Envirofond	12 %
	Modernisation of public lighting	11 %
	Health institutions/Renewal – ECB	7 %
	More categories of buildings/renovation – OP Environment OP 2014-2020	6 %
	Administrative buildings/Renovation – Own resources	5 %
	Provision of GES	4 %
	Social services/Recovery – SF 2007-2013	3 %
	Medical facilities/renewal – Act 321/2014 Coll.	3 %
	More building/renovation categories – SlovSEFF 3	2 %
	Miscellaneous/Renewal – MunSEFF 1	2 %

Source: MH SR, SIEA

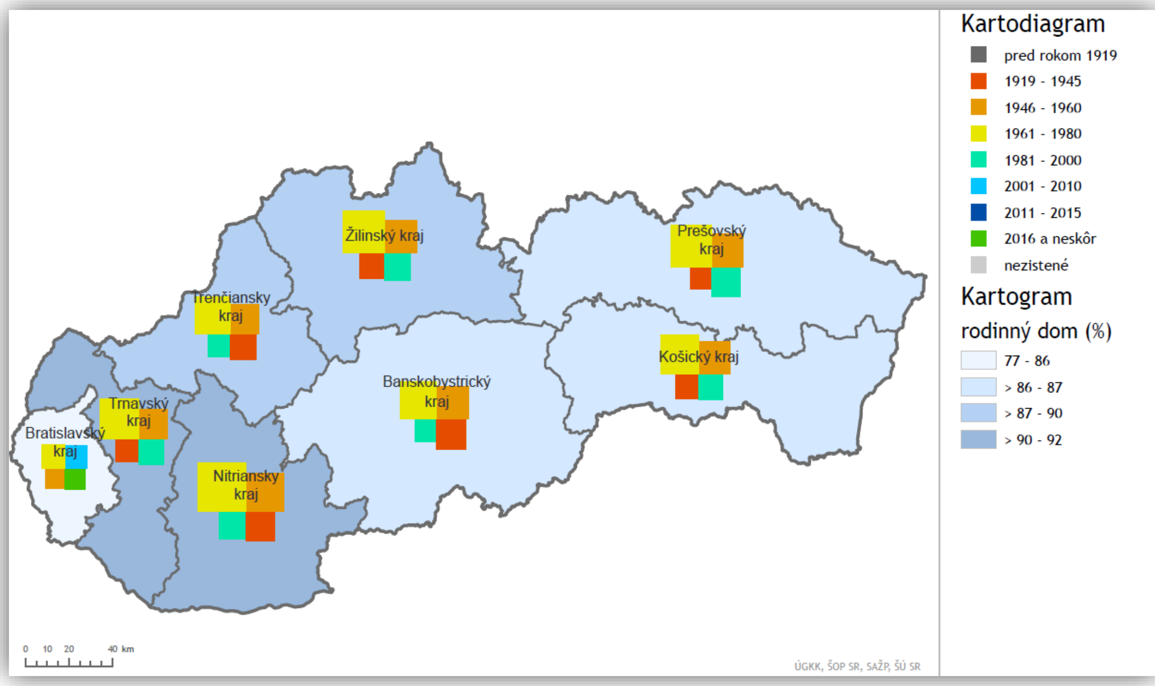
Households

The household sector will remain a key sector in terms of potential for energy savings after 2020. The new legislation adopted in line with the transposition of Directive 2018/844 will introduce new requirements for building renovation, with an emphasis on increasing the number of buildings undergoing deep renovation, additional requirements on technical building systems (installation of self-regulating devices, inspection of heating and cooling systems, etc.) and the implementation of building automation and control systems. The adoption of measures to improve the energy performance of a building is intended to reduce the overall energy demand of the building to be met as far as possible by energy supplied from renewable sources. Meeting the minimum requirements for the level of nearly zero buildings after 2020 for renovations will require deep renovations entailing higher financial costs, which will result in lower energy savings if the subsequent renovation (after the end of the lifetime of building elements) is carried out in the past than when a building is first renovated. The change in climate conditions observed over the last ten years in Slovakia and across the EU will result in higher requirements for cooling and ventilation of buildings, which will also translate into changing energy consumption patterns in buildings.

Single-family houses

In Slovakia, 1081293 single-family *houses are built according to the 2021 Housing and Houses Census*. 66 % of single-family houses were built 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.

Figure 3: Single-family houses by construction period in Slovakia as at 1 January 2021



Source: ŠÚ SR, SODB 2021

According to data from the 2021 Housing and Houses Census, around 69 % of single-family houses do not have a insulated envelope, 45 % do not have replaced windows and up to 70 % of single-family houses do not have an insulated roof. At least one of these measures is implemented in 60 % of single-family houses.

The renovations so far have been financed almost exclusively from the private sources of the owners, possibly in combination with the use of a building savings loan or a loan from a commercial bank. In order to motivate the owners of single-family houses, the State introduced support in the form of a State subsidy for the insulation of the single-family house in order to improve the energy efficiency of the single-family house in 2016. The allowance covers up to 40 % of the owner's eligible and expended renovation costs provided that the conditions of the allowance are observed. In the light of practical experience, the contribution has been revised, covering the increase in the amount of the contribution, the scope of the activities covered by the allowance as well as the simplification of administrative requirements in order to make the support mechanism for owners more attractive.

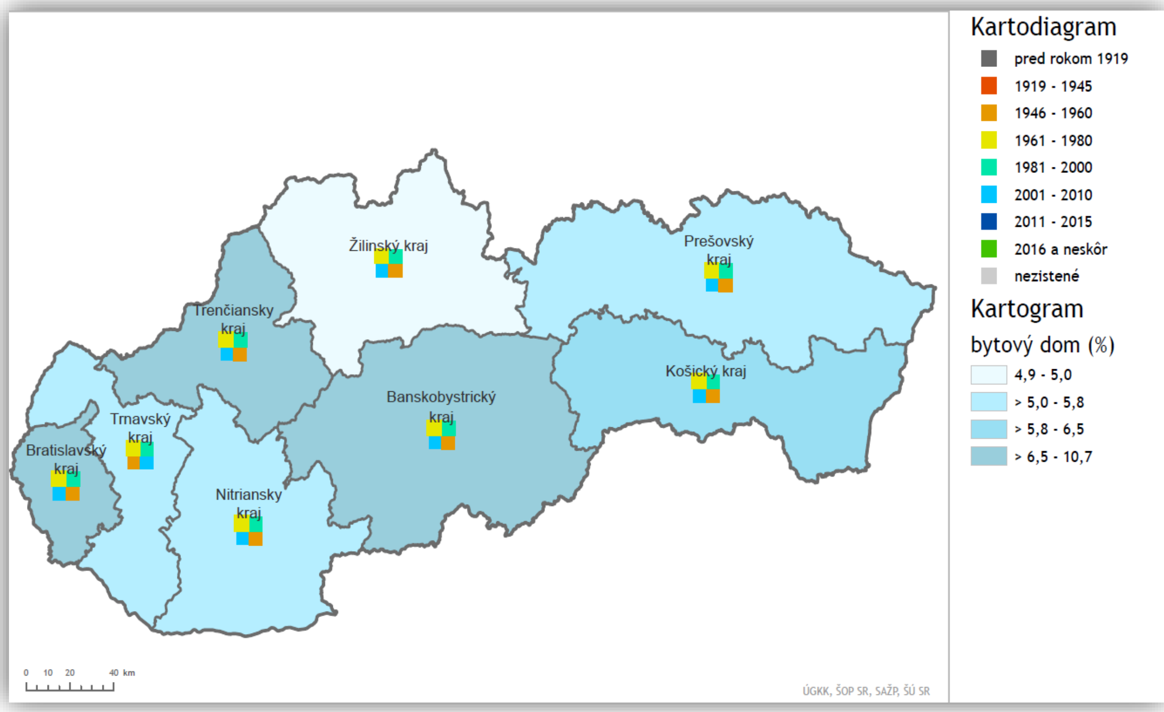
A key support programme for the renovation of single-family houses by 2030 will be the Recovery and Resilience Plan's recovery programme. The objective of the investment is to complete the renovation of at least 30000 single family houses, while achieving on average at least 30 % primary energy savings. The investment is aimed at owners of older family homes. 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. Where possible, measures to increase the climate resilience of buildings (such as green roofs, rainwater capture) will be applied. In order to mobilise a comprehensive and green recovery, support schemes will include a combination of mandatory and optional parts. A financial contribution from the owners is expected. Energy savings will be verified primarily through energy performance certificates or other relevant documents. The support will be implemented through the Slovak Environment Agency (SAŽP) and will lead to the improvement of the energy efficiency of single-family houses and the introduction of selected green elements in the renovation process. The allocation process will take into account the aspect of energy poverty and take into account the environmentally sound management of construction waste.

To support the recovery of households at risk of energy poverty, a support programme called 'Hom Light Recovery' was set up under the REPowerEU programme. This programme should allow 100 % funding for the comprehensive renovation of single-family houses. At the same time, it should allow low-income households to carry out partial renovations under significantly simplified conditions. The foreseen allocation is EUR 40.8 million.

Multi-apartment buildings

88 % of Slolvensk multi-apartment buildings were built after 1960. According to the Long-term Building Renovation Strategy, almost 70 % of apartments in multi-apartment buildings are renovated in Slovakia. The most important programme to support the renovation of multi-apartment buildings in Slovakia is the State Housing Development Fund, which will continue to play a key role in the renovation of multi-apartment buildings in the coming period.

Picture 4: Multi-apartment buildings by construction period in Slovakia as at 1 January 2021



Source: ŠÚ SR, SODB 2021

In addition to funding from the repayment of existing loans, an important source of financing for reconstruction through the State Housing Development Fund will also be EU structural funds from the Slovak programme. Projects whose energy saving measures reach a minimum level of 30 % primary energy savings will be supported. Eligible activities include, inter alia, the improvement of the thermal characteristics of the building structures of multi-apartment buildings (wall and roof heating, replacement of windows), modernisation of heating systems, including distribution and hydraulic control, installation of thermal control valves, installation of measuring and control systems to reduce energy consumption, modernisation of lighting to reduce energy consumption, modernisation of lifts to reduce energy consumption, removal of system failures in multi-apartment buildings to reduce energy consumption, installation of RES, green measures as well as debarierisation measures in buildings. The funds will be managed through the beneficiary, which will be the State Housing Development Fund. Revolving nature will allow these funds to be reused and reused in the future, significantly increasing the achievement of energy efficiency targets. Support through a financial instrument will be provided mainly, but not exclusively, through a combination of a grant and a financial instrument, in particular by providing loans.

Energy savings for meeting the target under Article 7 of the Energy Efficiency Directive will continue to be accounted for from investments supported through the SlovSEFF, MunSEFF and JESSICA programmes.

Multi-apartment + single-family houses

The Social Climate Fund will be a new financial mechanism that will, inter alia, serve the renovation of buildings for housing, and which should be dedicated exclusively to vulnerable households. The allocation for Slovakia is expected to be EUR 1.5 billion. EUR + 25 % national co-financing. 37.5 % of the total costs are projected to be dedicated to vulnerable households to compensate for high energy costs due to the extension of the ETS to the household and transport sectors. The remaining costs should be dedicated to increasing energy efficiency in buildings, decarbonising cooling and heating, integrating and storing energy from RES, and improving access to zero- and low-emission mobility and transport. The duration of the mechanism is foreseen for the period 2026-2032.

Policies

The legislative basis for the renovation of buildings, including residential buildings, is Act 555/2005 Coll. on the energy performance of buildings, including the corresponding decrees:

- Decree of the Ministry of Transport, Construction and Regional Development of the Slovak Republic 364/2012 implementing Act No 555/2005 on the energy performance of buildings and amending certain acts, as amended
- Decree of the Ministry of Transport, Construction and Regional Development of the Slovak Republic 324/2016 amending Decree 364/2012 of the Ministry of Transport, Construction and Regional Development implementing Act No 555/2005 on the energy performance of buildings and amending certain acts, as amended
- Decree of the Ministry of Construction and Regional Development of the Slovak Republic 311/2009 laying down the details of the calculation of the energy performance of buildings and the content of the energy performance certificate
- Decree of the Ministry of Construction and Regional Development of the Slovak Republic 625/2006 implementing Act No 555/2005 on the energy performance of buildings and amending certain acts

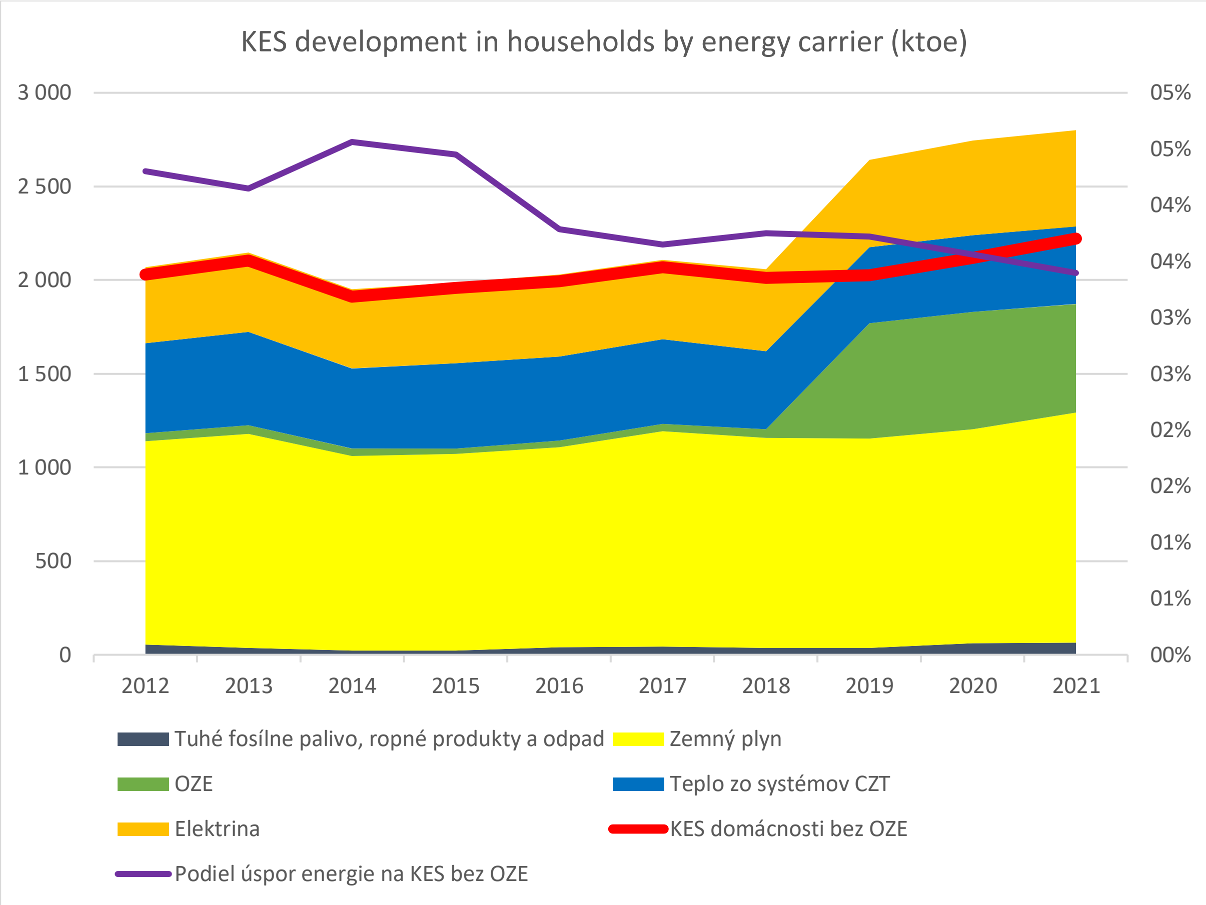
Impact of the measures on the evolution of final energy consumption by 2030

The share of households in final energy consumption in 2021 was 27 %. A significant increase was observed in 2019 due to the start of biomass accounting. The current share of biomass in household energy consumption is 21 %. Natural gas accounts for the largest share of total household consumption (44 %), with consumption in the sector increasing by 18 % since 2014. However, the actual consumption of natural gas is higher due to its dominant presence than energy in heat generation through central heating systems, which account for 15 % of households' final energy consumption in the heating of households.

The period between 2010 and 2015 in Slovakia was characterised by the highest renovation rates of both single-family and multi-apartment buildings in Slovakia's history – during this period, 37 % of apartments in multi-apartment buildings and 24 % of apartments in single-family houses were thermally insulated or replaced by windows. The share of energy savings achieved by the renovation of buildings for residential purposes ranged from 4.1 % to 4.6 % of households' total final energy consumption. On average, renovation of residential buildings saved as much as 87.2 ktoe per year. In the following period until 2021, there was a decrease of around 16 % in energy savings compared to the average of the previous period 2010-2015. This decrease, combined with the circumstances related to the pandemic situation in 2020 and 2021, reflected a 13 % increase in consumption[50] between 2015

50final energy consumption in households excluding RES/biomass and 2021. The increase in final energy consumption in households over the period 2012-2021, excluding RES, was 9.5 %. The trends described above are shown in Graph 2.

Chart 2: KES development in households by energy carrier (ktoe)



Source: Eurostat, Ministry of the Economy of the Slovak Republic

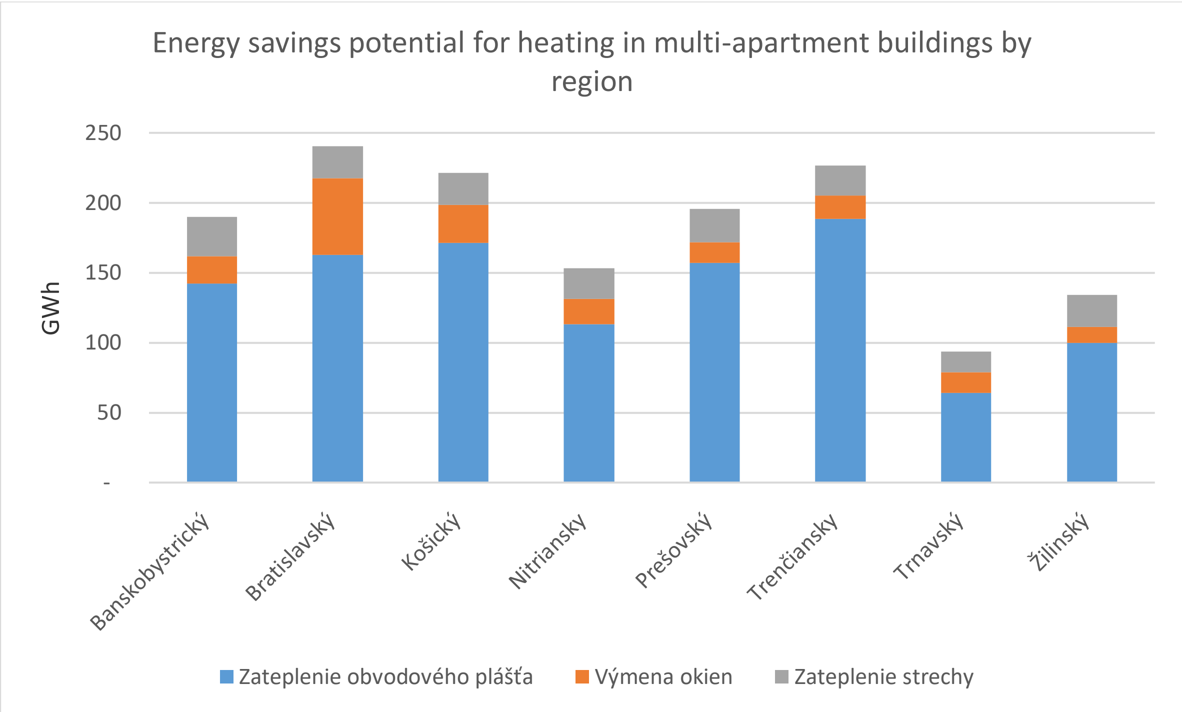
Thanks to data from the 2021 housing census, the household sector is the only sector of final energy consumption where all real energy savings achieved have been mapped and calculated at national level, not only those officially recorded and reported in the context of the implementation of Article 7 of the Energy Efficiency Directive[51]. A comparison of these data with the energy savings data monitored through the SIEA Energy Efficiency Monitoring System showed that on average 9 out of 10 renovated single-family houses are not in SIEA records, meaning that 90 % of renovated single-family houses in Slovakia either do not have an energy performance certificate or carried out renovations without State support.

51Energy savings achieved by the renovation of residential buildings, monitored for the purpose of complying with Article 7 of the Energy Efficiency Directive, are presented in the annual energy efficiency progress reports: https://www.mhsr.sk/energetika/energeticka-efektivnost/spravy-o-pokroku?csrt=8754926398670609545

Only single-family and multi-apartment buildings constructed after 1946 were included in the calculation of the energy savings potential and before 2000 – savings achieved by the renovation of these buildings account for more than 80 % of energy savings in single-family houses and almost 95 % of energy savings in multi-apartment buildings.

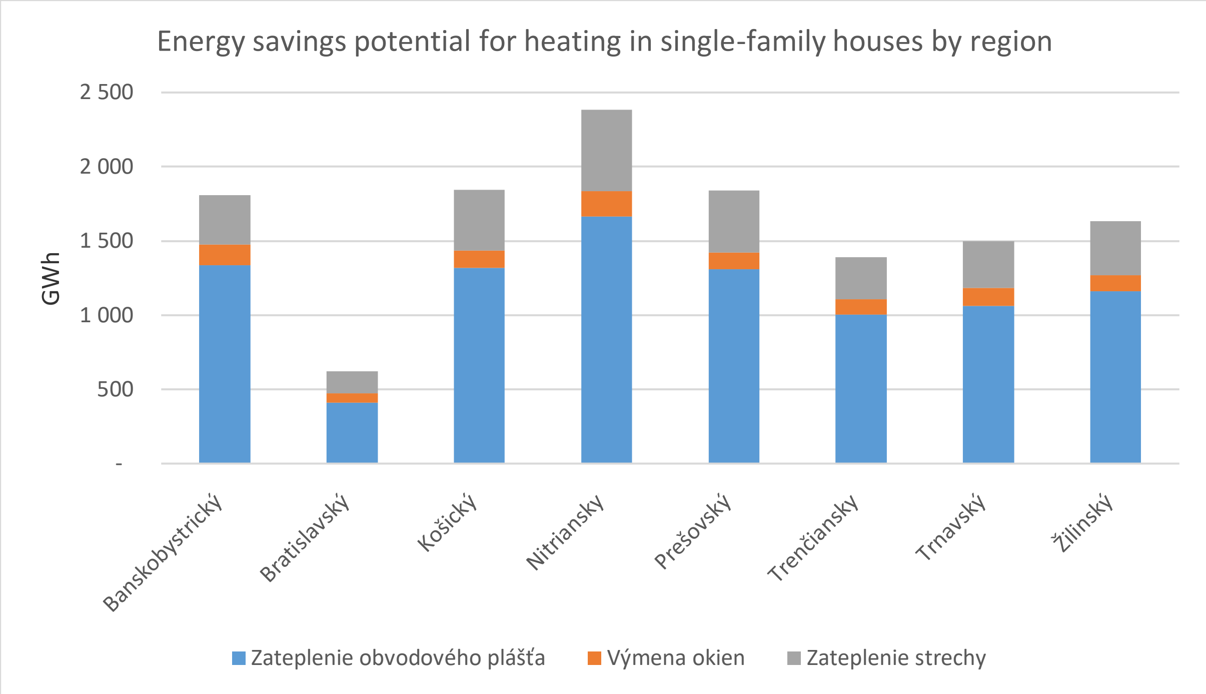
The results showed that despite a significant share of renovated single-family and multi-apartment buildings, the potential for energy savings for heating in residential buildings is significant, amounting to around 1245 ktoe. The energy saving potential of multi-apartment buildings is only 10 % of the total potential. The rest is for single-family houses. The situation in terms of recovery potential also varies depending on the districts in which the apartment/family houses with recovery potential are located. The above is illustrated by Graphs 3 and 4.

Graph 3: Energy savings potential for heating in multi-apartment buildings by region



Source: Processed by the Ministry of the Economy of the Slovak Republic for the load of SOBD data 2021, the Statistical Office of the Slovak Republic

Graph 4: Energy savings potential for heating in single-family houses by region

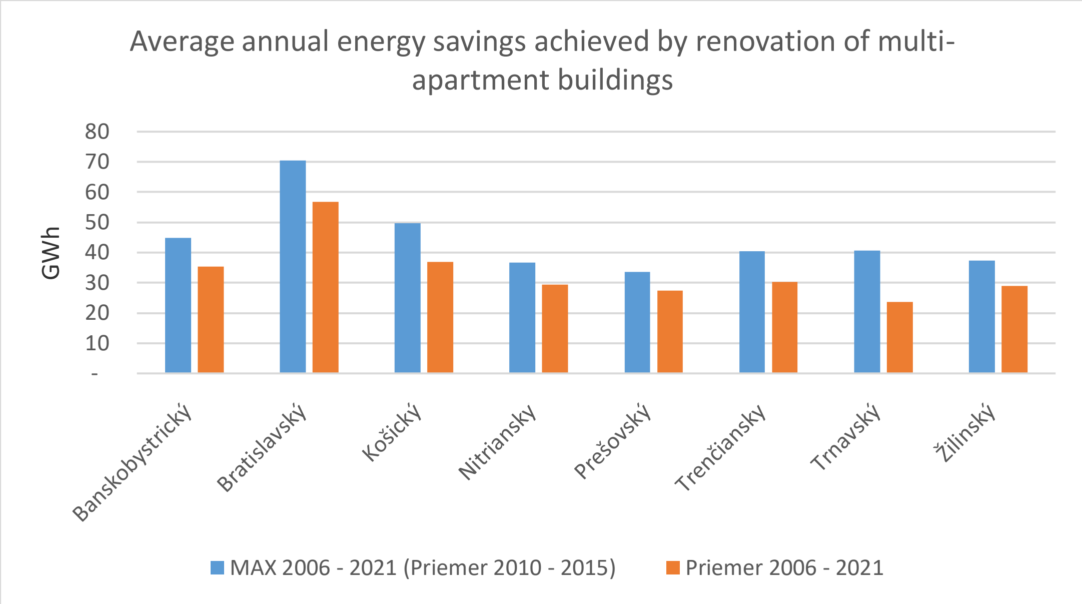


Source: Processed by the Ministry of the Economy of the Slovak Republic for the load of SOBD data 2021, the Statistical Office of the Slovak Republic

The pace of renovation between 2006 and 2021 was the basis for forecasting the future evolution of housing renovations. Two scenarios have been developed for this purpose.

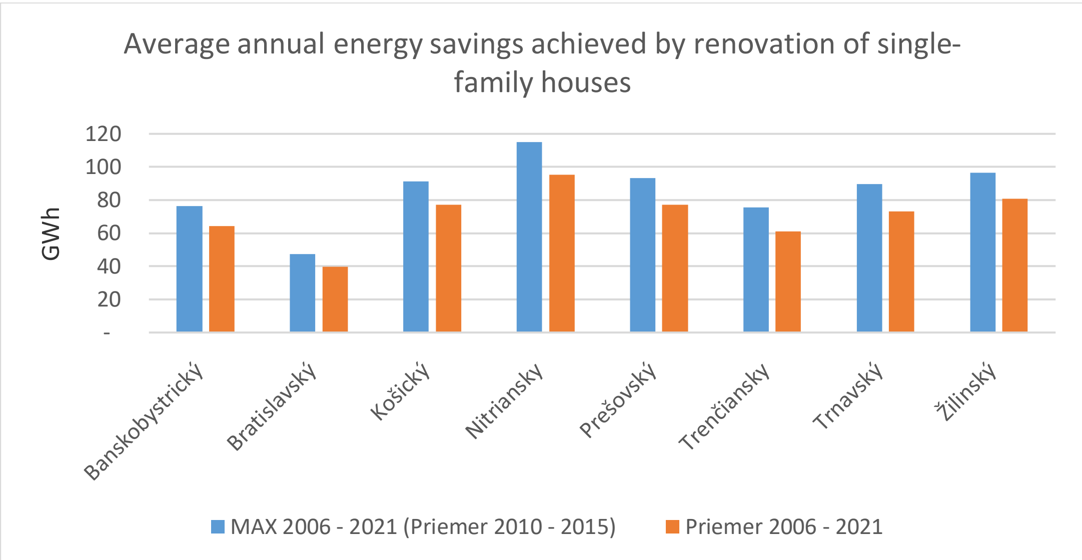
The first, optimistic scenario, called 'MAX 2006-2021', represents the average annual energy savings achieved by the renovation of residential buildings in a period when the renovation of both residential and single-family houses was most intensive, i.e. 2010-2015. The second realistic scenario "Average 2006-2021" represents the average annual energy savings achieved by the renovation of residential buildings over the period 2006-2021. Both scenarios include the impact at that time of existing financial mechanisms, such as the State Housing Development Fund, JESSICA, SlovSEFF, MunSEFF, and the support programme for the renovation of single-family houses called 'Business Efficient', and others. The average annual energy savings achieved by renovation of multi-apartment and single-family houses for both scenarios by county are shown in Graphs 5 and 6.

Graph 5: Average annual energy savings achieved by renovation of multi-apartment buildings



Source: Processed by the Ministry of the Economy of the Slovak Republic for the load of SOBD data 2021, the Statistical Office of the Slovak Republic

Graph 6: Average annual energy savings achieved by renovation of single-family houses

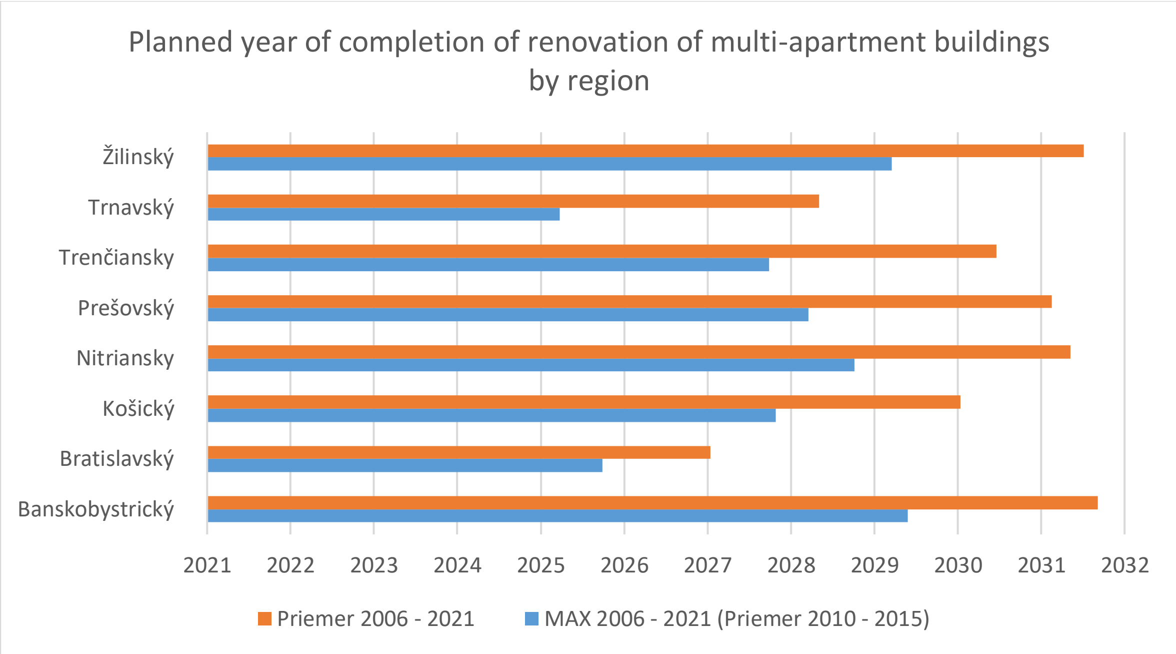


Source: Processed by the Ministry of the Economy of the Slovak Republic for the load of SOBD data 2021, the Statistical Office of the Slovak Republic

Based on data on the energy savings potential for heating and energy savings achieved by the renovation of single-family and multi-apartment buildings, a forecast was made for the period in which the renovation of single-family or multi-apartment buildings is expected to be completed. It is important to point out that this forecast applies only to houses built before 2000, as houses built after that year were already subject to higher standards of thermal properties, which, from a forward-looking perspective, paves the way for less renovation intensity.

At the pace of renovation in the 'Priemer 2006-2021' scenario, the renovation of multi-apartment buildings in Slovakia is projected to be completed by 2032. Under this scenario, the renovation of apartment buildings in Žilina, Prešov, Nitra and Banská Bystrica regions could be completed in 2031. The Bratislava region has a clear lead in terms of both the pace of recovery and the expected completion period. The forecast of the projected end of the renovation of multi-apartment buildings for each region is shown in Figure 7.

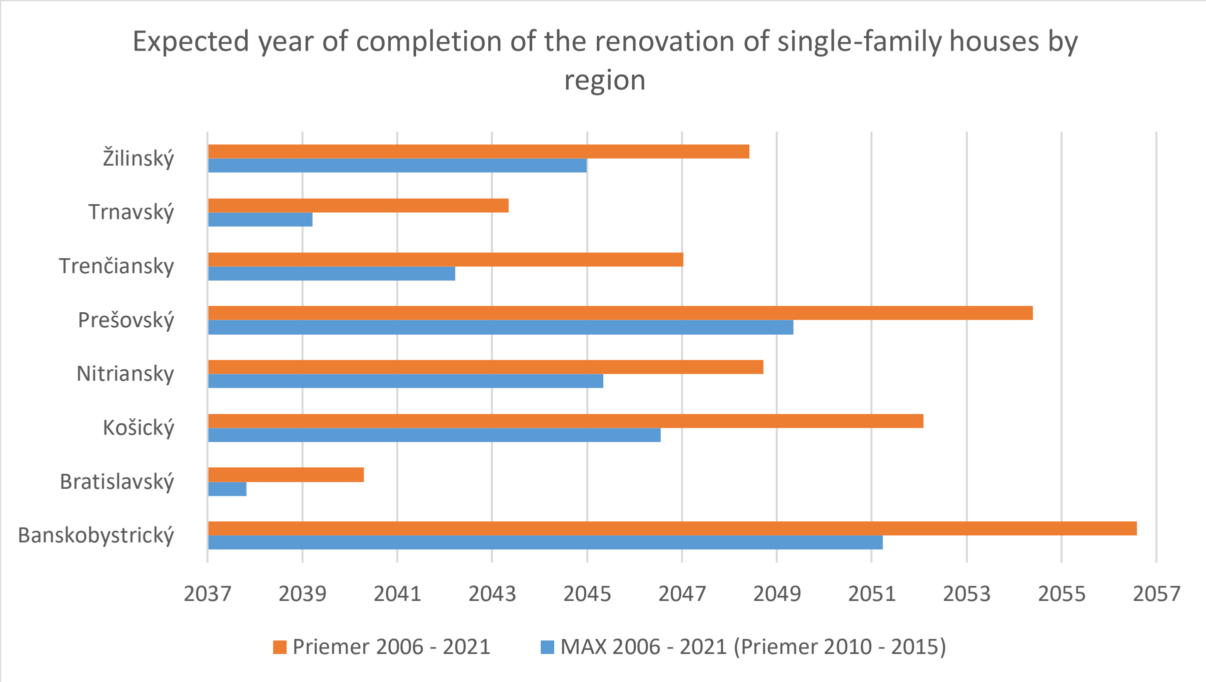
Graph 7: Planned year of completion of renovation of multi-apartment buildings by region



Source: Processed by the Ministry of the Economy of the Slovak Republic for the load of SOBD data 2021, the Statistical Office of the Slovak Republic

For single-family houses, the forecast does not foresee the completion of the renovation before 2038 in any of the counties. The optimistic scenario “MAX 2006-2021 (Priemer 2010-2015)” predicts the completion of the renovation in 2038 in the Bratislava region. In most counties, the process of renovation of single-family houses is expected to peak between 2045 and 2050. In the Prešov, Košice and Banská Bystrica regions, recovery is likely to continue beyond 2050. The forecast of the projected end of the renovation of single-family houses for each region is shown in Figure 8.

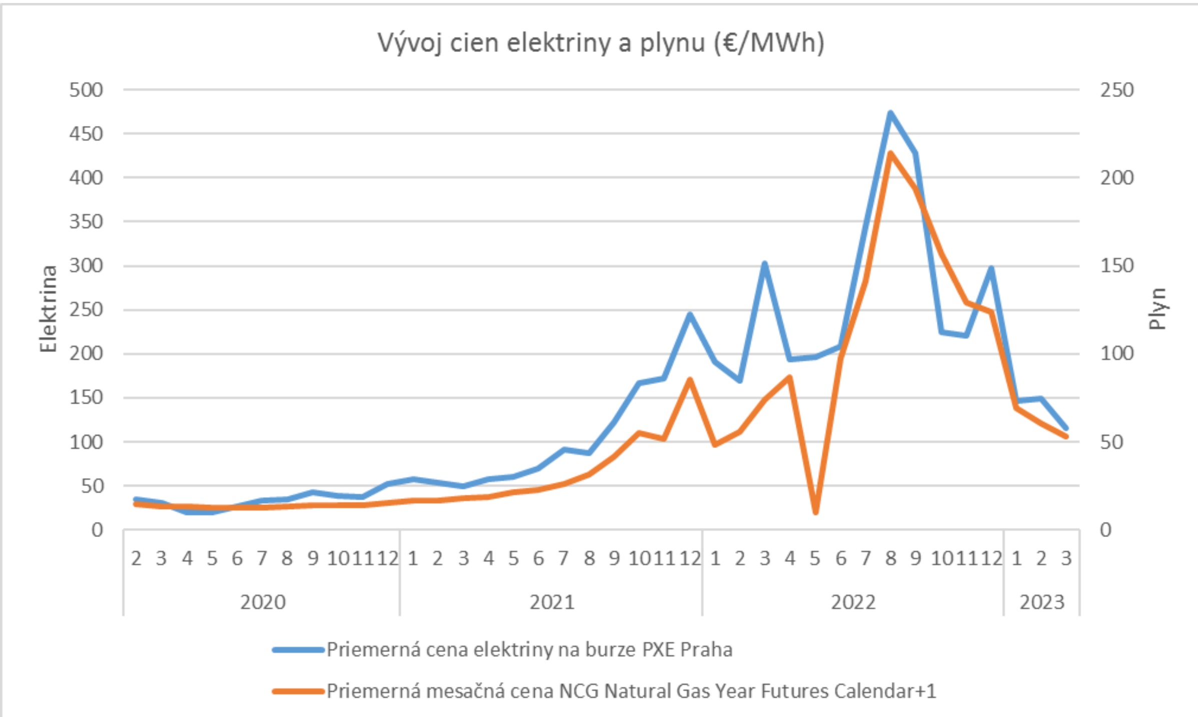
Graph 8: Expected year of completion of the renovation of single-family houses by region



Source: Processed by the Ministry of the Economy of the Slovak Republic for the load of SOBD data 2021, the Statistical Office of the Slovak Republic;

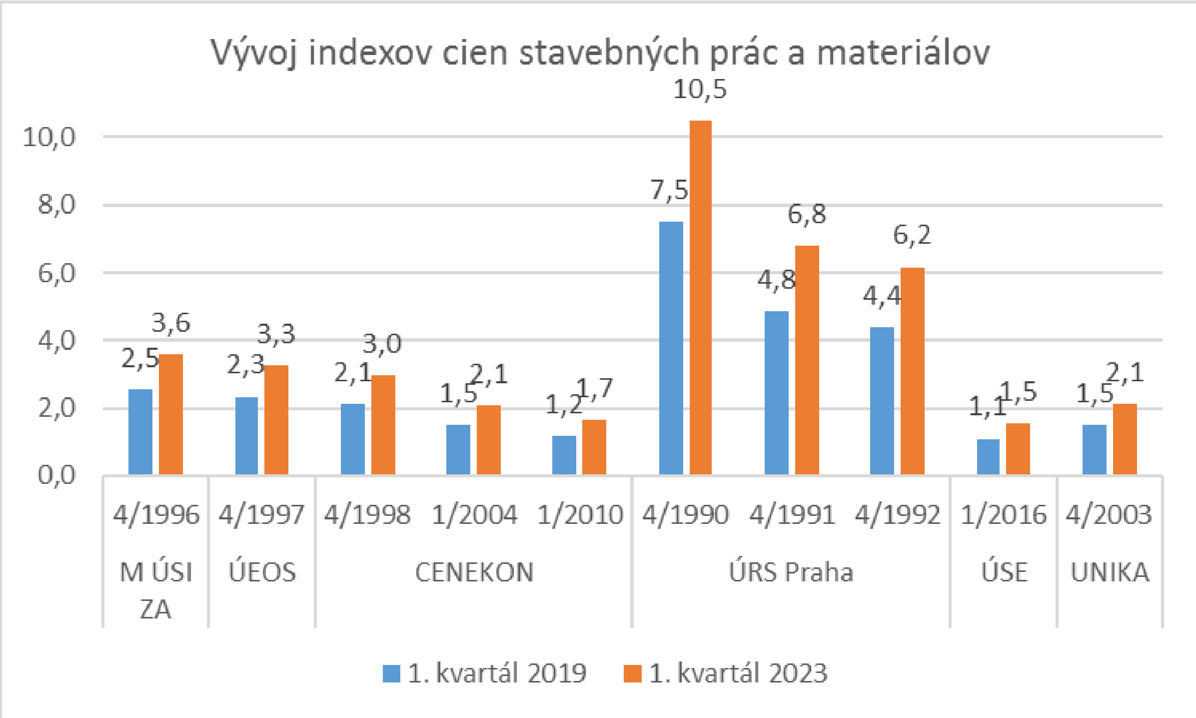
The impact of the human factor, in particular the willingness of property owners to carry out renovations, was not taken into account in the preparation of the projections. This factor is closely linked to the evolution of energy prices and building materials and works, but in particular to the social and economic situation of households. A special category for impacts that have not been taken into account is made up of historic residential buildings, whose technical options in terms of renovation are considerably limited.

Graph 9: Evolution of electricity and gas prices



Source: ÚRSO

Graph 10: Evolution of building and materials price indices



Source: Slovak Chamber of Value Adjudicators and Experts based on data from the Statistical Office of the Slovak Republic

The projections do not take into account the impact of ongoing or upcoming support programmes, whether from the Recovery and Resilience Plan or the Social Climate Fund, as it is not clear to what extent the funds from these programmes will be used in each region. However, the contribution rate of these programmes has been estimated due to the forecasting of the evolution of final energy consumption in the household sector up to 2030.

In order to establish the estimated rate of contribution of the support programmes to the forecast of the evolution of final energy consumption in the household sector up to 2030, the following assumptions have been used:

- Average primary energy savings: 40 %
- Estimated number of renovated houses through the RRP: 30 000
- Priority will be given to renovating single-family houses in energy class D-G (100 %)
- Average primary energy consumption for heating in single-family houses in energy class D – G: 314.6 kWh/(m^2.a)
- Average total floor area of a single-family house in energy class D – G: 120 m^2
- Projected natural increase in final energy consumption by 2030, taking into account pre-2020 support programmes (SFRB, live cost-effective, other): 1.8 %
- Conversion factor to calculate KES based on PES: 0,66
- The conditions for granting support from the SKF will be the same as for the POO*
- The budget for the period 2026-2032 will be EUR 1.5 billion. EUR + 25 % National co-financing*
- 37.5 % of the total SKF budget will be dedicated to offset energy prices*
- 62.5 % of the SKF budget will be dedicated to the renovation of single-family houses*

**The assumptions are hypothetical as the exact conditions, purpose and rules for the granting of support from the SKF are not yet approved*

In order to estimate the evolution of final energy consumption in households up to 2030, three scenarios have been developed, one baseline and two, based on the above-mentioned scenarios 'Average 2006-2021' and 'MAX 2006-2021 (Average 2010-2015)'. The characteristics of the scenarios are as follows:

Baseline scenario: The pace of renovation up to 2030 will reflect the evolution of the recovery achieved in the period 2012-2021. The contribution of energy savings over the period 2021-2030 will be zero, as these are energy savings that evolve in parallel with the natural evolution of KES (1.8 % up to 2030). The estimated contributions of the Recovery and Resilience Plan and the Social Climate Fund are fully reflected.

Table 35: Projected evolution of energy savings from renovation of multi-apartment and single-family houses, baseline scenario (ktoe)

	Script	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
RD	"Base"	48	44	42	41	39	37	36	34	33	31
	Contribution "BAU"		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	PO's contribution		**5**	**10**	**15**	**21**	**26**	**26**	**26**	**26**	**26**
	SKF contribution						**6**	**12**	**18**	**25**	**31**
BD	"Base"	28	27	27	27	27	27	26	26	26	26
	'Average'	28	23	23	23	23	23	23	23	23	23
	Contribution		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

"Average 2006-2021" scenario: The pace of renovation until 2030 will be equivalent to that achieved on average by the renovation of buildings for residential use in 2006-2021. The difference between the estimated 2030 energy savings corresponding to the average of energy savings achieved in the period 2006-2021 and the estimated energy savings by 2030 in the Base scenario represents the contribution of energy savings to the reduction of final energy consumption. The estimated contributions of the Recovery and Resilience Plan and the Social Climate Fund are fully reflected. The contribution of multi-apartment buildings is zero, as energy savings in this scenario are lower than energy savings in the Base scenario.

Table 36: Projected evolution of energy savings from renovation of multi-apartment and single-family houses, scenario "Priemer 2006-2021" (ktoe)

	Script	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
RD	"Base"	48	44	42	41	39	37	36	34	33	31
	'Average'	48	48	48	48	48	48	48	48	48	48
	Contribution "BAU"		**4**	**10**	**17**	**26**	**37**	**49**	**62**	**78**	**94**
	PO's contribution		**5**	**10**	**15**	**21**	**26**	**26**	**26**	**26**	**26**
	SKF contribution						**6**	**12**	**18**	**25**	**31**
BD	"Base"	28	27	27	27	27	27	26	26	26	26
	'Average'	28	23	23	23	23	23	23	23	23	23
	Contribution		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

Scenario "MAX 2006-2021": The renovation rate until 2030 will be equivalent to the renovation rate achieved on average by the renovation of buildings for residential purposes in 2010-2015 (the period with the highest annual average of energy savings achieved by the renovation of buildings for residential purposes). The difference between the estimated 2030 energy savings corresponding to the average energy savings achieved over the period 2010-2015 and the estimated energy savings by

2030 in the Base scenario represents the contribution of energy savings to the reduction of final energy consumption. The estimated contributions of the Recovery and Resilience Plan and the Social Climate Fund are fully reflected.

Table 37: Projected evolution of energy savings from renovation of multi-apartment and single-family houses, scenario "MAX 2006-2021" (ktoe)

	Script	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
RD	"Base"	48	44	42	41	39	37	36	34	33	31
	'Average'	59	59	59	59	59	59	59	59	59	59
	Contribution "BAU"		**15**	**31**	**49**	**69**	**90**	**113**	**137**	**163**	**190**
	PO's contribution		**5**	**10**	**15**	**21**	**26**	**26**	**26**	**26**	**26**
	SKF contribution						**6**	**12**	**18**	**25**	**31**
BD	"Base"	28	27	27	27	27	27	26	26	26	26
	'Average'	28	29	29	29	29	29	29	29	29	29
	Contribution		**2**	**3**	**5**	**7**	**9**	**11**	**14**	**17**	**19**

Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

Although there is no obligation for Member States to set and meet a specific final energy consumption target for the household sector by 2030, an indicative target of 12 % (KES target for Slovakia) of reducing final energy consumption in households compared to the final energy consumption achieved in this sector in 2020[52] – 'REF 2020 – 12 %' – has been set for illustrative purposes.

This indicative household target of 'REF2020-12 %' was most closest to the scenario 'MAX 2006-2021', which reduced final energy consumption in the household sector by 5 % compared to 2020, thus missing only 7 % to reach the indicative target. The 'Average 2006-2021' scenario achieved a reduction in consumption of 0.2 % compared to 2020, implying a need for an additional reduction in energy consumption to reach the indicative target of 'REF2020-12 %' by 11.8 %. In the Base scenario, final energy consumption would increase by 3.7 % in 2030 compared to 2020.

Table 38: Contribution of selected scenarios to the reduction of KES in the household sector

KES 2030 scenarios	Δ KES 2030 – 'REF 2020-12 %' (ktoe)	Need to reduce KES 2030 to reach REF2020 – 12 % (%)	Need to reduce KES 2030 to reach the "30.3 %" scenario (%)
Base	379,7	15.7 %	0.5 %
Average 2006-2021	285,5	11.8 %	—2.9 %
MAX 2006-2021	170,2	7.0 %	—7.0 %

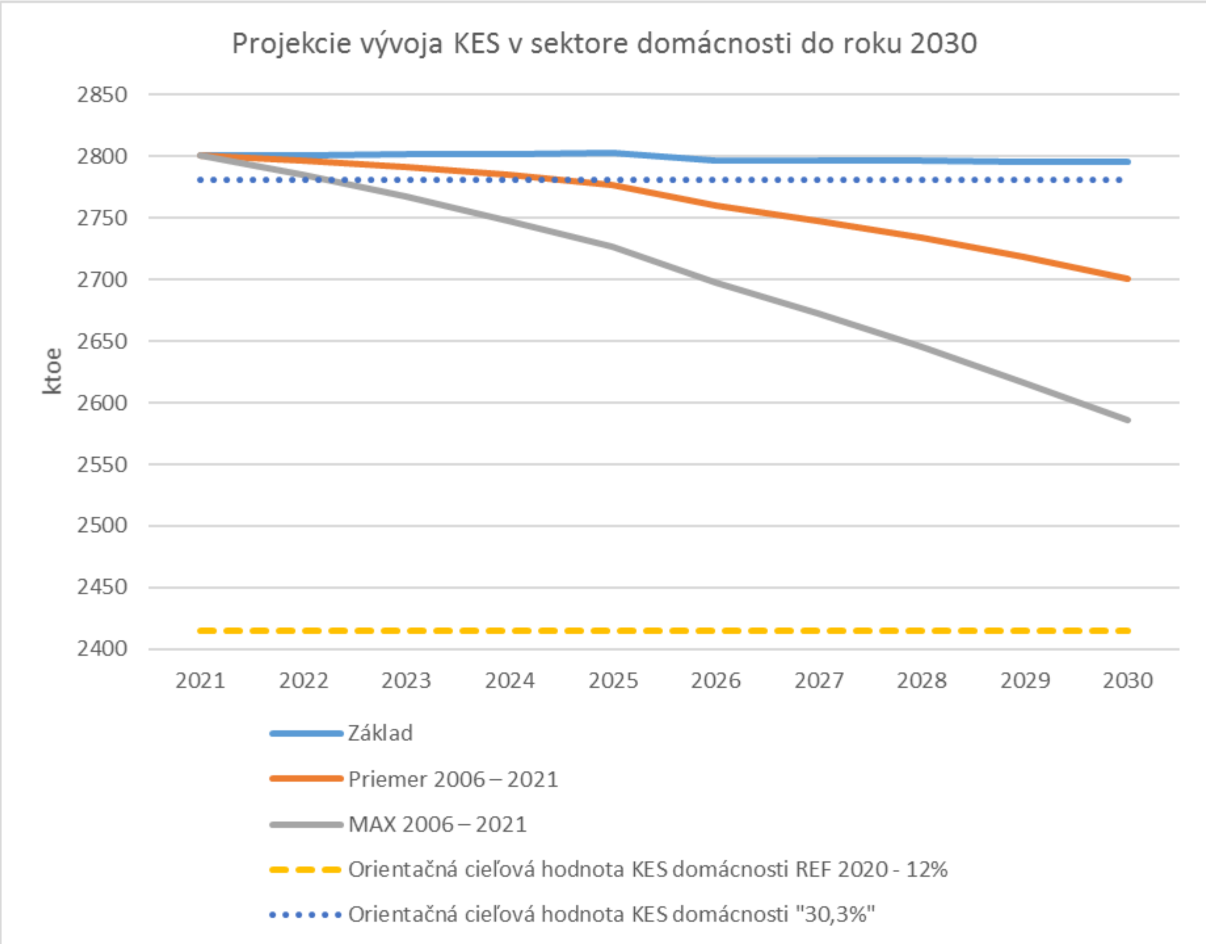
Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

Assuming that the ambitious target for final energy consumption as notified in the Integrated National Energy and Climate Plan of the Slovak Republic (30.3 %), submitted to the European Commission in December 2019, was submitted to the European Commission in December 2019, the 'Prime average 2006-2021' scenario would exceed the indicative target of '30.3 %' for households by 2.9 % and the

52The reason for using final energy consumption in households for 2020 as a benchmark instead of EU REF 2020 for Slovakia is that using the average share of household consumption in total final energy consumption for the period before 2019 would be misleading, given the accounting of biomass in this sector from 2019 onwards. Moreover, the EU REF 2020 value for Slovakia (9614 ktoe) is almost the same as the 2020 KES value for Slovakia (9611 ktoe).

'MAX 2006-2021' scenario by 7 %. In the 'Basic' scenario, this indicative target would be missed by 0.5 %. The scenarios are illustrated in Graph 11.

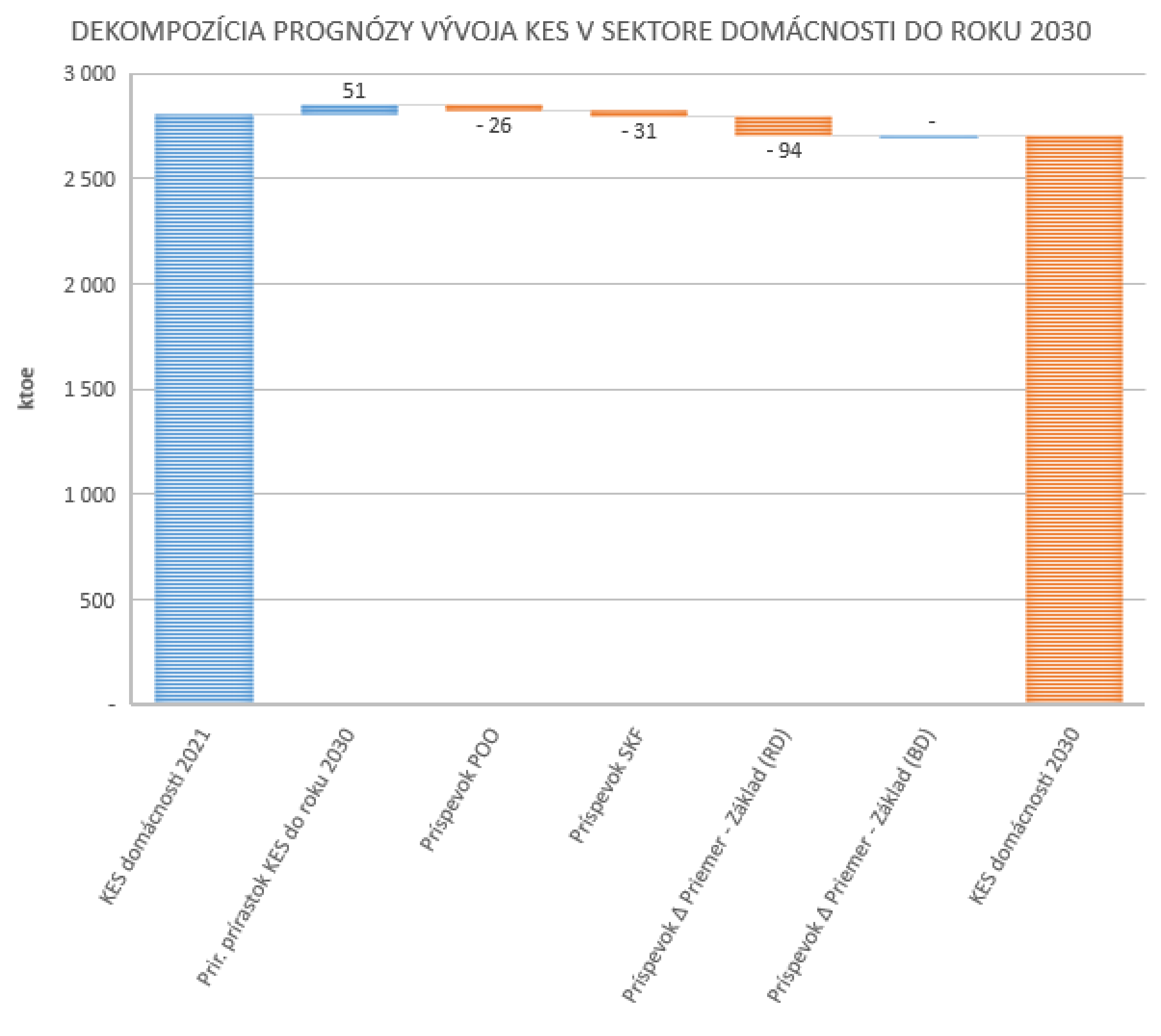
Figure 11: KES projections for the household sector by 2030



Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

In view of the forecast of the evolution of final energy consumption in the household sector, the scenario 'Average 2006-2021' appears to be the most plausible taking into account the underlying underlying assumptions. The decomposition of key aspects affecting the evolution of final energy consumption in the household sector under this scenario is illustrated in Figure 12.

Graph 12: Decomposition of the KES projection in the household sector up to 2030



Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

The estimated contribution of energy savings from the RRP to the reduction of final energy consumption is 25.71 ktoe. The Social Climate Fund contribution, assuming 50 % co-financing of renovation by households and under the conditions set out above, is 31 ktoe until 2030.

In order to reduce final energy consumption in the household sector by 12 % compared to 2020 (REF2020-12 %), it will be necessary to provide additional public funding for the renovation of single-family houses corresponding to the achievement of nearly 286 ktoe energy savings on the final energy consumption side. The exchange of a source for heating and hot water can also contribute to an additional reduction in energy consumption. The WEM scenario target (2630 ktoe) is assumed to be reached if a fossil fuel source is replaced by a heat pump of 1 out of four households undergoing the renovation of a single-family house.[53] In order to reach the WEM

53applicable to AVG scenario

target (2452 ktoe), a source exchange is assumed in 2 out of 3 households undergoing the renovation of the single-family house.

The contribution of the Recovery and Resilience Plan and the Social Climate Fund to the achievement of the Article 7 objective in the “Average 2006-2021” scenario ranges from 4.5 to 5 %, depending on Eurostat’s methodology.

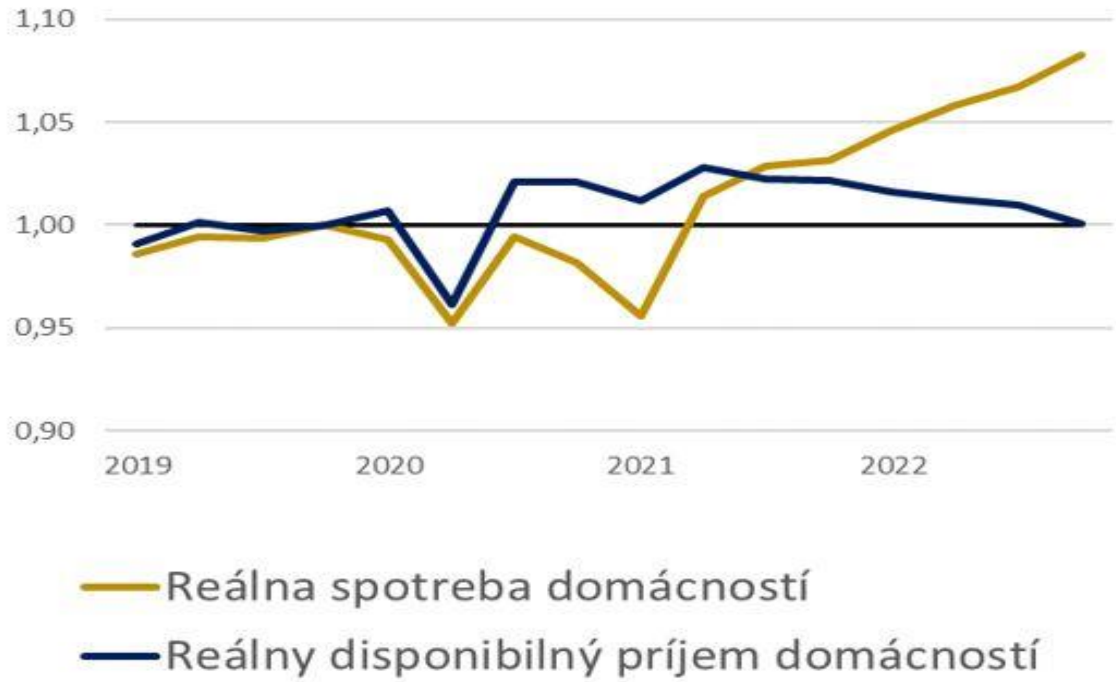
Table 39: Contribution of the RRP and the Social Climate Fund to the objective under Art. 7 (ktoe)

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	TOGETHER,
F_CE	774	697	620	881	755	726	581	552	368	184	6137
FEC 2020-2030	870	783	696	990	849	816	653	620	413	207	6899
Contribution		**46**	**41**	**36**	**31**	**69**	**34**	**26**	**17**	**9**	**309**

Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

In particular, households’ financial capacity will be key to financing the recovery. According to the National Bank of Slovakia (NBS), despite record inflation, the real consumption of Slovak households did not fall until the end of 2022, on the contrary. The number of goods and services purchased by people grew, although the incomes of the population stagnated after taking inflation into account.

Graph 13: Real consumption of Slovak households did not fall despite record inflation



Source: NBS

People were willing to defer less money from their incomes in favour of consumption, with the rate of saving on household disposable income steadily decreasing. Consumer appetites culminated in a situation in Q4 2022, when the savings rate fell to 2 %. In other words, **households consumed almost all their income**.

Table 40: Household structure in terms of district disposable income in 2020 (%)

Disposable income/household (EUR)	Household structure in terms of disposable income by districts (%)							
	BA	TT	TN	DB	FOR	BB	PO	KE
up to 100	0	0	0,1	0,3	0,4	1	0,5	0,8

101-200	0,2	0,3	0,2	0,8	0	2,8	2,2	2
201-300	1,4	1,5	1,6	2,3	1,6	3,7	4,6	3,9
301-400	1,2	5,3	3,7	3,4	6,5	8,5	4,6	6,2
401-500	5,4	8,7	8,6	10,1	10,2	9,4	14	8
501-600	10	14,2	16,6	15,7	14,9	15,2	19,3	14,7
601-700	11,3	12,6	15	16,3	14,5	15,8	17,3	17
701-800	13,7	12,5	14,9	15,7	13,2	11,6	13,6	15,6
801-900	15,1	13,9	12,9	11,2	11,9	10,1	10,1	11,1
901 – 1000	11	10,2	9,2	9,4	11,8	7,6	5,4	8,2
1001 or more	30,6	20,7	17,1	15	15	14,3	8,4	12,4

Source: STATISTICAL OFFICE OF THE SLOVAK REPUBLIC

Taking into account debt servicing, i.e. interest and principal repayments, and the small remaining scope for further reducing savings, **household consumption is likely to be weak in the next period**. Mortgages have grown significantly in recent years. Mortgage rates have also risen since last year. Overall, people will therefore increasingly put more and more money on loan instalments. Therefore, stronger growth in household consumption is likely to take place only after a sufficient and sustained acceleration in income growth above the inflation rate. According to estimates by the NBS, this could only happen in 2024. For a certain period, households will also have to rebuild some depleted financial reserves.

Industry

In the period 2014-2021, the industry sector contributed 35 % of the total amount of energy savings monitored through the SIEA Energy Efficiency Monitoring System. The measures were clearly dominated by energy savings agreements, also known as 'voluntary agreements'. Their share of the total energy savings achieved in industry was 72 %. The introduction of energy audits and an energy management system resulted in energy savings of 15 % and investment incentives contributed 13 % together. The main sources of investment incentives were the Quality and Economic Growth and Incentives Operational Programme provided by the Ministry of the Economy, whose contribution was around 11.2 %. A contribution of less than 2 % was provided by SLOVSEFF 2, SLOVSEFF 3 and the Operational Programme Quality of the Environment. In view of the results achieved, the Slovak Republic will continue to support these measures after 2021.

Voluntary agreements will remain the main measure for meeting the target under Article 7 of the EED. By 2030, emphasis will be placed on increasing the number of actors actively contributing to the target, as well as the gradual involvement of industry associations and associations. The Slovak Republic's ambition is gradually to apply this measure to the public sector or to other sectors of the national economy. In particular at the level of the public sector and municipalities, close cooperation with regional sustainable energy centres and regional energy centres is expected. Voluntary agreements will be under the responsibility of the Ministry of the Economy of the Slovak Republic. The implementation will be carried out by SIEA in cooperation with the Slovak Ministry of the Economy.

Slovakia's programme under policy objective 2 will support the implementation of the measures recommended in the energy audit, which evaluates energy consumption and proposes measures for three essential parts: buildings, technological equipment and means of transport. Measures such as improving the thermal protection of business buildings, improving the efficiency of existing plants for electricity/heat/cooling in enterprises, or replacing them with new more efficient installations, and introducing systems for monitoring, optimising and managing energy consumption, including increasing the efficiency of energy distribution, will be supported. Preparatory investment works, including energy audits and certificates, relevant studies and project documentation, will be eligible, provided that this does not conflict with State aid rules in relation to the incentive effect. The support will be implemented through a grant/financial instrument. Implementation will be ensured by SIEA. The foreseen allocation is EUR 42.7 million.

Policy Objective 1 Slovakia will support measures that will contribute to reducing energy intensity in enterprises indirectly. An example of such action is Action 1.1.1 "Promoting cross-sectoral cooperation in science, research and innovation" and increasing R & I capacities in enterprises. The measure will support the application of solutions and technologies of Industry 4.0 as well as investments to increase the competitiveness and innovation performance of businesses. The introduction of innovation into the production process will also be supported. The contribution of energy savings is also expected from Measure 1.3.1 aimed at supporting small and medium-sized enterprises, in particular to support SMEs' access to investments in the transition to a green and circular economy and to develop competitiveness.

The State aid scheme for the decarbonisation of industry financed by the Recovery and Resilience Plan is intended to reduce greenhouse gas emissions by supporting projects to decarbonise industry that lead to **energy savings** and introduce the use of innovative environmental technologies in industrial production by industrial enterprises that are part of the European Emissions Trading System. The scheme will be implemented in the period 2022-2026 with an estimated allocation of EUR 357 million. The RRP will also support the area of research and innovation for decarbonisation and digitalisation of the economy through Component 9 "More efficient governance and strengthening R & D & I funding". The programmes should aim to support the development of innovative solutions.

The Modernisation Fund will be an important financial mechanism to reduce energy intensity in industry. The Modernisation Fund was established in accordance with Article 10d of the revised EU ETS Directive and serves to support investments in modernising energy systems and improving energy efficiency. The indicative expenditure for the period 2022-2030 is around EUR 1 billion. EUR. Allocation to projects that achieve energy savings on the final energy consumption side is not specified. Only those measures that do not prolong the use of solid fossil fuels, significantly reduce greenhouse gas emissions, lead to the phasing out of fossil fuels, better energy efficiency and a just transition in carbon-dependent regions will be supported.

Contributions from measures financed through the operational programmes of the European Structural Funds in the 2014-2020 programming period will continue to be counted towards the achievement of the target under Article 7 of the Energy Efficiency Directive. These include measures Innovation and technology transfers in industrial enterprises, implementation of energy efficiency measures from energy audits, investment incentives for industrial enterprises, etc. It is also envisaged to develop the provision of energy services in industry.

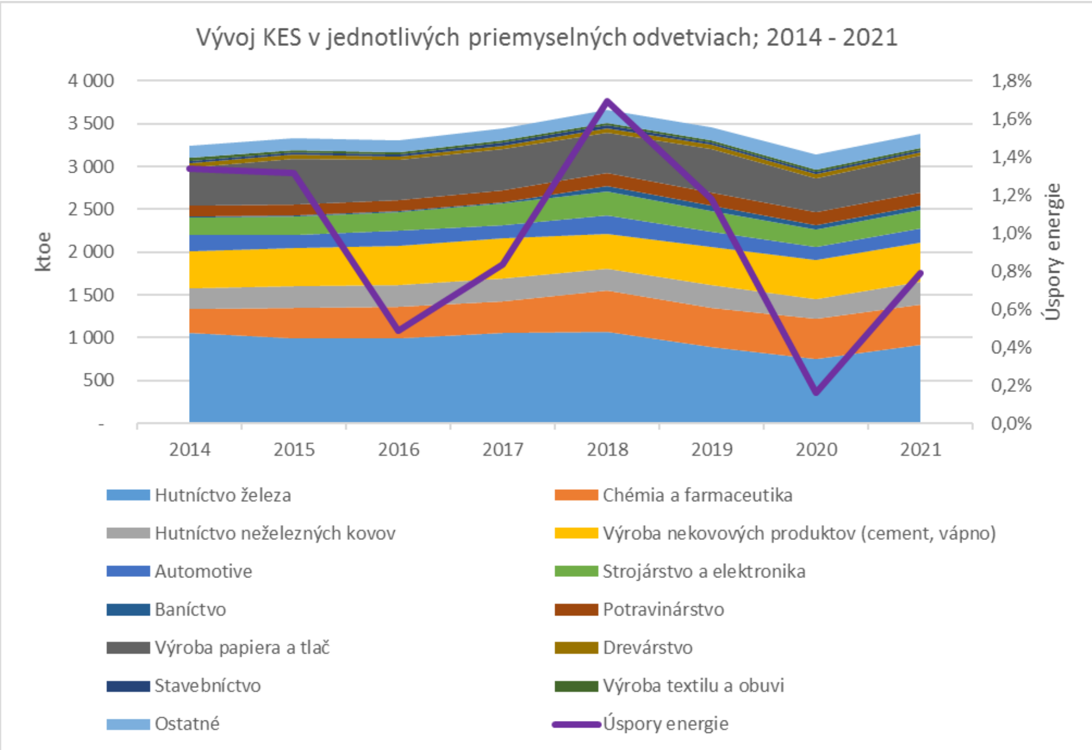
Due to a significant increase in the target for Article 7(8) of the Energy Efficiency Directive, it is also envisaged to introduce a new measure, the so-called competitive system, whose contribution to meeting the target under Article 7(8) of the Energy Efficiency Directive may be decisive. The measure will be aimed at supporting the implementation of investment projects to reduce energy intensity and CO_2 production. Support for the implementation of projects will be provided only to the extent necessary for their implementation, which will also result in significant savings in public funds. Compliance with the energy efficiency first principle will be a condition. Applications for renewable installation will also be accepted as long as they are part of projects that prioritise reducing energy intensity. The main criterion for the evaluation of tenders will be the cost in EUR per MWh/tCO_2 saved.

Impact of the measures on the evolution of final energy consumption (CES) by 2030

Industry's share of final energy consumption ranged from 33 % to 37 % since 2012. Of this, the share of iron and steel production is more than 25 % and the share of cement and lime, paper and chemical industries is between 13 % and 14 %[54]. The energy consumption of these four sectors accounts for around two thirds of the final energy consumption of Slovak industry.

The energy intensity of industry was55 0.44 GWh per million euro of output in 2019. In the V4 it was the second highest. The evolution of energy consumption in the period 2014-2021 by sector is shown in Figure 14.

Graph 14: Evolution of KES in industrial sectors 2014-2021



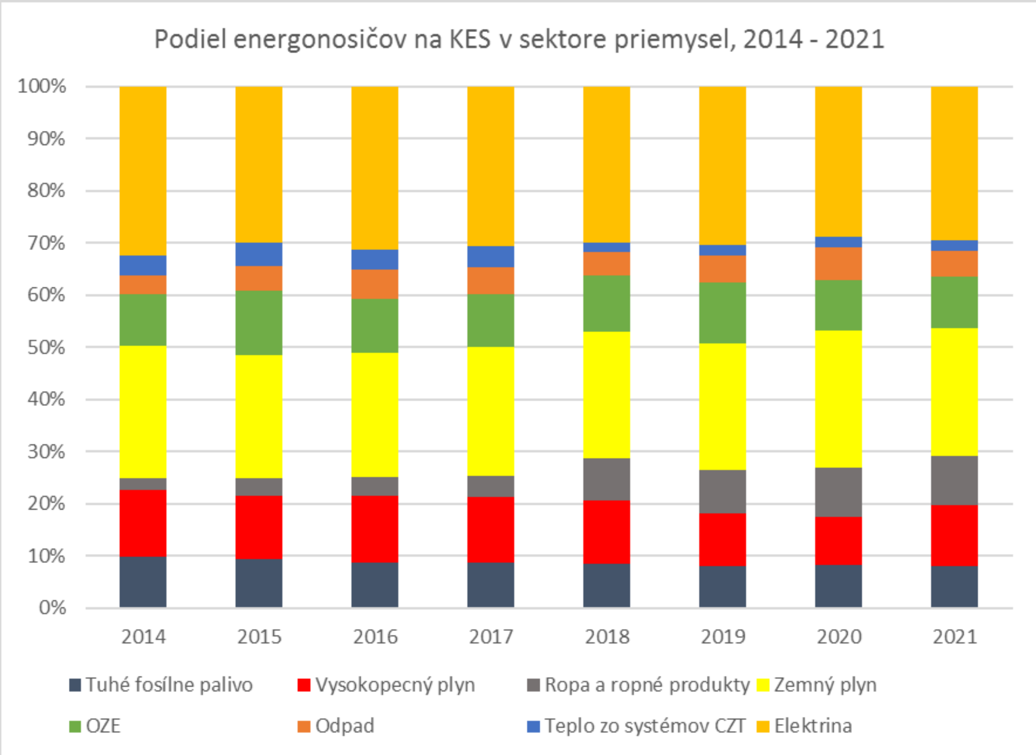
Source: Eurostat

In terms of energy carriers, the dominant share of electricity and natural gas is more than half of the total energy consumption. The share of fossil fuels, outside natural gas, is less than 30 %. The remainder consists of renewable energy sources and heat. The representation of individual energy producers in the Slovak industry in the period 2014-2021 is shown in Figure 15.

54For each sector separately

552019 is used due to a misrepresentation of the following years by the pandemic.

Graph 15: Share of energy producers in KES in industry 2014-2021

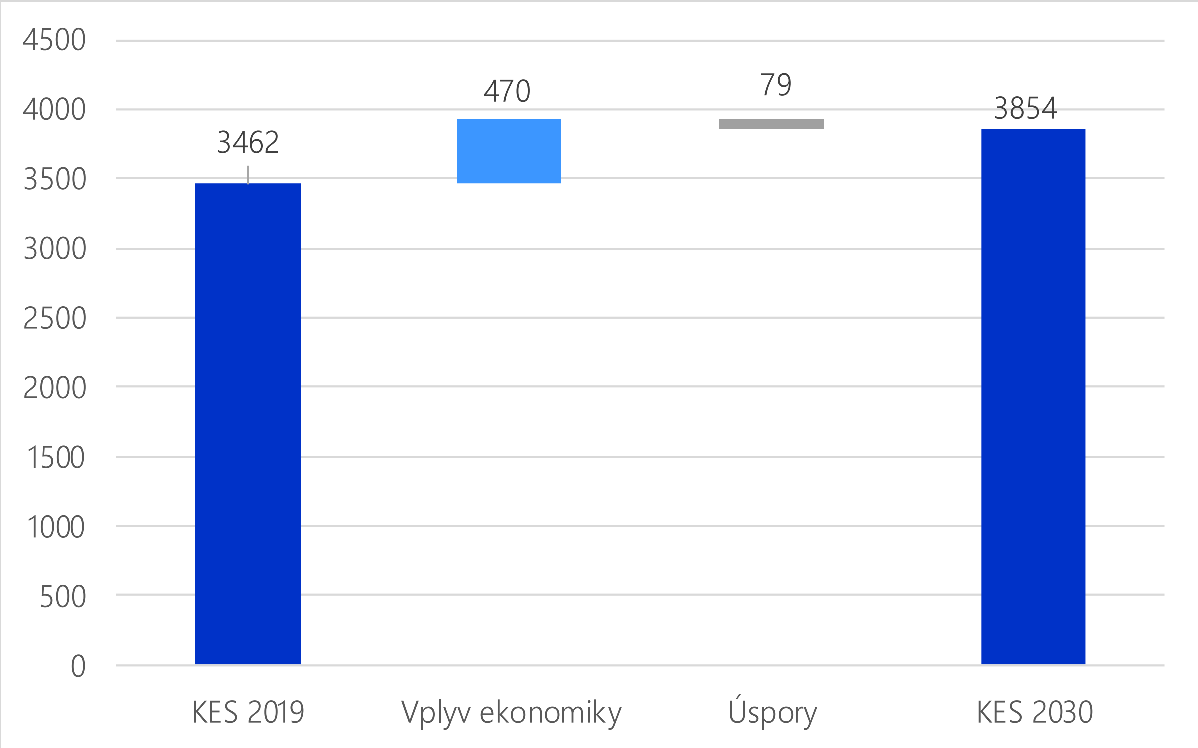


Source: Eurostat

In addition to energy intensity, gross value added also has a major impact on the evolution of final energy consumption in industry. At company level, in addition to the potential for energy savings, in particular changes linked to the introduction of new production technologies and technological processes, as well as increasing, reducing or shutting down production, are key in this respect. In order to prepare a forecast of the evolution of final energy consumption in industry up to 2030, the Ministry of Economy has developed 3 scenarios in which these impacts are taken into account. Due to fluctuations in official data for 2020 and 2021 due to the pandemic, the reference data are the statistics for 2019.

Scenario 1: it assumes a natural decline in energy intensity and an optimistic trend in production. The contribution of energy savings from implemented measures and projects to total final energy consumption in industry will be negligible. Battery production is foreseen with a total production capacity of 40 GWh. The closure of more energy-intensive businesses is not foreseen. The iron and steel industry will not make key planned decarbonisation investments.

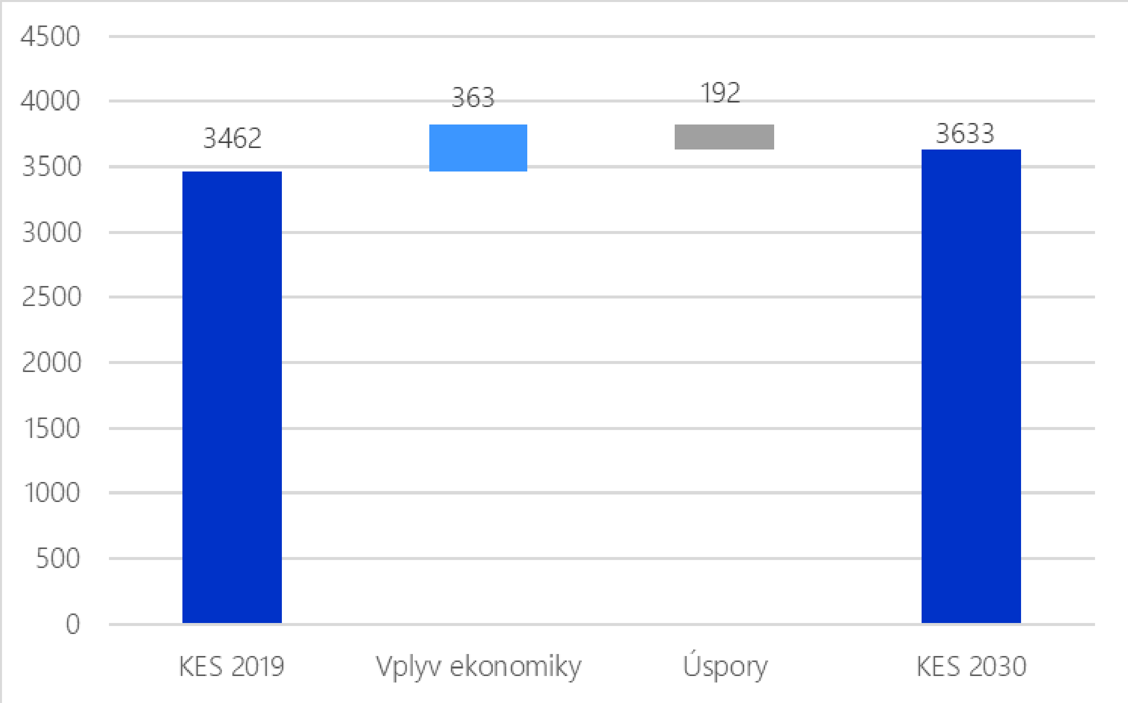
Graph 16: Decomposition of the industrial KES forecast until 2030 (ktoe), Scenario 1



Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

Scenario 2: it assumes a natural decline in energy intensity and a realistic scenario for the evolution of output. The contribution of energy savings from implemented measures and projects is estimated at around 4 % of final energy consumption in industry. Battery production with a capacity of 20 GWh is foreseen. The closure of more energy-intensive businesses is not foreseen. The iron and steel industry will not make key planned decarbonisation investments.

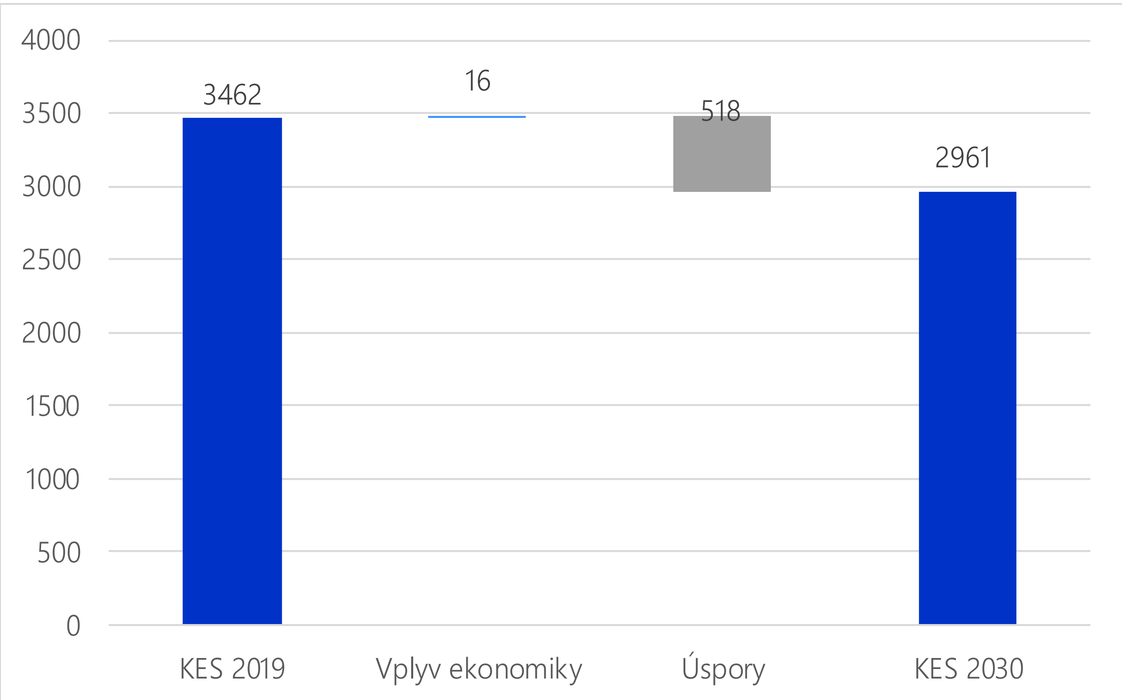
Graph 17: Decomposition of the industrial KES forecast until 2030 (ktoe), Scenario 2



Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

Scenario 3: it assumes a natural decline in energy intensity and a more pessimistic increase in production. The contribution of energy savings from implemented measures and projects amounts to around 4 % of final energy consumption in industry. The construction of a battery factory is not foreseen. Production in more energy-intensive businesses is expected to be shut down. In the iron and steel sector, key planned decarbonisation investments will be made.

Figure 18: Decomposition of the industrial KES forecast until 2030 (GWh), Scenario 3



Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

Energy savings achieved by implementing investments with the state (e.g. Voluntary Agreements) and EU financing mechanisms (e.g. Modernisation Fund, Recovery and Resilience Plan, Slovakia programme,...) are the most important contributors to the overall energy savings achieved. The energy savings achieved by measures with a short payback period are realised by businesses almost exclusively from their own resources. The share of such savings in the total energy savings achieved is between 20 and 28 %. In view of its economic advantage, it can be assumed that most of the measures of this type have already been implemented by the undertakings.

In relation to meeting the target under Article 8 of the proposal for an Energy Efficiency Directive, the forecast of the contribution of energy savings depends on the assumptions of each scenario. When scenario 1 is filled, the energy savings contribution is estimated to be around 3 %. In scenario 2, the contribution is estimated at 11-12 %. Scenario 3 assumes the amount of the contribution, the share of which in meeting the target under Article 8 of the draft Energy Efficiency Directive exceeds the average share of energy consumption in industry in Slovakia’s total final energy consumption. In this scenario, the impact of the RRP and the Modernisation Fund is crucial. The forecasts of contributions are presented in Tables 41 and 42.

Table 41: Forecast of the evolution of energy savings contributions to the implementation of Art. 8 of the proposal for an Energy Efficiency Directive

Contribution (ktoe)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	TOGETHER,
Scenario 1	34	30	27	24	20	17	14	10	7	3	**186**
Scenario 2	135	122	108	95	81	68	54	41	27	14	**743**
Scenario 3	135	122	108	95	81	1 647	54	41	27	14	**2 323**

Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

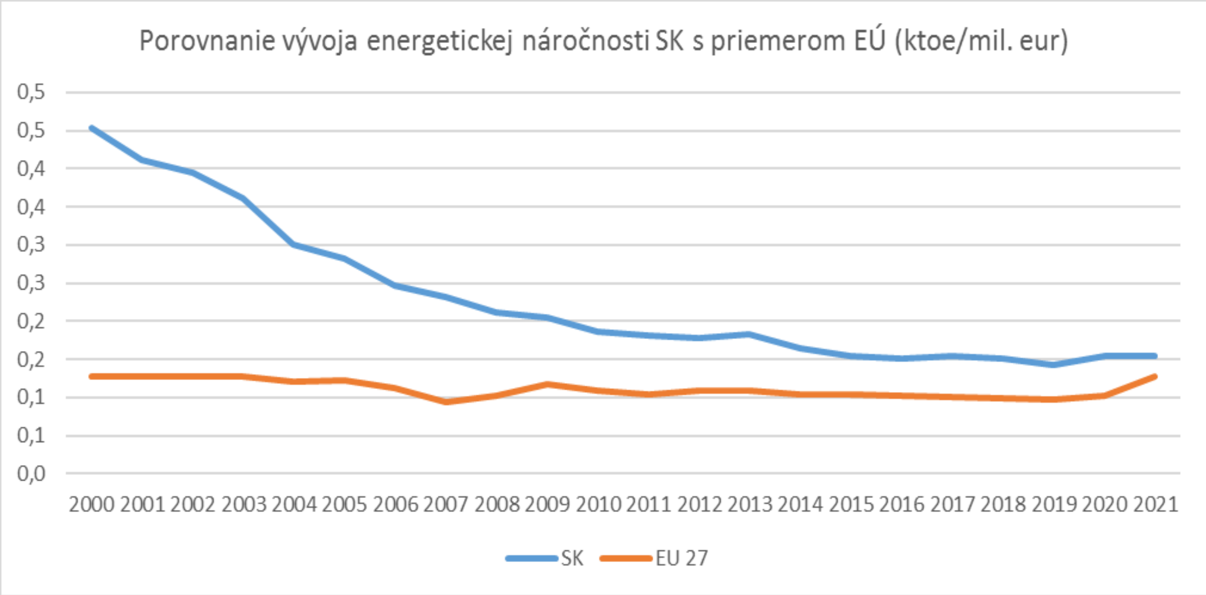
Table 42: Expected contribution of scenarios 1 to 3 to the target under Article 8 of the proposal for an Energy Efficiency Directive

	Scenario 1	Scenario 2	Scenario 3
F_CE	3 %	12 %	38 %
FEC 2020-2030	3 %	11 %	34 %

Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

The rate of energy savings potential is closely linked to the evolution of energy intensity. Between 2001 and 2021, Slovakia reduced its energy intensity by more than two and a half times, with a decrease of just under 7 % between 2015 and 2019. In 2021, energy intensity in industry was at its 2015 level. Taking into account these developments, it can be assumed that the energy savings potential is currently reaching its limits. Thus, while maintaining the current structure of industry, the reduction in final energy consumption is largely limited.

Graph 19: Comparison of the evolution of Slovakia’s energy intensity with the EU average (value added is in constant percentages)



Source: Ministry of the Economy of the Slovak Republic, Eurostat

The Recovery and Resilience Plan and the Modernisation Fund will make the most significant contribution to reducing energy consumption in industry by 2030. Nevertheless, it is assumed that current financial mechanisms will not be sufficient to make investments that would deliver energy savings corresponding to scenarios 2 and 3. In order to achieve additional energy savings, it will be necessary to allocate new resources and put in place an optimal way of financing that ensures cost-effective use of the funds while not administratively burdensome. This is the so-called 'competitive system' to increase energy efficiency in industry.

Forecast of the evolution of final energy consumption in industry in relation to the target under Article 3 of the EED

Although there is no obligation for Member States to set and meet a specific final energy consumption target for the industrial sector for 2030, an indicative target has been set for illustrative purposes, corresponding to a 12 % reduction in final energy consumption in industry. This value is the product of the average share of industry in total final energy consumption 2012-2019 and the EU REF 2020 value for Slovakia[56]. The indicative target for final energy consumption in industry, based on the 2030 target for final energy consumption, as notified in the Integrated National Energy and Climate Plan of the Slovak Republic, submitted to the European Commission in December 2019, multiplied by the share of industry in total final energy consumption for 2012-2019, has also been supplemented for comparison. The title of this indicative target is "30.3 %" (the so-called ambitious scenario of "30.3 %").

If the scenario 2 assumptions were met, Slovakia would have to reduce its final energy consumption in industry by 21 % in order to reach the level of 'REF 2020-12 %', which would require investments to achieve energy savings of almost 630 ktoe. Scenario 3 projects that the indicative 'REF 2020-12 %' target for industry is exceeded by 1 %.

Table 43: Contribution of selected scenarios to the reduction of KES in the industry sector

[56] 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

KES 2030 scenarios	Δ KES 2030 – 'REF 2020-12 %' (ktoe)	Need to reduce KES 2030 to reach REF2020 – 12 % (%)	Need to reduce KES 2030 to reach the "30.3 %" scenario (%)
Scenario 1	850	28 %	6 %
Scenario 2	629	21 %	—0 %
Scenario 3	—44	—1 %	—19 %

Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

Assuming that the ambitious target for final energy consumption, as notified in the Integrated National Energy and Climate Plan of the Slovak Republic (30.3 %), submitted to the European Commission in December 2019, was maintained, the indicative target for industry corresponding to this scenario would be achieved even if the assumptions corresponding to scenario 2 were carried out. Scenario 3 would exceed it by up to 19 %.

A prerequisite for increasing the pace of energy savings in industry will be to create an environment that maximises incentives for businesses to invest in reducing self-consumption. Reducing administrative complexity and simplifying processes related to the absorption of public funds to promote energy efficiency will be at least as important as ensuring financing in this regard. A predictable energy policy that minimises shocks and changes with a major impact on energy price developments will be a key factor. It will be important to continuously raise the state's awareness of existing and upcoming tools to promote energy efficiency in industry. The State will endeavour to contribute to an environment conducive to the exchange and sharing of information between businesses, sectors and associations in order to reduce energy intensity. Systematic data collection, verification, evaluation and subsequent reporting will be put in place for the continuous updating and adjustment of measures to promote energy efficiency, their prioritisation and subsequent implementation.

Transport

Transport is the sector which among all sectors of the national economy is the sector with the fastest growing energy consumption. In addition to the energy climate targets, the proposed measures must contribute in particular to meeting the targets in the Strategic Transport Development Plan 2030. These objectives include in particular:

- increasing the share of public passenger transport, in particular rail passenger transport by rail, from individual car transport;
- increasing the share of rail freight transport by shifting from road freight;
- improving the efficiency of rail transport operations;
- deployment of intelligent transport systems and intelligent means of transport

Energy savings achieved through energy efficiency measures in transport accounted for only 6 % of the total savings achieved in the period 2014-2021 in meeting the target for Article 7 of the EED. Key measures were the replacement of car fleets, electro-mobility and the construction and modernisation of transport infrastructure. The most important financial mechanisms to support energy efficiency improvements in transport were the Structural Funds, namely the Operational Programme Transport 2007-2013, the Operational Programme Integrated Infrastructure 2014-2020 and, in the case of support for infrastructure development on the Trans-European Transport Network TEN-T, the CEF Connecting Europe Facility). In the case of electro-mobility, it was primarily national budget resources intended to promote the purchase of vehicles.

Table 44: Contribution of energy efficiency measures in transport to the 2014-2021 target under Article 7 of the Energy Efficiency Directive

Measure	Energy saving (GWh)	Share (%)
Renewal and modernisation of rolling stock	300	42 %
Electromobility	175	24 %
Building and upgrading transport infrastructure	137	19 %
Organizational measures for road and rail freight transport	93	13 %
Promoting cycling	10	1 %
Integrated transport systems	1	0 %

Source: Energy efficiency monitoring system, SIEA

The central state administration body for transport is the Ministry of Transport of the Slovak Republic. Its priorities in terms of financing sustainable modes of transport are to support the development of rail transport, in particular in the areas of infrastructure, renewal and modernisation of fleets and quality of service, the development of intermodal freight transport, the development of public passenger transport, the development of cycling, the development of sustainable waterborne and air transport, and the promotion of digitalisation and automation. Support for electromobility will be covered by the Ministry of the Economy of the Slovak Republic. From the financial mechanisms under the responsibility of the Ministry of the Environment of the Slovak Republic, transport support is foreseen in the Social-Climate Fund. However, the areas of support, the form of support and the amount of funding to be allocated to support are not yet known.

The development of electro-mobility will be supported mainly through funds from the Recovery and Resilience Plan. By 2026, 228 UFC points are planned to be constructed for an estimated value of EUR 29.64 million, 500 DC points and 2635 AC points for EUR 16.32 million. In addition to this support, direct support for the purchase of zero- and low-emission vehicles, the introduction of a right to a recharging point or tax support is also considered. The introduction of charging rules for company cars should introduce clear rules for charging the service car at home and privately at work. The introduction of the polluter pays principle foresees a reduction in imports of non-organic older vehicles or an increase in the payment for registration of a vehicle depending on the volume of exhaust gases. The simplification and acceleration of the construction of the infrastructure and new legislation leading to increased safety in the operation of electric vehicles should help to simplify and speed up the construction of stations. Benefits for green EVNs are expected to be introduced, e.g. through favourable parking or the establishment of low emission zones.

As part of the promotion of vehicles with lower or zero CO2 emissions, the Ministry of the Economy has drawn up an action plan for the development of electromobility in the Slovak Republic, which is 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 that aims to ensure that consumers perceive low-emission mobility as seamless, also taking into account the pace of deployment of the relevant infrastructure.

The Slovak programme, the Connecting Europe Facility (CEF2) and the Slovak Recovery and Resilience Plan (RRP) are the most strongly supported in terms of rail transport support. The recovery and resilience plan, namely component 3 – Sustainable transport, plans to implement 2 reforms and two investments totalling EUR 638.7 million by 2026. One of the reforms focuses on the preparation of investment projects – a prioritised investment plan for railway infrastructure projects. Another reform is the reform of public passenger transport. It envisages the establishment 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 diagram, which was put into practice in Graphic 2022/23 on the basis of the Rail Transport Service Plan. An important part of the reform is the Public Passenger Transport Act, which creates the conditions for unifying tariff and transport conditions between rail transport, suburban bus transport and municipal public transport, in order to allow travel on a single travel document by all means of public passenger transport in the public interest. The aim is to improve coordination and coherence between the different modes of transport operated in the public interest.

The RRP investments focus on the reconstruction and upgrading of 49.7 km of railway infrastructure, the dispatching of 82 km of railway lines and the purchase of 5 clean rolling stock. From the RePowerEU chapter, it is planned to boost these investments by a total of EUR 84.5 million, making it possible to support the reconstruction and modernisation of up to 51.7 km of railway infrastructure and the purchase of 5 full electric train units and 15 trams in total. The purpose of the investment is to reduce the consumption of fossil fuels in public passenger transport and to increase the share of zero-emission public passenger transport in the overall division of transport work.
Slovakia's programme will support the development of rail transport through two measures. Action 3.1.1 'Removing key bottlenecks on railway infrastructure through the modernisation and development of main railway lines and nodes' aims at supporting the modernisation and/or refurbishment of railway lines and key nodes, upgrading and building maintenance bases for the railway passenger fleet, implementing the European Rail Traffic Management (ERTMS), including station and trackside safety equipment, construction and upgrading of intermodal transport terminals and renovation of station buildings. The foreseen allocation is EUR 600,2 million (EU resources + co-financing + own resources). Building/upgrading TEN-T railway lines (33 km), building new or modernised intermodal connections, reducing travel time and improving the quality of service should significantly increase the number of passengers travelling by public rail passenger transport.

Measure 3.2.1, entitled 'Removing key bottlenecks on railway infrastructure through the modernisation and development of railway lines and increasing the attractiveness and quality of rail public passenger transport services through the renewal of rolling stock', aims at modernising and renovating regional railway lines (improving technical parameters, increasing capacity, electrification and dispatching lines), restoring rolling stock of rail public passenger transport, improving safety at level crossings, constructing and upgrading intermodal terminals and renovating station buildings. Reconstructed and upgraded lines of 119 km length (outside TEN-T) and new/upgraded intermodal connections are intended to contribute significantly to time savings and ensure an increased number of users. The foreseen allocation is EUR 214 million (EU resources + co-financing + own resources).
An important financial mechanism to support rail will be the Connecting Europe Facility 2021-2027 (CEF 2) with EUR 584.7 million to upgrade and electrify cross-border rail connections between Member States and promote the use of alternative fuels and the construction of related infrastructure.

The Concept for the Development of Intermodal Transport up to 2030, approved by the Slovak Government in April 2022. This includes 4 key actions. The first is the introduction of one-off support for intermodal transport. The measure is financed by the recovery and resilience plan for an amount of EUR 16.1 million. The objective of the investment will be the establishment of at least 1 new intermodal transport line and the purchase of 1000 new intermodal units. Implementation is foreseen by 2026. Other measures include the introduction of regular support for accelerating intermodal transport performances, the introduction of regular support for individual wagons and support for the construction and modernisation of terminal infrastructure. A condition for the successful implementation of measures financed by the State budget is an amendment to Act 514/2009 on railway transport in order to allow the granting of state subsidies relating to the use of railway infrastructure which compensate for demonstrably non-reimbursable environmental costs by competing modes of transport and the approval of State aid schemes by the European Commission. EUR 30 million is proposed in the Slovakia 2021-2027 programme to support terminal infrastructure.

Public passenger transport will be supported by Slovakia's programme and also by the Recovery and Resilience Plan. Investments from POPs in VOD have been described above. In the Slovak Programme, public passenger transport will be supported through Specific Objective 2.8 ‘Promoting sustainable multimodal urban mobility as part of the transition to a net-zero carbon economy’. Two measures focus on the development of public transport (action 2.8.1) and sustainable mobility in the Bratislava Self-Governing Region (action 2.8.3). The aim of the support is the construction and modernisation of railway MHDs, including elements of preference and the renewal and modernisation of rolling stock of railway MHDs and vehicles providing MHDs and suburban transport (alternative power buses, including related refuelling and charging infrastructure). In addition, the construction and modernisation of public passenger transport infrastructure (e.g. transfer terminals, stops and reception facilities, 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 dispatching systems, the construction and upgrading of the power supply infrastructure should also be supported. The measures will result in 6 km of new tram lines, 15 km of new trolleybus lines, 12 km of upgraded or upgraded tram lines, 79 km of reconstructed or upgraded trolleybus lines, and an increase of 30581 passengers in the capacity of environmentally friendly public transport vehicles.

In addition to the Recovery and Resilience Plan, the**development of cycling is also supported by the Slovak programme.** Together with the development of a methodology for the selection, preparation and implementation of projects for cycling, the RRP will support in particular the construction of 161.8 km of cycling infrastructure under Component 3 Sustainable Transport. An allocation of EUR 85 million is foreseen for this purpose. Implementation should be completed in 2026. In 2019, EUR 13 million were allocated from the state budget to support the construction of infrastructure, the purchase of stands, shelters and the preparation of project documentation. This budget was increased by 750 thousand in 2022 through a new call. EUR. An update of the strategic document on the development of cycling (National Cycling and Cyctour Development Strategy in Slovakia) is foreseen at the end of 2023/2024. Under Specific Objective 2.8 ‘Promoting sustainable multimodal urban mobility as part of the transition to a net-zero carbon economy’, the Slovak Programme formulates measure 2.8.2 ‘Promoting cycle repair’. With the support of EUR 101 million from EU funds, this measure will implement the construction of 325 km of specialised cycling infrastructure.

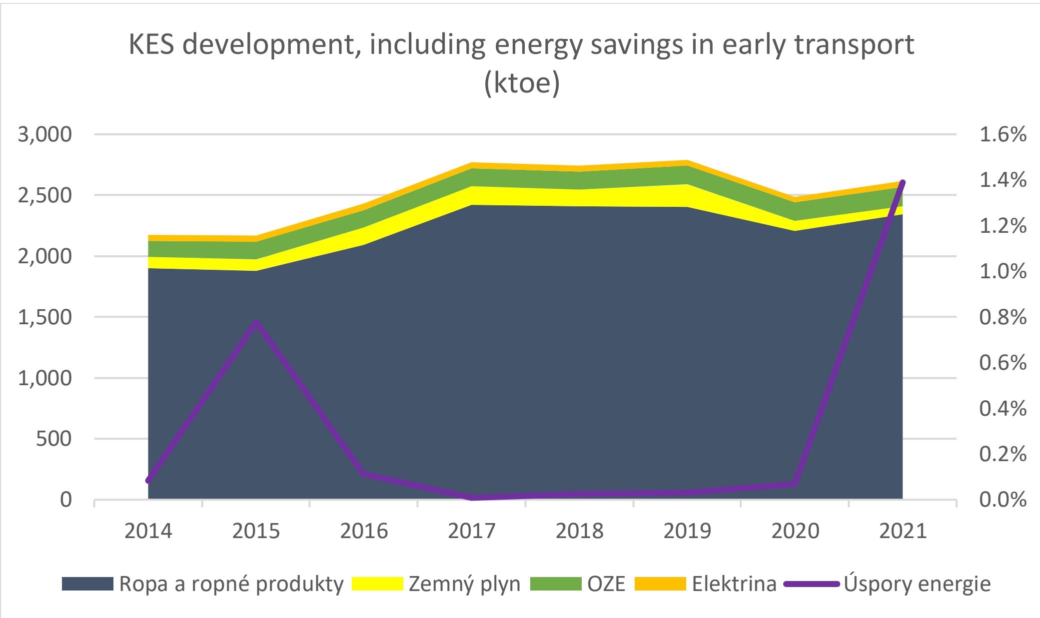
The digitalisation and automation of transport will be the basis for the development of intelligent transport systems in a road infrastructure environment, with the impact of reducing the number of vehicles on the roads in the context of individual passenger transport for the benefit of public passenger transport. In addition, smart vehicles will also enable traffic management to be optimised, better use of transport infrastructure capacity, improved safety and fluidity of transport, with positive impacts on reducing the energy intensity of transport and reduced negative impacts on the environment. In Slovakia, activities related to this issue are coordinated by the National Coordinator for Smart Mobility, established at the Slovak Ministry of Transport. Three strategic documents have been drawn up by the Slovak Ministry of Transport for this area: The Smart and Sustainable Mobility Strategy of Slovakia, the Long-term Plan addressing the challenges in road transport and smart mobility 2021-2030 and the Action Plan on 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 connection with the development of automated vehicles. In addition to the Specific Objective 2.8 Promoting sustainable multimodal urban mobility as part of the transition to a net-zero carbon economy, the Slovak Programme also supports the area of digitalisation and automation through specific objective 1.2 Reaping the benefits of digitalisation for citizens, businesses, research organisations and public administrations. Policy objective 3 A more connected Europe by enhancing mobility will support this area through two specific objectives – 3.1 Developing a sustainable, climate-resilient, smart, secure and intermodal TEN-T and 3.2 Developing and enhancing sustainable, climate-resilient, smart and intermodal national, regional and local mobility, including improved access to TEN-T and cross-border mobility.

Projections for 2030

According to projections from energy modelling in the CPS model, final energy consumption in transport in a scenario without additional measures is projected to increase by 11.6 % to 3163 ktoe by 2030 compared to 2019. In a scenario with additional measures, final energy consumption in transport would increase by 11.7 % to 2991 ktoe.

Motor fuels are the most prominent among energy carriers in transport, whose share of final energy consumption in the sector has gradually increased from 85 % in 2012 to 89 % in 2021, with a 14 % increase in total final energy consumption in the transport sector. The share of final energy consumption in transport in total final energy consumption in Slovakia is between 25 and 27 %.

Figure 20: Evolution of KES and evolution of energy savings in the transport sector

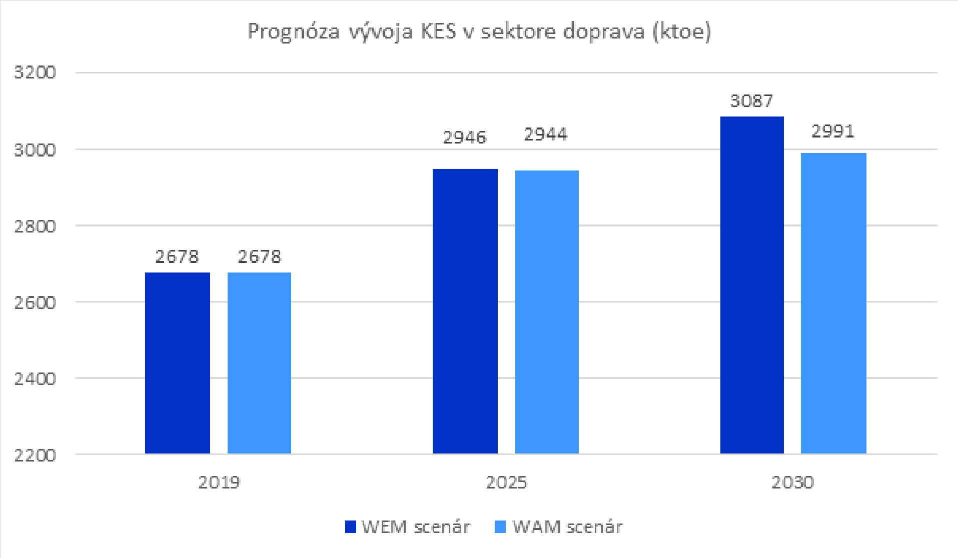


Source: Eurostat; Energy efficiency monitoring system, SIEA

The proportion of motor oils among energy carriers in transport is projected to remain at 86 % and 82 % respectively by 2030. The share of biofuels will increase, in the scenario without additional measures (WEM scenario) to 6 % and in the additional measures scenario (WAM scenario) to 10.2 % in 2030. The share of electricity consumption in 2030 is forecast at around 2 % in both scenarios, mainly in passenger and rail transport by road.

Both forecast scenarios assume a continued upward trend in final energy consumption in transport, driven by the continued growth of the vehicle fleet, in particular with internal combustion engines, until 2030. Although in particular the scenario with additional measures foresees a gradual slowdown in final energy consumption growth in the passenger car segment (due mainly to the gradual electrification of the fleet), the growth in consumption will be driven by the freight segment, where final energy consumption is expected to increase by 13.5 % and 11.7 % respectively in each scenario.

Figure 21: Projection of KES in the transport sector



Source: results of modelling in CPS

The evolution of final energy consumption is monitored in a structure by transport mode and vehicle type:

- Passenger transport – public road transport, non-public road transport, rail passenger transport, air transport, inland waterway passenger transport;
- Freight transport – heavy duty vehicles, light commercial vehicles, rail freight, inland waterway freight;
- Pipeline transport,

and per fuel type – LPG, gasoline, diesel, jet kerosene, natural gas, conventional and advanced biofuels, hydrogen electricity.

The scenario with existing measures includes all European legislation already adopted on emission targets for vehicles. The additional measures scenario envisages a higher level of modal shift and faster electrification of passenger transport. Freight transport is expected to switch to alternative fuels only later and will not play a significant role by 2030.
The post-2030 scenario foresees the adoption of the Regulation of the European Parliament and of the Council amending Regulation (EU) 2019/1242 as regards strengthening the CO2 emission performance standards for new heavy-duty vehicles, which will have a significant impact on the pace of transition of heavy-duty vehicles to alternative propulsions, which may therefore be overestimated.

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. The structural funds will continue to support the renovation of public buildings through the Slovak programme. This support will mainly be based on co-financing with the help of grants, but an increased use of financial instruments is planned. The Enviro Fund and the Just Transition Fund are also foreseen. Improving the energy performance of non-residential buildings of the private trade and services sector will be financed mainly from private sources.

A key financial mechanism to support the renovation of commercial non-residential buildings in the trade and services sector will be the Slovak programme through action 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, by means of co-financing, the improvement of the thermal protection of business buildings. Guaranteed energy services will play an important role, in particular, but not only, in restoring outdoor lighting (parking, in-house, other).

Support from the RRP will focus on increasing the energy performance of historic and heritage-protected 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 objects, 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 monumental protected public buildings, while improving their energy performance, while also improving the possibilities for use by the public and extending their lifetime. The main objective of the investment activity in 2020-2026 shall be to support, on average, at least a medium deep renovation of at least 117 000 m² of the total floor area of historical and detached public buildings, where, in addition to energy efficiency measures (on average at least 30 % primary energy savings), while maintaining their historical and heritage value, relevant measures for building renovation, the renovation of the technical building system, including the application of building automation and management systems, electromobility elements and cycle repairs (if applicable), accessibility and the implementation of green measures will be implemented. With an average floor area of historic and heritage buildings between 500 m² and 1 500 m², at least 100 historic buildings are planned to be renovated. The expected allocation amounts to EUR 211 million.

The renovation of public buildings will also be supported through REPowerEU through the 'Quick fixes' support programme. The aim is to reduce energy consumption by means of rapidly feasible and procedurally inexpensive structural, technical or technological measures in public buildings. Central government buildings are the primary target group. Measures that have a demonstrable impact on reducing the energy consumption of the building will be financed. The investment will be made in the form of a non-repayable financial contribution through a direct invitation. The selection of specific project objectives will be based on the eligibility criteria and the potential for saving energy consumption for the amount requested.

Data collection on public buildings will also be supported through REPowerEU. The activity will include the analysis and the resulting identification of a possible reference list of buildings to ensure data collection. In addition to the information obligation from the national database of data on the energy performance of buildings, it will be necessary to introduce a building renovation passport system by December 2024 at the latest and a new obligation for public buildings related to energy certification. The collection of data on public buildings is foreseen on a one-off, professionally competent basis, to the extent and detail of the selected data of the energy performance certificate, including the preparation of the building renovation passport and the design of concrete measures for effective renovation of the building. The data will be part of the digital data platform on the energy performance of the building stock in Slovakia, which will also be created through REPowerEU. The platform will allow the collection, treatment, storage and provision of all relevant and consistent information as a key tool for planning energy performance policies and measures at national level, including public buildings, 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 Stock Renovation Plans and the Long-term Building Stock Renovation Strategy.

The Slovak programme will support the renovation of public buildings applying the energy efficiency first principle to reduce final energy consumption. Where relevant and feasible, renovation will also include the installation of RES and the application of elements to protect biodiversity and green infrastructure to support adaptation to climate change, so-called green measures such as green roofs, green walls, etc. Energy efficiency and the coverage of environmentally sustainable energy consumption, taking into account security of energy supply, will continue to be a priority in the renovation of public buildings.

The minimum medium level of renovation of the building (primary energy saving 30-60 %) will be required, with the intensity of support taking into account primary energy savings. It will also be a necessary requirement to respect the quality of the indoor environment by ensuring the required indoor air exchange, or by other measures improving the indoor environment. Expenditure on debarierisation measures and infrastructure for electromobility will also be eligible. In order to make the operation of buildings more efficient and maximise the exploitation of the energy savings potential, the deployment of energy management, monitoring of operational data, including technical support by the contractor over the lifetime of the project, will also be supported. Support for the installation of RES equipment related to building renovation will be financed by Measure 2.2.2.

Through the Just Transition Fund, the planned renovation of public buildings is expected to save 10.3 MWh of primary energy. The allocation amounts to EUR 41,3 million, of which EUR 25 million are financial instruments and the remainder is for grant support. The renovation of public buildings in Upper Nitra, Banská Bystrica and Košice regions will be supported.

The reduction of energy consumption in public buildings will also be implemented through guaranteed energy service projects implemented by a public sector guaranteed energy service provider 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 GES would use in the future to cover energy costs.

The concept of developing guaranteed energy services in the public sector, drawn up by the Slovak Ministry of Finance in cooperation with the Ministry of the Economy, and the associated legislative, conceptual and support measures for public authorities, i.e. the state and public administration, can be seen as an important incentive in this regard. Guaranteed energy services can be used primarily for the renovation of public buildings and the renovation of public lighting. The evaluation of public sector buildings will show the real potential for using this support scheme and how it can be further developed, as far as possible by combining different financial mechanisms allowing for the most efficient use of funds. Resources from the Slovak programme will be allocated to co-finance projects for guaranteed energy services. Co-financing through grants will be possible up to 49 % of the eligible costs of the investment.

The use of guaranteed energy services is still envisaged for the modernisation of public lighting. Comprehensive investment in both the energy and telecommunications infrastructure of cities and municipalities is a prerequisite for promoting the development of public lighting. In addition to replacing original luminaires with lower energy luminaires, intelligent control systems that ensure optimal operation of individual light points and, ultimately, optimum operation of the whole system at city or municipal level will contribute significantly to energy savings. Moreover, supporting the development of local energy infrastructure will make a crucial contribution to increasing the number of charging points in cities and municipalities.
It is therefore desirable, as far as technically and economically feasible, for the implementation of new local energy infrastructure to take into account as many aspects as possible which, in addition to increasing the security and comfort of the population, also contribute to reducing energy intensity and, last but not least, reducing the operating costs of municipalities.
In this context, a strong emphasis will be needed to ensure that newly installed intelligent systems are universal in terms of compatibility with those of other manufacturers and brands.

Green public procurement will play an important role in meeting energy efficiency targets. In Slovakia, it constitutes a specific form of public procurement where requirements are applied in relevant steps to ensure that the procured subject-matter of the contract, including activities related for example to its delivery, assembly, installation and operation, will have a more favourable environmental impact than is the case for products with comparable functional or performance parameters for which the environmental impact is not normally taken into account.
In particular, the aim is to take into account aspects contributing to the achievement of the energy-climate targets, including final and primary energy consumption, i.e. not just the minimum purchase price. Based on legislative, technological changes and developments in green public procurement in the EU and Slovakia, the National Action Plan for Green Public Procurement 2016-2020 (NAP GPP III) was drawn up and approved by the Slovak Government on 14 December 2016 by Resolution No 590/2016.

Supporting the development of regional energy

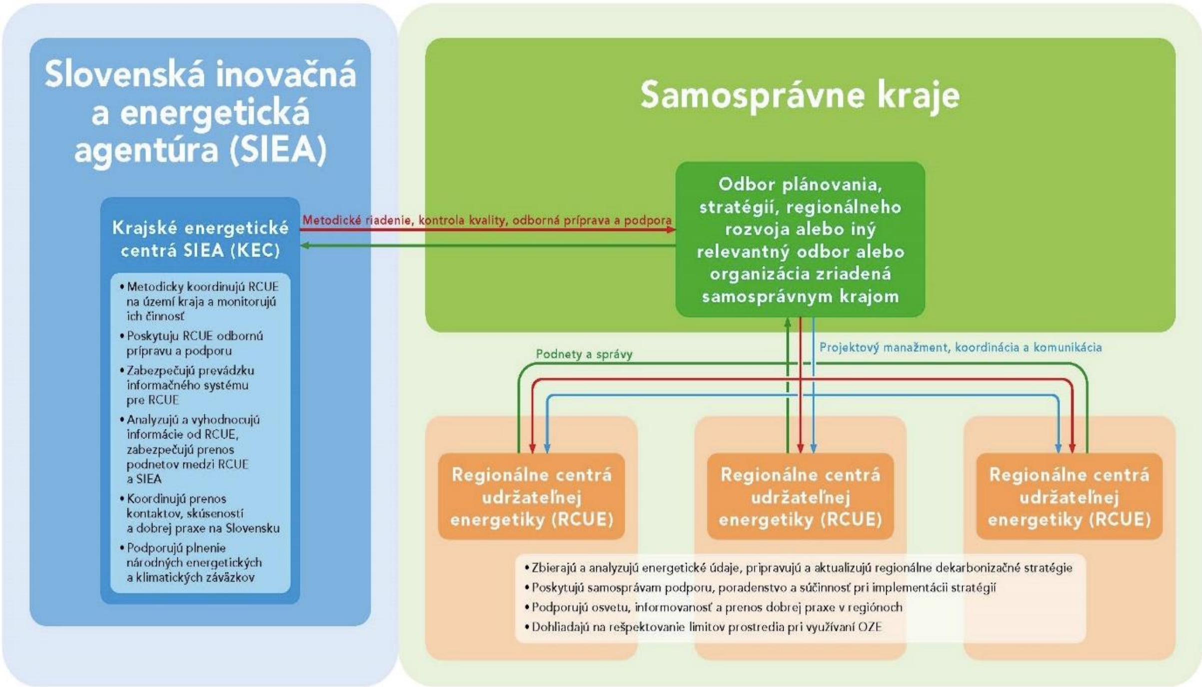
Systematic planning and coordination of regional energy development is a key prerequisite for optimising energy needs and consumption, for the sustainable use of available renewable resources, for achieving high levels of self-sufficiency and energy security and thus for the economic stability of regions.

Currently, the regions in Slovakia lack the professional capacity, which is a prerequisite for systematic energy planning. The aim of the measure is to ensure that all Slovak regions have such capacities at the same time, while ensuring that the newly created regional capacities are closely coordinated at national level, that they have a clear territorial definition in advance, uniform methodological management, high-quality professional support, high-quality technical and information backgrounds, and that they are mutually effective. All these needs will be ensured by the new infrastructure for the planning and coordination of sustainable energy and decarbonisation of regions. It consists of a network of SIEA regional energy centres (KECs, altogether 8) and regional sustainable energy hubs (RCUE, 22 in total).

Organisational Model

KEC and RCUE are the two essential and complementary components of the new infrastructure for the planning and coordination of sustainable energy and decarbonisation of regions. Both of these components have a clearly defined mission and interrelationship, as illustrated by the diagram in Figure 5. Their scope covers the entire territory of the Slovak Republic.

Picture 5: Scheme of cooperation between key partners



Source: SIEA

Dividing lines between KEC and RCUE

Table No.45: Dividing lines between KEC and RCUE

	Regional energy centres (KEC)	**Regional Sustainable Energy Hubs (RCUE)**
Sector	National administration	Local authority
Founder	Slovak Innovation and Energy Agency (SIEA)	Self-governing regions
Number	8	22
Territorial scope	Regions of the Slovak Republic	Region (merged strategic planning regions and urban development territories/districts)
Method of financing	Programme Slovakia (Measure 2.1.3 PSK 21-27), State Budget	Programme Slovakia (Measure 2.1.3 PSK 21-27), State Budget
Estimated amount of funding (2021-2030)	Approx. EUR 47.4 million[57]	Approx. EUR 33.9 million[58]
Targeted sectors/sectors	As a matter of priority, public administration (local and regional government, state administration, including organisations under their authority), households, people at risk of energy poverty and self-consumers, secondary business sector. Priority sectors for buildings, transport, energy production, storage and distribution (with an emphasis on RES) and public lighting, secondary other sectors affecting the energy and emissions balance of regions (e.g. land management, waste management, etc.).	
Key activities	**Coordination of decarbonisation at regional level** (in particular the methodological management of RCUE at regional level, expert support and ensuring access to information for RCUEs) **Support for the fulfilment of national commitments** (experty and work with energy data at regional and Slovak level in the fields of energy efficiency, use of RES, social, environmental and other aspects of decarbonisation) **Advisory and information activities at Slovak level**	**Planning decarbonisation in the RCUE region (** collection, processing and analysis of energy and related data in the region, development and updating of regional decarbonisation strategies, preparation of incentives to adjust/setting the conditions for public-funded support mechanisms) **Supporting the implementation of regional decarbonisation strategies (monitoring** of implementation, preparing recommendations for municipalities on budgeting, intentions and projects, commenting on the compliance of upcoming projects with decarbonisation strategies) **Promoting regional regulation of the use of renewable resources**

[57] Includes the total cost of KEC + IT system in the upcoming NP (2024-2029) + estimated costs in 2030 (gross estimate).

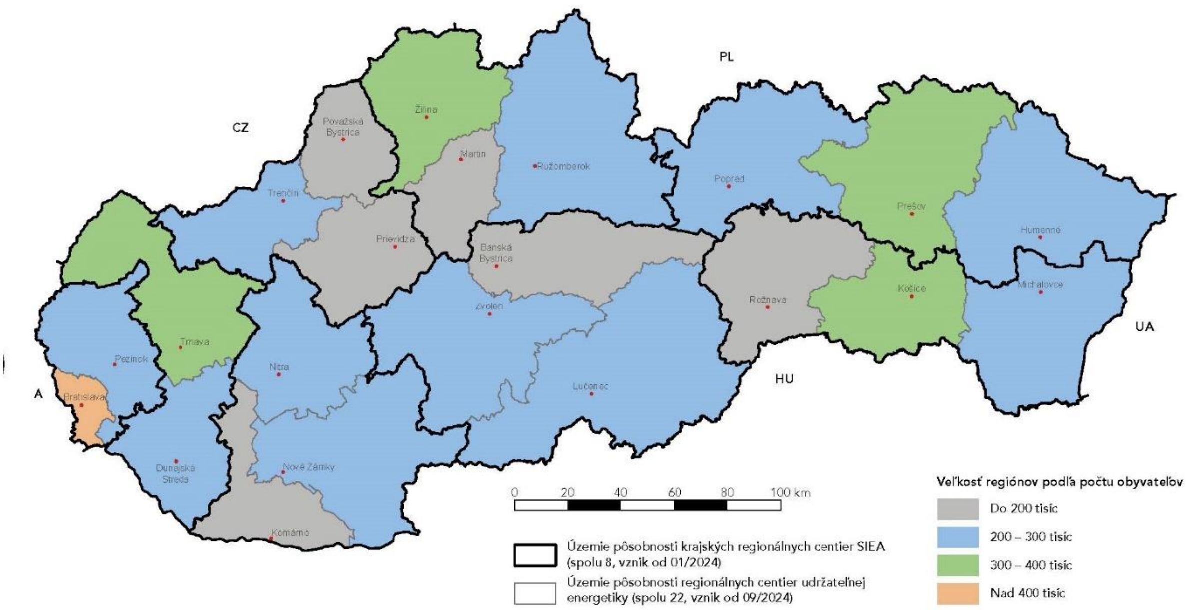
[58] Includes the total cost of RCUE in the upcoming NP (2024-2029) + estimated costs in 2030 (gross estimate).

		Awareness raising, communication and transfer of good practice at regional level
Expected start of activity	01/2024	09/2024

Source: SIEA

Territorial scope of KEC and RCUE

Figure 6: Territorial scope of KEC and RCUE



Source: SIEA

Staffing capacities

Regional Energy Centres (KECs)

KECs represent the enhanced expertise of the SIEA. As the primary function of the KEC will be to manage the RCUEs methodologically and provide them with expert support, each of the 8 KECs will employ a full-time methodology and a technical staff member for RCUE in its territorial area (i.e. in the region concerned).

In addition, additional specialists will be active in the KEC, in particular: KEC/RCUE National Coordinator, Analyst – Specialist (expert on required fields/sectors/sectors in energy efficiency, use of RES and social, environmental and other aspects of energy transition and decarbonisation, including energy poverty, energy communities/communities, etc.), expert on modelling regional decarbonisation scenarios, legal expert and coordinator of activities. The KEC expert team will be complemented by a project management team and the necessary administrative and organisational service.

Regional Sustainable Energy Hubs (RCUE)

The RCUEs represent the new expertise of the local government in the regions. For practical organisational, technical and economic reasons, they will be covered by the self-governing regions directly as part of the structure of the county authorities or within their contribution or budget organisations. Each self-governing region will autonomously manage and manage the RCUE activities in their territorial area (countries are SIEA partners in the national Capacities for Regions project and will be separate beneficiaries of financial assistance for their part in the project), while RCUE specialist staff will be methodologically managed from KEC/SIEA. This will ensure a consistent process of all RCUEs according to standardised methodologies, compatibility and equal structure, quality and reliability of input data and harmonisation of outputs.

Table 46 shows the preliminary distribution of expertise across RCUEs and counties and assignments for project managers. The quantification of assignments is mainly based on the size of the population of the RCUE territory or counties.

Table 46: Indicative allocation of expertise

Region/RCUE	Districts	Number of dwellings. (2020)	Number of municipalities/cities	RCUE (FTE) Professional Staff	Total professional staff in the region (FTE)	Project Manager (FTE)
BSK-1	BA I – V	439 805	17	5,5	8,5	1,0
BSK-2	PK, SC, MA	236 076	72	3,0		
TTSK-1	TT, HC, PN, SI, SE	347 790	148	5,0	8,0	0,8
TTSK-2	GA, DS	217 534	103	3,0		
NSK-1	NR, TO, ZM	278 854	152	3,5	9,0	1,0
NSK-2	CN,	144 836	51	2,0		
NSK-3	NZ, LE	247 818	151	3,5		
TSK-1	PD, PE	178 184	75	2,5	8,0	0,9
TSK-2	TN, BN, NM, WE	239 443	131	3,0		
TSK-3	IL, PU, PX	164 940	70	2,5		
ŽSK-1	FOR, BY, KM, CA	311 896	102	4,0	9,0	1,0
ŽSK-2	MT, TR	111 775	69	1,5		
ŽSK-3	LM, RK, DK, NO, TS	267 465	144	3,5		
BBSK-1	BB, BR	171 536	72	2,5	9,0	0,9
BBSK-2	ZV, DT, KA, BS, ZC, ZH	211 012	145	3,0		
BBSK-3	RS, RA, LU, VK, PT	260 554	299	3,5		
PSK-1	PO, SB, BJ, SK	347 853	288	4,5	11,0	1,2
PSK-2	PP, KK, SL, LE	268 964	147	3,5		
PSK-3	VT, HE, ML, SP, SV	210 211	229	3,0		

KSK-1	KE I, II, III, IV and KS	369 443	136	5,0	10,5	1,2
KSK-2	TV, WITH,	238 581	207	3,0		
KSK-3	RV, GL, SN	194 068	118	2,5		
Together,		**5 458 638**	**2 926**	**73, 0**	**73,0**	**8,0**

Source: SIEA

Regional Energy Planning Information System

For the purposes of regional energy and decarbonisation planning, KEC and RCUE will have at their disposal a robust information system (IS) created by the extension of the existing Energy Efficiency Monitoring System (operated by SIEA). It will make it possible to systematise the collection, updating and archiving of data from all sectors and sectors targeted by the RCUE, within the limits set by the methodologies for regional energy planning. (A pre-requisite is legislation allowing data that already exists or is collected through various public registries and databases to be integrated and used for regional energy and decarbonisation planning purposes.)

It will also enable KEC and RCUE to automate established calculation procedures, e.g. for quantifying regional fuel and energy saving potentials across sectors and sectors, sustainable regional RES potential, etc. The output of the IS will make the findings and conclusions of regional energy planning available in the form of factsheets, tables, charts and maps to public administrations (in particular municipalities), academia, the public and the media. In doing so, they will contribute to more efficient monitoring of the progress made in increasing energy efficiency, the use of RES, the achievement of energy and emission targets, the comparison of the state and potential of savings and RES between regions, municipalities, counties, sectors, sectors or segments thereof, thereby making forecasting developments, policy settings, support mechanisms, public budgets, etc. more effective.

Financing

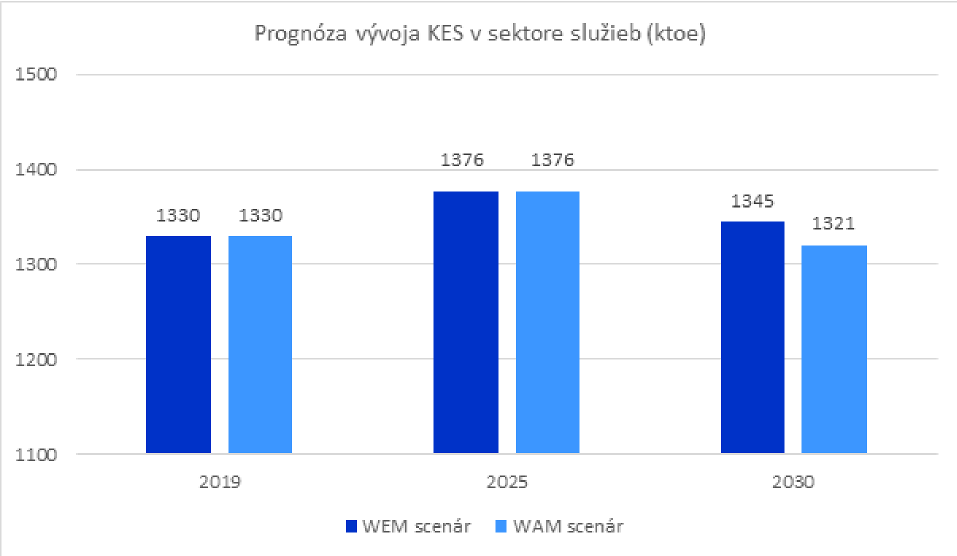
The main source of funding for both KEC and RCUE (including IS) is EU funds (Measure 2.1.3. Support for regional and local energy development under Priority 2P1 Energy Efficiency and Decarbonisation) with co-financing from the national budget of the Slovak Republic. The intermediate body is SIEA. To this end, two national projects are being developed: NP1 for the financing of KEC and RCUE in 2024-2029 (downstream scheme), NP2 for the financing of IS in 2024-2029.

Projections for 2030

According to projections from energy modelling in the CPS model, final energy consumption in the trade and services sector will remain stable by 2030. In a scenario without additional measures, final energy consumption in the sector is expected to increase by 4.6 % to 1391 ktoe and in the scenario with additional measures it is expected to fall by 0.7 % to 1320,6 ktoe.

Heating and cooling are projected to remain the largest component of final energy consumption, but are expected to decline by 5.7 %-8.7 % in 2030 under each scenario. The biggest change is assumed for electrical equipment consumption, which will increase by more than 20 % under both scenarios.

Figure 22: Forecast of KES development in the trade and services sector

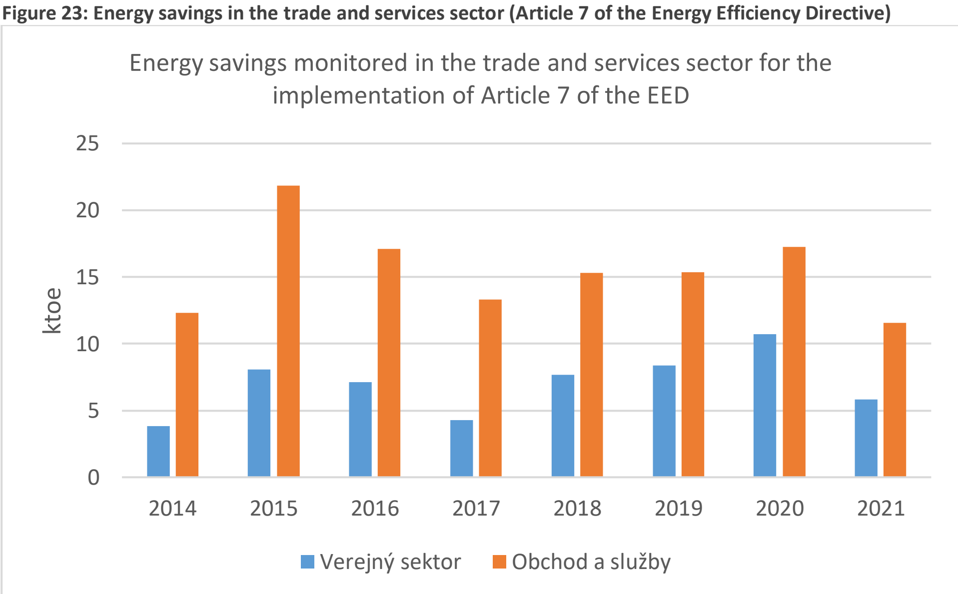


Source: Results of modelling in CPS

The energy intensity of the sector is projected to decrease by 15.5 % – 17.1 %. The macroeconomic assumption is a 20 % growth in the sector's value added. Meeting the scenarios will require significant additional investment costs, which may amount to over EUR 12 billion by 2030. EUR.

Similarly to the development of the KES in this sector in 2014-2021, an irregular trend can be observed for energy savings monitored for the purpose of meeting the target of Article 7 of the Energy Efficiency Directive.

Figure 23: Energy savings in the trade and services sector (Article 7 of the Energy Efficiency Directive)



Source: Ministry of the Economy of the Slovak Republic on the basis of SIEA data

The projected amount of energy savings achieved by using the planned policies and measures is 104 GWh (9 ktoe). The target for energy savings in public buildings is 52.17 GWh/year. The contribution of each measure is shown in Table 47. The RRP contribution is calculated on the basis of the projected specific investment intensity per MWh saved in grant support to public buildings through SIEA. For other forms of support, the expected primary energy savings were reported.

Table 47: Contribution of selected measures to the reduction of KES in the trade and services sector

Intermediary of support/forms of support/subject	PES saving (MWh)	KES saving (MWh)	KES saving (ktoe)
SIEAs/grants/commercial buildings	18 093	11 942	1,0
SIEAs/grants/public buildings	67 322	44 433	3,8
SIEA/FN/commercial buildings	13 928	9 192	0,8
SIEA/FN/public buildings	10 608	7 001	0,6
JTF/FN+grants/Public buildings	10 319	6 811	0,6
MDV-POO/grants/Public buildings	37 701	24 883	2,1
TOGETHER,	**157 971**	**104 261**	**9,0**

Source: SIEA, MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

The contribution of energy savings to the target under Article 7 of the EED achieved by the measures listed in Table 48 is 0.6 % and 0.7 % respectively, depending on Eurostat's methodology.

Table 48: Contribution of the measures to the target under Article 7 of the Energy Efficiency Directive

Methodology	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
F_CE (ktoe)	774	697	620	881	755	726	581	552	368	184
FEC 2020-2030 (ktoe)	870	783	696	990	849	816	653	620	413	207
Amount of contribution (ktoe)			**11**	**10**	**8**	**7**	**3**	**3**	**2**	**1**

Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

High-quality planning is a prerequisite for kick-starting intensive renovations of public buildings in a cost-effective way. In particular, the digital data platform on the energy performance of the building stock in Slovakia, which will be managed by the Slovak Ministry of Transport, will fulfil this task in the future. At regional level, the energy planning function for all final energy consumption sectors will be provided by regional sustainable energy centres, in cooperation with regional energy centres, under the responsibility of the Slovak Innovation Energy Agency and the Ministry of the Economy. Mutual coordination, exploitation of synergies and two-way information sharing between these support programmes will play a key role in reducing the energy intensity of Slovak regions.

Legislative basis/laws and decrees to promote energy efficiency

- Act No 321/2014 on energy efficiency

    - Decree of the Ministry of the Economy No 88/2015 laying down the scope of the assessment, the method of calculating and the value of energy efficiency of energy sources and distribution systems

- Decree of the Ministry of the Economy No 99/2015 laying down details for the provision of energy support services and guaranteed energy services
- Decree of the Ministry of the Economy No 179/2015 Coll. on energy audit
- Decree of the Ministry of the Economy No 319/2015 on the examination of professional competence for the performance of the activities of an energy auditor
- Decree No 327/2015 of the Ministry of the Economy on the calculation and fulfilment of energy efficiency targets
- Decree of the Ministry of the Economy No 13/2016 laying down details of the set of data to be provided for the energy efficiency monitoring system
- Decree No 14/2016 of the Ministry of the Economy laying down technical requirements for the thermal insulation of heat and hot water distribution systems
- Decree of the Ministry of the Economy No 192/2015 on monitoring the energy intensity of public buildings

- Act 555/2005 on the energy performance of buildings

  - Decree of the Ministry of Transport, Construction and Regional Development of the Slovak Republic 364/2012 implementing Act No 555/2005 on the energy performance of buildings and amending certain acts, as amended
  - Decree of the Ministry of Transport, Construction and Regional Development of the Slovak Republic 324/2016 amending Decree 364/2012 of the Ministry of Transport, Construction and Regional Development implementing Act No 555/2005 on the energy performance of buildings and amending certain acts, as amended
  - Decree of the Ministry of Construction and Regional Development of the Slovak Republic 311/2009 laying down the details of the calculation of the energy performance of buildings and the content of the energy performance certificate
  - Decree of the Ministry of Construction and Regional Development of the Slovak Republic 625/2006 implementing Act No 555/2005 on the energy performance of buildings and amending certain acts

- Law 657/2004 on thermal energy

  - Decree of the Ministry of the Economy No 151/2005 laying down the procedure for preventing and remedying the consequences of an emergency in the thermal energy sector
  - Decree of the Ministry of the Economy No 152/2005 on the specified time and the specified quality of the supply of heat to the final consumer
  - Decree of the Ministry of the Economy No 159/2005 laying down the scope of the training and knowledge required for examinations of professional competence, details of the establishment and operation of examination committees and the content of the certificate and professional competence
  - 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

- Decree No 3240/2016 of the Ministry of the Economy laying down the temperature of domestic hot water at the abstraction point, the rules on the allocation of quantities of heat delivered in domestic hot water and the allocation of heat quantities

- Law 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 No 422/2012 of the Ministry of the Economy on the procedure for the periodic inspection of the heating system
  - Decree of the Ministry of the Economy No 44/2013 Coll. 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 Coll. on up-to-date training

II. Long-term renovation strategy to support the renovation of the national stock of residential and non-residential buildings, private and public59, including policies, measures and actions to stimulate cost-effective deep renovations and policies and actions to target the worst segments of the national building stock in accordance with Article 2a of Directive 2010/31/EU

A long-term strategy for the renovation of residential and non-residential buildings in the Slovak Republic was submitted to the European Commission in 2020.

III. Description of policies and measures to promote energy services in the public sector and measures to remove regulatory and other barriers preventing the uptake of guaranteed energy service and other energy efficiency service models60

As such, energy services have been legally supported since 1 December 2014 in Act No 321/2014 on energy efficiency and amending certain acts (‘Act No 321/2014 on energy efficiency’). Article 15 to 20 of that law introduced the entire system for the definition and promotion of energy services. Energy services are broken down into ancillary energy services and guaranteed energy services – energy services with guaranteed energy savings, which are further specified if it is a guaranteed energy service for the public sector.

Supporting energy service

The auxiliary energy service is specified in Section 15 and has as its object, in particular, consultancy, training and the provision of services of a similar nature in order to improve energy efficiency.

<u>Guaranteed energy service (GES)</u>

The Ministry of the Economy maintains on its website61 lists of GES providers and a list of persons with professional competence to carry out a guaranteed energy service. The method of listing is dealt with in the form of Decree No 99/2015 of the Ministry of the Economy on providers of supporting and guaranteed energy services. GES is an energy service provided on the basis of an energy performance contract with guaranteed energy savings, i.e. energy performance contracting. The provision of an energy service with guaranteed energy savings is a tied trade. 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 also carries out support and awareness-raising for the development of the energy service. It shall also provide training and refresher training for a qualified person to provide a guaranteed energy service and shall inform the public body of the possibilities for implementing the energy efficiency improvement measures within its remit. Energy service providers shall be obliged to transmit data on energy services performed for the preceding calendar year to the energy efficiency monitoring system. GES is a contract between the GES provider and the beneficiary of GES as defined by Act No 321/2014 on energy efficiency.

Barriers and barriers

In 2012-2014, barriers to the development of energy services in Slovakia were identified, such as low awareness of GES, low trust in GES providers and an insufficient basic regulatory framework. Some of the above barriers were removed by Act No 321/2014 on energy efficiency, which introduced a basic energy service system, introduced an institute of qualified persons to provide a guaranteed energy service and the content of an energy performance contract for the public sector, as well as information obligations for the Slovak Innovation and Energy Agency. The basic political and regulatory barriers to energy services have thus been largely removed. However, removing barriers in particular to demand flexibility, regulation and design of appropriate support schemes remains a challenge.

One of the key barriers to the GES was the issue of private sector capital expenditure on public buildings under the GES Treaty, which, according to Eurostat's recent understanding, increased public debt. The financing provided by the GES provider was thus calculated as a loan to the public sector, thereby increasing public debt and deficits. As part of the evaluation of the priorities that can be financed within the limits on public sector debt, GES has generally come to the backs. This was not the specificity of the Slovak Republic, but the same issue concerned other EU Member States. Discussions at European Commission level, to which Slovakia also contributed significantly, resulted in the issuance of Eurostat's methodological guidance of 19.9.2017, which allowed a system for the use of energy service in the public sector that does not lead to an increase in public debt. In the User's Guide of 8.5.2018, Eurostat then specified in detail, in cooperation with the European Investment Bank, which requirements must be fulfilled by GES contracts in order to be recorded outside the general government sector, that is to say, without prejudice to public debt.

Policies and measures

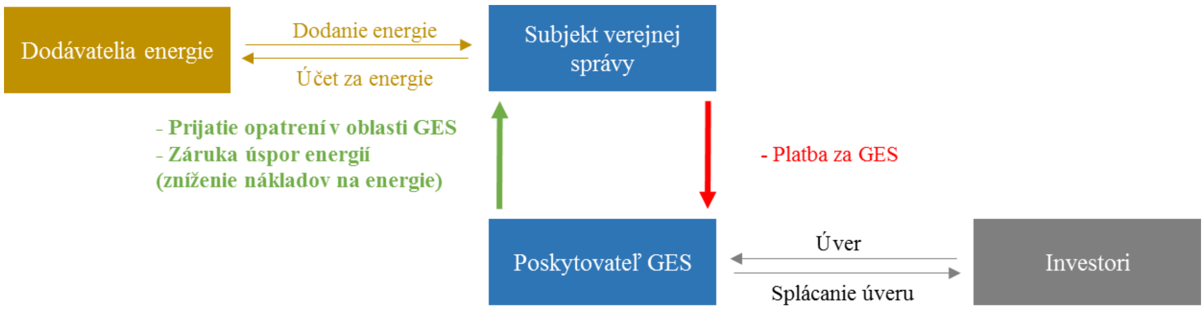
The new methodology and user manual aimed to significantly improve the conditions for the use of GES in the public sector. This led to the creation of a concept for the development of guaranteed energy services in the public administration of the Slovak Republic, which was approved by the Slovak

[61] http://www.economy.gov.sk/energetika/energeticka-efektivnost/poskytovanie-energetickej-sluzby

Government on 10 July 2018. Subsequently, an adaptation of the legislative framework allowing the use of GES according to Eurostat rules was prepared. The amendment to Act No 321/2014 on energy efficiency includes the necessary adjustments for the use of GES in the public sector, in line with Eurostat's methodological manual, and adjustments to other related legislative provisions on the management of state, municipal and municipal property and the VÚC. A model contract approved by Eurostat is also available.

A schematic illustration of the provision of a guaranteed energy service is given in Figure 7.

Figure 7 Single schematic representation of the provision of a guaranteed energy service



In the area of demand flexibility, it is important to facilitate the preparation of GES projects by final consumers (especially from the public sector). In particular, it is important to develop appropriate methodological guidance addressing the specific problems of GES project preparation, maximising the use of GES in combination with other forms of implementation of energy-efficient measures, and the issue of efficient and transparent public procurement of GES projects. In order to ensure the effectiveness of the methodologies prepared and to support the implementation of GES projects, it is necessary to establish a permanent technical assistance scheme allowing public authorities to use and finance the services of qualified consultants in the process of preparing and implementing energy efficiency projects.

The regulatory framework will have to comply with the energy efficiency first principle, which requires energy efficiency improvements to be made whenever they are more cost-effective than equivalent supply-side solutions.

In particular, it will be important to adapt the regulatory framework flexibly to the practical experience of implementing GES projects in response to the current market situation. In particular, it will be necessary to eliminate the unintended effects of introducing mandatory implementation of GES projects without affecting public debt, in line with the Eurostat methodology, consisting of a significant reduction of the market potential of GES in the public sector. Enabling GES projects also 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.

It will also be no less important to design support schemes effectively, i.e. that public and public entities in particular are incentivised as far as possible to cost-effective State resources in order to achieve the best possible result. In view of the need to increase the pace of building renovation and public sector lighting, it will be desirable that providers of guaranteed energy services should also be able to apply directly for support in addition to public authorities. It will also be necessary to allow GES to be combined with other ways of implementing projects in such a way as to maximise the use of future guaranteed energy savings to finance the necessary investments also from private sources.

Last but not least, market distortions for guaranteed energy services will need to be avoided in the next programming period through the provision of purely non-repayable financial assistance with a high intensity (i.e. above 70 % of eligible costs) from EU resources to public authorities to improve energy efficiency in public buildings and to upgrade public lighting. The use of non-repayable financial assistance in this area has the potential, but non-repayable financial assistance needs to be combined with repayable assistance from financial instruments under the same operation.

IV. Other planned policies, measures and programmes to achieve the indicative national energy efficiency contributions for 2030 as well as other objectives referred to in point 2.2 (such as measures to promote the exemplary role of public buildings, and energy efficiency of public procurement, measures to support energy audits and energy management systems, consumer62information and educational measures63, and other measures to promote energy efficiencyi)

All other measures contributing to the implementation of Article 7 of the Energy Efficiency Directive by 2030 are listed in Annex II.

v. Where appropriate, a description of policies and measures to promote the role of local energy communities in contributing to the implementation of policies and measures under points (i), (ii), (iii) and (iv)

In particular, regional energy centres and regional sustainable energy centres will contribute to the implementation of the policies and measures under 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 infrastructure64

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.

[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.

[64]In accordance with Article 15(2) of Directive 2012/27/EU.

Electricity

In the area of electricity, the energy efficiency potentials of the transmission system operator and distribution system operators have been assessed. The evaluation was carried out by entities involved in the operation of the transmission system and distribution systems.

The main contributors to improving energy efficiency in the field of electricity include the transmission system operator, Slovenská Electricá Transmission Systema, a.s. (SEPS) and distribution system operators.

The primary objective of SEPS is to ensure the security and reliability of electricity supply in a defined territory and to meet the international obligations of ENTSOE membership. At the same time, however, it designs and implements measures that contribute to reducing grid losses and thus reducing energy intensity. This includes building new lines and renovating older ones to ensure that impedance in transmission is reduced and 220 kV is shut down over time and 400 kV systems are replaced. Specific projects are listed in the Ten Year Transmission System Development Plan 2020-2029, which sets out investment plans for the next 10 years for the requirements of ensuring electricity transmission, load management and network interoperability. The energy efficiency of electricity transmission shall be assessed on the basis of annual balance sheet data for the transmission system.

In the Slovak Republic, electricity is currently distributed through three regional distribution systems (Eastern, Central and West of Slovakia) and approximately 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 No 88/2015 of the Ministry of the Economy laying down the scope of the assessment, the method of calculating and the value of the energy efficiency of energy sources and distribution systems, 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 roll-out of smart metering systems according to Decree 358/2013;
- installation of VN/NN transformers pursuant to Commission Regulation 548/2014 implementing the Ecodesign Directive 2009/125/EC with regard to small, medium and large power transformers;
- the distribution network development plan which, under the Energy Act, must be sent to the Ministry of the Economy by distribution system operators with more than 100 thousand delivery points;
- implementation of ÚRSO Methodological Guideline No 05/12/2015 of 11 June 2015.

Main measures that distribution system operators contribute to increasing energy efficiency:

- replacement and modernisation of existing facilities, in particular the replacement of transformers
- installation and deployment of smart metering systems in grids
- reconstruction of electrical stations
- optimisation of operation and number of transformers depending on the expected electricity consumption in the system
- implementation of control and diagnostic processes in the system

- reactive power compensation and introduction of automatic compensation control
- replacement of wiring of IWT, N & NN and NN
- mapping of distributions and modernisation of distribution cabinets
- replacement of luminaires with 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 installations are located.

Gas

In the gas sector, the assessment shall be carried out by the transmission system operator, gas distribution system operators and also gas storage operators. The necessary investments identified in the gas sector amount to around EUR 30 million for the entire ten-year period, to which should be added the major investment projects for cross-border interconnections referred to in the TYNDP.

The transmission system operator eustream a.s. has implemented most of the key actions in 2005-2015. This mainly involved optimising the operation of the transmission network and optimising the compressor technology.

The main projects that contribute to reducing energy intensity, which are planned to be implemented in the future, include upgrades and upgrades of gas transmission technology:

- upgrade of compressor station control system
- redizajn of compressor stations RENet
- further improving the accuracy and objectivity of measurement systems
- improving the safety of operations
- increasing the flexibility of the transmission network linked to new cross-border connections that have been opened or are planned for the next three years.

Approximately 50 distribution system operators ensure the distribution of gas. The assessment of the energy intensity of gas distribution is drawn up in accordance with Decree No 88/2015 of the Ministry of the Economy of the Slovak Republic.

The most important actions planned include:

- implementation of the heat-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 compressor power, measurement and remote data transmission and network pressure height
- insulation of heat pipes and exchangers
- improving the energy efficiency of heating operations at control stations
- control of gas conversion and gas preheating and heating, route caps, tightness of gas pipelines and additional insulation of gas pipelines
- introduction of intelligent metering systems in gas distribution and supply

The potential for energy savings is very limited, especially given the way in which gas installations are operated and maintained. Its value due to technical losses is around 300 GWh. Even with maximum effort and sufficient resources to ensure measures to reduce energy intensity, this potential can be reduced by at most around 10 %, which amounts to around 3 GWh savings per year.

Gas storage operators identified as their most important measures the optimisation of storage operations, the upgrade of the monitoring system and the management of the productivity of machinery and technology units, and the possibility of using the technological heat in operation.

Energy efficiency criteria for network tariffs and network regulation (Article 15 EED)

Description of measures planned or taken to ensure that tariff incentives that harm the overall efficiency of generation, transmission, distribution and supply of electricity are eliminated (Article 15(4) EED)

Under Section 11(1)(d), access to the transmission system and transmission of electricity (point d) and access to the distribution system and distribution of electricity (point (e)) are also subject to price regulation. The method for calculating the maximum price is laid down in the ÚRSO Decree.65

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 organises a tender procedure for a technology supplier that ensures that the energy efficiency of the systems is improved or electricity consumption is reduced and that the supplier prepares the construction and construction of 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)

ÚRSO's Ordinance on price regulation in electricity favours individual tariffs for end-users of electricity directly connected to the transmission system.

In this context, it is also necessary that regulatory policy takes sufficient account of the energy efficiency first principle as set out in DIRECTIVE (EU) 2018/2002 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 2012/27/EU on energy efficiency, for example by introducing incentives that would incentivise energy suppliers and distributors to achieve energy savings on the part of final users to the maximum extent possible.

VII. Regional cooperation in this area, where applicable

The Slovak Republic is one of the founding members of the international association CESEC (Central and South Eastern Europe energy connectivity). The initial aim of the group was to coordinate efforts to facilitate the rapid completion of cross-border and trans-European projects diversifying gas supplies 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 CESEC Ministerial Meeting in

[65] E.g. Ordinance 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.

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

The Recovery and Resilience Plan – REPowerEU – will be the key financial mechanism to support the development of electricity in Slovakia. The main investment will be the modernisation and digitalisation of the transmission system and regional distribution networks. The development of the electricity system 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 electricity from RES from abroad. In order to ensure the energy security and resilience of the Slovak Republic, it is essential to have a robust transmission system with sufficient regulatory performance and an adequate distribution system.

Investments in the transmission system are directly followed up by investments in regional distribution networks (RDSs) in order to enhance the distribution capacity of the transmission lines, transformers and other facilities of individual RDCs. In the context of the development of decentralised RES electricity generation, the proposed investments will contribute to the creation of new grid capacity for the connection of new renewable energy sources in specific locations and increase local permeability in distribution systems. Such improvement of the technical preconditions for the connection of new RES electricity generation facilities is crucial for meeting the national RES targets and the decarbonisation of the economy. The emergence 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;
• upgrading transmission lines;
• investments in regional distribution systems;
• the creation of an EDC.

3.3. Dimension: energy security[66]

I. Policies and measures related to the elements set out in point 2.3[67]

Diversification of sources and transport routes is appropriate for the stability of the provision of primary energy sources. Thanks to austerity measures and industrial restructuring, despite relatively strong economic growth, energy consumption has been growing at a lower pace in Slovakia. Such developments contribute to increasing energy security and dependence on energy imports.

As a consequence of the war in Ukraine and the unpredictability of supplies from Russia, and in order to reduce dependence on these supplies as quickly as possible, the European Commission has proposed the establishment of an EU Energy Platform which would aggregate gas demand for individual Member States or gas consumer companies and then contract awards if agreed by individual participants.

The legal basis for 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 reference prices and cross-border gas exchange.

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 the Member State is required to prepare 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 possible impact on the operation of the electricity system and to set out measures to address or prevent the emergence of crisis situations. The risk-preparedness plan for the electricity sector is drawn up by the Ministry of Economy in cooperation with the TSO, Slovenská Electricá Transmission Systema, a.s.

The transmission system operator ("TS") shall have at its disposal measures to address or prevent emergency situations. The PS operator shall have a defence plan to prevent the occurrence of major faults, measures for accidental changes in frequency and voltage, as well as a plan for system restoration after full or partial blackout.

If changes occur in the system during its operation that cause sudden congestion, the PS operator in order to remove the congestion

a. activates purchased support services;
b. use contractually agreed emergency reserves;
c. change the involvement of electricity installations in the transmission and distribution system;
d. activates redispatching or countertrading.

[66] Policies and measures shall reflect the energy efficiency first principle.

[67] 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).

The issue of safety and reliability is given high attention by the PS operator. In order to secure it, the following are carried out within the Slovak electricity system:

- preventive measures – analysis of the results of network running calculations and short-circuit rate calculations, protection adjustment, optimisation of the shutdown plan, regular maintenance of transmission equipment and processing of measures to deal with emergency situations. In addition, measures against the proliferation of large system failures and measures to eliminate the consequences of major system failures (the so-called 'Defence Plan'), operational preparation measures and measures to optimise maintenance and development of PS;
- dispatching measures – emergency assistance (guaranteed/non-guaranteed), interruption of work on PS facilities in coordination with distribution system operators (DSOs), use of PSP and system services, use of emergency response measures, topological changes in PS, redispatching and countertrading;
- technical measures – setting protections, use of PSP, operation of frequency characteristics and automatic voltage control.

In addition to the emergency measures referred to above, the legislation provides for restrictive measures:

- a consumption reduction plan;
- emergency shutdown plan,
- frequency switch-off plan.

The electricity dispatching of the PS operator shall update each year all three plans in accordance with the SARPs, be it European or national legislation and the internal procedures of the PS 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. Furthermore, energy security, infrastructure development and market integration are under discussion by CESEC (Central and South Eastern Europe Energy Connectivity).

Slovakia-Hungary Interconnector

The gas interconnection of Slovakia and Hungary connects high-pressure transmission systems between Veľký Zlievce on the Slovak side and the Hungarian municipality of Vecsés in the suburb of Budapest. The bi-directional gas pipeline with an annual capacity of 4.38 billion m³ will be 110.7 kilometres long (of which 92.1 kilometres on Hungarian territory and 18.6 kilometres on Slovak territory). The Slovak-Hungarian Pipeline is not only in the nature of new business opportunities, but also of strategic importance for the whole country. Slovakia will ensure access to the planned Southern Gas Corridors or LNG terminal in Croatia. Hungary will gain new access 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.

The inter-State interconnection of the transmission systems of the Slovak Republic and Hungary is a priority not only for Eustream and its Hungarian counterpart, but also for national governments and the European Commission.

Slovak-Ukrainian interconnection point Budince

The Memorandum of Understanding signed on 28 April 2014 between Ukrtransgaz and Eustream concerned the entry into operation of a pipeline that would allow reverse gas supply to Ukraine. The solution implemented consisted of the rapid entry into operation of the unused Vojany-Uzhhorod pipeline (Budince border point; small reverse).

It was launched on 2 September 2014 with the participation of 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, as well as from the point of view of technical, legal, temporal and full compatibility with the EU legislative framework.

The gas pipeline can provide transport capacity of up to 40 million m^3 per day (of which 27$^{\text{million}}$ m^3 is provided on a fixed basis), with the possibility of transporting up to 14.6 billion m of^3 natural gas to Ukraine annually.

As of 1 April 2016, the Budince border point has become a two-way point, with entry capacity to the Eustream transmission network out of Ukraine, with a maximum fixed entry capacity of 17 million$^{\text{m}}$3/day. The Ukrainian carrier Ukrtransgaz expects that the launch of two-way operations will increase interest in using underground gas storage facilities in Ukraine.

Slovakia-Poland interconnection

The Slovak and Polish Transmission Network Interconnection Project followed the mutual agreements of the Transmission System Operators Eustream, a.s. and GAZ-SYSTEM S.A.

Commission Delegated Regulation (EU) No 1391/2013 of 14 October 2013 amending Regulation (EU) No 347/2013 of the European Parliament and of the Council on guidelines for trans-European energy infrastructure as regards the Union list of projects of common interest ('PCIs') approved the list of projects. Under point 6 'Priority corridor North-South gas interconnections in Central Eastern and South-Eastern Europe ('NSI East Gas')', the Slovak-Polish interconnection project was also included. The project was also included in the 'second PCI list' under Commission Delegated Decision (EU) 2016/89 of 18 November 2015 amending Regulation (EU) No 347/2013 of the European Parliament and of the Council ('Commission Decision 2016/89'). The project was also granted PCI status for the third time when it was included in the list of projects of common interest issued by Commission Delegated Regulation 2018/540 of 23 November 2017 amending Regulation (EU) No 347/2013 of the European Parliament and of the Council.

On 22 November 2013, an Agreement between the Government of the Slovak Republic and the Government of the Republic of Poland on cooperation in the implementation of a gas pipeline project connecting the Polish transmission network and the Slovak transmission network was signed in Bratislava. The working group set up under this intergovernmental agreement (in which the relevant ministries, regulators as well as operators are represented) conducts negotiations where necessary to address issues related to the project. On 18 September 2018, a construction start ceremony took place in the premises of the Veľké Kapušany compressor station, with symbolic signatures by the Prime Minister of the Slovak Republic, the Minister of Economy, the Plenipotentiary of the Government of the Republic of Poland for Strategic Energy Infrastructure, the Chairman of the Board of Directors of GAZ-SYSTEM, the CEO of Eustream as well as the Deputy INEA.

Slovakia – The Polish interconnection was launched in mid-November 2022.

Solidarity Ring

The aim of the project is to provide an import route for gas supplies from Azerbaijan at an expected volume of 5-20 bcm³/year with a minimal adjustment of the transmission network. The project would connect the existing key infrastructure in Slovakia, connected to the Western gas hubs, with gas infrastructure in the territory of Hungary, Romania, Bulgaria, Türkiye and gas resources in the Caspian region. This solution would effectively help 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 possible shortfall. 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 to fulfil the Memorandum of Understanding on a Strategic Energy Partnership signed on 18 July 2022 between the European Commission and Azerbaijan to increase gas imports into Europe. The project is at an early stage of preparation. Ring solidarity is a quicker solution in time for ensuring the security of gas supply, especially for the Central European region, compared to the Eastring project, as it is the use of already existing infrastructure and not the realisation of a new line.

Nuclear energy

The diversification of nuclear fuel falls within the competence of the Community by virtue of Article 2(d) of the Euratom Treaty. In order to implement this Article, the 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 fair supply of nuclear fuel is ensured.

In 2018, Slovak Power Plants, a.s., under the supervision of Euratom Supply Agency, carried out an international tender for the supply of nuclear fuel, to which all relevant suppliers in the world came forward. Based on the results of the international tender, Slovenské elektrárne, a.s., TVEL and Euratom Supply Agency signed a contract for the supply of nuclear fuel for nuclear power plants in Slovakia in 2019. The fuel will be used in the operational units in both Mochovce and Bohunice, including the two completed units in Mochovce. The contract covers the period 2022-2026 with an 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. Czech, Slovak and Hungarian energy companies, together with the Finnish company Fortum, started to work closely together to secure alternative nuclear fuel suppliers. Although the basic fuel design for the VVER440 reactors 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. Slovakia's power plants with WH signed a confidentiality agreement, on the basis of which the data and information on the design of the VVER440 reactor fuel needed to enable WH to start developing fuel suitable for our nuclear power plants is exchanged. Wh would provide production, part of the documentation necessary for licensing, and transport of fuel. The use of that fuel and even its storage is subject to a complete licensing process.

- Framatome – a French energy company with extensive experience in the field of nuclear energy, including nuclear fuel production. It has not yet been active in VVER, but is currently discussing possibilities for cooperation with TVEL for both VVER1000 and VVER440 reactors.

Due to the technical complexity and licensing process, Slovenské elektrárne decided to order for 2023 a partial amount of nuclear materials and services for the supply of nuclear fuel from suppliers located in the EU and outside the Russian Federation.

The alternative supplier of VVER 440 nuclear fuel for reactors operated by Slovak Power Plants will be the US company Westinghouse Electric Sweden AB based on the results of the tender. At the same time, a project was created between the VVER 440 operating companies and the French company Framatome, which would result in a second potential fuel supplier for VVER 440 reactors. Slovak elektrárne, a.s. signed a confidentiality contract with Framatome. A Memorandum of Understanding between SE a.s. and Framatome was signed in June 2023.

The Memorandum provides the basis for the further development of long-term relationships in the field of nuclear energy – operation and maintenance of nuclear power plants, safety and modernisation, efficiency gains, instrumentation, digital security and cybersecurity. In order to ensure the safety and continuity of the operation of the nuclear power plants with the VVER 440 pressurised water reactors, Framatome, in cooperation with Slovak Power Plants and other European operators, will focus on the development of 100 % European nuclear fuel design for this type of reactor.

As regards the objective of diversifying by 2026, Slovenské elektrárne, a.s. is well ahead of 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 in dealings with providers (Westinghouse and Framatome) allows exploiting existing synergies and similarities in the nuclear fuel used.

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

Slovakia-Hungary Interconnector

The financial support under the European Energy Programme for Recovery (EEPR) was EUR 30 million. The total investment cost is around EUR 170 million (of which around 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 with the European Commission's Innovation and Networks Executive Agency (INEA) a tripartite agreement on EU financial assistance for the project 'Development of project documentation and performance of engineering activities for the Polish-Slovak gas interconnection'. Under this agreement, the project received EUR 4.6 million of financial support from the European Union 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 contract for the construction of the interconnection in question entered into force, under which the grant agreement allowed both the Polish and Slovak transmission system operators to receive financial support from the European Union from CEF funds amounting to a total of 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 can benefit from a subsidy to study the feasibility of the planned pan-European Eastring pipeline. On the basis of this contract, the European Union supported a study of up to 50 % of its eligible costs (up to a maximum of EUR 1 million) of CEF funding. The results of the study were presented on 20 September 2018.

3.4. Dimension: internal Energy Market68

3.4.1. Electricity infrastructure

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

As stated in point 2.4.1 of the NECP, the interconnection targets of the European electricity networks at Member State level are also met from the perspective of Slovakia's current and planned transmission capacities in the event of a conservative approach to the projected load and development of RES by transposing the National Action Plan (NAP) by 2030. However, the development of these two parameters affecting the level of import and export capacity of the PS SR depends on a number of factors reflecting socio-economic developments and the national economic direction of the Slovak Republic, which can to a certain extent be broken down by national policy and targets set at national level.

II. Regional cooperation in this area69

In order to support the preparation and implementation of cross-border investment projects in electricity infrastructure, where necessary, bilateral cooperation shall primarily take place at the level of the PS operators concerned. 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 taking place either bilaterally or multilaterally within ENTSO-E in the System Development Committee.

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

The financing of any SEPS electricity transmission infrastructure projects is primarily secured from TSOs' own resources, which are also acquired through network users' payments for electricity

[68] Policies and measures shall reflect the energy efficiency first principle.

[69] Other than the PCI Regional Groups established under Regulation (EU) No 347/2013.

purchased. 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 the 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 Slovakia Report defines the priority to implement solutions for smart distribution grids and electricity storage – linked to demand and supply planning at local level.

Support for energy distribution and storage facilities, including systems for monitoring, optimising and managing energy consumption, will contribute to increasing the efficiency of energy use facilities as well as the possibilities for installing new equipment for the use of RES. 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 No COM/2020/299. Support will focus on the establishment of local distribution networks, in particular within RES energy communities, including energy storage, the creation of possibilities for the active involvement of end-users in the process of optimising and reducing their energy demand and costs. Further integration of RES in the electricity sector is conditional on the comprehensive strengthening and development of the transmission and distribution system in order to increase its flexibility with regard to the involvement of diverse renewable sources. The activities will contribute to integration into the concept of smart management of the whole electricity system in order to improve the quality, security and sustainability of the 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 the exchange of more data and greater transparency in the provision of information on the operation of electricity systems, which will facilitate the integration of new entrants, communities and aggregators. At the same time, the emphasis on cybersecurity is growing as data volumes and communication links increase.

The Slovak programme foresees the use of support in the field of RES support. In the area of the transmission and distribution system, the construction, reconstruction and modernisation of lines and conversion plants will also be supported under the Slovak programme, which will contribute to 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 (notably RES). Cybersecurity measures will always be coordinated with the superior system so as to ensure the compatibility of interconnected systems.

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. The Modernisation Fund complements other European funding instruments such as the cohesion policy and the Just Transition Fund.

REPowerEU supports the modernisation and digitalisation of the transmission system and regional distribution systems and its allocation for this purpose is EUR 133 million.

3.4.2. Energy transmission infrastructure

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

In order to promote the smooth implementation of projects of common interest (PCI), Slovakia has adopted a modification of the relevant legislation (Energy Act, Act on Significant Investments, Construction Act, etc.), "one-stop-shop" access within the meaning of Regulation (EU) 2022/869 of the European Parliament and of the Council on guidelines for trans-European energy infrastructure. This allows the Ministry of the Economy to monitor and effectively enter into the PCI permit process of projects in Slovakia in order to speed up the issue of the relevant permits.

II. Regional cooperation in this area70

See previous sections, point 3.4.1 ii.

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

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 Slovak Republic's objectives in the area of electricity market integration in all timeframes, increasing the flexibility of the energy system and the relevant projects stem from and are in line with the requirements of superior European legislation, which is directly applied in the circumstances of the Member States (i.e. the relevant market network codes and regulations). Therefore, these objectives, as defined today, do not result from conceptually defined objectives at national level, national policies and official government decisions in this area.

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 have access to a secure and affordable gas supply.

The implementation of gas network codes on the basis of supranational legislation has created the conditions for the integration of gas markets and for increasing their liquidity. In the coming period, measures will be put in place which will contribute to their further development by reducing the administrative burden on the operators concerned.

[70] Other than the PCI Regional Groups established under Regulation (EU) No 347/2013.

II. Measures to increase the flexibility of the energy system with regard to renewable generation, 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 the previous sections, point 2.4.3, a description of the objectives, objectives and measures.

Measures for the development of smart metering systems and smart grids (Slovak energy policy, 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;
- continuously review the scope 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;
- to ensure that the technical parameters of IMS 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 construction and development of IS by ensuring the interoperability of the IMS components and adequate communication capabilities;
- to support the local or wide-spread testing of IS and, by 2035, the development of smart cities, municipalities and regions, the development of network management towards the construction of IS at the level of distribution systems and the transmission system of the Slovak Republic;
- create the conditions for the development of local smart grids with close to balanced balances, minimising flows towards the surroundings;
- use IMS and IS to support electromobility;
- increasing the number of households equipped with smart appliances and IMS with the possibility of remotely supervising the household electricity consumption diagram;
- develop conditions for electricity storage as close as possible to the point of consumption.

III. Where applicable, measures to ensure the non-discriminatory participation of renewable energy, demand response and storage, including via aggregation, in all energy markets

See related parts, point 2.4.3, description of objectives, objectives and measures.

IV. Policies and measures to protect consumers, especially vulnerable and, where applicable, energy poor consumers, and to improve the competitiveness and contestability of the retail energy market

See related parts, 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').

According to the Regulation Act, a vulnerable customer in the electricity market is:

- household customers;
- a non-household customer with an annual electricity consumption of less than 30 000 kWh (so-called 'small electricity customer');
- other groups of selected non-household 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 Authority') adopted a **regulatory policy** for the 6th regulatory period from 1.1.2023 to 31.12.2027. The main starting point for regulatory policy for the next regulatory period since 1.1.2023 was to assess the need for further regulation and to justify the scope and manner of implementation of price regulation. 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 the degree of volatility in the wholesale electricity market, which started in the second half of 2021, persisting in 2022, mainly due to the ongoing military conflict in Ukraine and related developments in the wholesale gas market.

In the area of the electricity retail market, Slovakia's conditions are, in particular, regulating the **supply of electricity and gas** to defined segments of vulnerable customers within the scope of the universal service, i.e. the supply of electricity (and gas) to the exhaustive categories of customers under primary legislation. In the implementation of price regulation, the regulator relies on the current text of primary legislation, with the way in which price regulation is regulated and the scope of price regulation flexibly responding to current market needs and the need for consumer protection. It is important for the regulator to closely monitor competition, market concentration and overall price developments, price volatility and liquidity in wholesale commodity markets and will therefore carry out an ongoing analysis. In the area of price regulation of the supply of electricity (and gas supply), linked to the forthcoming 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 so-called small enterprise 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, in which there would be an entitlement for household customers to supply energy in the form of a price-regulated universal service).

In parallel to the preparation of the Regulatory Policy **in early 2022, the Slovak Republic prepared new legislation on retail prices for electricity** (and gas) also in response to the requirements of Article 5 of Directive (EU) 2019/944 of 5 June 2019 concerning common rules for the internal market in electricity ('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 fully market-based supply prices, had to be reviewed and adjusted in response to the sharp increase in prices on wholesale electricity/gas markets.

The upcoming amendments on the regulation of price regulation of retail electricity and gas prices have responded to the requirements of the Article of Directive (EU) 2019/944, according to which price regulation is generally considered to be one of the largest (if not the largest) barriers to increasing competitiveness in retail markets in EU Member States. Directive (EU) 2019/944 provides in principle, in general terms, that a Member State may not intervene in the price setting for the supply of electricity, but may apply regulated prices to energy poor or vulnerable household customers and other household customers and micro-enterprises under specified conditions.

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 the soaring prices on wholesale electricity/gas markets. A so-called 'partial price deregulation' model in the electricity and gas supply market has been proposed, allowing for the coexistence of regulated and unregulated (market) prices/products (applicable from 1 January 2023) with equal access to electricity and gas supply.

In**response to the particularly unfavourable situation on the European market of energy commodities, in particular electricity and natural gas, which threaten the affordability of electricity and natural gas supplies for household customers and certain other groups of electricity and natural gas customers, the Slovak Republic adopted an update of the legislation on the regulation of retail prices 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 electricity and gas supply market for the 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 Office for the Regulation of Network Industries, but while allowing the transition to a market product (or, in the case of entities with unregulated electricity/gas supply, to remain in a market product and not to use 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, conversely, to enter it if it was previously outside the regulated environment (opt-in), ensures the parallel existence of regulated and unregulated products for vulnerable customers, thus increasing the supply to vulnerable customers and allowing the market to react flexibly. The right to switch suppliers remains with the vulnerable customer. At the same time, it is proposed to allow the Office for the Regulation of Network Industries to adjust in a flexible manner the scope for price regulation of the supply of electricity or gas to vulnerable customers, where justified by the market situation.

The draft law also aimed at strengthening the security of supply of electricity and gas through the institute of a supplier of last resort. It introduces a specific liability for electricity or gas suppliers who have lost their capacity to supply electricity or gas for damage caused by loss of capacity to supply or delivery of last resort itself, and an obligation for an electricity or gas supplier who has lost its capacity to supply electricity or gas to offer without delay the amount of electricity or gas it has provided to its customers.

The partial deregulation of electricity and gas supply prices was linked to **changes in consumer protection legislation**, with the emphasis on the free choice of supplier/aggregator, the right to change supplier/aggregator and rules on fees associated with it, collective switching rights, the legal enactment of a tool for comparing suppliers' offers, rules on the content and formalities of invoices and billing information, the right to out-of-court settlement of disputes and rules on the negotiation of contracts, including dynamic price contracts.

In view of the exceptionally high energy prices in the course of 2022, the Slovak Government has taken **extraordinary measures** to eliminate the impact of the increase in electricity prices on selected groups of customers in 2023 (vulnerable electricity and gas customers – household, small and selected non-household customers) pursuant to Article 13 of Council Regulation (EU) 2022/1854 (temporary possibility to set electricity prices below cost).

The exceptional measures are implemented by setting end-price caps on electricity for household customers and for selected vulnerable non-household 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 ('EIG') 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), as part of the so-called crisis regulation pursuant to Section 16a of the Regulatory Act and by determining the maximum amount of selected regulated charges (tariff for losses in the distribution of electricity, tariff for system services, system operation tariff) for household customers and for selected vulnerable non-household customers under Section 16a of the Slovak Government Regulation No 46 on the basis of the government regulation No 16 of the Slovak Republic. From May 2023 until the end of 2023, Slovak Government Regulation No 465/2022 Coll. frozen the prices of collected regulated charges (system operating tariff, system service tariff and system loss tariff) at 2022 level for all electricity end-users.

The Slovak legislation in force on price regulation in the electricity market in Slovakia and the exceptional government measures taken to mitigate the effects of high energy prices are in line with the Commission's 'Guidance on the application of Article 5 of the Electricity Directive in the current energy market situation' (Annex 1 to the Commission Communication REPowerEU of 8 March 2022) and in accordance with Articles 12 and 13 of Council Regulation (EU) 2022/1854, reflecting the unfavourable 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 those addressing tariffs to support dynamic pricing71

See previous sections, point 2.4.3. i.e. description of intentions and measures and regulatory policy of the Office for Regulation in Network Industries for the 6th regulatory period until 2027.

[71] In accordance with Article 15(8) of Directive 2012/27/EU.

3.4.4. Energy poverty

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

Eradicating energy poverty is a long-term process of adopting legislative adjustments, inter-ministerial measures, setting up support mechanisms, systems and operational solutions.

Under the legislation, Slovakia has a number of generally binding legal standards that create the conditions for tackling energy poverty:

- Act No 321/2014 on energy efficiency and amending certain acts laid down measures to promote and improve energy efficiency and contributes to reducing energy poverty
- Act No 250/2012, which partially implements the 2009 EU Third Energy Package for the internal market in electricity and natural gas, as well as the EU legislative package "Clean Energy for all Europeans" on the internal electricity market
- Act No 443/2010 on housing development subsidies and social housing, which provides subsidies for the elimination of systemic disorders in multi-apartment buildings
- Act No 150/2013 on the State Housing Development Fund which provides loans for the insulation of existing multi-apartment buildings
- Act No 417/2013 on assistance in material need and amending certain acts, as amended, on the basis of which entitlement to housing assistance, which is part of the total assistance provided in material need, can be obtained;
- Decree No 18/2017 laying down price regulation in the electricity sector;
- Decree No 107/2023 Coll. providing for price regulation of the supply of electricity
- Decree No 312/2022 laying down price regulation in thermal energy;
- Decree No 450/2022 Coll. providing for price regulation of gas supply.

Under Section 10(g) of Act No 250/2012, ÚRSO 'shall take measures to achieve universal and public service and contribute to the protection of vulnerable electricity and vulnerable gas customers and customers meeting the conditions of energy poverty in accordance with the concept under Section 9(3)(f)'. In line with this legislative mandate, ÚRSO proposes to proceed with the implementation of the measures set out below in the next 6th regulatory period. The measures are divided into possible instruments within the competence of ÚRSO and recommendations for possible measures under the responsibility of other state and public authorities, which can be adopted and implemented by individual proposals depending on their legislative competences and policies, or on the basis of the tasks assigned to them by the Government of the Slovak Republic.

Proposals for measures within the competence of ÚRSO

Promoting the use of pre-paid (credit) electricity consumption systems

The draft measure is based on the solution currently applied by Východoslovenská distribučná a.s. in selected areas in eastern Slovakia and is based on the credit system and the use of intelligent metering systems (IMS). The solution is built on IMS technologies and connects several actors, including the involvement of municipalities.

Households falling within the definition of energy poverty would be able to subscribe to the supply of electricity in advance and thus better manage their consumption in connection with disposable income.

Legislative mandate for the creation of EICs for energy and water customers

In the course of 2023, the operator of the short-term electricity market operator OKTE a.s. will, on the basis of Decree No 24/2013 of the ÚRSO laying down the rules for the functioning of the internal market in electricity and the rules for the functioning of the internal market in gas, as amended, start assigning an EIC to each market participant. This will also create an identifier of the final electricity customer who will combine further information on all demand points in Slovakia owned by one and the same customer. If primary and secondary legislation are adapted accordingly, it will also be possible to use the register of electricity customers for matching the EIC identifier with selected socio-economic parameters of the customer or matching with a sign of meeting the definition criterion for energy poverty. This would create a single register of electricity consumers at risk of energy poverty. A similar identifier model (possibly through an appropriate link to EICs in the electricity market) could also be used in the gas market as well as in the heating and drinking water supply sector. The aim is to create a coherent support instrument across all network industries, which will enable targeted and fair identification of households at risk of energy poverty.

Legislative modification of the mandate of the ÚRSO to strengthen consumer protection and households at risk of energy poverty

Primary legislation, in particular Act No 250/2012, gives ÚRSO the competence to regulate prices and substance in network industries. However, each regulated sector – the network sector – has one or more separate legislative provisions which lay down the conditions for carrying out activities in that sector. The ÚRSO needs a legislative mandate to adapt the details and conditions of energy and water supply, taking into account the specific needs of households at risk of energy poverty in all regulated sectors – network industries. Thus, measures aimed at helping energy poor households can be implemented on the basis of a legislative mandate, as they are specific to a selected group of buyers of goods and related regulated activities.

In this context, the Authority proposes to amend the legislation in order to implement the following measures to protect households at risk of energy poverty:

- optimisation of supply and network tariffs;
- offering free payment schedules and energy advice;
- a ceiling for the application of supplementary list services;
- a ban on interrupting the supply of energy and water during the winter season;
- ban on door-to-door energy sales;
- rules enabling all households, including those not directly contracted to the supplier, to ‘regulate’ (i.e. to be able to extract energy and water under conditions applied in a price-regulated environment).

Recommendations for possible further State policy measures, under the responsibility of central government bodies

The issue of energy poverty is a multi-sectorial problem, and it is therefore necessary to work together to address it in a comprehensive way. The ÚRSO 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 as time-limited measures during the prevailing energy crisis situation. Social policy, among other things, has a role to play in tackling energy poverty. In particular, financial support to low-income households at risk of energy poverty can be highlighted in this area. It is possible that these measures will be accompanied by additional measures that will be developed in addressing the transposition of the proposed Energy Efficiency Directive under the Fit for 55 package.

<u>Tax advantages for energy poor households</u>

One possible and relatively quickly feasible 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 sewage through invoices from the 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 through state-certified sellers of goods and services.

<u>Introduction of measures to strengthen financial support to households at risk of energy poverty</u>

Financial contributions can be important tools to support households at risk of energy poverty. In the Slovak Republic, this is a housing benefit which forms part of assistance in material need. Under Section 14 of Act No 417/2013 on assistance in material need and amending certain acts, as amended, e.g. an owner or tenant who is a member of a household to whom assistance in material need is provided is entitled to housing assistance if he duly pays the costs for all housing services (e.g. rent, property tax, municipal waste charges) or, in the case of arrears linked to the payment of the costs of housing services, submits an instalment agreement and a certificate that the instalment plan has been properly implemented. Housing benefit alone cannot solve the problem of energy poverty, but in combination with the materially deprived allowance and other assistance in material need, it can be an instrument to cover part of the energy expenditure. However, the current set-up of the housing allowance, in particular its level, is not sufficient in the current economic and social context. The parliamentary proposal currently submitted to the National Council of the Slovak Republic for discussion by the National Council of the Slovak Republic reflects the need to increase it and change its terms. It would be appropriate to adopt further financially sustainable support measures targeting a wider population in order to mitigate the negative consequences of energy poverty.

<u>Increasing the availability of energy efficiency measures and the use of renewable energy from public sources</u>

Improving the thermal insulation properties of buildings is unaffordable for many households, especially for those that meet the criteria for being at risk of energy poverty. 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 costs, while increasing the standard of living of the household concerned. The objective of the measure is to reduce energy consumption in buildings, in particular through the comprehensive renovation of buildings. As part of this measure, it would be necessary to allocate part of the funding targeted to households at risk of energy poverty, e.g. from programmes: REPowerEU, Recovery and Resilience Plan, Social Climate Fund, Envirofond, etc. The funds allocated from these programmes could be used under existing programmes, such as renovation programmes or Green Households. However, these programmes need to become available also to households at risk of energy poverty, ideally so as to enable this group of consumers to finance 100 % of the cost of energy renovation of worst-quality buildings. In this context, it is important to highlight the extension of the renovation programme to include, for example, low-income families, families with a SRM child, or households with at least 4 children, to whom state support should cover 95 % of the costs associated with the renovation and modernisation of heating. The long-standing Green Households programme is currently still unavailable for low-income households due to the difficulty of registering and proving documents and documents, as well as for co-financing.

<u>Establishment of control rules for energy evaluation of buildings</u>

Energy performance standards for buildings and building energy standards can also be introduced in the context of combating energy poverty. Protecting households from the risk of energy poverty is intended to lead to energy and water efficiency and reduction of the waste of energy and drinking water in the building. It follows that there is a need to set a prescriptive and minimum energy consumption of a building, i.e. how much energy should be delivered to the building in such a way as to ensure that the hygiene criteria and technical limits for the operation of the building are met. A subsequent comparison of actual energy consumption with prescriptive energy consumption by monitoring the operation of a building could show whether energy is managed economically in the building and whether the building is operated cost-effectively. In doing so, it is possible to evaluate whether the building has all the required austerity measures in place. EPCs could also be one of the instruments in this category of requirements, if they properly cover electricity consumption in installations and lighting.

In addition, there is a need to focus on awareness-raising about the so-called major renovation of buildings, which represents building modifications to an existing building that intervenes in its envelope covering more than 25 % of its surface area, in particular by insulation of the perimeter and roof envelope and by replacing the original holes. The benefits and savings potential of building insulation represent a significant space for awareness-raising. Raising awareness can also be suitably combined with a measure related to the financing of such construction operations.

<u>Extension of existing advice to an easily accessible network of energy advisors</u>

The theme of energy poverty places great demands on consumers in terms of energy and information literacy, which would enable them to actively address their situation.
There are already a number of possibilities for consumers to deal with their consumer agenda or how to assert their rights. For example, the Slovak Innovation and Energy Agency (SIEA) provides free advice on energy efficiency through a telephone line or at the 'Helve Energy' consultation centres in Bratislava, Trenčín, Banská Bystrica and Košice. The ÚRSO has established a separate Consumer

Protection Department and at the same time operates the subpage 'ÚRSO Ombudsman' on its website in order to deal efficiently with consumer complaints and raise public awareness. Also, heating suppliers from CZT systems are obliged under Act No 321/2014 on energy efficiency to provide final customers with contact details of organisations that provide information on available energy efficiency improvement measures in heating, cooling and hot water consumption and on the technical specifications of installations using heating, cooling and hot water.

However, there is a need to further promote household awareness of how to address their energy needs. The creation of an accessible network of energy advisors, fulfilling the following attributes, seems to be a forward-looking solution: free of charge, regional accessibility, complexity of the proposed solutions. The aim is to advise households in energy poverty, free of charge, on the choice of the correct delivery tariff and distribution tariffs, the setting of advance payments, as well as other information on available state support schemes and assistance.

<u>Active involvement of local and regional authorities in tackling energy poverty</u>

Local and regional authorities can play a key role in combating energy poverty, given their local knowledge of the population and housing stock, as well as their responsibilities and capacity to represent the interests of local citizens. Their activities may include the provision of social housing, the provision of social services or financial support, contact with consumer associations. Last but not least, granting local tax reliefs to households meeting the criteria of energy poverty is to be considered; for example, a temporary reduction in the tax on buildings where households live in energy poverty, which have undergone renovations and improved their energy efficiency.

<u>Creation of a single one-stop-shop website with comprehensive information on energy poverty</u>

The creation of a separate information platform, with a specific module on energy poverty, a website within the website of the Slovak Government, a ministry or a state institution, would also appear to be an appropriate information tool. The aim is to provide all relevant information in one place, including the possibility of prior verification via an automatic or contact form, whether the household meets the criteria for being at risk of energy poverty (the management of the form would be provided by the institution operating the website as a whole).

The above-mentioned measures, which are set out in the Blueprint for the protection of energy-poverty customers, are so far only a proposal and are subject to expert assessment by a cross-ministerial working group to assess their potential to contribute to the eradication of energy poverty.

3.5. Dimension: research, innovation and competitiveness

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

National R & D & I Strategy 2030 and Research and Innovation Strategy for Smart Specialisation of the Slovak Republic 2021-2027

The National R & D & I Strategy 2030 (hereinafter N & D & I) is a key strategic document at national level which sets out the vision and long-term strategic objectives for R & D & I and forms the basis for other related strategic documents of the Slovak Republic, as well as the implementation of PSK resources allocated under Political Objective 1. NS R & D & I stresses the need to prioritise research areas through the continuous development of smart specialisation of Slovakia through missions. Missions are emerging through the gradual transformation of the smart specialisation domains of RIS3. NS R & D & I also proposes changes in the management and funding of science in order to improve the quality of the R & D & I activities of publicly supported activities as well as to increase the involvement of businesses in the implementation of R & D & I activities. The theme of energy autonomy and security, together with the social and economic impacts of the climate crisis, is highlighted in NS R & D & I as major challenges on which Slovakia needs to concentrate its efforts and resources, including in the field of R & D & I.

The R & I R & I Strategy for Smart Specialisation of the Slovak Republic 2021-2027 is a concept of innovation policy that aims to boost national or regional innovation, contribute to growth and prosperity by helping and enabling states or regions to focus on their strengths. SK RIS3 2021+ is also the basic document determining the content of support from the European Union cohesion policy funds for the 2021-2027 period for the R & I area and the concentration of resources in this area. This document puts greater emphasis on supporting applied research for the needs of the economy and government and identifies key areas and research themes on which applied research should focus. The priorities defined in the RIS3 framework identified in the smart specialisation domains, which are developed with the representation of a wide range of actors of the innovation landscape in the EDP process.
An update of the Synthesis Report of the Entrepreneurial Discovery Process will take place in 2024, where each domain priority 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 approved by the Government Council for Science, Technology and Innovation by Resolution No 1/25 of 10 May 2022.

Summary Report of the Entrepreneurial Discovery Process, Smart Specialisation Houses and Priority Areas

EU Member States were obliged to prepare their National Research and Innovation Strategies for Smart Specialisation in order to identify appropriate 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 that should be targeted by EU fund programmes but also by other selected R & D support programmes.

In SK RIS3 2021+, Smart Specialisation Houses were defined through the entrepreneurial discovery process. It shall include information regarding the rationale for the choice of domain, the objective of the domain, the priority areas, the transformative objectives and the presumption of cooperation and synergies with other domains.

The table below shows the priority areas related to energy R & D & I based on SK RIS3 2021+. The approval of this document by the Government Council for Science, Technology and Innovation and the European Commission was a necessary condition for receiving funding from the relevant EU funds (under the “enabling conditions”).

Table 49: Priority areas related to energy R & D & I based on SK RIS3 2021+:

Priority area Target status	
1-4 Enhancing 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 demand (with high added and export value)
	Better use of available energy through an appropriate energy mix, minimising excess energy that is not usefully released to the surroundings
	Eliminating the negative effects of burning poor-quality fossil fuels and waste in heating buildings by making better use of industrially generated waste heat
	Creating new possibilities for efficient storage of energy surpluses for future needs
1-6 Energy security	Transform Slovakia’s energy system in order to improve energy security, competitiveness and environmental sustainability of Slovakia’s economy
	Implementation of smart grids and efficient management of the energy grid
	Flexible operation of nuclear energy installations and support to electricity grid requirements
	Efficient and environmentally friendly spent fuel storage 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’s territory 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, there will be a reduction in the number of priorities in the continuous EDP process during 2024. The aim will be to promote, as a matter of priority, topics with high innovation potential and applicability at home or within the EU. 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.

Every year, the Ministry of Education carries out an in-depth analysis of the Slovak Republic's energy technology, development and innovation research for the International Energy Agency, working at the OECD.

In order to obtain relevant information on the financing of energy research in Slovakia, the MŠVVaŠ SR addresses the relevant institutions (the Slovak Academy of Sciences, the Agency for the Promotion of Research and Development, the Research Agency, the Slovak Innovation and Energy Agency, the Statistical Office of the Slovak Republic, the Ministry of the Economy, the Ministry of the Environment of the Slovak Republic, the Ministry of Agriculture and Regional Development of the Slovak Republic, the National Centre for Research and Applications of the OZE, the National Forestry Centre – the Forest Research Institute Zvolen, the National Agricultural and Food Centre, Horizon 2020, etc.), which have up-to-date information on R & D projects financed from the state budget, European Union resources and private sources.

An analysis of the last years shows that R & D was spent EUR 20,351 million in 2014, EUR 2,944 million in 2015, EUR 18,451 million in 2016 and EUR 1.02 million in 2017.

According to the Commission's statistics provided through ECORDA and the Funding and Tender Portal as of April 2023, Slovak institutions were involved in a total of 20 successful projects for which they received a final EC contribution of 4.67 million euro.

Agency for the Promotion of Research and Development (AGD)
Each year, the APVV launches a public call for applications to address R & D projects in each group of science and technology disciplines. The Agency's basic endeavour 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 of 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 project resolution period supported under this call is EUR 33 million. The funds are distributed according to requirements in each group of science and technology disciplines. The total amount of funds provided by the Agency to deal with one project is capped at a maximum amount of EUR 250000 for the entire duration of the solution.
Information on approved R & D projects in each area, 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 RES Research and Applications Centre
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 National RES Research and Applications project: Faculty of Chemical and Food Technology, Faculty of Electrical and Informatics, Machinery Faculty, Construction Faculty. The research strands of the National Centre are biomass, solar and hydropower.

Smart Grid Research Laboratory
There is an interest in setting up a laboratory for research on smart grids. The laboratory's role would be to test new technologies on the grid, demand and production side and interoperability. The laboratory should also be a showcasing centre.

Research and development in hydrogen and hydrogen technologies

R & D linked to innovation and training for hydrogen technologies can be one of the strategic areas of Slovakia's energy and industrial policy in the future. The various areas of basic and applied R & D & I are in line with EU policies, the approved National Hydrogen Strategy and its Action Plan or future updates, as well as other strategic documents of the Slovak Republic, such as SK RIS3 2021+, focusing in particular on the following areas:

- management of key R & D pilot projects supporting hydrogen value chains;
- proposals for calls under the Innovation Fund, which will support solutions for improving the EU Emissions Trading System;
- preparing innovation calls for hydrogen technologies in grey hydrogen regions;
- establishment of international partnerships and subsequent preparation of calls for projects for bilateral/multilateral applied research and industrial development;
- building partnerships on hydrogen use;
- Slovakia's involvement in EU programmes (the Hydrogen Europe, which is 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 stemming from hydrogen properties.

Related intellectual property protection will be an integral part of R & D & I in this area, as well as promoting knowledge transfer of hydrogen from the market environment, hydrogen use and its environmental benefits in education and study programmes, vocational education at secondary and tertiary level, as well as in dual and lifelong learning systems.

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

Slovakia is widely involved in international R & D & I activities through bilateral S & T cooperation agreements with EU and non-EU countries.

The MŠVVaŠ SR provides support for the participation of Slovak institutions and researchers in the Horizon Europe Framework Programme, including support activities for participation in EURATOM calls.

Support activities are provided through the national contact point and national delegates in the EURATOM programme within the Slovak Office of Horizon Europe, provided in cooperation between the MŠVVaŠ SR and CVTI SR. Information is provided on calls for projects, consultations and through participation in the European Commission’s committees, the promotion of Slovakia’s priorities in the work programme and, subsequently, the text of the EURATOM calls.

The MŠVVaŠ SR also actively participates in the regular meetings of the Governing Board of the European Joint Undertaking Fusion4Energy, through which it contributes to the international ITER thermonuclear reactor project. Participation is provided 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 represents 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 in the field of nuclear energy between Slovakia, Hungary and the Czech Republic and France).

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

The above mentioned funding measures in this area at national level, including EU support and the use of EU funds, were already included in the previous chapters.

Table 50 Proposed costs per year of solution and whole resolution period (million euro)

Year	**2019**	**2020**	**2021**	**2022**	**2023**	**Together,**
National budget	17,940	21,038	21,599	18,916	4,600	**84,093**
Of which BV	5,741	13,370	21,599	18,916	4,600	**64,225**
Of which KV	12,199	7,668	0	0	0	**19,868**
Indicative extra-	5,953	7,253	7,450	6,515	1,580	**28,751**

budgetary resources						
Total eligible costs	**23,893**	**28,291**	**29,049**	**25,431**	**6,180**	**112,844**

Source: MŠVVaŠ SR

The indicative budget for the entire ENERGETIK SECURITY amounts to EUR 84,093 million for the period 2018-2023. The proposed budget below takes into account the sum of the three SEE sub-programmes. The figures are in millions of euro. If requested, the budget will be increased by 35 %.

Table 51 Indicative budget for R & D S & D Energy from 2024 to 2028

Year	**2024**	**2025**	**2026**	**2027**	**2028**	**Together,**
National budget Figures are in millions of euros	16,819	17,155	17,498	17,848	18,205	**87,525**

Source: MŠVVaŠ SR

The envisaged financial provision for the implementation of the forward-looking objective. The indicative budget for R & D R & D "Energy" between 2024 and 2028 amounts to EUR 87,525 million. The proposed budget below takes into account the projected evolution of GDP and covers all three SEP sub-programmes.

SECTION B: ANALYTICAL BASIS[72]

4. THE STATE OF PLAY AND PROJECTIONS BASED ON EXISTING POLICIES AND MEASURES[73;74]

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

I. Macroeconomic forecasts (GDP and population growth)

As at 31 December 2021, the population of the Slovak Republic was 5434712. The average population density is 110.8 inhabitants per km². Apart from cities, the population is concentrated on lowlands and boilers, hills and mountains are sparsely populated. Large-scale settlements and land use have profoundly affected the landscape’s original structure and ecosystems. The capital city of Bratislava is the largest city in the Slovak Republic with a population of 475503.

In 2021, 56565 living children were born and 73461 people died. This resulted in a natural population loss of 16896 people. These numbers thus show a slight trend in population decline despite recent years when this trend has been put on hold.

The average age of the population of the Slovak Republic is 39.7 years for men and 42.8 years for women. However, the main demographic trend is an increase in the share of the group over 65 years old. The main reason for this is the change in reproductive behaviour, which caused the Slovak Republic to fall below the fertility rate needed to rebuild its population.

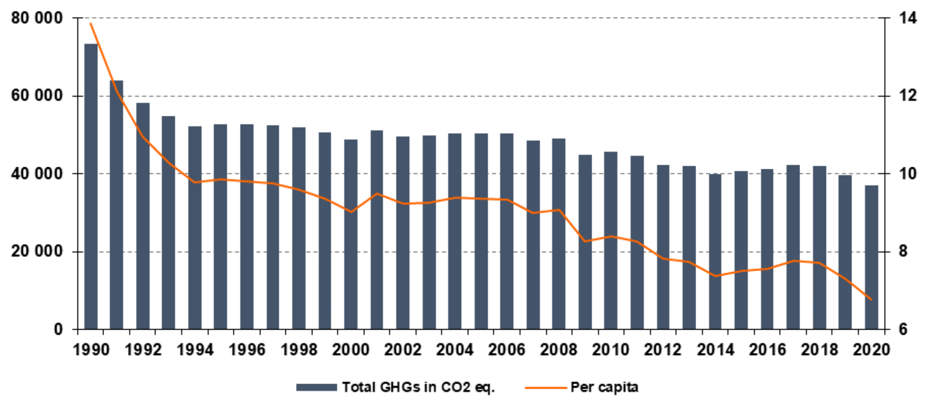
In the context of demographic developments, a very positive trend is the decline in emissions per inhabitant – 6.78 tCO_2 eq. in 2020 compared to 1990, at 13.85 tCO_2-eq. This level of emissions per capita in the Slovak Republic is below the EU average of 7.37 tCO_2 eq. per capita at the time.

[72] See Part 2 for a detailed list of parameters and variables to be reported in Section B of the Plan.

[73] Current situation shall reflect the date of submission of the national plan (or latest available date). Existing policies and measures encompass 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.

[74] The 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.

Figure 24 Total greenhouse gas emissions per capita in the Slovak Republic from 1990 to 2020



Based on the annual reports of the National Bank of Slovakia (NBS) for the relevant years, gross domestic product accelerated the year-on-year growth rate to 3.4 % in 2017 (from 3.3 % in 2016). Economic growth accelerated on the back of growth in domestic demand, with household consumption growth being a crucial component. However, the development of net exports has also contributed positively. The nominal amount of GDP generated amounted to EUR 85 billion. EUR. Gross domestic product accelerated a year-on-year growth rate to 4.1 % in 2018 (from 3.2 % in 2017), driven by domestic demand, as both investment and household consumption increased. Nominal GDP generated amounted to EUR 90 201.8 million, 6.3 % higher than in 2017. The Slovak economy slowed its growth rate in 2019 to 2.3 % year-on-year (from 4.0 % in 2018). The slowdown was due to a gradual moderation of foreign demand, with a negative impact on Slovakia's export performance. The main source of growth was the domestic part of the economy. Household consumption grew by 2.2 %, supported by a still favourable labour market situation. Wages and salaries continued to grow relatively strongly in 2019 and constituted the main source of income for the population. The growth in consumption has been absorbed by services, in particular expenditure on restaurants and hotels. This was partly related to the considerable use of holiday vouchers and also to the preference of households to consume more luxury goods. On the contrary, expenditure on everyday goods, such as food, has slowed down. Despite having enough incomes, households spent relatively less on consumption than in the past and saved more. This resulted in an increase in the savings rate above 10 %, where it was last in 2000. The Slovak economy, like other countries, was unexpectedly hit by the COVID-19 pandemic in early 2020. Subsequently, the pandemic measures adopted resulted in a contraction in activity of 5.2 %. The domestic part of the economy was particularly affected. While households reduced their consumption only slightly, firms reduced investment activity to a large extent. Despite a year-round decline in exports, net exports contributed positively to the economy's growth. This was due to the restriction of imports in the context of lower domestic demand and, at the same time, a greater use of stocks. Due to the measures in place, consumers were not able to spend their money as they could and want. This was mainly reflected in the low revenues of the services most affected by the pandemic. On the contrary, food and housing expenditure has increased as a result of increased use of work from home. To some extent, lower household consumption has also been driven by forward-looking precaution.

In terms of the structure of the primary energy sources used, Slovakia has a balanced share of individual energy sources in gross domestic consumption, which in 2020 was as follows: gaseous fuels (natural gas) 24.9 %, oil and petroleum products 22.7 %, nuclear fuel (heat) 24.0 %, solid fuels 13.7 % and renewables (RES, waste and electricity produced by hydroelectric power plants) 14.7 %.

Gross domestic energy consumption (HDS) decreased by 12 % between 2005 and 2020, with slight fluctuations. The energy efficiency target expressed in absolute value of primary energy consumption for 2020 has been met (686 PJ).

In terms of the country's natural conditions and current technological capabilities, Slovakia is poor in primary energy resources. Almost 90 % of primary energy sources (including nuclear fuel) are imported. Slovakia's dependence on imports is therefore high, but in view of the current situation in Ukraine, it is taking steps to reduce this dependency or to seek other sources of resources. In 2019, dependency reached 69.8 %, the highest level for the whole reporting period. This was supported by a significant increase in dependency of 9.6 % year-on-year. In the long term, the level of import dependency ranged from 60.1 % (2015) to 69.8 % (2020).

Slovakia is facing Europe-wide socio-economic crisis linked to the coronavirus pandemic, which has significantly affected the state of the economy. Economic growth in the euro area slowed down in 2019, reaching 1.2 %, compared to 1.9 % the previous year. The slowdown in economic growth was primarily influenced by the weakening of the global economy and international trade. In 2020, the coronavirus crisis persisted and continued to affect the state of the world's economies. Anti-pandemic measures translated into strong economic closures, in particular at the turn of the first two quarters. In the first half of the year, the economy contracted by around 15 %. Subsequently, as the number of infected people shrunk, the economy recovered rapidly. However, at the end of the year, anti-pandemic measures needed to tighten again and the economy declined slightly again.

The growth of the Slovak economy slowed down to 2.3 % year-on-year in 2019, compared to 4.0 % in 2018. . The slowdown was due to a gradual moderation of foreign demand, with a negative impact on Slovakia's export performance. The Slovak economy fell by 5.2 % in 2020, under the impact of the pandemic and strict quarantine measures. All components with the exception of net exports contributed to the decrease. The domestic part of the economy was particularly affected. While households reduced their consumption only slightly, firms reduced investment activity to a large extent. Despite a year-round decline in exports, net exports contributed positively to the economy's growth. This was due to the restriction of imports in the context of lower domestic demand and, at the same time, a greater use of stocks.

Table 52 The evolution of GDP

GDP SR + selected sectors (b.c.)

Category	GDP_SR (b.c.)	GDP_Production (b.c.)	GDP_Agriculture (b.c.)	GDP_tourism (b.c.)	GDP_forestry (b.c.)	GDP_energy (b.c.)	GDP_Transport (b.c.)
2005	50485,66	10403,84	527,53	135,14	288,46	2132,69	2730,72
2006	56361,42	11641,50	694,75	139,01	344,65	3265,66	2325,34
2007	63163,35	12847,11	1025,79	167,39	420,31	3053,80	2831,45
2008	68590,53	13033,16	1263,09	174,91	469,70	2975,29	2889,66
2009	64095,52	9727,48	936,15	192,92	398,92	2650,26	2669,12
2010	68492,15	12358,84	621,46	186,06	452,15	2266,16	2535,35
2011	71214,39	12995,79	1128,33	219,54	410,77	2555,66	3288,04
2012	73483,82	13403,99	1227,49	201,23	440,76	2593,13	3457,56
2013	74354,85	13007,84	1498,56	223,89	521,45	2219,22	3708,70
2014	76255,86	14687,38	1851,68	233,74	571,98	2367,18	4633,76
2015	79888,15	15663,61	1139,47	171,89	579,25	2087,67	4723,38
2016	81014,25	15085,70	1211,89	171,35	582,82	2102,44	4412,26
2017	84442,87	15166,60	1157,67	218,19	593,45	1911,42	4697,15
2018	89430,02	16930,54	1307,08	203,67	611,25	1753,08	4871,09
2019	94048,03	18555,59	956,65	140,86	606,32	2606,30	5180,64
2020	92079,25	16149,64	1015,49	87,24	596,94	2613,19	4839,51

Source: DATAcube

Table 53 Environmental expenditure (million euro)

Indicator	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Investments for the protection of RUs	260,0	269,47	252,11	201,79	246,67	581,74	287,70	273,35	304,07	327,71	221,63
Investments financed through State resources	23,3	37,62	46,35	27,01	37,10	73,90	41,02	40,08	52,93	40,37	39,98
Foreign-funded investments	56,2	73,73	63,84	46,75	39,22	155,88	55,20	6,95	57,69	64,28	11,66
Total current costs of protection of RUs	474,0	515.83	550,65	554,10	547,54	599,44	616,10	639,29	835,80	883,50	864,60
Total revenue from the protection of the RU	449,02	528,17	596,99	579,54	644,69	716,19	736,99	808,88	1 063,09	1 068,68	1 036,20
Turnover from the sale of products, appliances and components	5,78	16,03	17,43	10,70	13,02	21,11	26,60	32,00	41,85	38,94	37,78
Revenue from the sale of technology	1,63	—	—	—	—	—	—	—	—	—	—
Revenue for services rendered	326,4	329,37	381,60	407,05	465,10	525,39	523,44	553,92	632,84	651,61	637,68

Source: DATAcube

Table 54 Gross domestic expenditure on R & D (million euro)

Indicator	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Gross domestic expenditure on R & D	416,37	468,44	585,23	610,88	669,63	927,27	640,84	748,96	750,95	776,59	838,93

Source: DATAcube

As shown in Table 53, total R & D expenditure excluding inflation has continuously increased since our accession to the EU and has increased twice over the period under review.

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

It can now 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 depleted and will not, by definition, 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, but also regional development are current challenges that the Slovak Republic will need 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.

The changes related, for example, to the introduction of Industry 4.0 represent societal changes, covering a wide range of areas from industry, safety, technical standardisation, science and research, labour market, education system to the legal framework.

The new nature of the competitiveness of the Slovak economy is therefore determined by five key areas, namely: the development of human capital, technological change, the green and energy efficiency of the economy, the 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 in the administrative burden for those concerned.

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

Table 55 Recommended international fossil fuel prices (values set in 2017 with updated deflators, exchange rates, US inflation and price index)

	Constant 2016 price in EUR/BOE			Constant 2016 price in EUR/GJ			Constant 2016 price in EUR/toe		
	EUR/BOE	EUR/BOE	EUR/BOE	EUR/GJ	EUR/GJ	EUR/GJ	EUR/toe	EUR/toe	EUR/toe
	Oil	Gas (GCV)	Coal	Oil	Gas (GCV)	Coal	Oil	Gas (GCV)	Coal
2015	51,77	41,68	12,32	8,90	7,17	2,12	372,72	300,09	88,74
2016	60,36	43,72	12,95	10,38	7,52	2,23	434,60	314,75	93,25
2017	65,90	45,67	13,57	11,33	7,85	2,33	474,49	328,81	97,69
2018	71,66	47,66	14,18	12,32	8,20	2,44	515,95	343,15	102,07
2019	76,25	49,75	14,78	13,11	8,56	2,54	548,97	358,22	106,39
2020	80,58	51,84	15,37	13,86	8,91	2,64	580,18	373,23	110,65
2021	84,57	53,84	16,26	14,54	9,26	2,80	608,93	387,63	117,04

2022	85,95	54,01	16,75	14,78	9,29	2,88	618,85	388,89	120,58
2023	88,61	54,88	17,21	15,24	9,44	2,96	638,03	395,16	123,90
2024	90,45	55,57	17,78	15,56	9,56	3,06	651,26	400,12	128,01
2025	91,47	56,08	18,36	15,73	9,64	3,16	658,59	403,80	132,21
2026	93,75	56,97	19,07	16,12	9,80	3,28	675,04	410,19	137,28
2027	95,82	57,80	19,77	16,48	9,94	3,40	689,91	416,17	142,33
2028	97,23	58,72	20,50	16,72	10,10	3,52	700,02	422,81	147,57
2029	99,43	59,65	21,23	17,10	10,26	3,65	715,89	429,46	152,86
2030	100,77	60,99	22,04	17,33	10,49	3,79	725,51	439,13	158,67
2031	102,04	61,84	22,24	17,55	10,63	3,82	734,67	445,26	160,09
2032	102,66	62,81	22,52	17,65	10,80	3,87	739,17	452,25	162,14
2033	103,38	63,68	22,82	17,78	10,95	3,92	744,36	458,52	164,29
2034	104,20	64,47	23,09	17,92	11,09	3,97	750,22	464,20	166,27
2035	105,12	65,14	23,34	18,08	11,20	4,01	756,83	469,00	168,02
2036	106,15	65,77	23,49	18,25	11,31	4,04	764,30	473,52	169,14
2037	107,33	66,28	23,68	18,46	11,40	4,07	772,80	477,20	170,53
2038	108,62	66,77	23,91	18,68	11,48	4,11	782,03	480,78	172,12
2039	109,94	67,33	24,15	18,91	11,58	4,15	791,60	484,75	173,87
2040	111,30	67,34	24,32	19,14	11,58	4,18	801,36	484,81	175,13

Source: EC

one barrel of oil is the equivalent of 5 815 GJ
1 barrel of oil equivalent corresponds to 0.138889 t of oil equivalent

IV. Technology cost developments

The evolution of technology prices is estimated according to the reference data provided by the European Commission in May 2017.

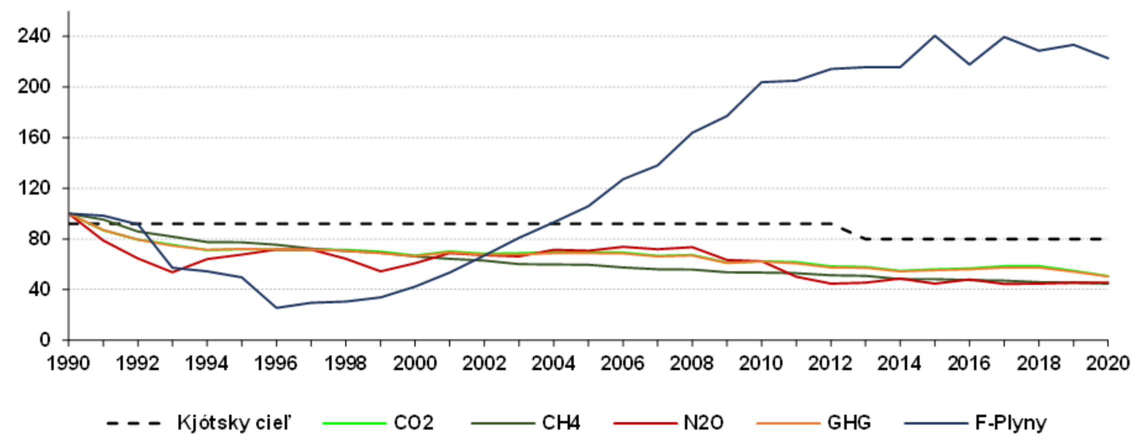
4.2. Dimension: decarbonisation

4.2.1. GHG emissions and removals

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

In 2020, total GHG emissions in the Slovak Republic excluding LULUCF were 49.6 % lower than the 1990 base year, at 37 002.7 Gg CO2-eq. Compared to 2019, total emissions decreased by 7 %. The decrease in emissions is also accompanied by a year-on-year reduction in logging and thus an increase in sinks in LULUCF. Total GHG emissions excluding LULUCF have continued to decrease at moderate speed in recent years compared to the base year. Significant changes in methodologies and emission factors have been introduced to ensure consistency with the 2006 IPCC Guidebooks for National Greenhouse Gas Inventories, which represents significant progress in the quality of estimates through refined methodologies, in completeness and accuracy. In addition, the comparison with verified emissions for all installations included in the EU ETS improved the energy and industrial inventory. F-gases are the only gases with an increasing trend since 1990 due to their increased use in industry.

Figure 25 SP emissions excluding LULUCF; emissions are determined on 13 April 2020



Total GHG emissions in the Slovak Republic decreased significantly in 2020, by 7 % compared to the previous year, driven by emission reductions in the energy and industry sectors linked to the economic impact of the COVID-19 pandemic. Total GHG emissions excluding LULUCF have continuously decreased since the base year, with an almost stable trend in recent years and a sharper decrease in recent inventory years. In an effort to maintain consistency with EU ETS data and the new 2006 and IPCC 2019 guidelines, significant changes in methodologies and emission factors have been introduced. The analysis of changes in the trend of GHG emissions between 2018 and 2020 was:

- Decrease in CO2 emissions$_{\text{in the}}$ energy sector – Category 1.A.1 – Energy industry (0.6 Tg CO_2) due to decrease in electricity and heat production.
- Decrease in CO_2 emissions in the energy sector – Category 1.A.2 – Processing industry (0.4 Tg CO_2) due to decrease in heavy metals and chemical production.
- Decrease in CO_2 emissions in the energy sector – Category 1.A.3 – Transport (1 Tg CO_2) due to decrease in road transport performance.
- Decrease in CO_2 emissions in the industrial processes and product use sector – Category 2.C – Manufacture of metals (450 Gg CO_2) due to the decommissioning of one of the three furnaces in the largest steel and iron producing company in Slovakia.
- Increase of CO_2 sinks in the LULUCF sector (2 000 Gg CO 2$_{)}$– Category 4.A – Forests mainly due to reduced logging.

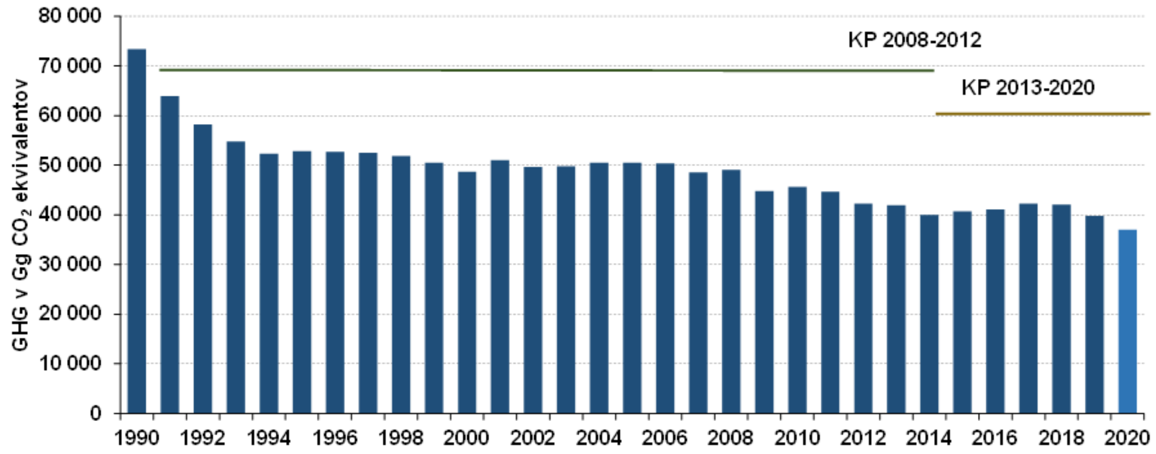
- Decrease in $CH4_{emissions}$ in the energy sector – categories 1.B.1 and 1.B.2 – Fugitive emissions mainly due to improvements in infrastructure and equipment and methodology for measuring these emissions.

- Decrease in category 2.B – nitric acid production of 5 Gg of N_2O emissions compared to the previous year due to a decrease in production.

- Significant decrease in F-gases (40 Gg CO_2 eq.) due to a decrease in service activities in facilities in 2020.

Slovakia will take a longer period of transition to a less carbon-intensive economy due to the implementation of new technologies, especially in combination with high dynamics in the development of energy-intensive industry. Pressure continues to be put on the development of effective strategies and policies to achieve further emission reductions. Examples include a combination of regulatory and economic instruments (tolls for trucks based on their environmental characteristics combined with fuel and emission standards for new vehicles).

Figure 26 Trends of total GHG emissions (1990-2020) compared to the Kyoto target (8 % and 20 %) in the Slovak Republic



Source: SHMÚ

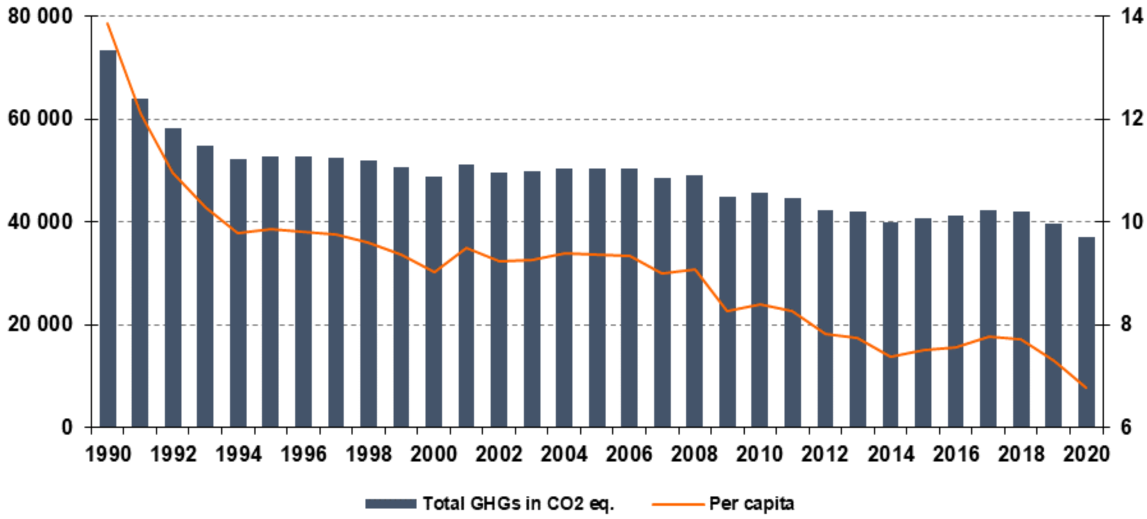
As at 31 December 2021, the population of the Slovak Republic was 5434712. The average population density is 110.8 inhabitants per km². Apart from cities, the population is concentrated on lowlands and boilers, hills and mountains are sparsely populated. Large-scale settlements and land use have profoundly affected the landscape's original structure and ecosystems. The capital city of Bratislava is the largest city in the Slovak Republic with a population of 475503.

In 2021, 56565 living children were born and 73461 people died. This resulted in a natural population loss of 16896 people. These numbers thus show a slight trend in population decline despite recent years when this trend has been put on hold.

The average age of the population of the Slovak Republic is 39.7 years for men and 42.8 years for women. However, the main demographic trend is an increase in the share of the group over 65 years old. The main reason for this is the change in reproductive behaviour, which caused the Slovak Republic to fall below the fertility rate needed to rebuild its population.

In the context of demographic developments, a very positive trend is the decline in emissions per inhabitant – 6.78 tCO_2 eq. in 2020 compared to 1990, at 13.85 tCO_2-eq. This level of emissions per capita in the Slovak Republic is below the EU average of 7.37 tCO_2 eq. per capita at that time.

Figure 27 Total greenhouse gas emissions per capita in the Slovak Republic from 1990 to 2020



Source: SHMÚ

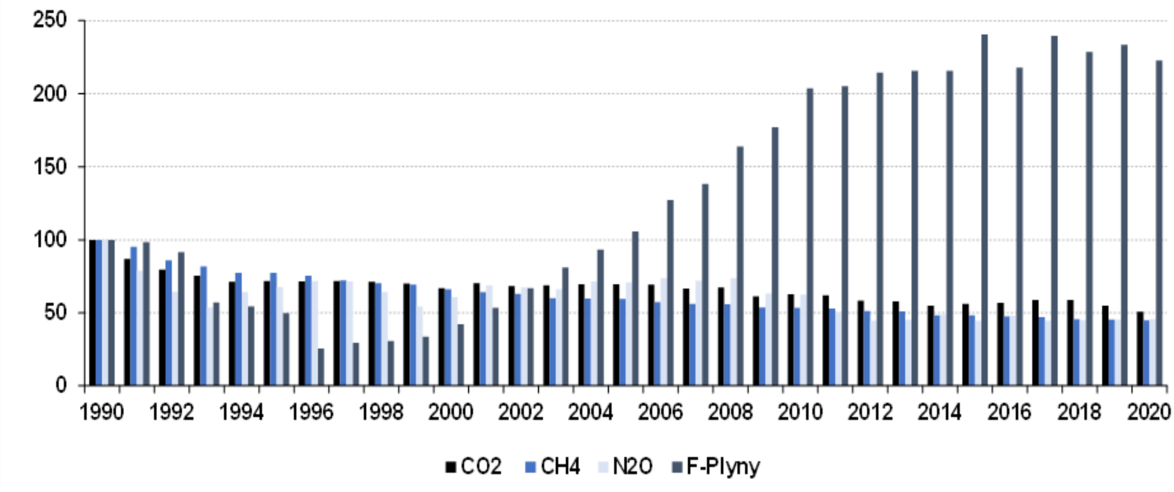
Total anthropogenic carbon dioxide emissions excluding LULUCF decreased by 49.4 % in 2020 compared to the base year (1990). In 2020, total CO_2 emissions are 31 094.73 Gg. CO_2 emissions decreased by 10 % compared to 2015 reported in the previous Seventh National Report. CO_2 emissions were historically lowest in 2020, falling mainly in the energy and industry sectors, mainly due to a decrease in energy intensity and heavy industrial production. Emissions together with sinks from the LULUCF sector decreased significantly compared to 2019 (by 17 %) and decreased by 56.5 % compared to 1990.

Total anthropogenic methane emissions excluding LULUCF have decreased by 55.3 % compared to the base year (1990) and are currently at 3 261.6 Gg CO_2 eq. In absolute terms, CH_4 emissions were 130.5 Gg excluding LULUCF. Methane emissions from the LULUCF sector were 0.89 Gg CH_4, mainly caused by forest fires. The trend in methane emissions is influenced by the implementation of new waste legislation and fugitive emission measurements, the year-on-year decrease (2019 and 2020) was due to reduced emissions in agriculture.

Total anthropogenic N_2O emissions excluding LULUCF have decreased by 54.7 % compared to the base year (1990) and currently these emissions are 1 944.7 Gg CO_2 eq. N_2O emissions in absolute terms amounted to 6.5 Gg excluding LULUCF. Emissions of N_2O from LULUCF are 0.14 Gg. N_2O emissions are decreasing mainly due to decreasing numbers of animals and fertiliser use.

Total anthropogenic emissions of F-gases were as follows: 678.9 Gg HFC, 5.6 Gg PFC and 17.1 Gg SF_6 expressed in CO_2 eq. HFC emissions have increased since 1995 as a result of an increase in consumption and substitution of PFCs. The trend of PFC emissions is decreasing and SF_6 emissions are increasing slightly due to their increasing consumption in industry.

Figure 28 Emissions trends by gases for 1990-2020 relative to 1990 level (%)



The main share of CO_2 emissions comes from the energy sector (combustion of fuels and transport), which accounts for 76 % of total carbon dioxide emissions in the 2020 inventory, 23 % of CO_2 is generated by industrial processes and product use, and negligible amounts are generated in waste (0.01 %) and agriculture (0.2 %). Energy-related CO_2 emissions from waste incineration are included in the energy sector. 47 % of CH_4 emissions come from the waste sector, 21 % from energy and 32 % from agriculture. More than 75 % of N_2O emissions occur in agriculture (nitrogen from soil), 7 % in the industrial process sector (nitric acid production), 8 % in waste and 10 % in the energy sector. F-gases are produced in large quantities in the industrial process sector.

Total GHG emissions from the energy sector, calculated according to the sector approach, were 24 183.4 Gg CO_2 eq. in 2020, including transport emissions (7 069.2 Gg CO_2 eq.), a 55 % decrease from base year and a 10 % decrease compared to 2015. The transport sector decreased by 3 % compared to 2015 and increased by 3.5 % compared to the base year.

Total emissions from the industrial process sector were 8 129.8 Gg CO_2 eq. in 2020, a 16 % reduction from base year and a 10 % decrease compared to 2015. This sector also includes emissions from the use of solvents and other products and indirect CO_2 emissions.

Emissions from the agricultural sector were estimated at 2 579.7 Gg CO_2 eq. This represents a 57 % decrease compared to the base year and a 2 % increase compared to 2015. The agricultural sector is the sector with the most significant decrease compared to the 1990 base year due to a decreasing trend in livestock numbers and the use of synthetic fertilisers.

Emissions from the waste sector were estimated at 1 684.7 Gg CO_2 eq. Emissions are at the same level as in 2015 compared to the base year by more than 20 % due to increased methane emissions from landfills. Emissions from waste incineration with energy use are included in energy.

Structural changes in the energy sector and the implementation of economic instruments have played an important role in reaching the current situation where the trend of GHG emissions does not duplicate GDP growth. In this context, the most important measure appears to be the adoption of national air quality legislation, which was adopted in 1991 and launched a positive trend in reducing emissions of basic air pollutants and, indirectly, GHG emissions. At the same time, both primary energy and overall energy consumption decreased.

Transport is a major source of GHG emissions in the energy sector, accounting for 19 % of total Slovak GHG emissions. The share of transport is growing every year and policies and measures adopted do not have a visible positive impact on the trend in transport emissions in recent years. Road transport emission balances are modelled on COPERT Model 5. GHG emissions from non-road transport are balanced using EMEP/EEA 2019 methodology on a type-by-mode basis (aviation, waterborne and rail).

Fugitive methane emissions from extraction (only 0.3 % of total GDP) and distribution of fossil fuels are important as the Slovak Republic is an important transit country for the transportation of oil and gas from the former Soviet Union countries to Europe. The raw materials are transported through high-pressure pipes and distribution networks and pumped with pipe compressors.

The industrial process sector covers all GHG emissions from technological processes producing raw materials and products, accounting for 36 % of total GDP in the Slovak Republic. In drawing up the balance sheet for GHG emissions in the Slovak Republic, a constant emphasis is placed on the analysis of the different technological processes and the difference between emissions from the combustion of fuels in the production of heat and energy and those from technological processes and production. The most important emission sources are accounted for separately, emission and oxidation factors, as well as other parameters entering the balance sheet equations, are reassessed and the results compared to verified emissions in the European Emissions Trading System. The baseline inventory of solvent emissions is based on a non-methane volatile organic matter (NMVOC) balance according to the revised EMEP/EEA Manual methodology for 2019. Emissions shall be converted according to stoichiometric factors to CO_2 emissions. Indirect CO_2 emissions are recalculated for the whole time series based on the 2006 IPCC methodology.

Agriculture, accounting for more than 2 % of the total GDP of the Slovak Republic, is the largest source of methane and N_2O emissions in Slovakia’s emission balance. The balance of emissions is drawn up once a year on the basis of sectoral statistics and, in recent years, on the basis of the new regionalisation of agricultural areas in the Slovak Republic. The Ministry of Agriculture and Rural Development of the Slovak Republic issues annual statistics ‘Green administration’, part of agriculture and the food industry.

The areas of forest land in the Slovak Republic cover 41 % of the territory and logging is a historically important economic activity. Since 1990 sinks from the LULUCF sector have been at 8-10 % of total GHG emissions, with removals increasing to around 15 % of total GHG in recent years. The historically stable trend was disturbed in 2004 by the wind calamity in the High Tatras, resulting in increased logging of wood damaged by calamity and pests and subsequently decreasing total removals to half of the previous volumes.

The forestry and land use sector covers a wide range of biological and technical processes within the country, which are reflected in the GHG emission inventory. This sector includes all SPs (CO_2, CH_4 and

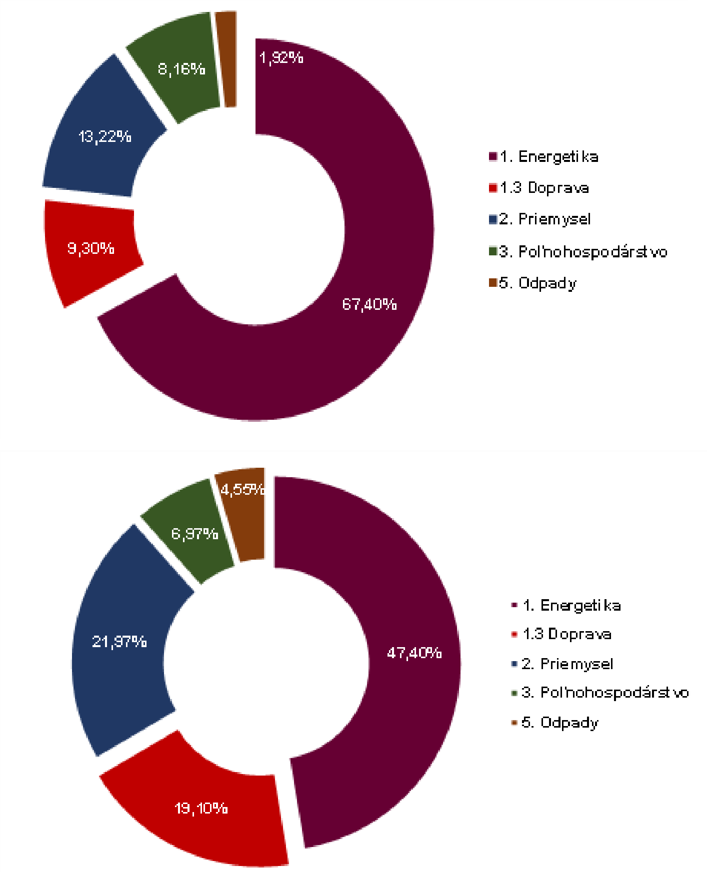
N2O) and essential pollutants from forest fires (NOx and CO). The different inventory categories are linked to the respective processes related to all five carbon stocks (live biomass, aboveground and underground, dead biomass, soil carbon) as defined in the conclusions of the Marrakech Accords. In addition, timber products are reported as an additional LULUCF stockpile, namely HWP (CRF Sector 4.G).

The LULUCF inventory is based on the definition of representative land use types: forest landscape, grassland, agricultural landscape, wetlands, settlements and other landscapes and their time changes. The first three types of land use are most important, as they cover more than 90 % of the territory of the Slovak Republic. From the point of view of balancing greenhouse gas emissions, these processes apply only to carbon dioxide (CO2) balances.

A number of significant changes in methodology and calculations have been made in the waste sector. Methane emissions from solid waste disposal account for the largest share of total emissions from the sector. The GHG emission balance methodology is based on Tier 2 of the biodegradable waste decay approach and has been used to recalculate the full time series until 1950. The trend of methane emissions is stabilised and dependent on approved legislation and lower waste generation and recycling. A more detailed description of Monte Carlo's methodology for the analysis of uncertainties can be found in the references (Szemesová J., M. Gera Gera Estimate of emissions from solid waste landfills according to the uncertainty analysis methodology, Bioclimatology and Natural Risks, ISBN 978-80-22-28-17-60).

Emissions from the incineration of waste using energy are reported under the energy sector, category 1.A.1.a (other fuels). Emissions from waste incineration without energy use are reported in the waste sector.

Figure 29: Sectorial share of total GHG emissions in 1990 and 2020



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Key categories are defined as emission sources or removals that have a significant impact on the inventory as a whole, in terms of absolute emission levels, trends, or both.

CO2 emissions from category 1.A.3.b – Road transport – diesel is the largest key category, accounting for 22 % of total CO2 emissions excluding LULUCF in 2020. Between 1990 and 2020, road transport emissions increased by 2.2 Mt CO2, a 50 % increase due to an increase in fossil fuel consumption in this key category. The biggest increase in road-related CO2 emissions has been observed since 1990. Solid fuels of category 1.A.1 Fuel combustion – The energy industry is the second largest key category without LULUCF (8.7 %), with a decrease of 79 % between 1990 and 2020. The main factors explaining the decline in emissions are energy efficiency improvements and the transition from coal to gas.

CO2 emissions from fuels in category 2.C.1 – Iron and steel production are the largest key source without LULUCF in the industrial processes and product use sector (IPPU) and account for 10 % of total CO2 emissions in 2020. CO2 emissions from category 1.A.2 – Energy industry and manufacturing are the third largest key source in the Slovak Republic, accounting for 10 % of total GHG emissions in 2020. Emissions from this category decreased by 65 % between 1990 and 2015.

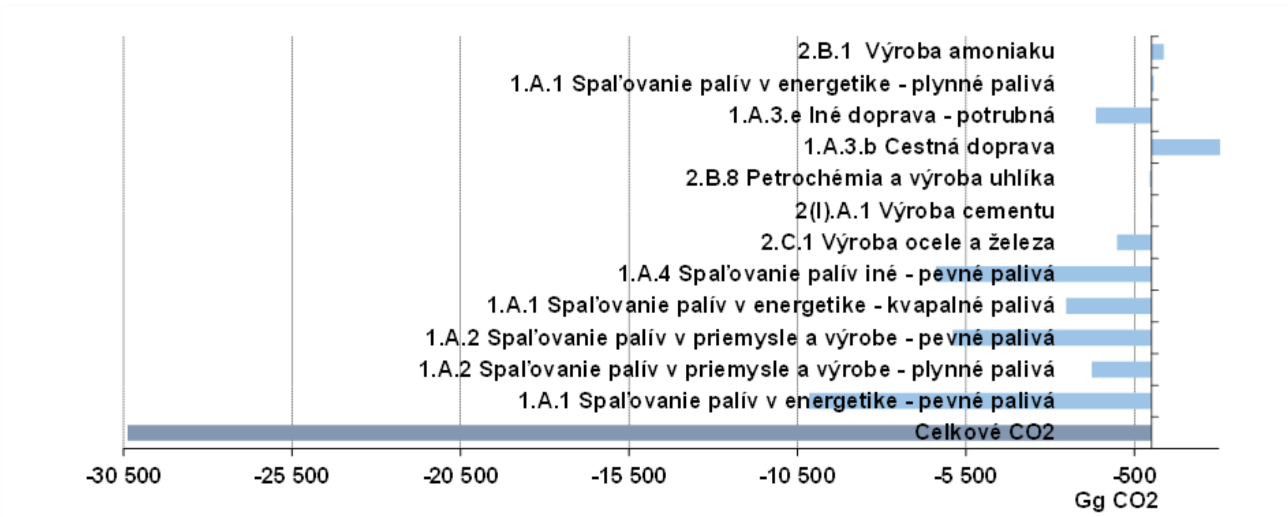
Methane emissions account for 8.8 % of total emissions in 2020 and have fallen by 55 % since 1990 to 130.46 Gg CH4 in 2020. The top three key sources are 5.A – Solid Waste Storage with 35 %, 3.A – Energy fermentation with 30 % and 5.D – Wastewater treatment with 8.5 % of total CH4 emissions in 2020 and together account for 72 % of CH4 emissions in 2020. The main reasons for the decrease in CH4 emissions were the reduction in enteric fermentation, mainly due to falling numbers of animals and reductions in fugitive emissions and coal mining.

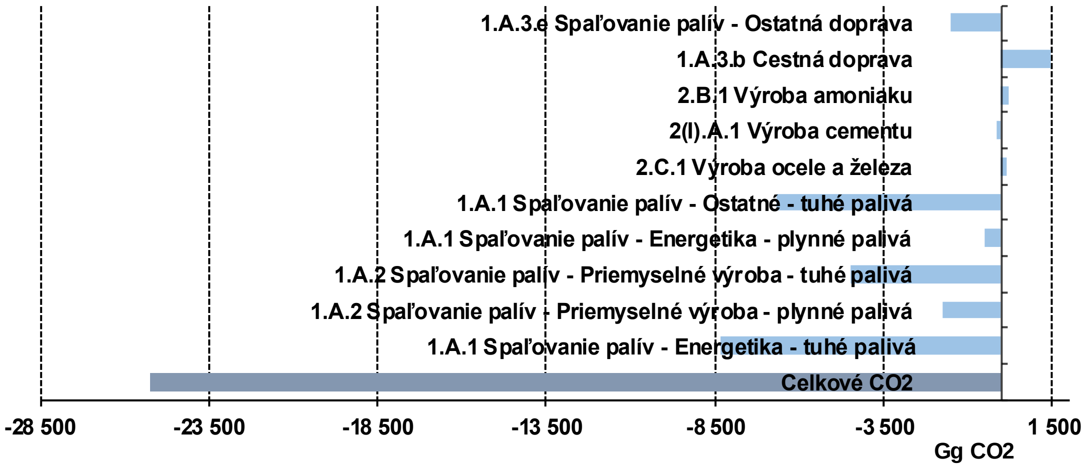
There is a significant decrease in categories 3.A and 3.B and an increase in category 5.A – Solid Waste Storage due to the change in the IPCC methodology used for landfills considering the time layer since 1960. A slight increase in emissions is visible in category 5.B – biological treatment of solid waste, which is linked to the change in waste management in Slovakia.

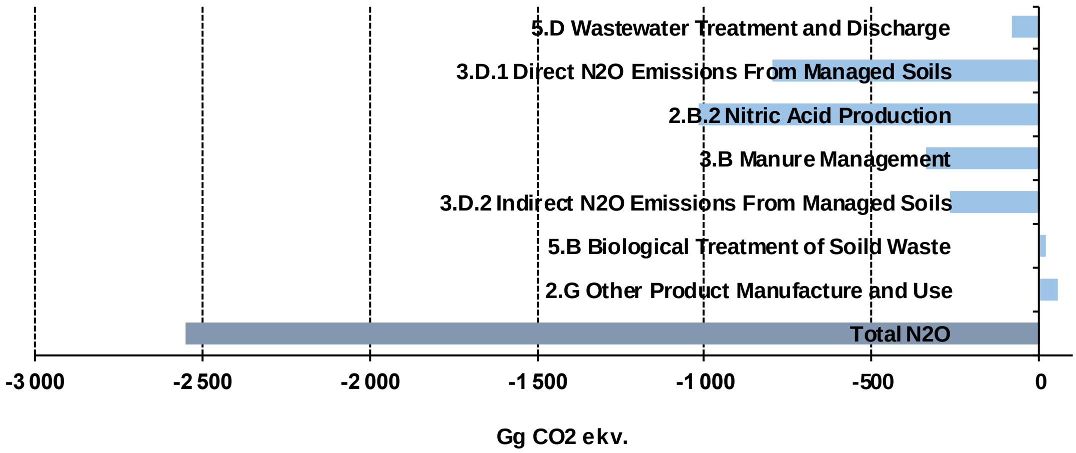
N2O emissions account for 5.3 % of total GHG emissions and fell by 55 % in 2020 to 6.53 Gg N2O without LULCF. This trend was caused by the three largest key sources: 3.D.1 – Direct N2O emissions from agricultural land (57 %), 3.D.2 – Indirect N2O emissions from agricultural land (10 %) and 3.B – Animal waste management with 7.7 % of total N2O emissions in 2020. The main reasons for reducing N2O emissions were the reduction measures in nitric acid production (category 2.B.2) and the reduction of agricultural activities. Emissions of N2O have increased in category 5.B -Biologic treatment of wastes and 2.G – Other products from production. This increase was due to the increase in operation and production.

F-gas emissions account for 1.9 % of total GHG emissions. In 2020, emissions stood at 701,69 GgCO2 eq., 2.2 times higher than 1990 levels. Category 2.F.1 – Cooling and air conditioning is the largest key source and is responsible for 95 % of F-gas emissions in 2020. HFC emissions from halogen hydrocarbon consumption increased significantly between 1990 and 2020. The main cause was the elimination of ozone depleting substances such as chlorofluorocarbons under the Montreal Protocol and the substitution of these substances by HFCs (mainly in refrigeration, air conditioning, foam production and aerosol propellants). On the other hand, PFC emissions have decreased substantially. The decline started in 1996 and was the strongest between 1999 and 2000.

Figure 8 Absolute change in CO2 emissions by large key categories between 1990 and 2020




1.A.3.e Spaľovanie palív - Ostatná doprava
1.A.3.b Cestná doprava
2.B.1 Výroba amoniaku
2(I).A.1 Výroba cementu
2.C.1 Výroba ocele a železa
1.A.1 Spaľovanie palív - Ostatné - tuhé palivá
1.A.1 Spaľovanie palív - Energetika - plynné palivá
1.A.2 Spaľovanie palív - Priemyselné výroba - tuhé palivá
1.A.2 Spaľovanie palív - Priemyselné výroba - plynné palivá
1.A.1 Spaľovanie palív - Energetika - tuhé palivá
Celkové CO2
-28 500
-23 500
-18 500
-13 500
-8 500
-3 500
1 500
Gg CO2


5.D Wastewater Treatment and Discharge
3.D.1 Direct N2O Emissions From Managed Soils
2.B.2 Nitric Acid Production
3.B Manure Management
3.D.2 Indirect N2O Emissions From Managed Soils
5.B Biological Treatment of Soild Waste
2.G Other Product Manufacture and Use
Total N2O
-3 000
-2 500
-2 000
-1 500
-1 000
-500
0
Gg CO2 ekv.

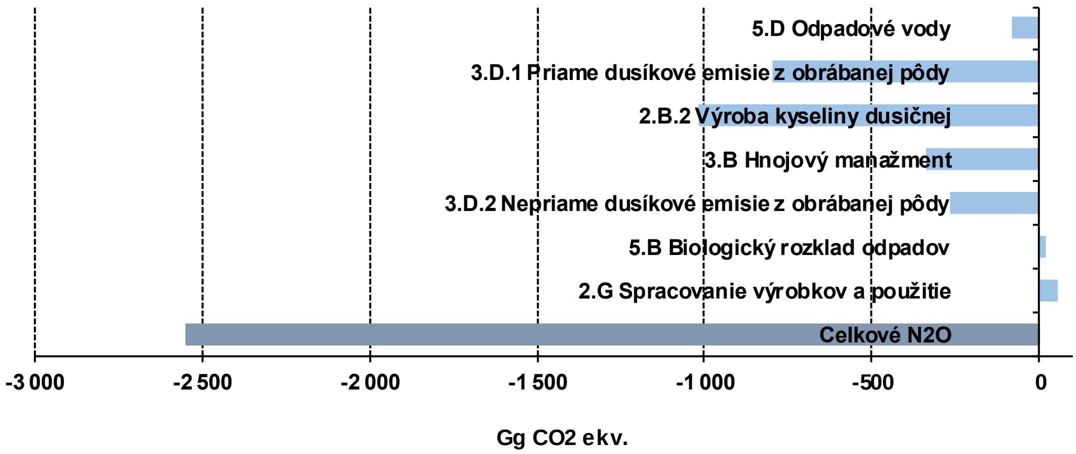

5.D Odpadové vody
3.D.1 Priame dusíkové emisie z obrábanej pôdy
2.B.2 Výroba kyseliny dusičnej
3.B Hnojový manažment
3.D.2 Nepriame dusíkové emisie z obrábanej pôdy
5.B Biologický rozklad odpadov
2.G Spracovanie výrobkov a použitie
Celkové N2O
-3 000
-2 500
-2 000
-1 500
-1 000
-500
0
Gg CO2 ekv.

Figure 9: Absolute change in CH4 emissions by large key categories between 1990 and 2020

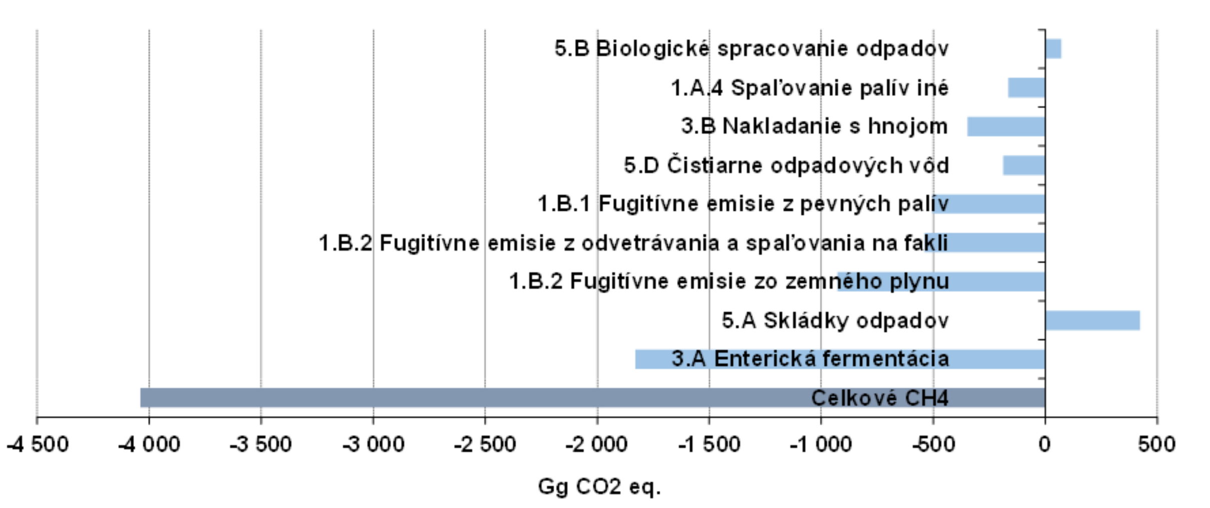
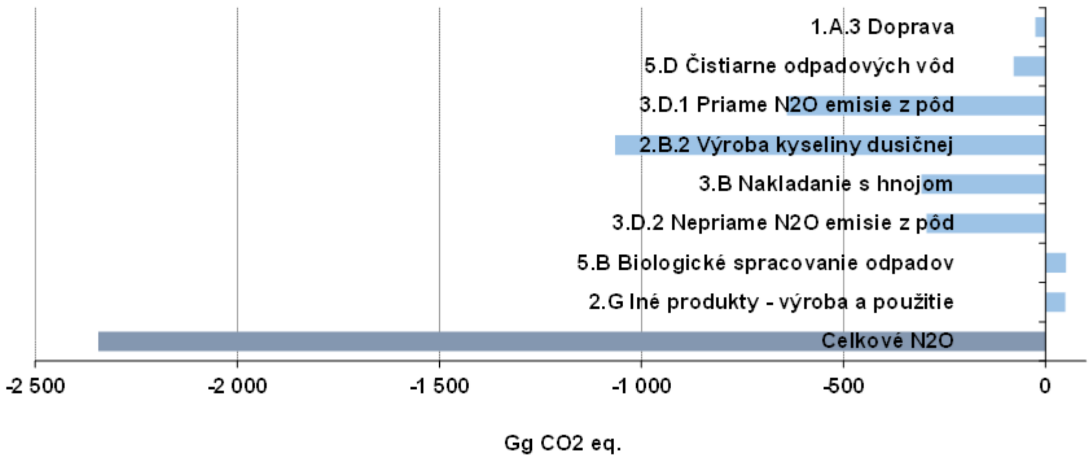


Figure 10: Absolute change in N2O emissions by large key categories between 1990 and 2020



Waste Management Plan of the Slovak Republic 2021-2025

The main objective of waste management in the Slovak Republic for the period 2021-2025 is to divert waste away from landfilling, in particular for municipal waste, to increase recycling together with improved separate collection and to introduce and increase reuse.

It includes a number of key objectives related to climate change mitigation: Increase the separate collection of municipal waste to 60 % by 2025 and the preparing for re-use and recycling rates for municipal waste to 55 %; reduce the share of biodegradable municipal waste in mixed municipal waste to 25 % by 2025, divert landfilling of municipal waste to 10 % by 2035. In the area of textile collection, the main objective is to establish a functional system for textiles in the Waste Act with effect from 1. 1. 2025.

II. Projections of the evolution of emissions by sector in light of existing policies and measures at Member State and EU level until at least 2040 (including 2030) – WEM scenario

II-a) Description of the Measure Scenario (WEM)

WEM (with existing measures) description – the WEM scenario was prepared on the basis of a broad discussion to reflect the conditions of the baseline scenario. It reflects developments with measures taken and planned for implementation until 2020-2021. Policies and measures at European and national level are included. The modelling results show the evolution of this scenario by 2050, with an outlook up to 2070. Beyond these policies and measures, the scenario envisages a more conservative evolution of the EU ETS price compared to the WAM scenario.

Thus, the WEM scenario represents the projected evolution taking into account the currently known policies and measures. Nevertheless, the evolution of the scenario in the coming years retains the momentum resulting from gradual technological progress, slight improvements in process efficiency. These gradual changes are more moderate in this scenario compared to the scenario with additional measures.

(II-b) Description of the models used

Compact Primes Slovakia (CPS) Model is a mathematical system implemented in GAMS (General Algebraic Modeling System). This is a model for high-level mathematical programming. The CPS model is a downgrade of the Primes model, which is continuously used to assess energy and climate policies at pan-European level. In the CPS case, Slovakia's energy system is more detailed in detail to reflect its specificities as far as possible. The energy model is designed to support the development of an energy strategy, including assessment of policy instruments, planning of energy demand and supply and evaluation of policies to mitigate the impacts of climate change. The model includes the main metrics of the energy sector at a more detailed level:

- production site of individual energy products
- energy demand by sector and fuel;
- modelling of energy efficiency options;
- technology capacities;
- electricity generation mix, combined heat and power generation and other energy supply technologies;
- fuel prices and system costs;
- investments by sector and energy- related CO2 emissions.

The energy model for Slovakia captures the details of energy supply and demand, which are critical when designing a low-carbon pathway. CPS provides technology-rich analysis for key elements of the energy sector and has been designed to assess low-carbon options for the energy sector. CPS is a country-specific partial balancing model for the energy sector, which balances energy supply and demand. As this is a hybrid model with details of technology and technology together with micro-economic and macroeconomic interactions and dynamics, CPS sector decisions consider technologies and costs. On the supply side, it captures electricity and heat supply as well as biomass supply. Energy demand modelling covers the energy needs of industry, households, transport and services. The design of the CPS model is appropriate for quantifying long-term energy planning and policies to reduce energy-related greenhouse gas emissions. Similarly, the Primes model is used at pan-European level.

The GEM-E3 model is a macro-economic model that is used both at a pan-European level and as a narrower for specific Member States. In the case of Slovakia, it complements the energy model, using the detailed results of the CPS energy model and assessing the impacts and impacts on the whole economy. It has all the characteristics of a standard model of a general computable balance with additional specialisation in energy, electricity generation and emissions, so it is useful to evaluate climate policies. The GEM-E3 macroeconomic model is tailor-made to reflect the specific characteristics of the Slovak economy. An important feature is that the demand for energy commodities in households and firms is sensitive to the price of the commodity, allowing for the analysis of different options for electricity generation. Compared to the CPS energy model, the GEM-E3 model aims to simulate the wider economic impacts of the shift towards a low-carbon economy.

(II-c) Emissions in the energy sector (excluding transport) **-** The energysector produces greenhouse gas emissions from the combustion and conversion of fossil fuels. In line with the complexity of projections of greenhouse gas emissions in energy and industry, methodological improvements needed to be focused. The energy sector has been modelled through the CPS model.

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 categorisation of GHG emissions for compliance with reporting obligations, therefore the model results had to be adjusted to the GHG inventory. The modelling outputs were determined on the basis of the reduction potential of measures to reduce greenhouse gas emissions. Projections of greenhouse gas emissions in the energy sector are modelled in the WEM scenario, which includes the following policies and measures at EU level:

- The Ecodesign Framework Directive (Directive 2005/32/EC);
- Energy Labelling Directive (Directive 2010/30/EU);
- The Energy Performance of Buildings Directive, the Energy Efficiency Directive (Directive 2012/27/EU);
- The completion of the internal energy market, including the provisions of the 3 rd package (Directive 2009/73/EC, Directive 2009/72/EC), Regulation (EC) 715/2009, Regulation (EC) 714/2009;
- Directive on the promotion of the use of energy from renewable sources – Renewable Energy Directive – including amendment on ILUC (Directive 2009/28 EC as amended by Directive (EU) 2015/1513);
- EU ETS Directive 2003/87/EC as amended by Directive 2004/101/EC (International Credits), Directive 2008/101/EC (Aviation), Directive 2009/29/EC (Revision of the 2020 Climate and Energy Package), Regulation (EU) 176/2014, Decision (EU) 2015/1814 (Market Stability Reserve) and Implementing Decisions, in particular 2010/384/EU, 2010/634/EU, 2011/389/EU, 2013/448/EU, 2011/278/EU, 2011/638/EU (benchmarking and carbon leakage list);
- EP and Council Regulation on emission standards for cars, Regulation (EC) 443/2009, as amended by EU Regulation 333/2014, EURO 5 and 6;

- EP and Council Regulation 715/2007 on type-approval of motor vehicles;
- Regulation 510/2011 setting emission performance standards for new light commercial vehicles, as amended by Regulation 253/2014.

In addition to the above-mentioned EU and national policies needed to implement the 2020 commitments, the WEM scenario includes the following nationally specific measures:

- Optimisation of district heating systems – transition away from fossil fuels biomass and natural gas;
- Phasing out solid fuel heating plants from 2025;
- Subsidy for the promotion of alternative fuel vehicles – EUR 5 000 for BEV and EUR 3 000,— for PHEVs until 2020.

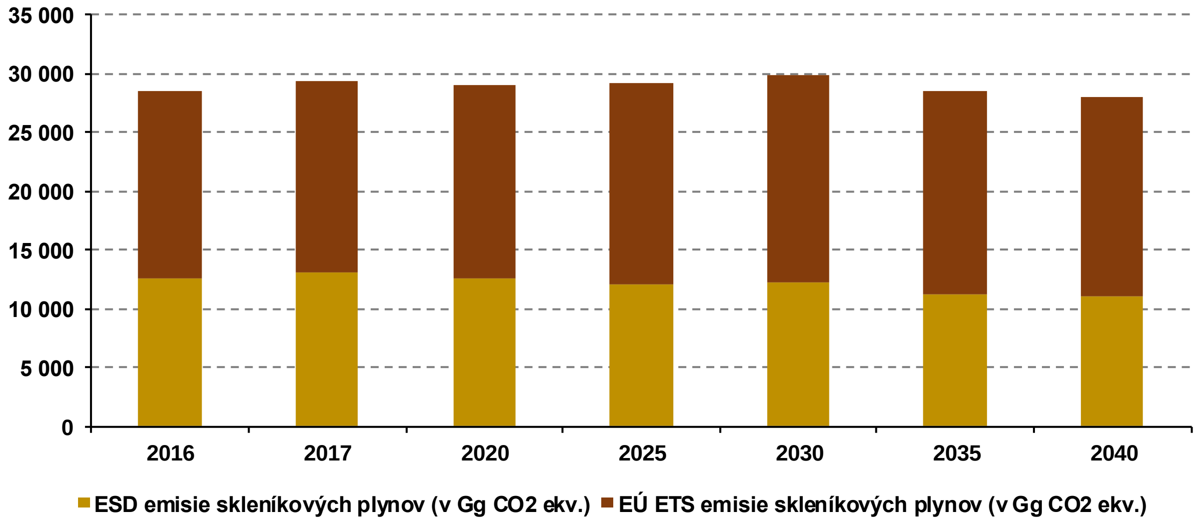
The evolution of the projections of greenhouse gas emissions in the energy sector in terms of CO_2 equivalent is shown in*t* Table 56 and Graph 30.

Table 56 Projections of greenhouse gas emissions from the energy sector under the WEM scenario

Total greenhouse gas emissions in the energy sector (in Gg CO_2 eq.)							
Year	**2016**	**2017**	**2020**	**2025**	**2030**	**2035**	**2040**
Total emissions excluding LULUCF	**42 154**	**43 316**	**42 355**	**42 046**	**41 399**	**39 526**	**38 521**
Total emissions with LULUCF	**35 427**	**36 727**	**36 210**	**37 006**	**36 965**	**35 370**	**34 290**
1. Energy	28 483	29 442	29 000	29 268	29 890	28 507	27 997
1.A.1. Energy industry	7 540	7 487	7 113	6 828	7 058	6 252	6 465
1.A.2 Manufacturing industry	6 710	7 136	6 817	6 642	6 791	6 546	6 158
1.A.3 Transport	*7 536*	*7 660*	*7 772*	*8 525*	*8 797*	*8 778*	*8 583*
1.A.4 Other	4 942	5 357	5 387	5 369	5 360	5 239	5 051
1.A.5 Other	66	66	66	64	67	64	63
1.B. Fugitive emissions from fuels	1 689	1 737	1 845	1 840	1 816	1 628	1 678

Source: MINISTRY OF THE ENVIRONMENT OF THE SLOVAK REPUBLIC

Graph 30 Projects of greenhouse gas emissions from the energy sector broken down into EU ETS and ESD by WEM scenario



Source: SHMÚ, 2016 and 2017 are realistic

(II-d) Projections for the fugitive emissions of CH_4 and CO_2 of coal mining and post-mining activities in 2017-2040

The assumptions of the WEM scenario are based on the already outdated cut-off dates for coal mining in Slovakia, which were prepared on the basis of the following data:

- Data on coal mining in 2017 from individual underground mines were obtained from official sources – companies: HBP, a.s. and the Statistical Office of the Slovak Republic;
- Data on projected coal mining were obtained from the Ministry of the Economy – 'Energy Policy of the Slovak Republic for 2014'.

The WEM scenario envisages a phase-out of mining in 2030, but the actual end date of support for coal production in Slovakia has been postponed to 2023. The sum of total emissions calculated on the basis of the WEM scenario will thus be lower for 2025-2040.

II-d) Projection of fugitive greenhouse gas emissions from the extraction, transport and distribution of natural gas and oil in Slovakia for the period 2017-2040

The input data was obtained from the following sources:

- Statistical Office of the Slovak Republic (for 2017);
- CPS model.

Emission factors from the following sources were used to calculate fugitive emissions (and projections) of methane from the extraction, transport and distribution of natural gas and oil in the Slovak Republic:

- 2006 IPCC Guidelines for National Greenhouse Gas Inventories – Chapter 4: Fugitive emissions (IPCC 2006 GL);
- IPCC Guidelines on good practices and uncertainties for national greenhouse gas inventories (IPCC 2000 GPG).

Projections for fugitive methane emissions from the extraction, transport and distribution of natural gas and oil in the Slovak Republic were estimated on the basis of the following assumptions:

- Oil production in the Slovak Republic is expected to cease after 2020;
- Natural gas production will only slowly decline;
- Consumption/distribution of natural gas and oil in Slovakia will be unchanged;
- The redirection of natural gas supplies via the North Stream pipeline will reduce the amount of gas transported to other countries by pipelines in Slovakia, resulting in a reduction in fugitive CH_4 emissions.

Table 57 Projections of activity data for the preparation of projections for 2017-2040 under the WEM scenario

Activity	Units	2017*	2020	2025	2030	2035	2040
Oil production	T	8 000	10 254	0	0	0	0
Oil processing	T	5 587 000	5 749 078	5 664 604	5621 146	5 458 604	5 282 346
Transport of oil over long distances	T	9 582 252	9 727 295	9 454 590	9 181 885	8909 180	8 636 475
Production of natural gas	10^6 m^3	140,000	110,605	114,095	100,413	85,417	75,361
Transport of natural gas over long distances	10^6 m^3	64 200,000	69 069,617	67 882,186	67 036,012	66 102,132	68 622,506
Distribution of natural gas	10^6 m^3	5 248,000	4 871,149	5 556,479	5 466,016	5 267,342	5 355,552

*real values; Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

Projections of greenhouse gas emissions in category 1.B.2 – Fugitive emissions from the extraction, transport and distribution of oil and natural gas are presented in Table 58.

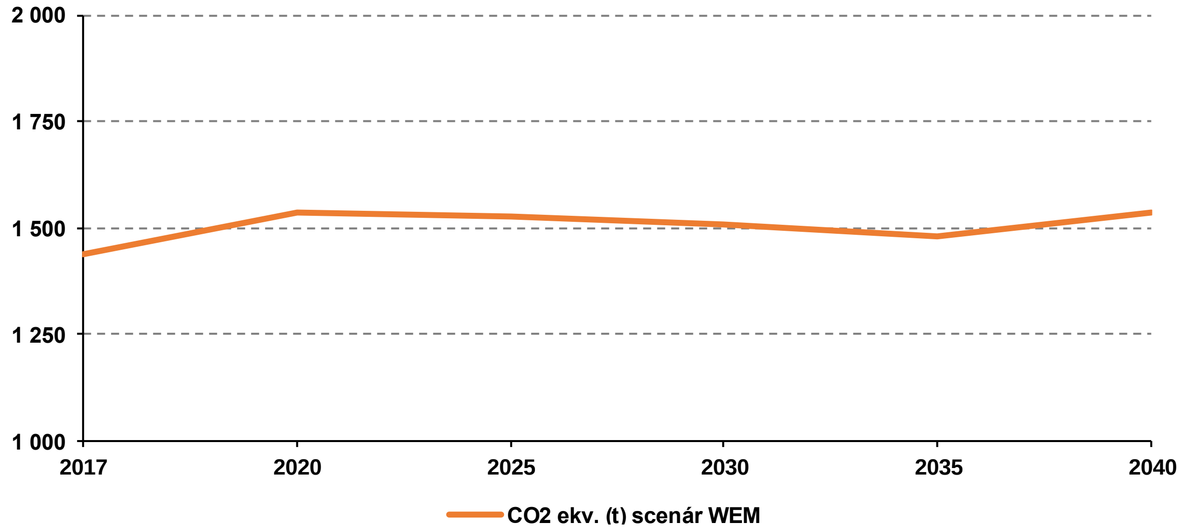
In addition to the projections for fugitive CH_4 emissions from the extraction, transport and distribution of natural gas and oil in the Slovak Republic, projections for CO_2, NMVOC and N_2O have been calculated, but their relevance to the overall projections of greenhouse gas emissions in this category is negligible. The same methodology and conditions were used for the calculations as for methane.

Table 58 Projections of fugitive oil and gas emissions for 2017-2040 under the WEM scenario

Year	CH_4	CO_2	NMVOC	N_2O
		tonnes		
2017*	57 543	1 317	8 747	0,0116
2020	61 355	1 330	9 043	0,0126
2025	61 088	946	8 868	0,0037
2030	60 262	892	8 771	0,0032
2035	59 239	827	8 771	0,0028
2040	61 310	807	8 292	0,0024

*real values; Source: SHMÚ

Figure 31 Projections of fugitive greenhouse gas emissions from oil and natural gas



2017 is real; Source: SHMÚ

II-f) Emissions from transport

Projections of transport emissions are based on the CPS energy model and its scenarios. The forecast of energy consumption in the transport sector was determined as a percentage of fuels in total consumption in the energy sector. The projections for road transport emissions have been calculated on the basis of the following data and activities:

- Aggregation of transmitted data from the model for road transport COPERT 5 for the period 2000-2017, as the current version of COPERT uses a total of 382 categories of road vehicles. The aggregation took into account the mode of transport, the fuel used and the EURO emission standard.
- Update of data on new registrations and decommissioned vehicles from the EVO IS.
- Allocation of new vehicle registrations to vehicle categories on the basis of projections of their energy consumption.
- Distribution of decommissioned vehicles into categories of older vehicles, so that their number gradually declines to zero due to the ongoing renewal of the fleet in the Slovak Republic.
- An estimate of the number of vehicles for each year (2018-2040) based on new registrations and the number of vehicles discarded.
- Aggregating the annual mileage as calculated by COPERT for the period 2000-2017, into defined vehicle categories and forecast of the evolution of kilometres over the years 2018-2040.
- The transfer of “implied” emission factors from COPERT and their appropriate split for the categorisation of vehicles in the design model.
- Calculation of future transport performances for the period 2018-2040 for those vehicle categories.
- Calculation of emission projections through a multiplication of performance and emission factors.

Projections of GHG emissions in category 1.A.3.b – Road transport in the action scenario were prepared according to EU 2016 RS (WEM). Projections of CO_2, CH_4 and N_2O emissions under the WEM scenario are decreasing until 2040. The trend is explained by the measures presented and used in the scenario. Emissions from biomass are not calculated separately in emission projections, but the increase in the share of biofuels in petrol and diesel affects$_{CO2}$ emission factors and, consequently, CO2$_{projections}$.
The Slovak Republic as well as other countries are implementing various policies and measures to reduce the environmental burden in the transport sector. All policies and measures described in the previous chapters for the transport sector are in line with the prepared low-carbon study of the Slovak Republic. Of these measures, only those for which the effect on emission reductions in the WEM scenario could be calculated were assessed and used.

Table 59 Overview of policies and measures in the transport sector

PAM	Name	What has been changed
PAM 01	Promotion of biofuels	CO2 emission factors, due to an increase in biomass
PAM 02	Regulation for CO2 emission$_{standards}$ for new passenger cars	Emission factors$_{for}$ new passenger cars (average 95 g/km)
PAM 03	Regulation for CO2 emission$_{standards}$ for light commercial vehicles	Emission factors for$_{new}$ light commercial vehicles (average 147 g/km)
PAM 04	ICAO Agreement to reduce CO2$_{emissions}$ from aircraft	No changes compared to 2016
PAM 05	Change in traffic distribution	Reduction in road freight transport performance for roads over 300 km, of which 30 % should be shifted to rail.
PAM 06	Economic and tax instruments	The change in projected energy consumption will be dominated by clean fuels, which should be subject to lower taxation.
PAM 07	Road charging	Demand for road freight transport varies according to price demand.

Table 60 Expected fuel consumption in transport in the WEM scenario until 2040

Fuel	unit	2017*	2020	2025	2030	2035	2040
Petrol	TJ	22 034,4	21 747,6	22 536,0	26 506,8	29 343,6	28 670,4
Diesel fuel	TJ	74 694,6	56 314,8	59 245.2	62 582,4	65 685,6	64 396,8
LPG	TJ	1 944,1	3 506,4	3 297,6	3 283,2	2 988,0	2 894,4
Natural gas	TJ	223,2	752,4	792,0	1 076.4	1 339,2	1 587,6
Biogas	TJ	0.0	3.6	25.2	43.2	54.0	79.2
Conventional biofuels	TJ	6 481,6	7 437,6	7 675,2	8 337,6	8 928,0	8 794,8
Advanced biofuels	TJ	0.0	0.0	0.0	0.0	3.6	14.4
Kerosene	TJ	45.0	2 268,0	2 768,4	3 409,2	3 852,0	3 956,4
Hydrogen	TJ	0.0	0.0	0.0	7.2	151,2	464,4
Electricity	GWh	0.2	707,0	860,0	991,0	1 160,0	1 241,0

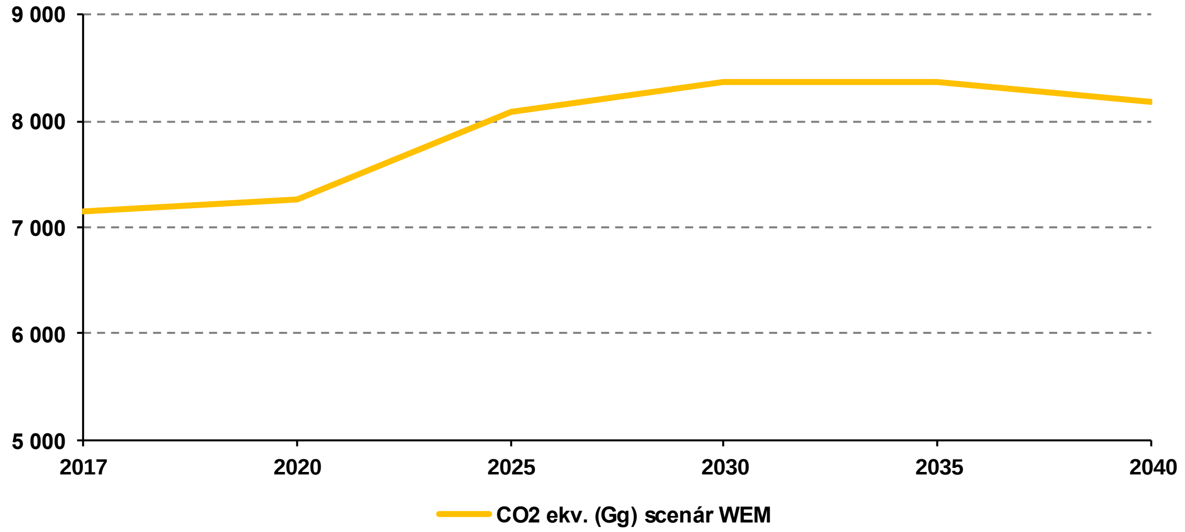
*real values; Source: SHMÚ

Table 61 Road transport emission projections 2017*-2040 under the WEM scenario

Year	CO_2	CH_4	N_2O
	kt	tonnes	
2017*	7 151,18	318,34	262,02
2020	7 261,43	182,04	237,96
2025	8 093,57	150,04	272,55
2030	8 373,25	130,25	284,17
2035	8 365,98	112,91	285,87
2040	8 173,54	99,32	280,80

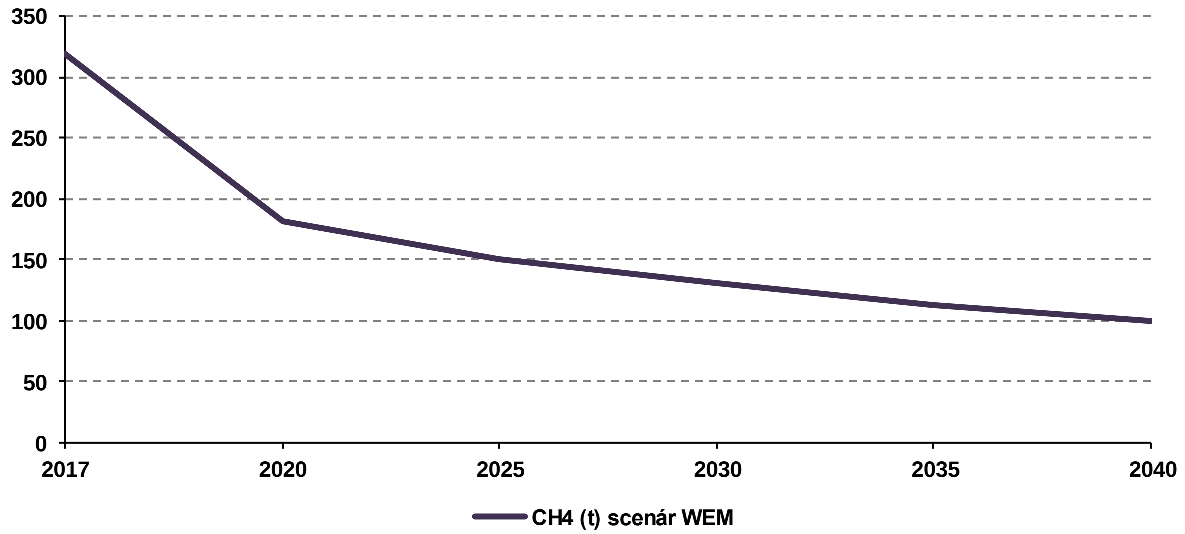
*real values; Source: SHMÚ

Figure 32 Projections of 2040 greenhouse gas emissions in road transport according to the WEM scenario



2017 are real values; Source: SHMÚ

Figure 33 Projections of 2040 methane emissions in road transport according to the WEM scenario



2017 are real values; Source: SHMÚ

In addition to projections of greenhouse gas emissions in road transport, projections for non-road transport emissions in the Slovak Republic have been calculated, but their share of total transport emissions is minimal. Non-road emission projections have been calculated in a simpler way using AutoRegressive Integrated Moving Average (ARIMA) modelling. Only a WEM scenario was prepared for these projections.

Table 62 Non-road emissions projections 2017-2040 under the WEM scenario

Emissions	Sector	unit	2017*	2020	2025	2030	2035	2040
CO_2	Air transport	kt	3,42	4,55	4,88	4,87	4,87	4,87
	Railways		84,35	94,45	97,87	100,99	104,44	108,09
	Transport by sea		4,69	3,01	2,64	2,25	2,06	1,87
CH_4	Air transport	tonnes	0,07	0,07	0,07	0,07	0,07	0,07
	Railways		5,07	5,27	5,47	5,67	5,87	6,07
	Transport by sea		0,45	0,30	0,30	0,30	0,30	0,30
N_2O	Air transport		0,09	0,09	0,09	0,09	0,09	0,09
	Railways		34,96	36,57	37,87	39,07	40,47	41,88
	Transport by sea		0,13	0,06	0,06	0,06	0,06	0,06

*real values; Source: SHMÚ

II-g) Emissions projections from the sector industrial processes and product use (IPPU)

Projections of greenhouse gas emissions from the IPPU sector (large industrial enterprises) included in the EU ETS are modelled together with the energy sector. Two **WEM** and **WAM** scenarios have been prepared for the purposes of setting a target for 2030 and subsequently for 2050 in the different categories of industrial activities not included in the EU ETS. Separately for all three groups of IPPU categories, namely emissions of CO_2, CH_4 and N_2O in categories 2.A-2.D, HFCs emissions in Category 2.F and N_2O and SF_6 in category 2.G.

WEMscenario – includes policies and measures adopted and implemented at EU and national level by the end of 2021. In industrial processes, increasing energy efficiency is essential for productivity growth, which is part of sustainable value added growth.
The Additional Measures Scenario (**WAM**) – is equivalent to the Dcarb2 scenario of the CPS-PRIMES model, in the IPPU sector outputs from CPS-PRIMES were used to develop trends across industry types. Projections of emissions of F-gases (HFCs) in Category 2.F have been prepared according to two **WEM** and **WAM** scenarios. The projections for emissions under the **WEM** scenario followed Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated

greenhouse gases and repealing Regulation (EC) No 842/2006 [5]. According to Annex III to this Regulation, the gas marked R404A (GWP 3922) is replaced by R448A (GWP 1387), R449A (GWP 1397) and R452A (2410). R410A is replaced by R452B (GWP 698) and R134a is replaced by R513A (GWP 631). In addition, R134a in MAC is replaced by R1234YF gas. Newer gases with a GWP of more than 750 shall be replaced with gases with a GWP of 150 or less.

Emission projections under the **WAM** scenario have taken into account the Regulation [5] together with the assumption of an obligation to include zero GWP gases (as complementary gases) in new installations to replace gases used in cooling after 2033.

Projections of SF_6 and N_2O emissions in category 2.G were prepared according to two **WEM** and **WAM** scenarios. Projections of SF_6 emissions in the **WEM** scenario were prepared by extrapolating the base year taking into account the time series since 1990. The mitigation measure in the scenario was the assumption of decommissioning of obsolete facilities.

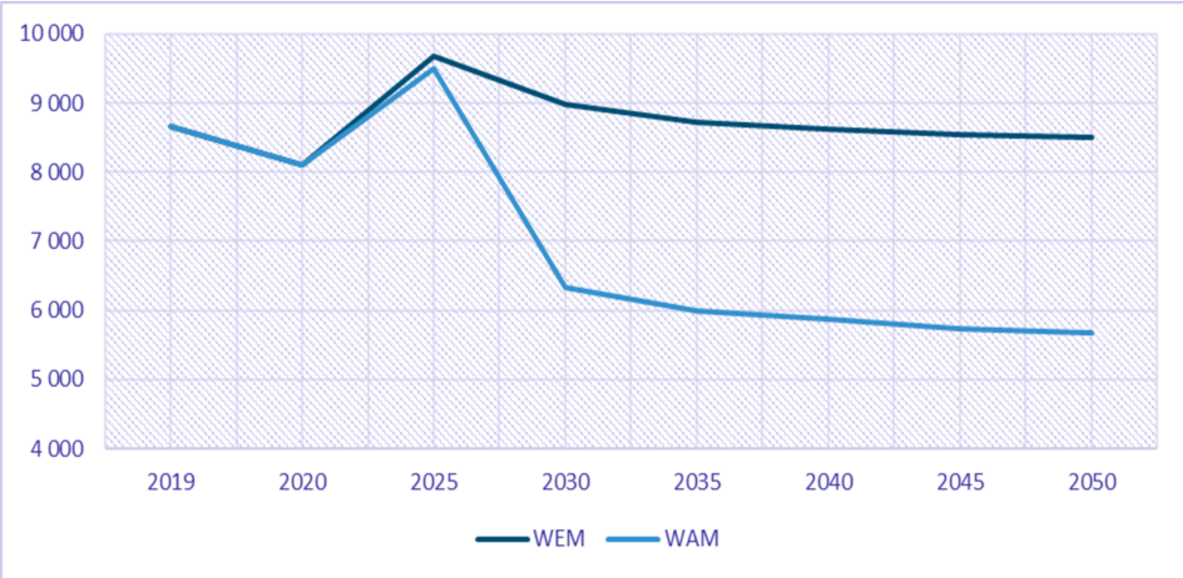
Emission projections in the **WAM** scenario took into account the restrictions on the use of SF_6 gas in new installations after 2025. Projections of N_2O emissions in category 2.G.3 have been prepared by extrapolating the time series over the last 10 years (**WEM**scenario). According to the **WAM** scenario, there is a gradual substitution of N_2O propulsion gas in anaesthesia.

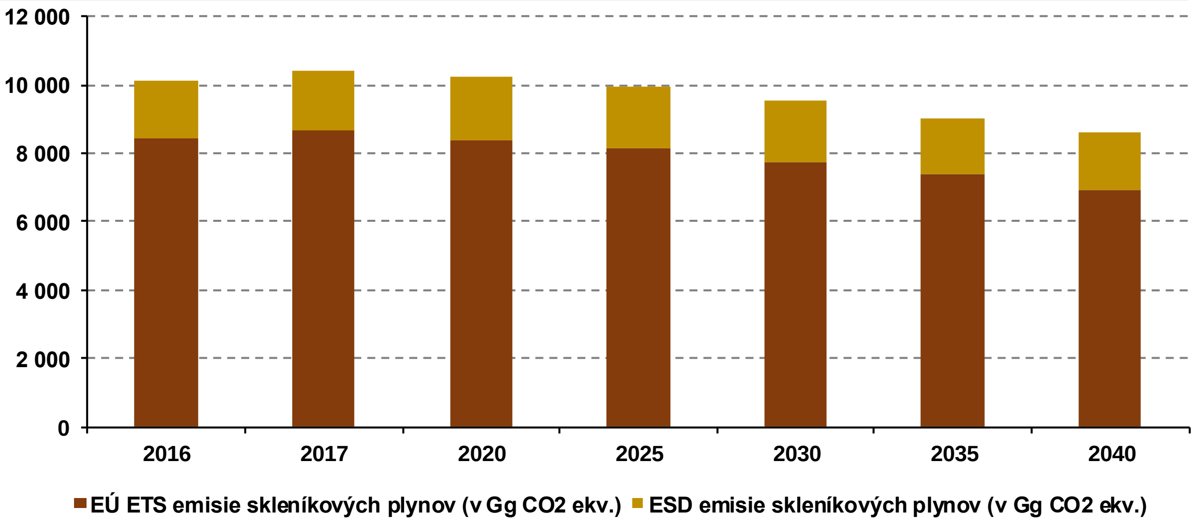
Table 63 Projections of GHG emissions from the sector industrial processes including F-gases under the WEM and WAM scenarios

WEM	**2019***	**2020***	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
2. **Industrial processes**	8 670	8 115	9 681	8 975	8 727	8 624	8 543	8 499
2.A. Mineral processing	2 285	2 219	2 207	2 189	2 224	2 333	2 314	2 336
2.B. Chemical industry	1 489	1 506	1 595	1 641	1 658	1 649	1 627	1 604
2.C. Metal industry	4 074	3 606	5 130	4 520	4 509	4 499	4 463	4 424
2.D. Non-energy use of products	35	30	37	37	33	26	26	26
2.E. Electronic industry	NO	NO	NO	NO	NO	NO	NO	NO
2.F. Use of products as a substitute for ODS – HFCs	719	679	643	521	241	58	56	55
2.G. Other processing and use of SF6	68	76	69	66	62	59	57	55
2.H. Other	NO	NO	NO	NO	NO	NO	NO	NO
WAM	**2019***	**2020***	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
2. **Industrial processes**	8 670	8 115	9 501	6 332	5 991	5 871	5 731	5 674
2.A.Mineral working	2 285	2 219	2 053	2 134	2 070	2 173	2 173	2 174
2.B. Chemical prime acid	1 489	1 506	1 568	1 614	1 632	1 621	1 599	1 576
2.C. Metal industry	4 074	3 606	5 130	1 966	1 983	1 977	1 869	1 846
2.D. Non-energy use of products	35	30	37	37	33	26	26	26
2.E. Electronic industry	NO	NO	NO	NO	NO	NO	NO	NO
2.F. Use of products as a substitute for ODS – HFCs	719	679	645	520	222	29	25	21
2.G. Other processing and use of SF6	68	76	69	61	52	45	38	31
2.H. Other	NO	NO	NO	NO	NO	NO	NO	NO

** base year 2019; 2019-2020 based on GHG inventory 20. 10. 2022*

Figure 34 GHG emissions projections in Gg CO2 eq. In the IPPU sector under the WEM and WAM scenarios by 2050





II-h) Emissions from agriculture

In the preparation of the projections, selected measures have been analysed which have a detectable impact on the estimated emissions and have been able to quantify the impact on the greenhouse gas inventory and pollutant inventory. All other measures proposed in the strategies and not implemented in the projections do not have a measurable effect on the inventory but have an impact on agriculture as a whole in relation to the environment.

On the basis of the qualification of the likely impact of mitigation measures on emission inventories, we distinguish:

- Measures which have a detectable impact on emissions. This impact can be specifically attributed to the implementation of a given mitigation measure. These measures are measurable and effective; this type of measures has been used in the preparation of emission projections.

- Measures which have an impact on the emissions reported in inventories, but that impact cannot be specifically attributed to a particular mitigation measure. This includes measures that are difficult to measure and have a different, often synergistic or antagonistic effect.
- Measures whose impact on the emissions reported in inventories is possible because emission reductions are visible. The effect of these measures depends on other factors.
- Measures that do not have a direct impact on emissions but can have a positive impact on farmers' actions or the environment in the sector.

The list of policies and measures used, as implemented in the agricultural projections, was taken from the National Pollutant Emission Reduction Programme, the low-carbon strategy of the Slovak Republic and the 'Farm to Fork' strategy document. The upcoming EU Food Strategy aims to reduce the use of pesticides, fertilisers and antibiotics in agriculture. By 2030, the consumption of hazardous pesticides should be reduced by 50 % and the consumption of inorganic fertilisers should decrease by 20 %. Targets are set for the whole of the European Union; Slovakia does not have a binding reduction resulting from the Farm to Fork Strategy; the projections have implemented the European targets.

The low-carbon strategy aims to identify measures, including additional ones, with a view to achieving climate neutrality in Slovakia in 2050 and achieving 55 % emission reductions in 2030 compared to 1990. This ambitious target was only formally defined at the final stage of the development of a low-carbon strategy and therefore other, less ambitious emission reduction scenarios are analysed in detail.

The EU's Common Agricultural Policy (CAP) will support the fight against climate change through the intervention of a farm-wide eco-scheme (31.1), which will improve the structure of arable land, extend non-productive areas in agricultural landscapes and intermediate grassland in orchards and vineyards. On-farm investment to reduce greenhouse gas and ammonia emissions will support investments in the reduction of greenhouse gas and ammonia emissions on farms in the form of an intervention Animal Welfare – Passive Farming (31.2). Non-productive investments necessary for the introduction of measures in agricultural production will also be supported.

The need to increase the share of renewable energy sources in the total amount of energy in agriculture will be addressed by intervention on-farm productive investments by investments in technology and related construction investments aimed at the energy transition, in particular by-products from agriculture and biodegradable waste. Investments in installations for the production of energy from other renewable sources in order to use all the energy produced on the farm or farm will also contribute to increasing the share of renewable energy sources.

Emission projections have been prepared in accordance with the 2006 Intergovernmental Panel on Climate Change methodology, Chapter IV (IPCC 2006 Guidelines). The computational analytical tool is based on MS Excel and the calculation includes different policies and measures (in numerical formulation) defined under the WEM and WAM scenarios. The model developed in the context of the implementation of Regulation (EU) 2018/841 of the EP and of the Council has been used to project emissions and removals in the category Agriculture.

The computational analytical tool used is based on MS Excel and the calculation includes the different policies and measures (in numerical formulation) defined according to the WEM and WAM scenarios. There are a number of specially developed mathematical models for the preparation of emission projections in the agriculture sector (such as CAPRI, FAPRI-UK model, GLOBIOM model and others), but given the need for comprehensive input data, including economic and energy indicators, it is currently not possible to use them for the purpose of reporting national projections. A small Slovak economy would need its own model developed precisely for our conditions.

Further improvements in the preparation of emission projections from the agricultural sector should enable the whole calculation process to be automated, which should result in a reduction of calculation time and the creation of more scenarios and sensitivities. Implementation of the model used to estimate projections from the agricultural sector is also an option.

Two scenarios have been prepared in this document:

- The WEM scenario is a scenario with measures that includes projections of anthropogenic emissions from agricultural sources, taking into account the effects of policies and measures adopted by the end of 2020.

The WEM scenario took into account policies and measures from national strategies published in the past. The list of policies and measures used was taken from the National Pollutant Emission Reduction Programme and the low-carbon strategy of the Slovak Republic. The increase in emission projections for WEM scenarios after 2005 is due to the projected increase in yields per hectare in part of crop production, putting pressure on higher consumption of nitrogen fertilisers applied, compensation for organic matter and nutrients in the soil as applied matter of cultivated plants will also increase. Emissions will also increase in the livestock sector, in particular meat, sheep and goat farming. Other livestock species are projected to stagnate or decline.

More efficient manure and slurry storage in the form of isolation of excrements from the surrounding environment by preventing soil contamination and avoiding leaching of nitrogen from stored waste, while contributing to avoiding NH_3 and N 2 O emissions. This measure is reflected in both the **WEM** scenario and the **WAM** scenario. The **WEM** takes into account the current status of the measure on farms as reported in the National Emission Information System. This measure is contained in a number of strategic documents and legislation, in particular Decree No 410/2012 of the Ministry of the Environment of the Slovak Republic implementing certain provisions of the Air Act. The implementation of this measure has an impact on ammonia emissions of nitrous oxide and methane from category 3.B Management of manure and slurry.

- The**WAM** scenario is a scenario with additional measures, with projections of emissions from agricultural sources that include the effects of policies and measures that will be adopted and implemented after 2020. **The WAM** scenario was modelled on the basis of strategic documents drawn up by the Ministry of the Environment of the Slovak Republic in cooperation with the Ministry of Agriculture and Rural Development and strategic documents drawn up by the Ministry of Agriculture and Rural Development.

Methane emissions from enteric fermentation in the WAM scenario were modelled by taking into account the measure proposed in the Slovak low-carbon strategy. One measure is the use of additives to reduce methane and nitrogen emissions. This measure affects category 3.A Enteric fermentation, 3.B nitrous oxide from manure and slurry management and has a partial impact on nitrous oxide emissions from category 3.D Agricultural soils. Methane from agriculture, waste and energy should also be reduced under the so-called methane strategy. The strategy will help the European Union to achieve more ambitious emission targets for 2030 and ultimately carbon neutrality by 2050. The strategy also proposes measures to improve data collection and monitoring of emissions. It also promises investment in research and the introduction of a mechanism for sharing useful practices between Member States. Measurable measures to reduce methane emissions include changing the way animals are fattened.

Emissions of nitrous oxide and ammonia from manure and slurry management (More efficient manure and slurry storage) in the WAM scenario have been modelled by taking into account a measure to introduce emission reduction requirements from livestock farms classified as medium source of air emissions. This measure was proposed in the National Pollutant Emission Reduction Programme and implemented in the calculation of NH3 and N2O emissions by implementing low-emission systems for manure and slurry storage. This measure has an impact on category 3.B Management of manure and slurry.

Another measure implemented is the Low Carbon Strategy of the Slovak Republic, which has an impact on N2O and CH4 emissions in category 3.B Management of manure and slurry, was the use of slurry and manure as feedstock in biogas stations. This measure has an impact on reducing emissions through two main pathways – the reduction of fossil fuel carbon emissions through the production of energy sources and the reduction of direct emissions of nitrous oxide from manure and sludge storage. Although anaerobic digestion actually produces methane, it is captured and used in energy production, which has a positive impact on increasing the share of renewable energy.

Emissions of nitrous oxide and carbon dioxide from the application of inorganic nitrogen fertilisers (category 3.D Agricultural soils) were modelled in the WAM scenario on the basis of a measure implemented from the Slovak Republic's low-carbon strategy. This measure recommends a transition or a legislative restriction on the application of urea-based nitrogen fertilisers. The implementation of this measure has an impact on the reduction of ammonia emissions, in particular due to the high volatility of ammonia from urea fertilisers. At the same time, limiting the consumption of urea will avoid carbon dioxide emissions. Nitrous oxide emissions are limited by reducing the total consumption of inorganic fertilisers in the resulting consumption summary.

The last implemented measure was taken from the European Green Deal outlined in the Farm to Fork Strategy. This measure provides for a 20 % reduction in the consumption of inorganic fertilisers by 2030. This measure has an impact on emission category 3.D.1 and 3.D.2, direct and indirect N2O emissions from agricultural soils and ammonia emissions.
The table and graph below show the aggregated trend in the projections of greenhouse gas emissions under the WEM and WAM scenarios (in Gg CO2 eq.) presented in the 'Greenhouse gas

projections report 2023'
(https://oeab.shmu.sk/app/cmsSiteBoxAttachment.php?ID=182&cmsDataID=0).

Table 64 Projections of aggregated emissions in agriculture (eq. Co_2 Gg)

WEM	1990*	2019*	2020*	2025	2030	2035	2040	2050
3. Farming	6 076.31	2 541.39	2 545.04	2 628.08	2 701.79	2 618.01	2 686.03	2 771.74
3.A Enteric fermentation	3 132.29	1 085.44	1 082.30	1 052.47	1 070.64	1 004.65	1 033.23	1 070.74
3.B. Handling of fertilisers	892.18	255.64	230.60	238.75	235.92	224.25	227.12	226.91
3.D Agricultural land	1 990.82	1 132.06	1 160.02	1 244.18	1 294.91	1 283.80	1 313.45	1 356.41
3.G Use of limestone and dolomite	45.73	4.71	8.45	18.95	20.97	23.70	26.12	30.44
3.H Utilisation of urea	15.29	63.54	63.67	73.73	79.36	81.61	86.11	87.23
WAM	1990*	2019*	2020*	2025	2030	2035	2040	2050
3. Farming	6 076.31	2 541.39	2 545.04	2 393.28	2 437.93	2 313.92	2 350.23	2 303.81
3.A Enteric fermentation	3 132.29	1 085.44	1 082.30	1 002.83	1 011.80	934.64	960.27	968.71
3.B. Handling of fertilisers	892.18	255.64	230.60	210.06	209.55	192.47	195.62	198.28
3.D Agricultural land	1 990.82	1 132.06	1 160.02	1 087.71	1 124.18	1 097.83	1 107.94	1 080.20
3.G Use of limestone and dolomite	45.73	4.71	8.45	18.95	20.97	23.70	26.12	30.44
3.H Utilisation of urea	15.29	63.54	63.67	73.73	71.42	65.29	60.28	26.17

*base year 2019, 1990-2020 based on GHG inventory 20.12.2022

Figure 35 Outcome of WEM and WAM scenarios modelling for GHG projections

II-i) Emissions and removals in the Land Use, Land Use Changes and Forestry (LULUCF) sector

The projections of emissions and removals in the LULUCF sector were based on the sectoral strategy document of the Rural Development Programme of the Slovak Republic for the period 2007-2013 and

2014-2020, taking into account the adopted National Forestry Programme (NLP) of the Slovak Republic, as well as the NLP Action Plans for 2009-2013 and 2015-2020, the Slovakia's 2030 low-carbon development strategy with a 2050 perspective, the Environmental Policy Strategy and the Climate Change Adaptation Strategy. Emission and sink projections take into account scenarios (WEM and WAM) based on available information.

Scenario with existing measures (WEM) – The scenario includes impacts of adopted and implemented measures up to 2020. This scenario takes into account policies and measures from the official national strategy documents and programmes in force in Slovakia up to 2020, in particular the National Forestry Programme of the Slovak Republic 2014-2020, the Rural Development Programme (RDP) 2007-2013 and 2014-2020 and Slovakia's 2030 low carbon development strategy with a 2050 perspective. Additional Measures Scenario (WAM) – The Scenario contains measures with available official strategy documents and programmes applicable in Slovakia after 2020 and the Environmental Policy Strategy of the Slovak Republic.

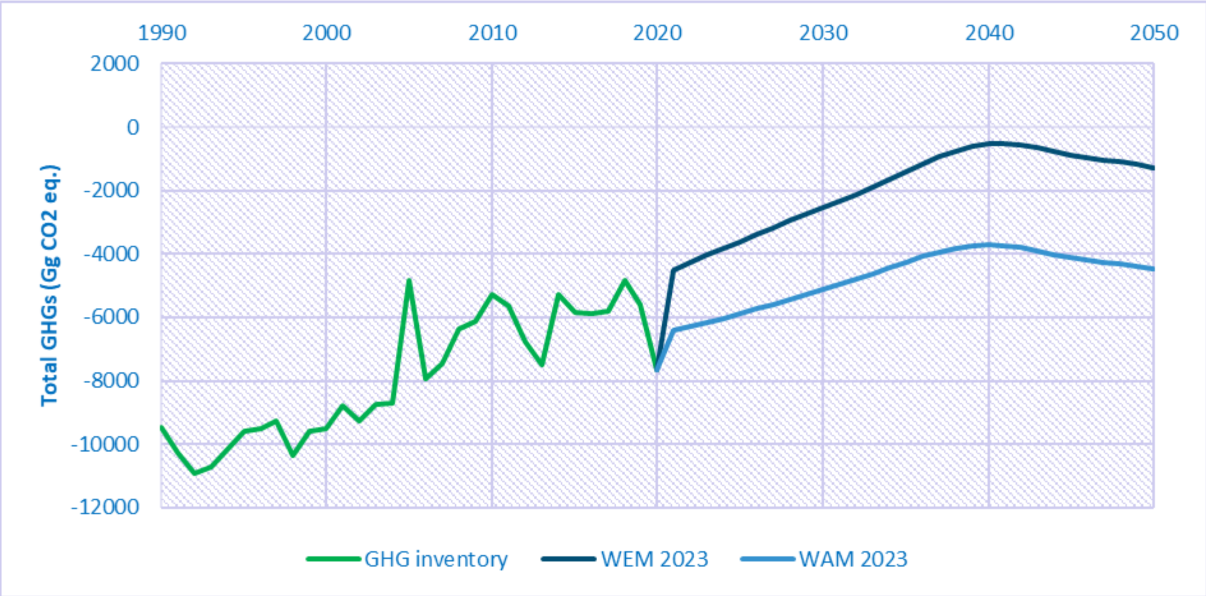
The result of the GHG emissions modelling is shown in the table and figure below and is in line with the ' Greenhouse gas projections report 2023' (https://oeab.shmu.sk/app/cmsSiteBoxAttachment.php?ID=182&cmsDataID=0).

Table 65 GHG emission/sink projections and trends in LULUCF under the WEM and WAM 2050 scenarios (eq. Co_2 Gg)

year	WEM	WAM
	GG CO_2 eq.	
1990*	—9 332.80	—9 332.80
1995*	—9 486.95	—9 486.95
2000*	—9 395.36	—9 395.36
2005*	—4 750.02	—4 750.02
2010*	—5 212.74	—5 212.74
2015*	—5 755.83	—5 755.83
2019*	—5 519.27	—5 519.27
2020*	—7 599.64	—7 599.64
2025	—3 551.37	—5 827.17
2030	—2 472.74	—5 063.98
2035	—1 337.39	—4 196.07
2040	—467.89	—3 661.77
2045	—811.01	—4 055.42
2050	—1 203.19	—4 409.79

*base year 2019, 1990-2020 based on GHG inventory 20.10.2022

Figure 36 Projections and trends of GHG emissions/sinks in the LULUCF sector according to the WEM and WAM 2050 scenarios (eq. Co_2 Gg)



Those modelling results show that obscenaries show a reduction in sinks compared to 1990 in 2030 and a reduction in sinks by 2050.

Projections of GHGs emissions/captures in the LULUCF sector have been modelled for the 6 main land use balance categories (forests, agricultural landscapes, permanent grassland, wetlands, settlements, other country) and the timber product category, as well as for various greenhouse gas emissions (CO2, CH4, N2O). The available time series of input data for the period 1990-2020 were used, which were obtained from various sources (Office of Geodesy of Cartography and Cadastre, NLC, Statistical Office of the Slovak Republic, NPPC-VÚPOP, NPPC-VÚTPHP, Fire Technical and Expert Institute of the Ministry of the Interior of the Slovak Republic, FAO database). All input data input to accounting for GHGs emissions/sinks in the LULUCF sector has been used as input data for the projections.

Input data necessary for the preparation of the projections:

- areas of land use categories – forests, agricultural landscapes, permanent grassland, wetlands, settlements, other landscapes (data for the period 1970-2020, source Statistical Yearbook on Land Fund of the Slovak Republic, Geodesy Cartography and Cadastre Office), data available in the regions, districts and cadastral areas;
- changes in areas to and from different land use categories – forests, agricultural landscape, permanent grassland, wetlands, settlements, other landscapes. (data for the period 1970-2020), data available in regions, districts and cadastral areas;
- annual tree increments in $m^{3/ha}$(1990-2020, Comparative Forest Status Information (SISL), as part of the Forest Information System (ISLH), data available at the counties;

- annual logging in m$^{3($ 1990-2020, source SISL), data available for Slovakia for timber;
- area of individual plants in ha (1990-2020, source SISL), data available in the counties;
- representation of individual trees in ha (1990-2020, source of SISL), data available in the counties;
- age structure of forests in ha (2014-2020), source ofSISL;
- area of forest fires in ha (1990-2020, source from the NLC in cooperation with the Fire Technical and Expert Institute of the Ministry of the Interior of the Slovak Republic);
- inputs for harvested wood products (1990-2020, source FAO database).

For more details, see the 'Report on greenhouse gas projections 2023' (https://oeab.shmu.sk/app/cmsSiteBoxAttachment.php?ID=182&cmsDataID=0).

(ii-.i) Emissions from waste management

The waste sector accounted for 4.6 % of total greenhouse gas emissions in 2020. Since 1990, methane emissions have increased by more than 100 % due to the use of the cumulative methodology in the category of landfilling of solid waste.
A similar, albeit not so significant, trend is expected in the coming years. The volume of emissions from landfills also depends heavily on the implementation of landfill gas capture and use.
The trend in emissions from waste management has been balanced over the whole reporting period since 1990. The most important gas is methane, accounting for more than 91 % of the sector's greenhouse gas emissions, followed by N2O with almost 9 % share. The most emissions come from landfilling and consequently from waste water.

Emission projections are based on the assumption of the demographic development of the Slovak population according to the EU Reference Scenario sent in 2022 (EU REF 2022), according to EUROPOP2019, the specific output of municipal solid waste (MSW) per inhabitant/year in kg, where the OECD standard annual municipal waste increment model was used for calculating the specific output of municipal waste (0.69 % of GDP), the share of landfilled municipal solid waste in total MSW production is gradually reducing the share of landfilled MSW in total municipal waste production by implementing a waste management policy. According to the landfill directive targets at EU level, a maximum of 10 % of MSW produced in Slovakia should be landfilled in 2035. The composition of the MSW and the degradable organic carbon (DOC) content of landfilled waste, based on the available data on the presence of these components in the MSW in Slovakia, as well as the trend of increasing separate collection and thus diversion of some components (kitchen wastes, textiles), have been determined with predicted DOC values for the following period. The calculated DOC values are in Table 67.

Table 66 Projections on the evolution of MSW landfilling in Slovakia by 2050

Year	2020	2030	2040	2050
DOC value	0,120	0,103	0,094	0,088

When forecasting methane emissions from the landfilling of ISW waste in Slovakia, the key calculation parameters are defined by the following indicators:
GDP (country's economic maturity as indicator of waste production), SWDs (share of landfilled ISW in total industrial waste production) and SWDs + DOC> 0 (share of landfilled industrial waste containing biodegradable carbon).

According to the WEM=WAM scenarios prepared for each category, it can be concluded that once all four main waste treatment categories have been recalculated, greenhouse gas emissions will be reduced by 24.41 % by 2030 compared to 2005 and 21.65 % compared to 1990. The reductions to 2050 will be even more pronounced, with emissions from the waste sector falling at 53.43 % compared to 1990. For more details, see the table and graphs below, which are available under the '2023 Greenhouse Gas Emissions Projection Report' available at:
https://oeab.shmu.sk/app/cmsSiteBoxAttachment.php?ID=182&cmsDataID=0.

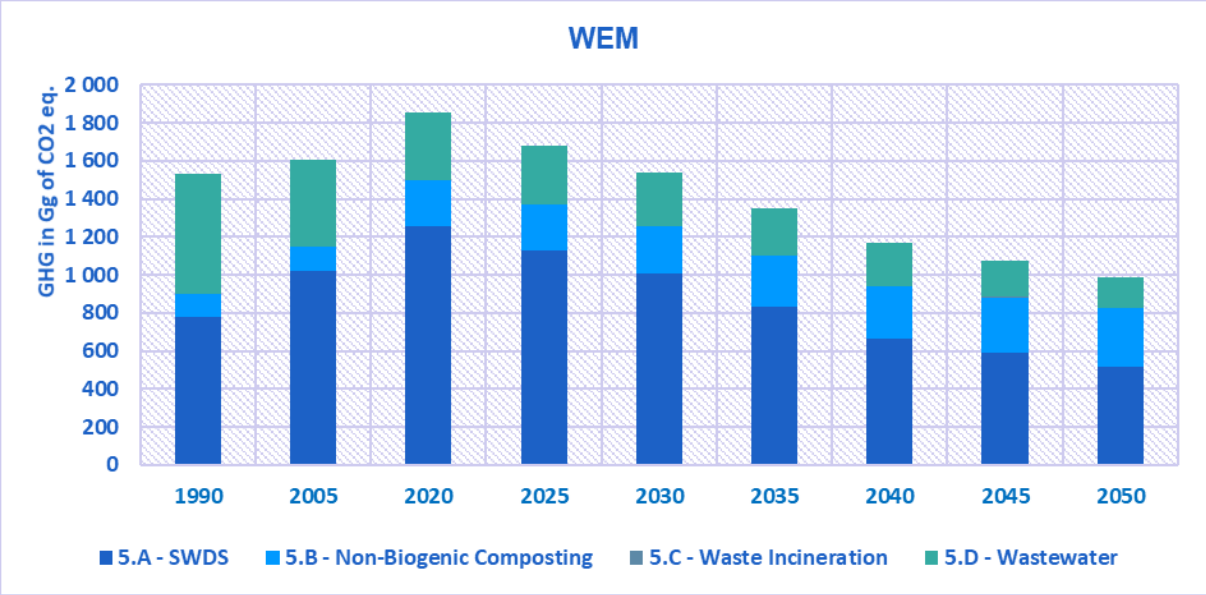
Table 67 Trends and GHG emission trends from the waste sector in the WEM and WAM 2050 scenarios

	Sector 5 – Waste management								
WEM	1990*	2019*	2020*	2025	2030	2035	2040	2045	2050
	GG CO_2 Equivalents								
	1 534.317	1 836.131	1 852.550	1 679.019	1 538.429	1 352.789	1 166.297	1 075.250	986.491

	Sector 5 – Waste management								
WAM	1990*	2019*	2020*	2025	2030	2035	2040	2045	2050
	GG CO_2 Equivalents								
	1 534.317	1 836.131	1 852.550	1 509.092	1 199.468	1 020.798	828.021	761.01	694.678

**base year 2019; 2019-2020 based on GHG inventory 20. 10. 2022*

Figure 37 Trends and GHG emission trends from the waste sector in the WEM 2050 scenario



Graph 38 Trends and GHG emission trends from the waste sector in the WAM 2050 scenario

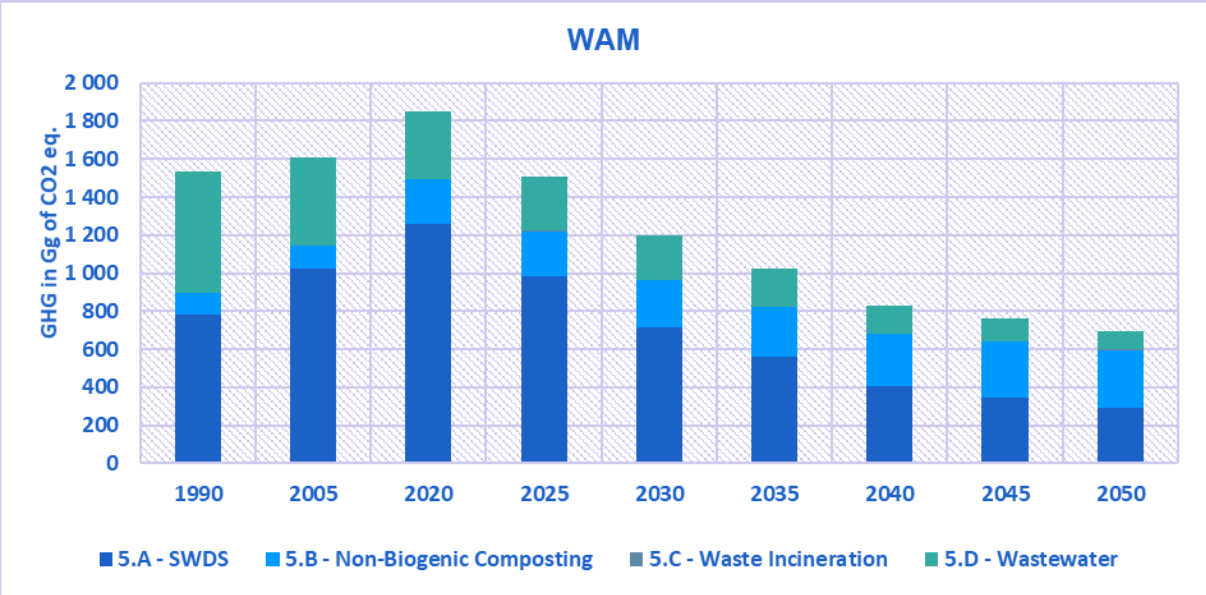
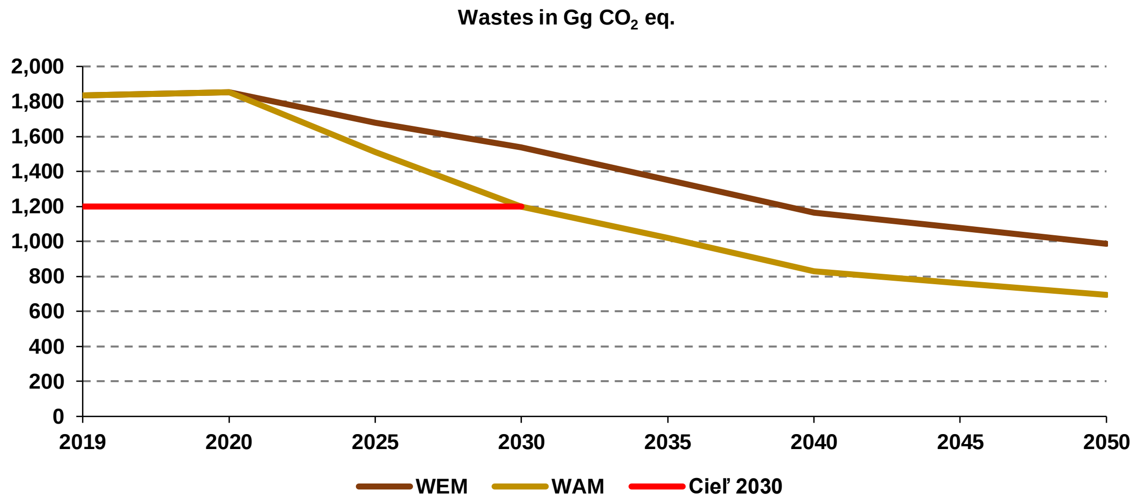


Figure 39 Trends and projections of GHG emissions from the waste sector in the WEM and WAM scenarios by 2050



II-j) Emissions from international transport

Greenhouse gas emissions from international transport are not included in the national balance. Projections of greenhouse gas emissions from international aviation and international navigation were compiled only for the WEM scenario. The data in the 'Greenhouse gas projections report 2023' in Table 69 shows that the projected GHG emissions from these categories are negligible in relation to other sources for Slovakia.

Table 68 GHG emissions projections (Gg CO2 eq.) from international transport in WEM =WAM 2050

	2019*	2020*	2025	2030	2035	2040	2050
Aviation	186.99	55.08	186.99	186.99	186.99	186.99	186.99
River transport	15.95	14.98	15.95	15.95	15.95	15.95	15.95
International transport	202.94	70.06	202.94	202.94	202.94	202.94	202.94

II-k) Projections of total greenhouse gas emissions

The general methodology for calculating emission projections is based on the same structure as for national greenhouse gas inventories. Table 69 and Figure 40 show the total GHG emissions for all monitored sectors in the Slovak economy in the 'Greenhouse gas projections report 2023'.

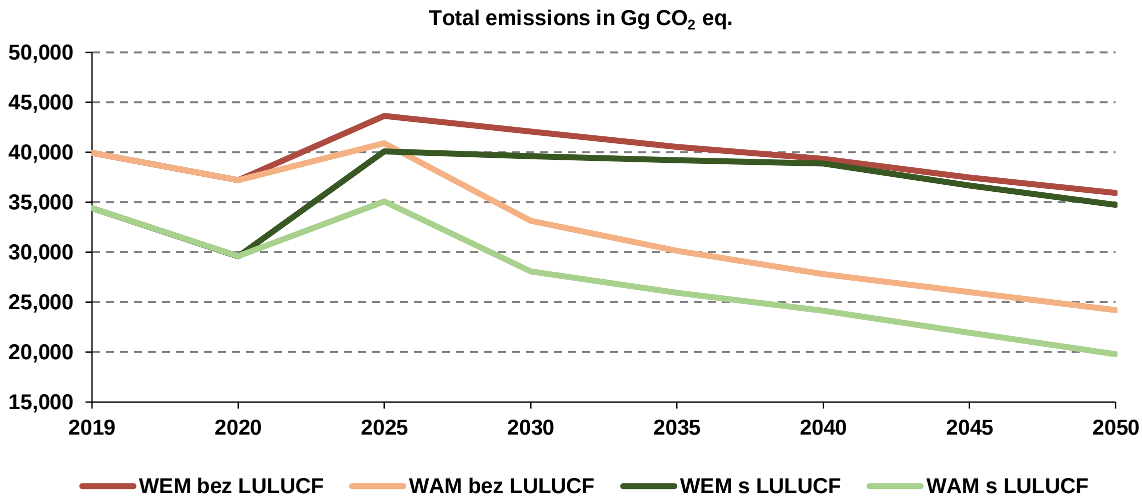
Table 69 Total GHG emissions for all monitored sectors in the Slovak economy

WEM	2019*	2020*	2025	2030	2035	2040	2045	2050
Total excluding LULUCF	39 957	37 179	43 643	42 065	40 563	39 329	37 473	35 934
Total including LULUCF	34 438	29 580	40 092	39 592	39 225	38 861	36 662	34 731
WAM	2019*	2020*	2025	2030	2035	2040	2045	2050
Total excluding LULUCF	39 957	37 179	40 911	33 142	30 172	27 818	26 003	24 204

Total including LULUCF	34 438	29 580	35 084	28 078	25 976	24 156	21 947	19 794

** base year 2019; 2019-2020 based on GHG inventory 20. 10. 2022*

Figure 40 Total GHG emissions for all monitored sectors in the Slovak economy



4.2.2. Renewable energies

I. Current share of renewable energy 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 in half of the 3 years is shown in the table below:

Table 70 Current share of energy from renewable sources in gross final consumption of energy

	2019	2020	Year 2021
Renewable energy sources – heating and cooling75 (%)	19,7	19,4	19,5
Renewable energy sources – electricity generation76 (%)	22,1	23,1	22,4
Renewable energy sources – transport77 (%)	8,3	9,3	8,8
Overall share of renewable energy sources78 (%)	**16,9**	**17,3**	**17,4**

[75] Share 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.

[76] Share 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.

[77] Share of energy from renewable sources in transport: final energy from renewable sources consumed in transport (cf. Article 5(1)(c) and Article 5(5) of Directive 2009/28/EC) divided by the transport consumption of 1. petrol; Diesel; Biofuels used in road and rail transport and (4) electricity in land transport (as referred to in row 3 of Table 1). The procedure is the same as that applied in Table 3 of the NREAP.

[78] Share of renewable energy in gross final energy consumption. The procedure is the same as that applied in Table 3 of the NREAP.

Of which the cooperation mechanism is79 (%)	0	0	0
Surplus for cooperation mechanism80 (%)	0	0	0

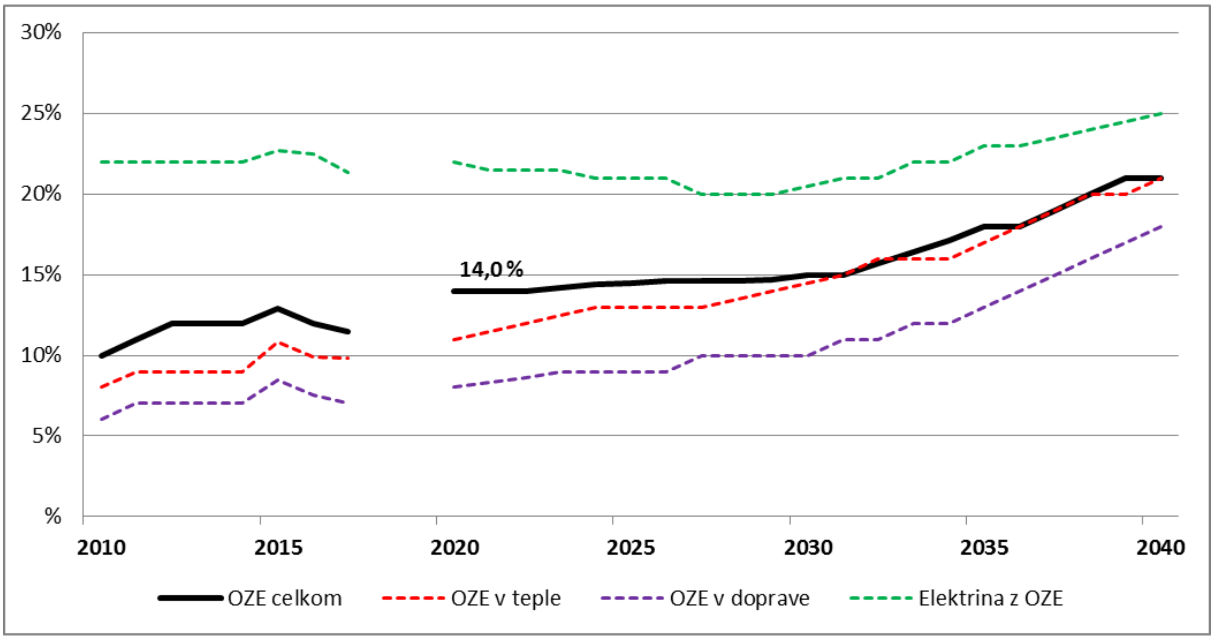
The Slovak Republic has met the 2020 binding RES target of 14 %. The share of RES in gross final energy consumption reached 17.3 % in the assessment year.

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 on the basis of the PRIMES-EUCO model scenario, which showed the possibility of reaching a 19 % RES share by 2030, as well as taking into account other additional factors, the agreed plan raised the RES target to 19.2 %.

Based on the increased ambition for greenhouse gas emission reduction policies, a new PRIMES modelling took place in 2023. Preliminary results have shown the need to increase the share of RES to between 23 % and 24 % in order to achieve these greenhouse gas emission policies. On the basis of these preliminary modelling results, the Slovak Republic has determined the share of RES as its contribution to decarbonisation in accordance with Chapter 2.1.

II. Indicative projections of development with existing policies for the year 2030 (with an outlook to the year 2040)

Figure 41 Indicative trajectory taking into account existing policies and measures



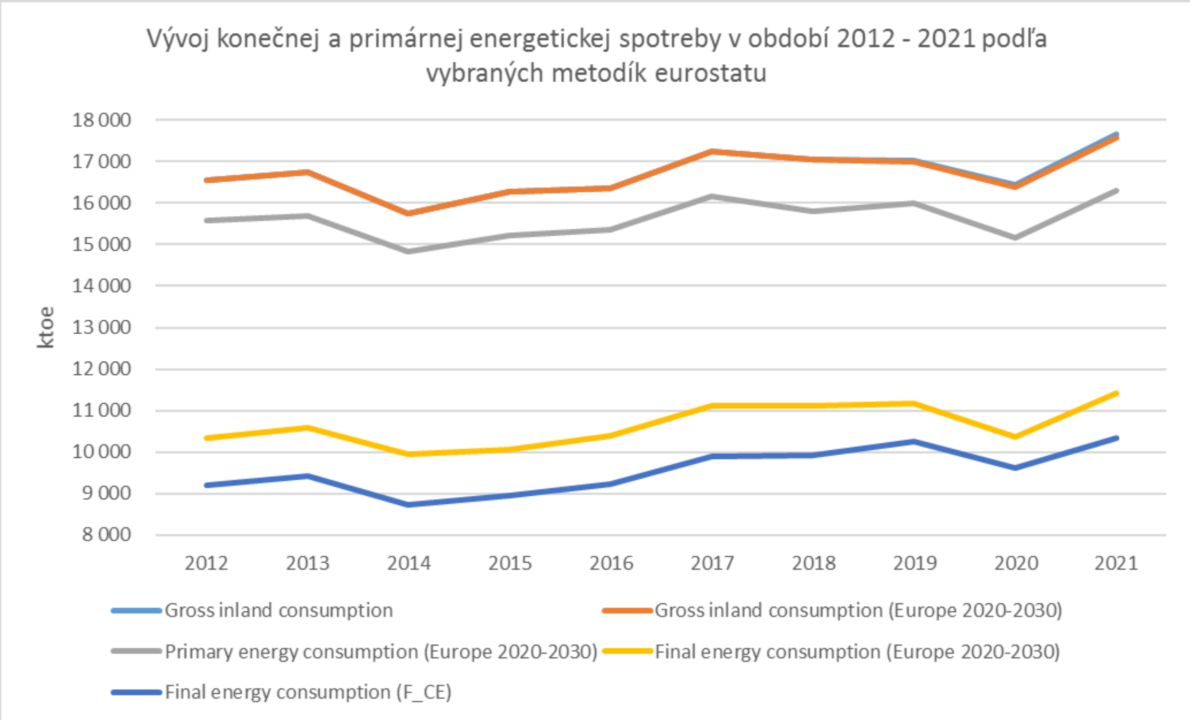
[79] In percentage point of overall RES share.

[80] In percentage point of overall RES share.

4.3. Dimension: energy efficiency

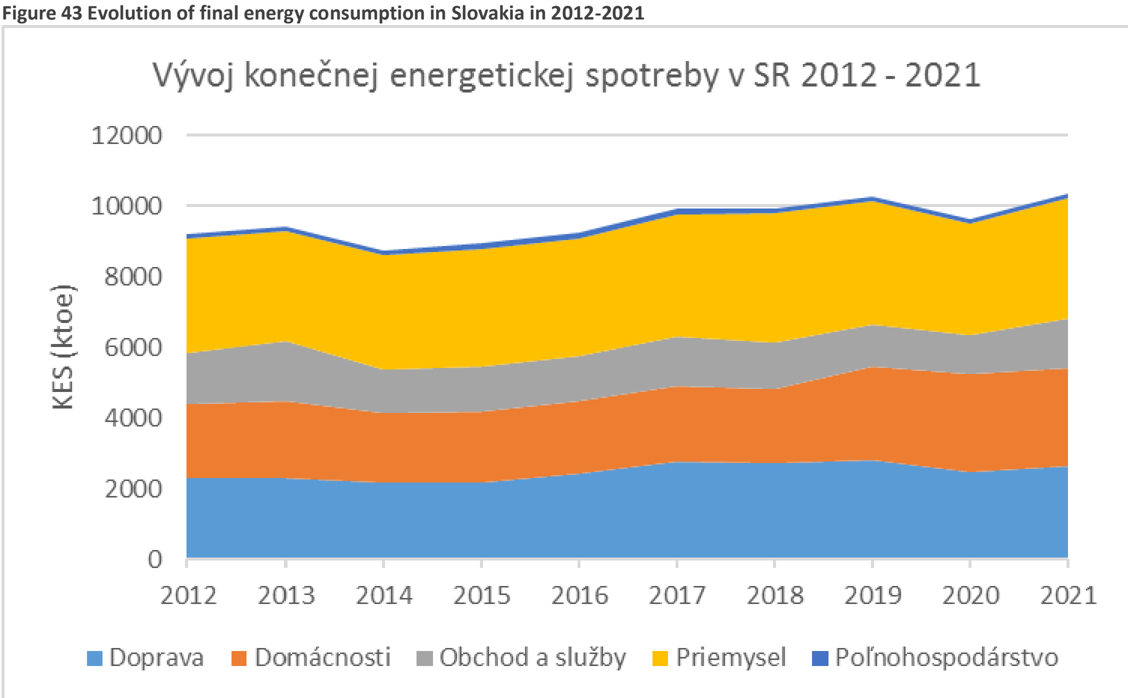
I. Current primary and final energy consumption in the economy and per sector (including industry, residential, service and transport)

Graph 42 Evolution of final and primary energy consumption in the period 2012-2021 according to selected Eurostat methodologies



Source: Eurostat 2022

Figure 43 Evolution of final energy consumption in Slovakia in 2012-2021



Source: Eurostat 2022

Table 71 Trend of the evolution of final energy consumption by sector for the period 2012-2021

Final energy consumption sectors (CES)	KES 2021 (ktoe)	Share in KES	Trend 2012-2021	KES 2021 – EU REF 2020 (-12 %)
KES Total	10 342	100 %	+ 12.4 %	—22 %
Transport	2 619	25 %	+ 13.9 %	
Households	2 800	27 %	+ 35.3 %	
Trade and services	1 408	14 %	—3 %	
Industry	3 382	33 %	+ 4.6 %	
Farming	132	1 %	—8.2 %	

Source: Eurostat

II. Current potential for the application of high-efficiency cogeneration and efficient district heating and cooling81

The assessment of the potential of additional high-efficiency cogeneration was based, inter alia, on the current and forecast energy balance of electricity production and consumption in Slovakia. According to the assumptions of the Slovak Republic's current energy policy and the annual 'Reports on the results of monitoring the security of electricity supply' drawn up by the Ministry of the Economy, the self-generation of electricity currently covers almost all electricity consumption. It is expected that the retrofitting of electricity generation facilities already under construction will not require the construction of additional sources by 2030 in order to cover electricity consumption in Slovakia. For CHP plants with steam and combustion turbines, only a slight increase is expected to be achieved by the necessary renovations of existing cogeneration technologies.

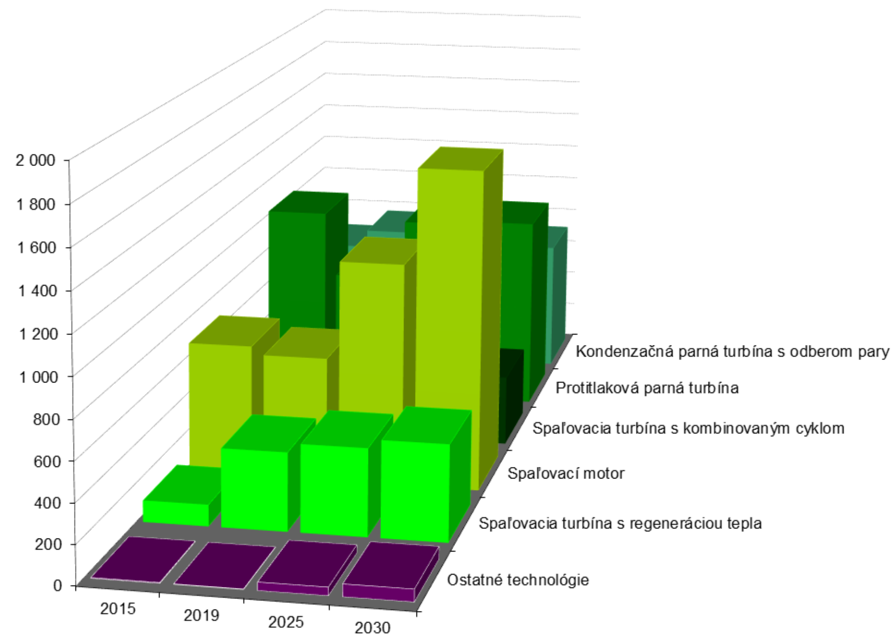
The greatest potential of additional high-efficiency cogeneration is assumed in existing district heating systems ('CZT systems'), from which heat is supplied to final customers.

The further development of these CZT systems is limited by the useful heat demand in the reach of existing heat networks. A significant increase in heat supply from these installations is not considered 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 consumers and by the reconstruction and modernisation of the existing CZT networks.

It is assumed that the greatest use of the technical potential of high-efficiency cogeneration will occur mainly in the heat generators segment of heating and central boiler rooms in which natural gas is burned using cogeneration technology with an internal combustion engine, by replacing or complementing separate production with cogeneration. Current and projected electricity generation by type of cogeneration technology is shown in Graph 44.

[81] In accordance with Article 14(1) of Directive 2012/27/EU.

Figure 44: Existing and projected electricity generation in the high-efficiency cogeneration process



Source: SIEA

Formulating scenes of application of CHP

The basis for formulating the different scenarios was the economic potential of new high-efficiency CHP plants, which is defined according to each type of cogeneration technology. In the CZT systems in Slovakia, the cold supply requirement is negligible. Therefore, this expert analysis covering the need for cold is not considered.

Baseline baseline

The baseline scenario envisages minimal or no development of micro- and small-scale cogeneration plants using cogeneration technology with internal combustion engines. The share of heat supply in CZT systems by heat technology and fuel type to the total heat supply in this scenario is presented in Table 72. Other fuels include blast furnace gases, refinery gases, fuel oils, etc.

Table 72: Share of heat supply in CZT systems according to heat generation technologies in the baseline scenario

Heat generation technology		Heat delivered to CZT systems		
		2019	2025	2030
		%	%	%
Separate heat generation – heaters according to fuels and energy combusted	natural gas	28,69	28,75	26,12
	lignite	0,19	0,00	0,00
	biomass	5,71	6,01	4,48
	geothermal energy	0,32	0,32	0,35
	other fuels	0,52	0,53	0,58
Together,		**35,42**	**35,60**	**31,52**
	natural gas	17,32	30,36	31,68

Combined heat and power – cogeneration technologies according to the fuels burned	lignite	8,50	0,00	0,00
	coal	10,04	4,47	4,35
	biomass	7,73	8,14	8,69
	biogas	0,11	0,11	0,12
	solid metal. Waste	0,06	0,06	0,06
	nuclear fuel	2,43	2,48	2,72
	other fuels*	18,40	18,79	20,60
Together,		**64,58**	**64,40**	**68,48**
Total heat technologies		**100,00**	**100,00**	**100,00**

Source: SIEA

Cogeneration plants (public heating plants, industrial heat plants) are not considered to increase installed capacity. These sources foresee the upgrading or upgrading of existing installations with a view to improving energy efficiency or diversifying the fuel base. The fulfilment of this scenario is based on the consideration that there will be no operational support for high-efficiency cogeneration, which would lose the economic incentive to construct and operate these plants.

The decrease in the shares of lignite fuel and hard coal from CHP plants in 2025 and 2030 takes into account the cessation of lignite mining by Hornonitrianske bane Prievidza, a.s., a commitment by the management of six state-owned heating plants to cease coal combustion from 2023, as well as a change in the fuel base of other private entities.

Heat supply is projected to decline from 2021 onwards (use of energy efficiency policy reduces useful heat consumption in the household and trade and services sectors).

Low CHP application scenario

The scenario ‘Low CHP scenario’ assumes that the greatest exploitation of the technical potential of high-efficiency cogeneration will take place in existing CZT systems (heat, central boilers) in which natural gas is combusted. It is considered that the separate production of heat from combined heat and power technologies will be partially substituted for these heat sources.

Based on the real real energy balances of these heat sources per district within the Slovak Republic (annual production and supply of heat, broken down into heating and hot water) by 2030, the economic potential for additional construction of new CHP plants with a total installed electricity capacity of 128.3 MW_e. This scenario envisages installing 55 % of the installed electrical power of new CHP plants out of the economic potential of the CHP technology with natural gas combustion engines.

Assumptions considered in the ‘Low CHP scenario’ scenario in 2030:

- 70.55 MW_e of newly installed very small and small-scale combined heat and power plants with natural gas combustion engines;
- projected generation from those installations of 380 975 MWh of electricity and 445 092 MWh of heat.

The share of the coverage of heat supply in CZT systems by heat generation technology and fuel type to the total heat supply in this scenario is presented in Table 73.

Table 73: Share of heat supply to CZT systems by production technology – “Low CHP scenario”

Heat generation technology	Heat delivered to CZT systems

		2019	2025	2030
		%	%	%
Separate heat generation – heaters according to fuels and energy combusted	natural gas	28,69	26,89	22,24
	lignite	0,19	0,00	0,00
	biomass	5,71	6,01	4,47
	geothermal energy	0,32	0,32	0,35
	other fuels	0,52	0,53	0,58
Together,		**35,42**	**33,75**	**27,64**
Combined heat and power – cogeneration technologies according to the fuels burned	natural gas	17,32	32,22	35,65
	lignite	8,50	0,00	0,00
	coal	10,04	4,47	4,35
	biomass	7,73	8,14	8,96
	biogas	0,11	0,11	0,12
	solid metal. Waste	0,06	0,06	0,06
	nuclear fuel	2,43	2,48	2,72
	other fuels*	18,40	18,77	20,58
Together,		**64,58**	**66,25**	**72,36**
Total heat technologies		**100,00**	**100,00**	**100,00**

Source: SIEA

When the ‘Low CHP scenario’ compared to the baseline scenario is fulfilled, separate heat production will decrease (mainly natural gas consumption, which is replaced by new CHP plants) and the share of heat supply from cogeneration will increase. Based on the results of the cost-benefit analysis in the ‘Low CHP scenario’ compared to the baseline scenario in the reference assessment period 2021-2030, the following changes will occur in economic terms:

- the total cost (OPEX, CAPEX, CO_2 cost, cost of externalities – TL emissions, SO_x, NO_x) compared to the baseline scenario will be EUR 28766662 higher;
- total benefits (fuel cost savings, CO_2 costs, $SO_{x,\ NO\ x}$, ITL, - for non-generated electricity in an electricity generating facility with a condensing steam turbine without heat generation; electricity transmission and distribution costs savings) will be higher by EUR 50858107 compared to the baseline scenario.

From a societal perspective, in the ‘Low CHP scenario’ compared to the baseline scenario, the following will occur: saving EUR 22091446, which, when converted into net present value (NPV), amounts to EUR 11801891, a reduction in CO2 emissions of 67 172 $t_/$ year, primary energy savings of 100.3 GWh/year, without changing the share of renewables in the national energy mix.

The results of the calculation of the ‘low CHP scenario’ are presented in Table 74.

Table 74: Costs and benefits in the 'Low CHP scenario' versus baseline scenario

	Parameter (EUR)		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
COSTS	OPEX	Variable cost component	1 549 653	3 443 775	5 240 009	8 615 497	11 790 408	13 748 134	15 832 551	18 044 858	20 386 256	22 857 944
		Fixed cost component	213 346	472 409	716 233	1 173 404	1 600 096	1 859 159	2 133 461	2 423 002	2 727 782	3 047 801
	Proportion of tax depreciation (CAPEX contribution)		134 927	298 767	452 969	742 098	1 011 952	1 175 791	1 349 269	1 532 384	1 725 137	1 927 527
	Co_2 – purchase of emission permits		41 336	91 529	138 770	227 347	310 019	360 212	413 358	469 457	528 508	590 512
	Externalities (TL, SO_x,NO_x)		24 001	53 146	80 576	132 008	180 011	209 155	240 014	272 588	306 876	342 878
	Total costs		**1 963 263**	**4 359 627**	**6 628 558**	**10 890 354**	**14 892 485**	**17 352 452**	**19 968 653**	**22 742 288**	**25 674 558**	**28 766 662**
BENEFITS	Fuel cost savings for non-generated electricity with CHP technology with condenser steam turbine		1 263 233	2 797 160	4 240 855	6 947 784	9 474 251	11 008 177	12 632 335	14 346 723	16 151 342	18 046 193
	Emission cost savings (SOx, NOx, TL) for non-generated electricity with condensing steam turbine CHP technology		374 052	828 258	1 255 746	2 057 285	2 805 389	3 259 595	3 740 519	4 248 160	4 782 520	5 343 598
	CO2 cost savings for$_{non}$ -generated electricity with CHP technology with condenser steam turbine		940 407	2 498 796	4 104 205	7 241 135	10 579 580	13 111 962	15 986 921	19 224 609	22 845 176	26 868 776
	Savings in transmission and distribution costs, including externalities		41 968	92 929	140 892	230 823	314 759	365 720	419 679	476 635	536 589	599 541
	Total benefits		**2 619 660**	**6 217 143**	**9 741 698**	**16 477 028**	**23 173 980**	**27 745 455**	**32 779 454**	**38 296 128**	**44 315 628**	**50 858 107**
BENEFITS – COSTS			**656 397**	**1 857 516**	**3 113 141**	**5 586 674**	**8 281 495**	**10 393 003**	**12 810 801**	**15 553 839**	**18 641 071**	**22 091 446**
Benefits – CONCLUSIONS (discounted)			**616 509**	**1 638 619**	**2 579 390**	**4 347 547**	**6 053 025**	**7 134 730**	**8 260 104**	**9 419 321**	**10 602 922**	**11 801 891**

Source: SIEA

High CHP application scenario

Compared to the ‘Low CHP scenario’ scenario, it is assumed that the electrical output of new CHP installations is higher.
Assumptions considered in the ‘High CHP application scenario’ scenario in 2030:

- 70.55 MW_e of newly installed very small and small-scale combined heat and power plants with natural gas combustion engines;
- 12.83 MW_e of newly installed very small and small-scale combined heat and power plants with cogeneration technology using RES;
- projected generation from those installations of 450 243 MWh of electricity and 526 018 MWh of heat.

The share of coverage of heat supply in CZT systems according to heat generation technologies and fuel type to the total heat supply in this scenario is presented in Table 75.

Table 75: Share of heat supply to CZT systems by production technology – “High CHP scenario”

Heat generation technology		Heat delivered to CZT systems		
		2019	2025	2030
		%	%	%
Separate heat generation – heaters according to fuels and energy combusted	natural gas	28,69	26,66	21,54
	lignite	0,19	0,00	0,00
	biomass	5,71	6,01	4,47
	geothermal energy	0,32	0,32	0,35
	other fuels	0,52	0,53	0,58
Together,		**35,42**	**33,52**	**26,94**
Combined heat and power – cogeneration technologies according to the fuels burned	natural gas	17,32	30,78	34,51
	lignite	8,50	0,00	0,00
	coal	10,04	4,47	4,35
	biomass	7,73	9,81	1062
	biogas	0,11	0,11	0,22
	solid metal. Waste	0,06	0,06	0,06
	nuclear fuel	2,43	2,48	2,72
	other fuels*	18,40	18,77	20,58
Together,		**64,58**	**66,25**	**72,36**
Total heat technologies		**100,00**	**100,00**	**100,00**

Source: SIEA

If the ‘High CHP scenario’ compared to the baseline scenario is met, there will be a stronger decline in separate heat production and a higher increase in the share of heat supply from cogeneration. The results of the cost-benefit calculation for this scenario are presented in Table 76.

Table 76: Costs and benefits in the "High CHP scenario" versus baseline scenario

Parameter (EUR)			***2021***	***2022***	***2023***	***2024***	***2025***	***2026***	***2027***	***2028***	***2029***	***2030***
COSTS	OPEX	Variable cost component	1 735 333	3 912 304	6 091 170	9 856 233	13 475 815	15 983 200	18 675 843	21 506 790	24 626 912	27 890 341
		Fixed cost component	351 883	749 482	1 214 964	1 893 793	2 569 851	3 133 694	3 740 484	4 362 512	5 082 902	5 818 530
	Proportion of tax depreciation (CAPEX contribution)		281 160	462 523	644 761	961 927	1 263 322	1 465 713	1 681 245	1 906 415	2 151 737	2 406 696
	Co_2 – purchase of emission permits		46 704	102 266	158 096	255 262	347 597	409 600	475 630	544 613	619 769	697 877
	Externalities (TL, SO_x,NO_x)		27 119	59 380	91 798	148 217	201 830	237 832	276 172	316 227	359 866	405 219
	Total costs		**2 442 198**	**5 285 954**	**8 200 789**	**13 115 432**	**17 858 415**	**21 230 040**	**24 849 375**	**28 636 557**	**32 841 185**	**37 218 663**
BENEFITS	Fuel cost savings for non-generated electricity with CHP technology with condenser steam turbine		1 427 290	3 125 272	4 831 458	7 800 877	10 622 645	12 517 495	14 535 388	16 643 511	18 940 299	21 327 318
	Emission cost savings (SOx, NOx, TL) for non-generated electricity with condensing steam turbine CHP technology		422 630	925 414	1 430 627	2 309 892	3 145 436	3 706 514	4 304 025	4 928 255	5 608 349	6 315 161
	CO2 cost savings for$_{non}$ -generated electricity with CHP technology with condenser steam turbine		1 062 538	2 791 910	4 675 778	8 130 247	11 861 954	14 909 728	18 395 341	22 302 305	26 790 001	31 754 007
	Savings in transmission and distribution costs, including externalities		47 418	103 830	160 514	259 165	352 912	415 864	482 903	552 941	629 246	708 549
	Total benefits		**2 959 876**	**6 946 426**	**11 098 376**	**18 500 181**	**25 982 947**	**31 549 601**	**37 717 657**	**44 427 011**	**51 967 895**	**60 105 036**
BENEFITS – COSTS			**517 678**	**1 660 472**	**2 897 587**	**5 384 749**	**8 124 531**	**10 319 561**	**12 868 282**	**15 790 454**	**19 126 710**	**22 886 373**
Benefits – CONCLUSIONS (discounted)			**486 220**	**1 464 796**	**2 400 793**	**4 190 409**	**5 938 299**	**7 084 312**	**8 297 167**	**9 562 613**	**10 879 151**	**12 226 564**

Source: SIEA

Based on the results of the cost-benefit analysis in the 'High CHP application scenario' scenario compared to the baseline scenario in the reference assessment period 2021-2030, the following changes will occur in economic terms:

- the total cost (OPEX, CAPEX, CO_2 cost, cost of externalities – TL emissions, SO_x, NO_x) compared to the baseline scenario will be EUR 37218663 higher;
- total benefits (fuel cost savings, CO_2 costs, $SO_{x,\ NO\ x}$, ITL, - for non-generated electricity in an electricity generating facility with a condensing steam turbine without heat generation; electricity transmission and distribution costs savings) will be higher by EUR 60105036 compared to the baseline scenario;

From a societal perspective, in the 'High CHP application scenario' compared to the baseline scenario, the following will occur:

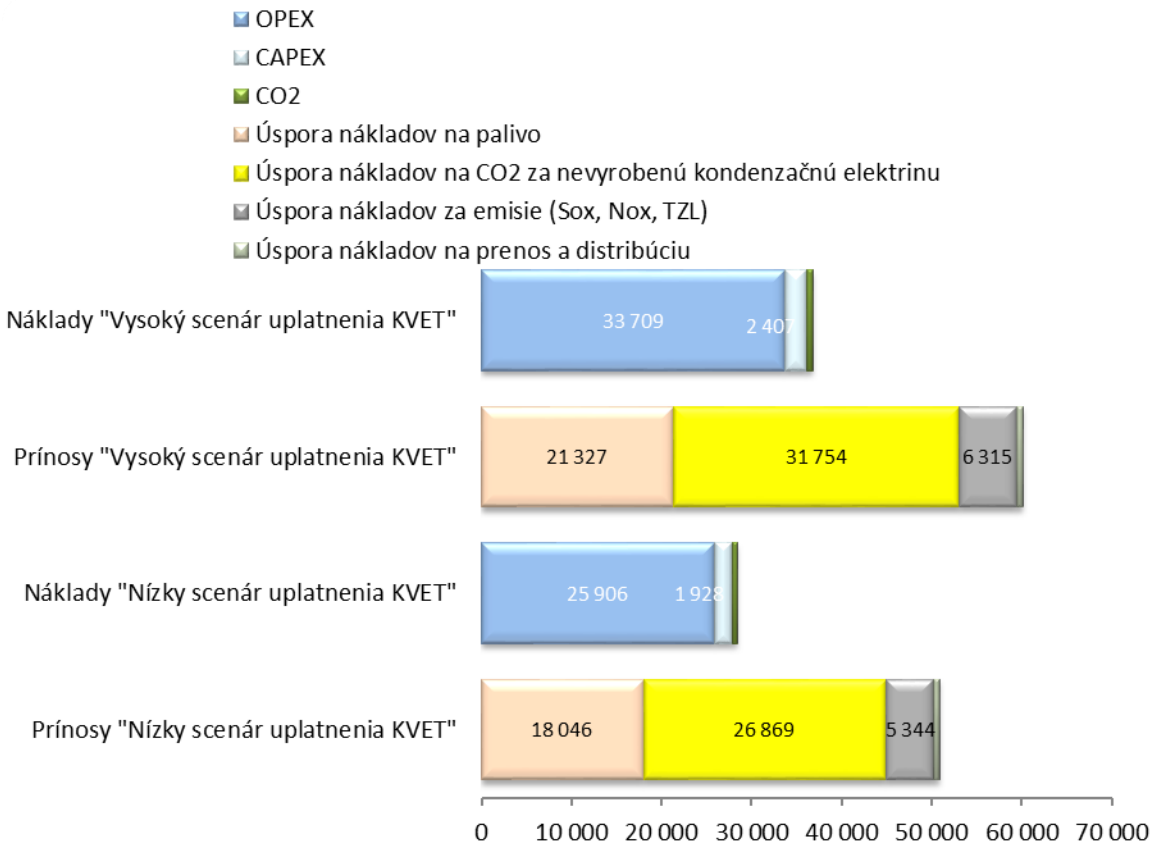
- a saving of EUR 22886373, which, when converted into net present value (NPV), amounts to EUR 12226564;
- reducing CO2 emissions$_{by}$ 79385 t/year;
- primary energy savings of 118.5 GWh/year;

the implementation of the above scenario will increase RES consumption in electricity and heat generation by 185 GWh/year, but will have a minimal impact on the share of renewables in the national energy mix itself.

Comparison of the scenarios formulated on the basis of a cost-benefit analysis

Compared to the baseline scenario in the alternative scenarios 'Low CHP Scenario' and 'High CHP Application Scenario' in ensuring heat demand from newly built CHP plants, the benefits outweigh the unavoidable costs over the reference period under assessment (2021-2030), as shown in Graph 23.
The predominance of benefits over costs in both alternative scenarios is mainly due to cost savings for non-generated electricity in a condensing steam turbine without heat generation with a primary energy source fossil fuels. That non-generated electricity will be replaced by the production of electricity from high-efficiency cogeneration, increasing savings through fuel cost savings and CO2 cost$_{savings}$. These savings are not for the benefit of operators and investors of high-efficiency CHP installations, but must be seen from a society-wide perspective.
The benefit of society as a whole is more beneficial if the 'Low CHP scenario' scenario is implemented. In the 'High CHP scenario' scenario, the absolute benefit is lower. This is mainly due to higher fixed operating costs and higher investments in new combined heat and power plants using RES, which, in addition to a stand-alone installation, are linked to higher infrastructure costs.

Figure 45: Total costs and benefits (in EUR) of alternative scenarios versus baseline



Source: SIEA

Sensitivity analysis

The decisive factors influencing the chosen cost-benefit analysis model are the evolution of the price of natural gas, which accounts for a significant share of the costs in both alternative CHP development scenarios, and the price of lignite, which has an impact on the level of benefits from a societal perspective. The price of the CO2 permit also has a significant factor for the results of the CBA. The analysis considered price escalation ranging from EUR 20/tonne in 2021 to up to EUR 50/tonne by 2030. By increasing the price of permits compared to assumptions, there will be an increase in the benefits in both alternative scenarios.

Summary of cost-benefit analysis for CHP and CZT

When processing the cost-benefit analysis of the additional use of high-efficiency cogeneration, it is considered that the greatest use of the economic potential of high-efficiency cogeneration will occur in existing heat sources in separate heat production CZT systems in which natural gas is combusted by the installation of very small and small-scale combined heat and power plants with natural gas combustion engines.
To compare the different scenarios in the CBA reference period, the same decrease in the amount of heat supply in the CZT systems is considered. Compared to costs and benefits, it is assumed that increasing the capacity of installed CHP plants will reduce the amount of condensing electricity produced without the supply of useful heat and also reduce the supply of heat from separate heat production. In the different scenarios, the benefits from a societal perspective are considered saved

fuel costs and externalities compared to separate electricity and heat generation. For the processing of the CBA, a methodology has been applied in accordance with the requirements of Part 1 of Annex IX to Directive 2012/27/EU

The analysed analysis showed that the discounted cumulative benefits are higher than the costs in both alternative scenarios for the retrofitting of CHP installations, compared to the baseline scenario where the installation of CHP plants is not envisaged. The societal benefit is highest if the “Low CHP scenario” scenario is implemented. EUR 22091446 will be saved from the baseline scenario, which amounts to EUR 11801891 when converted to a net present value. The scenario assumes that new CHP plants with natural gas combustion engines with a total capacity of 70.55 MWe will be installed by 2030, with an assumed production of 380 975 MWh of electricity and 445 092 MWh of heat. The decisive factors affecting the CBA are the price of fuels and the price of emission permits. The CBA’s analysis from a whole-of-society perspective demonstrated the need to continue to create the conditions for the development of high-efficiency cogeneration in Slovakia.

III. *Projections that take into account existing energy efficiency policies, measures and programmes as described in point 1.2(ii), primary and final energy consumption in each sector at least until 2040 (including projections for 2030)82*

Figure 46: Projection of KES development in households up to 2040 (WEM)

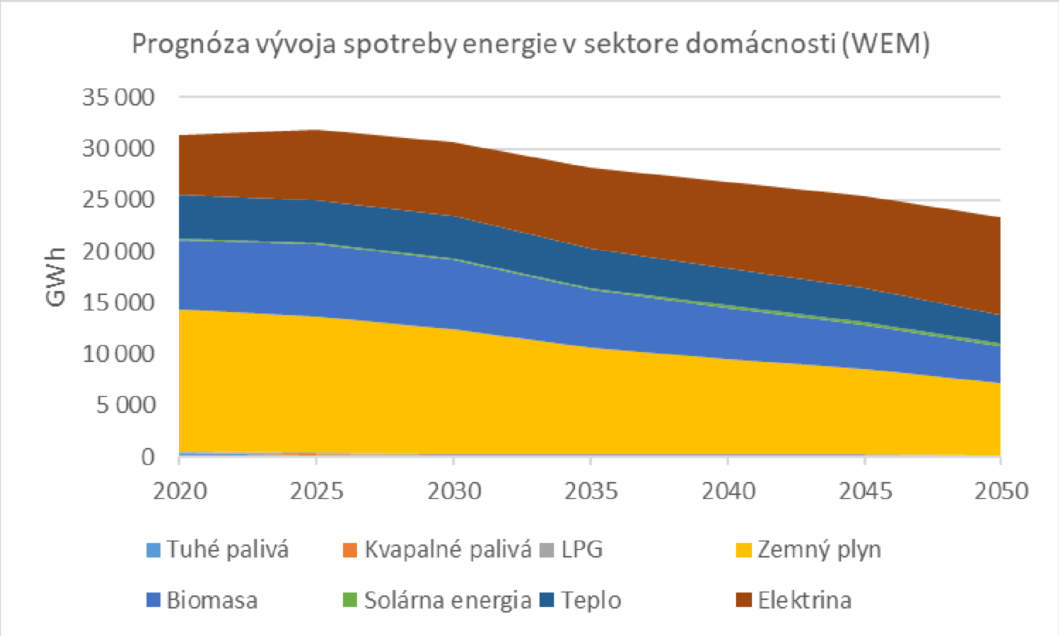


Figure 47:Progress of KES evolution in industry by 2040 (WEM)

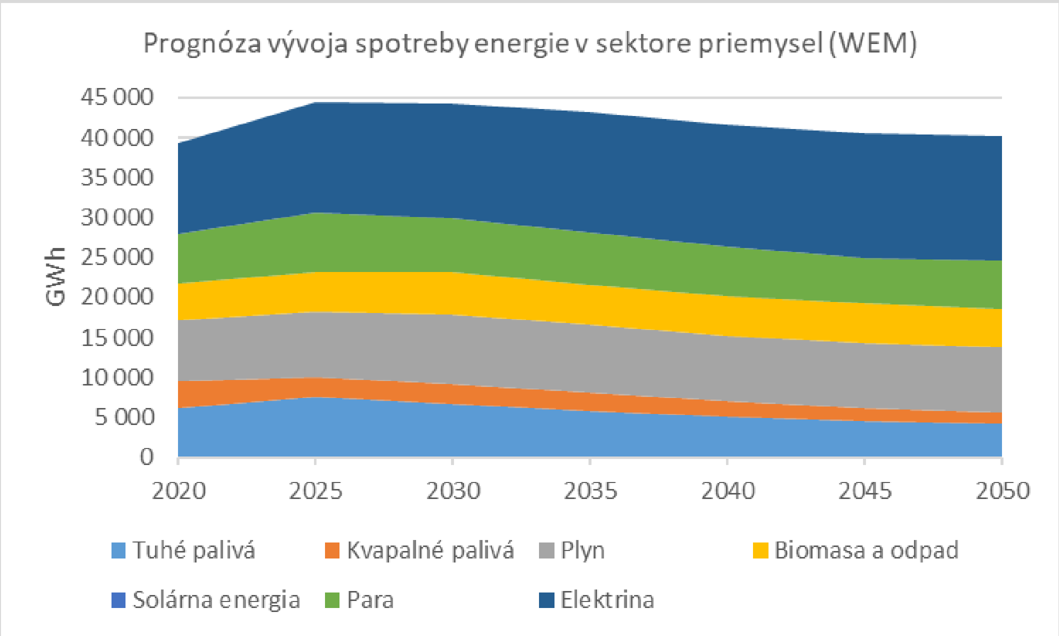


Figure 48: Projection of the evolution of KES in transport up to 2040 (WEM)

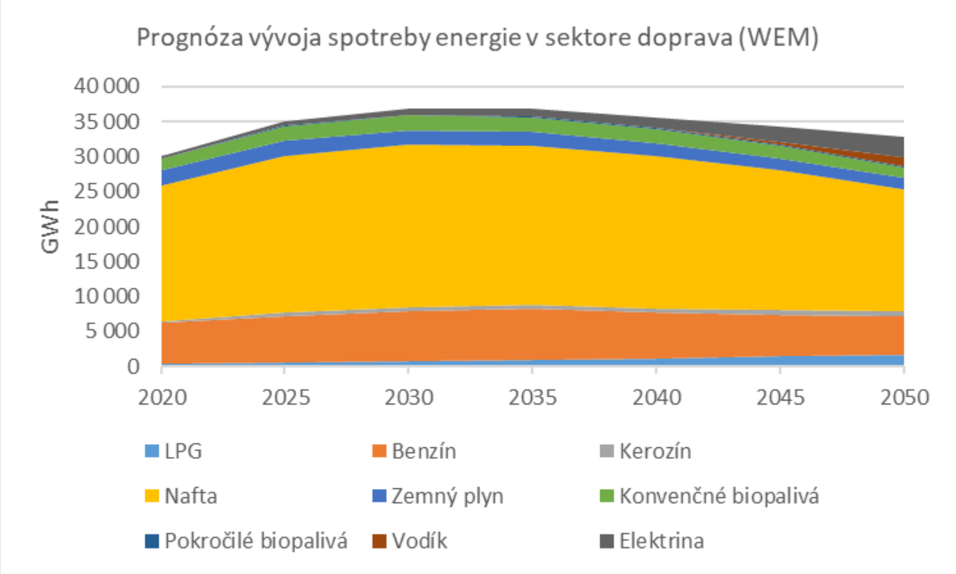
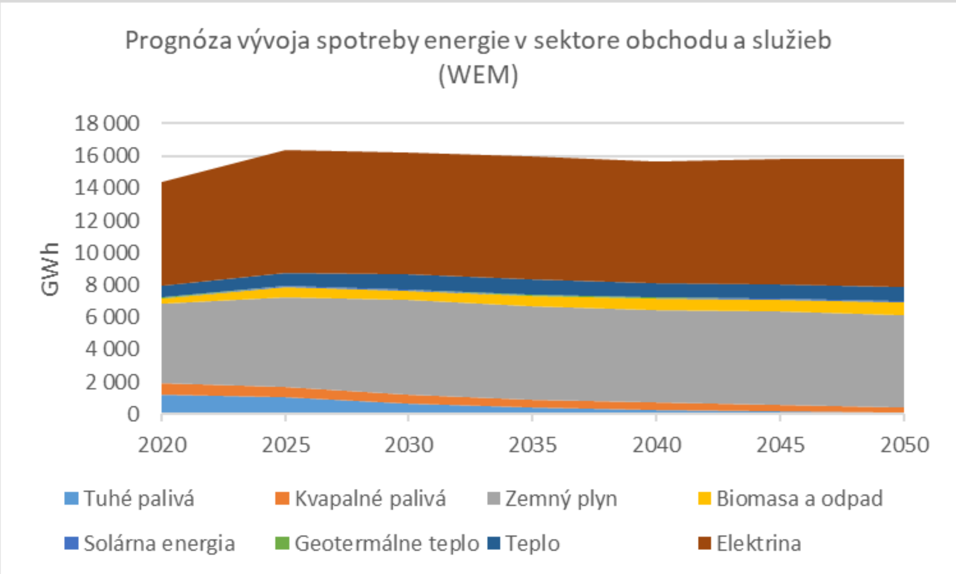


Figure 49: Projection of the evolution of KES in trade and services up to 2040 (WEM)



Source: CPS Energy Model – E3Modelling

Projected evolution of energy consumption in Slovakia up to 2050 versus 2020 consumption (WEM)

	2025	2030	2035	2040	2045	2050
Industry	2 %	2 %	−1 %	−5 %	−7 %	−8 %
Households	4 %	1 %	−8 %	−12 %	−17 %	−24 %
Trade and services	6 %	5 %	3 %	1 %	2 %	2 %
Transport	6 %	12 %	12 %	8 %	4 %	−1 %
Total	4 %	5 %	1 %	−2 %	−5 %	−8 %

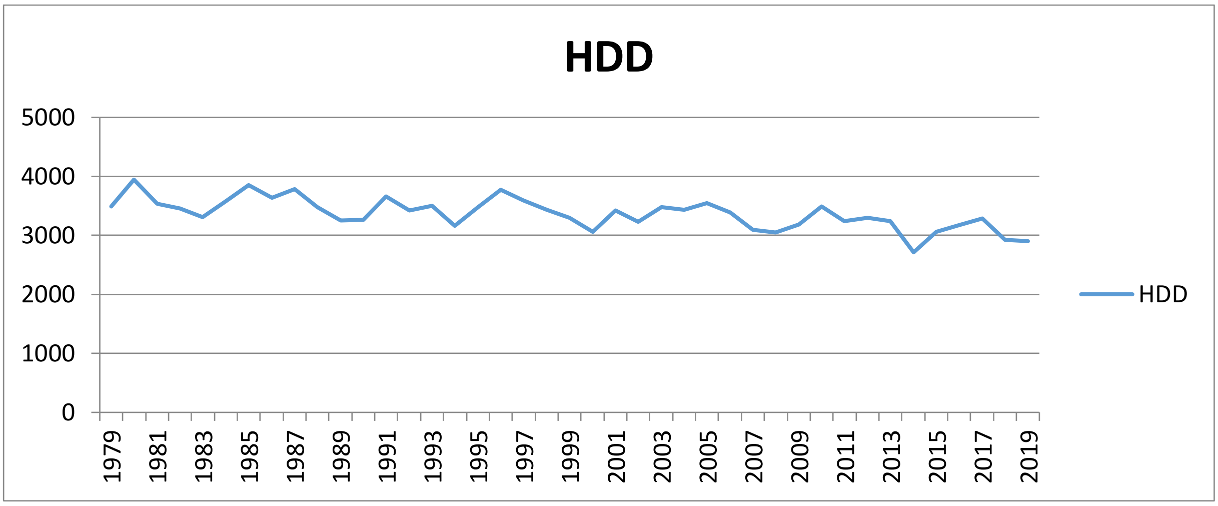
Source: CPS Energy Model – E3Modelling

82 This reference 'business as usual' projection for 2030 as described in point 2.3 and for the conversion factors.

Projected evolution of heat consumption

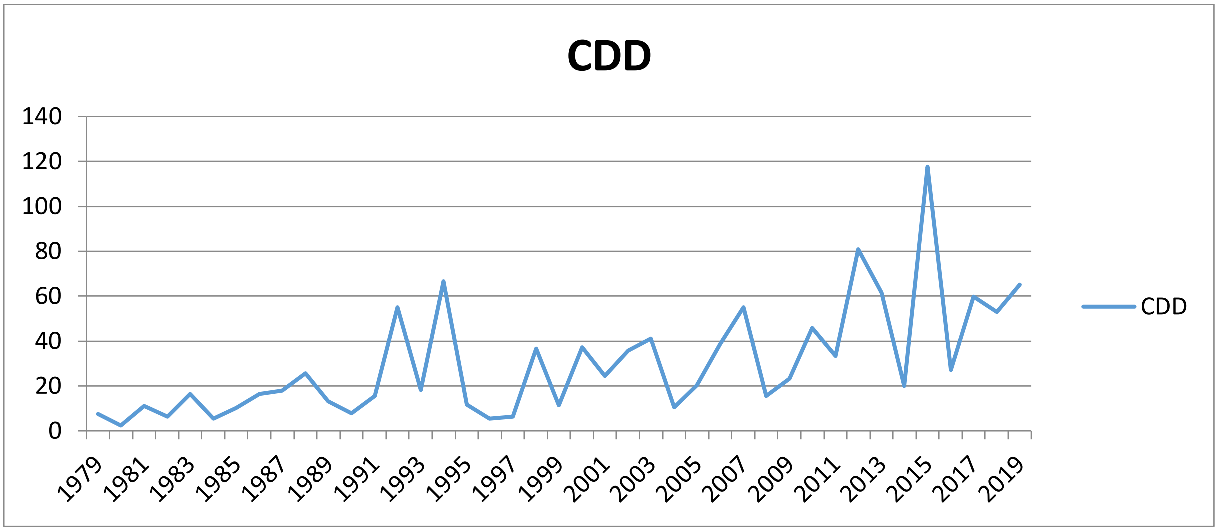
The set trend of decreasing heat consumption is expected to continue, mainly due to the planning and implementation of rationalisation measures for energy efficiency in different sectors of final heat consumption and modernisation and efficiency gains of existing heating systems. Energy efficiency measures in buildings have the greatest impact on heat consumption assumptions. From the point of view of heat sources and fuels for heat production, the transition is being made to alternative and low-carbon fuels with high support for renewable energy sources. It is also important to analyse the impacts of various policies aimed at reducing the consumption of heat and cold in society.
The climate neutrality commitment should keep but also moderately accelerate the process of reducing heat demand, in particular in public, service and residential buildings. In the industrial sector, further measures are also foreseen to reduce the need for heat, but also the possibility of using the heat produced by the industry in order to be located in heating or cooling. Climate conditions in the heating season have a significant impact on heat consumption for heating and cooling. In 2014, the worst weather conditions were in winter, which was also reflected in the absolutely lowest heat production in the years under review. The long-term trend in climate conditions is a slight decline in daily degrees (for heating needs). However, day-grade cold shows the opposite trend, with a slight increase in daily cold over the last ten years, which is mainly reflected in 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.

Graph 50: Long-term developments in the daily stages since 1979



Source: Eurostat

Figure 51: Long-term developments in daily cold since *1979*



Source: Eurostat

The following tables and graphs summarise the trend in heating demand in Slovakia for the next 10 years to 30 years.

Table 77: Forecast of the trend in heating demand in Slovakia for the period 2020-2030

Heating demand forecast (GWh)	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Individual heating – household sector	16 128	16 128	16 128	15 908	15 688	15 468	15 248	15 028	14 808	14 588	14 368
Individual heating – trade and services sector	4 460	4 460	4 460	4 385	4 310	4 235	4 160	4 085	4 010	3 935	3 859
CZT – Trade and Services sector	4 305	4 305	4 305	4 232	4 160	4 087	4 015	3 942	3 870	3 797	3 725
CZT – household sector	4 418	4 418	4 418	4 395	4 373	4 350	4 328	4 305	4 283	4 260	4 238
Together,	29 311	29 311	29 311	28 921	28 531	28 141	27 751	27 361	26 970	26 580	26 190

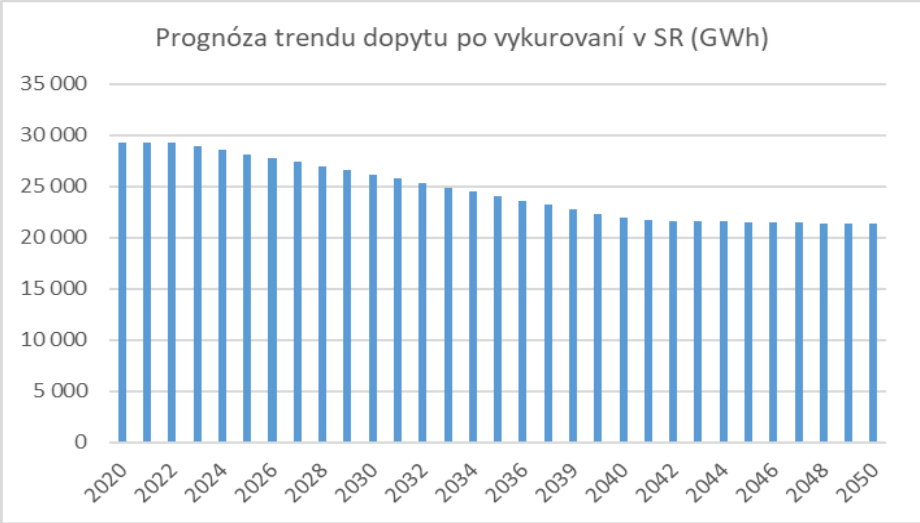
Source: SIEA

Table 78: Forecast of the trend in heating demand in Slovakia for the period 2020-2050

Heating demand forecast (GWh)	2020	2025	2030	2035	2040	2045	2050
Individual heating – household sector	16 128	15 468	14 368	13 157	11 945	11 830	11 718
Individual heating – trade and services sector	4 460	4 235	3 859	3 462	3 064	2 966	2 944
CZT – Trade and Services sector	4 305	4 087	3 725	3 341	2 957	2 863	2 841
CZT – household sector	4 418	4 350	4 238	4 082	3 927	3 862	3 820
Together,	29 311	28 141	26 190	24 041	21 893	21 522	21 323

Source: SIEA

Figure 52: Forecast trend in heating demand in Slovakia



Source: SIEA

On the basis of this forecast, heat consumption for heating in Slovakia is expected to fall by 10.6 % in 2030 and 27.3 % in 2050 compared to the reference heat consumption in 2019.

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

Cost-optimal levels of minimum energy performance requirements for buildings have been set according to the EC comparative methodology framework provided by Commission Delegated Regulation (EU) No 244/2012 of 16 January 2012 supplementing Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings by establishing a comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements and a guideline accompanying Commission Regulation (EU) No 244/2012. Calculations and comparisons needed to demonstrate that the current minimum energy performance requirements for buildings and building elements in the Member States are not significantly lower than the cost-optimal requirements. The calculated cost-optimal levels were compared with the applicable minimum energy performance requirements for buildings. The results of the comparison for the Slovak Republic have shown that the tightening of requirements after 2015 is justified.

11 reference buildings were proposed by selecting according to designated features (building category, construction period, size, availability of project documentation) using a database of residential and non-residential buildings based on statistical analysis methods. In addition to the obligation to design 2 reference buildings of the existing stock and 1 reference new building to represent the categories of multi-apartment buildings, single-family houses and office buildings, 1 reference building representing school buildings and 1 reference building representing the sports building was proposed.

The package of measures applied measures complying with the established requirements in force for the level of low-energy construction, ultra-low energy construction and nearly zero-energy buildings according to STN 73 0540-2+Z1+Z2 of 2019. All packages, including those with the optimal characteristics of the building structures considered, were used to determine primary energy, life-cycle costs, including net present value.

5 to 12 packages/variants of measures were used for each reference building. Separate sets of measures pertain to a reference case characterised by the original condition for existing buildings and to the valid requirements applicable to new buildings. Variants of the solution have been proposed for

the different levels of thermal protection of building structures (e.g. 12 variant for thermal protection of a envelope with a considered different thickness of thermal insulation with a thickness of 40 mm to 240 mm in additional thermal protection by a thermal insulation system). The value of the heat transfer coefficient reflected the original quality of the vertical envelope, roof covering and internal partition structures between heated and unheated spaces. For the different variations in the thermal characteristics of hole structures, a selection was made of products characterised by a heat transfer factor of the frame and glazing (Uf, *U glue,* U_w in W/(m^2.K)), solar energy permeability *g* (−) and a linear loss coefficient of the glazing distance frame. Options for heat production (7 variants, e.g. CZT for natural gas, wood chips, combined heat and power generation, gas condensing boiler, wood pellet boiler, air-to-water heat pump, ground-to-air heat pump), variants for hot water production and cooling were also considered. For lighting, a cost-optimal analysis of the measures was carried out separately as compared to energy demands. The option chosen was applied in all the packages of proposed measures when establishing the net value.

The results of the calculations show that global costs vary from a macroeconomic and financial perspective, but the location of optima does not change this. The national benchmark considered for Slovakia to compare the calculated cost-optimal levels with the current minimum energy performance requirements is the level in financial terms (microeconomic), i.e. including VAT and without considering $CO2_{costs}$.

Pursuant to Article 4(1) of Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast), minimum energy performance requirements are reviewed at regular intervals, which should not exceed five years.

The results of the 2013 calculation of cost-optimal levels of minimum energy performance requirements for buildings have been compared with the established requirements (as recommended) from 1 January 2016 for ultra-low energy construction levels. The 2019 amendment to standard STN 73 0540-2+Z1+Z2 introduced standardised requirements for ultra-low energy construction with effect from 1 July 2019, which correspond to the results of the calculation of cost-optimal levels of minimum energy performance requirements for buildings.

The process of calculating the cost-optimal levels of minimum energy performance requirements in 2018 respected the procedures used and the results of the calculations of the 2013 cost-optimal level of minimum requirements introduced in the applicable legislation. This means that the basic level of assessment is the applicable ultra-low energy construction requirements.

Both the calculation of minimum energy performance requirements for buildings and the second phase of the assessment concerned the calculation of the cost-optimal level of minimum energy performance requirements for nearly zero-energy buildings. For the second phase of assessing the cost-optimality of minimum energy performance requirements, information on reference buildings of categories was used: multi-apartment buildings, single-family houses and office buildings.

Given the introduced clarifications and adjustments to the input conditions of the calculations (e.g. taking into account the impact of thermal bridges, heat recovery, change in primary energy factors) and taking into account the supply of new construction products and changes in the performance of construction products, a new assessment of reference buildings at ultra-low energy level of construction also needed to be processed.

The 2018 material is available at:

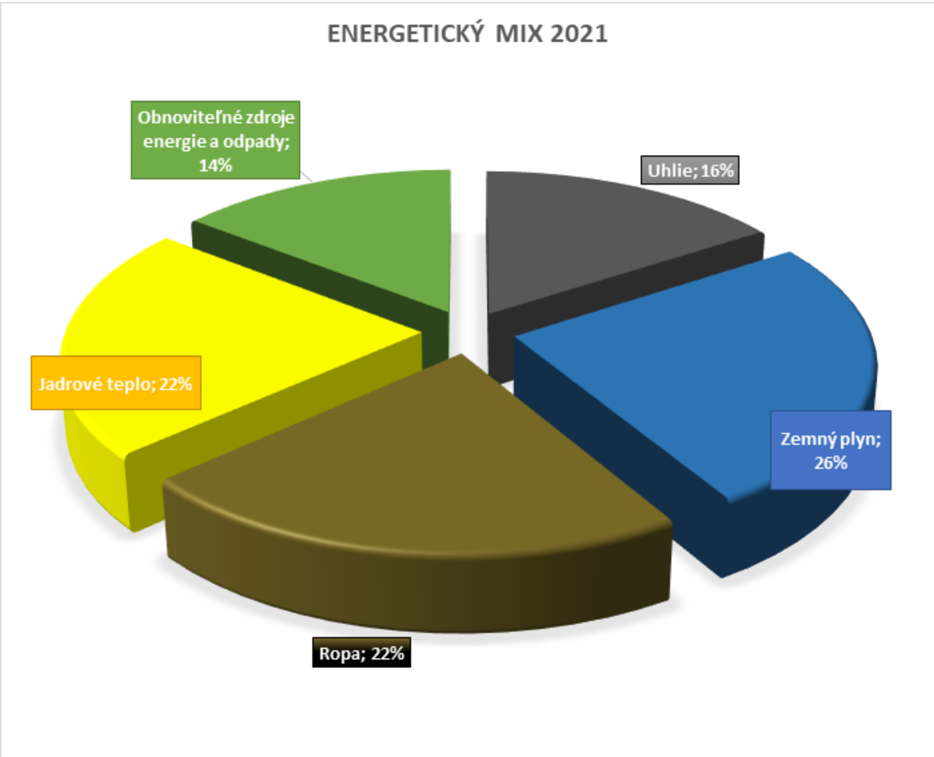
https://ec.europa.eu/energy/en/content/eu-countries-2018-cost-optimal-reports

4.4. Dimension: energy security

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

The main indigenous energy sources are renewable energy sources and lignite. After 2023, when support for electricity production from indigenous coal ceases, we expect a significant decrease in lignite mining. The decarbonisation of Slovakia's economy will also entail additional costs, so its implementation will require sensitive and gradual replacement of high emission sources with low emission sources that are available and low-cost. Renewables are one of the decarbonisation tools and therefore other low-emission energy sources will have their place in the energy mix.

Figure 53 SR energy mix 2021



The Slovak Republic is dependent on imports of primary energy sources for almost 90 %: nuclear fuel 100 %, natural gas 98 %, oil 99 % and coal 68 %.

<u>Oil</u>

Oil deliveries to and transit through Slovakia are relatively reliable and relatively smooth 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 by the European Parliament and the Council. The supply of crude oil 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 crude 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 from the level of the European Parliament and the Council, due to the ongoing war on Ukraine's territory, it will be necessary to adapt the existing oil transport logistics to future oil supply opportunities in line with the requirements of end-customers and to pave the way for possible changes in the storage of emergency oil stocks, including their replacements. Of the above, Transpetrol a.s. is preparing the construction of new large-scale oil storage facilities at the Tupá and Bučany pumping stations. These storage facilities 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 Russian export blends.

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 higher. The Slovak Republic implemented it by Act No 218/2013 on emergency stocks of oil and petroleum products and on dealing with an 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 Emergency Oil and Petroleum Products Agency, which was established on 13 September 2013, which are currently maintained at 100.8 days of average daily net imports. The total emergency stocks amount to approximately 883 thousand tonnes (63 % in the form of crude oil, 37 % in the form of petroleum products by category).

The Agency owns emergency stocks of crude oil and petroleum products, ensures their procurement, maintenance and alteration, and is responsible for the protection of the State in this segment as required by Council Directive 2009/119/EC. Emergency stocks must be ready to be readily removed to deal with emergencies at all times.

The minimum limit for emergency stocks for the calendar year in question is determined by the Administration of State Material Reserves of the Slovak Republic (SŠHR SR) on the basis of data collected in the context of the national statistical survey. Emergency oil stocks are held in Slovakia. The management of national material reserves cooperates with the European Union and the International Energy Agency to prevent and manage oil emergencies.

In the area of security of supply of crude oil and petroleum products, the Commission for Oil Safety (NESO), which is an advisory body to the President of the SSG SR, is responsible. In its activities, the Commission shall act 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 relevant government bodies, as well as the Agency for Emergency Oil and Petroleum Products.

The European Commission (EC), in coordination with Member States, may assess the emergency preparedness of individual EU Member States and, if the EC deems it appropriate, verify the level of emergency stocks. In preparing such assessments, the EC takes into account the work carried out by other institutions and international organisations and consults the Oil Coordination Group, which has been set up to prevent crisis situations. In the event of a serious supply disruption, an extraordinary meeting of this Working Party may be convened within a short period of time, or it may take the form of consultations – electronically.

Electricity

Balance of electricity production and consumption

In terms of electricity balance, Slovakia has been an import country since 2015. When launched, Mochoviec 3,4 becomes a net exporter of electricity. The main reason was the evolution of the electricity price on the market, which is below the production costs of some types of generation technologies.

In 2021, the total electricity consumption in the Slovak Republic amounted to 30 867 GWh. Domestic sources produced 30 093 GWh and thus the volume of imports amounted to 774 GWh in 2021 (2.5 % share of Slovak consumption). The main reason for this 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 79 Production, consumption and load from the Slovak Republic from 2015 to 2021

Rok	Výroba [GWh]	Celková spotreba [GWh]	Saldo* [GWh]	Priemerné zaťaženie ** [MW]	Maximálne zaťaženie [MW]
2015	27 191	29 548	-2 357	3 377	4 146
2016	27 451	30 103	-2 651	3 427	4 382
2017	28 027	31 056	-3 030	3 545	4 550
2018	27 149	30 947	-3 797	3 533	4 506
2019	28 610	30 309	-1 700	3 460	4 571
2020	29 010	29 328	-318	3 339	4 485
2021	30 093	30 867	-774	3 524	4 448

* Kladná/záporná hodnota salda znamená export/import.

** Celková spotreba podelená počtom hodín v príslušnom roku

The maximum network load in 2021 was recorded on 9 December at 12:00 at 4 448 MW, a decrease of 37 MW from the previous year. The minimum load (14 June at 3:00) reached 2 205 MW.

Source base for electricity production in the Slovak Republic

The installed capacity of electricity production facilities in the Slovak Republic reached 7 778 MW in 2021. At present, the transmission system operator is registering an interest in the construction of a new nuclear resource at the Jaslovské Bohunice site and, in particular, projects using RES technologies.

Figure 54 Structure of installed capacity in the EU SR in 2021

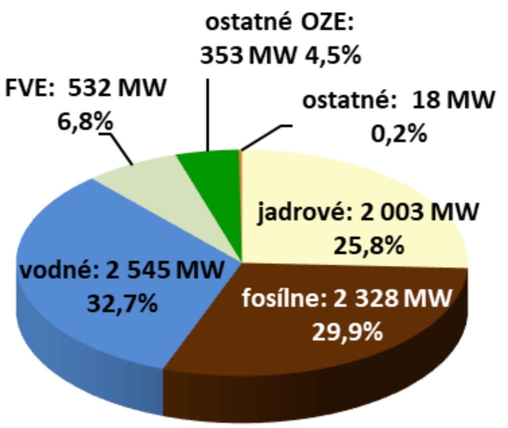
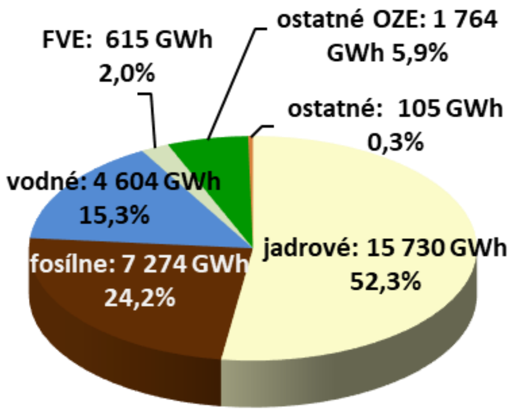


Figure 55 Structure of electricity production in the EU SR in 2021



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 plants were put into operation in 1998 and 2000 respectively. The technical adaptations have increased their power from the original value of 2 x 470 MW to the current 2 x 501,44 MWe.

The Bohunice V2 units were commissioned in 1984 and 1985. By means of technical adjustments, the power was gradually increased to 500 MWe. In addition to electricity generation, Bohunice AE supplies the heat of Trnava, Leopoldov, Hlohovec and the municipality of Jaslovské Bohunice. The planned operational duration of existing nuclear power plants is currently at least 60 years. The safety of nuclear units is checked at regular intervals every 10 years and results in a report submitted by the operator (the permit holder) to the Nuclear Regulatory Authority of the Slovak Republic.

The 3 rd Mochovce Power Plant with an installed capacity of 470 MW is currently in the final stage of completion. With 14 months apart, the launch of Unit 4 is planned and Slovakia will have 6 nuclear units in operation with a total installed capacity of 2 944.88 MW.

Given the strategic role of nuclear energy in Slovakia's energy mix, a key aspect is to ensure the long-term operation of existing nuclear resources, while increasing their efficiency for the future as far as possible.

Fossil fuel power plants

Electricity generation from coal has been declining for a long time. In 2013, the EVO 2 plant with an installed capacity of 4x110 MW was decommissioned, units 1 and 2 of the Vojany 1 plant 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 the conditions for emission limit values. In 2016, 2 additional units of the Vojany power plant and one of the Nováky power plants were decommissioned. A total of 1 210 MW of power was discarded.

Of the coal-fired power plants, 2 units of the Nováky power plant and 2 units of the Vojany power plant are currently in operation. The Nováky power plant, with an annual gross electricity production of approximately 870-1 100 GWh (in 2021-923 GWh), consists of an ENO A unit of 46 MWe providing heat supply to the Upper Nitra region and ENO B units of 2x110 MWe. The Vojany EVO 1 plant with a capacity of 2x110 MW and an annual gross electricity generation of approximately 460 GWh (in 2021 – 382 GWh) is deployed operationally based on the evolution of demand and the price of electricity on the market. The total share of these plants in electricity production in Slovakia was 4.4 % in 2021 (ENO – 3.1 %, GPP 1-1.3 %). In line with the Upper Nitra Transformation Action Plan, after its transformation from solid fossil fuels, the Nováky power plant can remain as the primary heat source for the region.

The district heating plants in Bratislava, Košiciach, Žilina, Martin, Zvolen, Martin and Považská Bystrica, in addition to heat production, account for more than 3 % of total electricity production in Slovakia. Another activity is the provision of ancillary services to the electricity system.

The share of Malženica's CCG (430 MWe) in total electricity generation in 2021 was 8.1 % (2.44 TWh). By its parameters, Malženice's PPC is one of the most advanced sources of electricity of this kind, particularly in terms of power ranges. PPC Bratislava (218 MWe) currently only provides ancillary services for the system.

<u>Renewable electricity sources</u>

Of the total installed hydropower output of 2542 MWe, 1626 MWe in flow-through power plants and 916 MWe are in pumped storage plants. The largest hydroelectric power plant is Gabčíkovo VE with an installed capacity of 720 MWe. Its production in 2021 was 1 946 GWh, representing more than 40 % of total hydroelectric power production in Slovakia.

PV power plants experienced the biggest development between 2011 and 2013, when 530 MWe of installed capacity was commissioned. Following the introduction of the new 2×400 kV Veľký Ďur – Gabčíkovo – Gönyű and 1×400 kV Rimavská Sobota-Sajóivánka on the Slovak-Hungarian cross-border profile, the bottleneck in the PS SR was removed from the point of view of system permeability. This allowed the allocation of capacity for the installed capacity increase for FVEs and VTEs.

There are currently 5 wind turbines in operation in Slovakia with a total installed capacity of 3.1 MW and some 4.7 GWh of electricity production in 2021. Biomass is currently represented in the energy mix with 234 MWe installed capacity, which produced 658 GWh in 2021.

<u>Security and reliability of the operation of the Slovak energy system</u>

The European Association of Transmission System Operators (ENTSO-E) has shown good results in meeting the criteria and recommendations of the European Association of Transmission System Operators (ENTSO-E) and there is a high level of security of electricity supply in Slovakia. At the same time, Slovakia is also meeting all the objectives of the Commission Communication on strengthening energy networks.

At all stages of the preparation of the operation, suitable solutions for the operation of the Slovak Republic are proposed and the necessary space is created for the maintenance, innovation and construction of electricity installations in order to ensure the long-term reliable, safe and efficient operation of the system under economic conditions. To deal with or prevent emergency situations, the PS operator shall have a defence plan to prevent the occurrence of major faults, measures for accidental changes in frequency and voltage, as well as a black-out system restoration plan. Operational security meets the requirements for electricity transmission and is controlled at each stage of operational preparation, namely annual, monthly, weekly and daily. The release of PS facilities from operation shall be carried out in coordination with neighbouring PS operators in all stages of the preparation of the operation.

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

Forecast of the evolution of the resource base until 2030

The evolution of electricity consumption will be influenced by the success of energy efficiency/saving measures and the speed of development of electro-mobility and the achievement of decarbonisation targets by the year.

Sufficient power is projected to be provided by 2030 and no further larger resources are expected to be needed. In thenom scenario, the available capacity from the net installed power of electricity sources is positive by 2030. Once EMOs 3 and 4 are completed, the system will also be sufficient in terms of providing power power in the absence of the largest fossil sources of electricity (PPC Malženice, PPC Bratislava, TE Vojany and TE Nováky). However, in case of non-operation of these fossil resources, there will be a lack of regulatory capacity in the grid, but appropriate solutions need to be found for this scenario.

The total installed capacity of the generating installations in 2030 is projected to be 8 720 MW, of which RES (including installed hydropower) between 3790 and 4 630 MW. The maximum load shall increase in proportion to a growth rate of 1.2 % year-on-year consumption up to 5 250 MW.

The operation of coal-fired power plants is non-perspective in the long term, with the decommissioning of TE Nováky due to take place by 31.12.2023 and Vojany's operation is under consideration by the end of 2027.

Taking into account the size and structure of the electricity transmission system, once TE Vojany is shut down in the east of Slovakia, it will be necessary to build a new thrust that would provide the necessary grid stability and flexibility and the associated security of electricity supply. In the medium term, the development of a new CCG source and, consequently, a carbon-free source in the form of SMRs appears to be a possible solution.

Given the evolution of the gas price in the previous period, the economic nature of the operation of CCG resources remains a question. The high price of gas and the low price of electricity on the market would not make it possible to operate them at a profit, and their future depends on the evolution of fuel prices and emission allowances.

At the same time, gas resources play a very important role in stabilising the transmission system, which will be a growing problem in the growth of unstable RES production across the region.

Building a gas source in Vojany, ideally with "hydrogen ready" technology, would be an appropriate solution for the secure operation of the electricity system in the east of Slovakia, where there will be a lack of a larger rotating source after the shutdown of TE Vojany. One solution for securing such an investment could be the use of a capacity mechanism.

Most biogas plants were put into operation between 2011 and 2013 and after 15 years it expects that their further operation will be possible after upgrading or switching to biomethane production.
The larger new investment in biomethane production is at Enviral Leopoldov with a capacity of approximately 30 million m³/year biomethane (primary for the use of biomethane in transport). In the absence of support, no increase in installed capacity is foreseen in the biogas plant sector.

There is scope for improving the operational possibilities of existing Slovak NPPs, in particular because of their contribution to the integration of RES. In particular, the operational improvements needed for RES integration could be achieved by:

- the definition of Vah as rivers for energy and industrial use;
- relaxing handling codes;
- solving the long-standing problem of sedimentation in water tanks 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 objectives aimed at increasing the regulatory scale and performance of existing installations.

An important element in providing flexibility to the electricity transmission system is the operation of the Black Váh PVE. Montenegro Váh was designed 50 years ago for a different type of operation than will be needed after 2030 for a high share of RES. Given its end of life in 2032, it is desirable to upgrade it to allow its continued operation with significantly improved parameters, following a model of upgrading similar to those built in the 1970s and 1980s. Such modernisation has the potential to efficiently address future needs for flexibility and WG.

Forecast of the evolution of the resource base beyond 2030

After 2030, there will be a loss of financial support for existing PV power plants of around 530 MWe that were connected to the grid between 2010 and 2012, therefore they can be expected to be disconnected or replaced from the system.

The construction of a new nuclear resource at the Jaslovské Bohunice site ('the NJZ project') is in line with the Slovak Republic's approach to decarbonising Slovakia's economy on the basis of the 'low-carbon strategy for 2030 of the Slovak Republic with a 2050 perspective', according to which Slovakia has scope for decarbonising energy, in particular in replacing coal with low-emission sources, in energy efficiency measures and in decarbonising transport, mainly because of the high share of nuclear resources in electricity production.

The main parameter for assessing whether the construction of a source is justified will be the future development of electricity consumption in Slovakia. The construction of a new nuclear source must therefore be made conditional on its adequacy. The projections made in the framework of the project 'Low Carbon Study' confirm the possibility of replacing the participating nuclear resources by the construction of NJZ after 2045. The new nuclear resource will also be assessed in the light of the state-of-the-art existing technology and its competitiveness (technical and economic) over that period.

The main parameter for determining the forecast for the development of the Slovak Republic's resource base until 2040 and 2050 is the assessment of the sufficiency of the Slovak Republic's resource base in the period under consideration, including planned new sources of electricity generation.

In order to meet the EU's and the Slovak Republic's targets for 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 rehabilitation of the nuclear resource base, it is necessary to create the conditions for the successful implementation of the project a new nuclear resource at the Jaslovské Bohunice site (hereinafter referred to as the "NJZ project") with a total installed capacity of 1 200 MW. If the NJZ project were implemented, this would be an important forward-looking project for Slovak energy and would also safeguard the essential security interest of the Slovak Republic.

According to the current implementation schedule of the NJZ project, the expected date of commissioning of the NJZ project is within the 2040 time horizon. A specific deadline can only be specified after the adoption of the Slovak Government's strategic decision on the construction of the NJZ project, which will take into account the objectives and measures to ensure energy security and self-sufficiency in electricity production for the period after 2040.

In the past, certificates of consistency of the investment plan with energy policy have been issued for potential projects under development, including the following new sources:

The Sereď Water Power Plant project aims at exploiting the untapped energy potential of the Váh river in the Sereď-Hlohovec section for electricity generation of around 180 GWh per year. A water works with a lock is part of the Weight Waterway project and its completion will create a fairway from Komárno to Hlohovec. The main obstacle to the realisation of the work is the long-term return on investment.

The Ipeľ pumped hydropower plant project with a proposed installed capacity of 560 MW represents a significant potential in providing a wide range of support services. It is a source with a weekly pumping cycle capable of shifting the weekend "surplus" energy from nuclear power plants to peak loads in working days. It is also an optimal balancing element for wind and photovoltaic power generation. The implementation of the project will depend on the evolution of the international electricity market and the interest of a strategic investor.

New innovative technologies

From the point of view of security of supply and diversification efforts, it is now important for Slovakia to explore new innovative technologies. An advanced reactor producing electricity up to 300 MW is considered a small modular reactor. Small modular reactors have the potential to cover flexible power generation and for a wider range of applications (e.g. power generation, hydrogen, heating). These reactors have advanced design characteristics and can be deployed as one or multi-module 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 subsequently transferred to a predetermined site.

The main advantages of small modular reactors are:

- less intensity for the size of a nuclear site
- use of new technologies and materials
- essential and passive safety features
- modular design
- shorter construction time of a nuclear installation

- potential for a possible shortening of authorisation processes
- cost of construction of such a nuclear installation -presumption

It is important that the Slovak Republic participates in projects tasked with exploring the possibilities and potential of small modular reactor technology in order to maintain energy security and stable electricity supply.

4.5. Dimension: internal Energy Market

4.5.1. Electricity interconnectivity

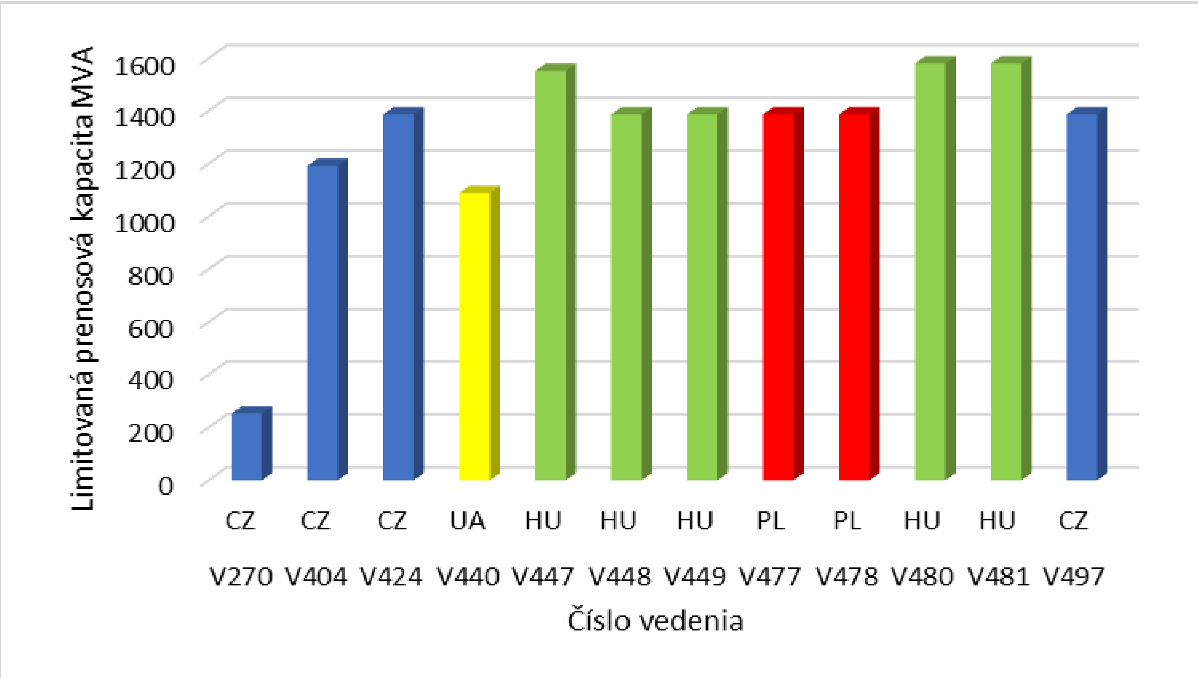
I. Current interconnection level and main interconnectors83

The current level of interconnection of the transmission system, including the main interconnectors, is shown in the table below and the graph documented the current transmission capability of the main interconnectors.

Table 80 Transmission capacities of cross-border lines

Vedenie	Elektrická stanica			Elektrická stanica SK		Napätie kV	Imax A	Limitovaná prenosová kapacita MVA
	krajina	názov	spoločnosť	názov	spoločnosť			
V270	CZ	Lískovec	ČEPS	Pov. Bystrica	SEPS	220	665	253
V404	CZ	Nošovice	ČEPS	Varín	SEPS	400	1720	1192
V424	CZ	Sokolnice	ČEPS	Križovany	SEPS	400	2000	1386
V440	UA	Mukačevo	Ukrenergo	V. Kapušany	SEPS	400	1570	1088
V447	HU	Sajóivánka	MAVIR	R. Sobota	SEPS	400	2240	1552
V448	HU	Győr	MAVIR	Gabčíkovo	SEPS	400	2000	1386
V449	HU	Göd	MAVIR	Levice	SEPS	400	2000	1386
V477	PL	Krosno	PSE	Lemešany	SEPS	400	2000	1386
V478	PL	Krosno	PSE	Lemešany	SEPS	400	2000	1386
V480	HU	Gönyű	MAVIR	V. Ďur	SEPS	400	2280	1580
V481	HU	Gönyű	MAVIR	Gabčíkovo	SEPS	400	2280	1580
V497	CZ	Sokolnice	ČEPS	Stupava	SEPS	400	2000	1386

Figure 56 Transmission capacities of cross-border lines



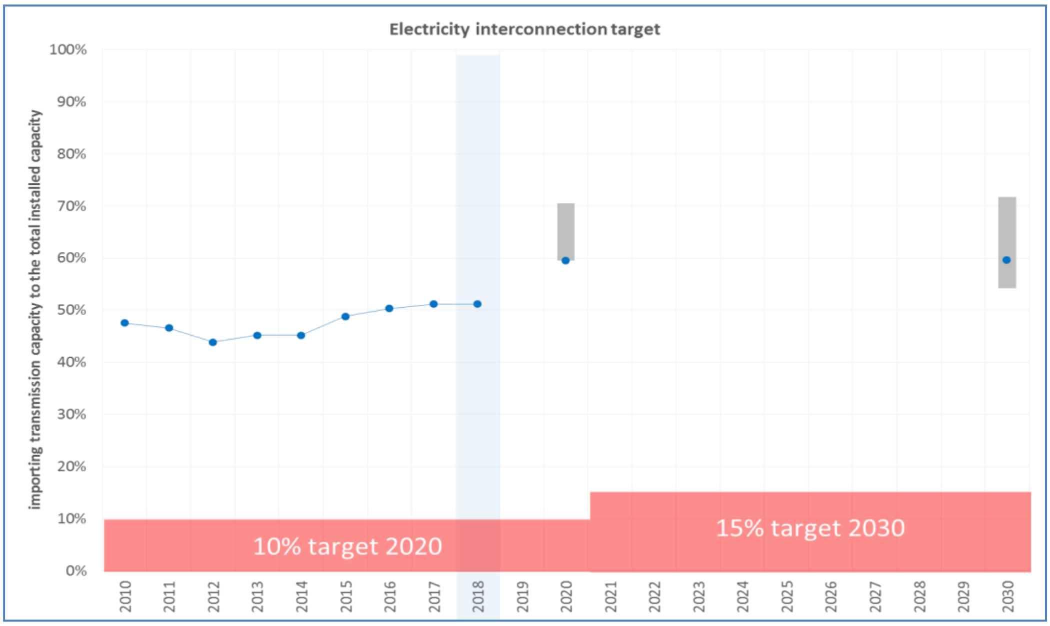
Note: The permissible current capacity of the V440 V. Kapušany-Mukačevo line (UA) is seasonally adjusted. Current capacity of the V440 line is currently allowed at 1980 A (summer period 1570 A).

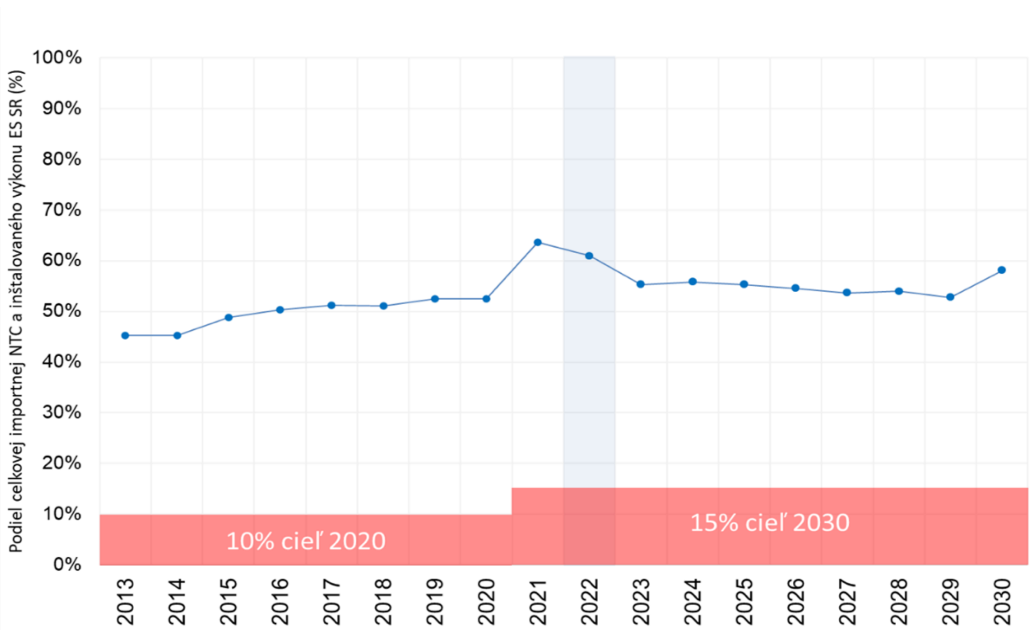
[83] With reference to overviews of existing transmission infrastructure by Transmission System Operators (TSOs).

II. Projections of interconnector expansion requirements (including for the year 2030)84

The evolution of Slovakia's overall level of interconnectivity up to 2030, i.e. the share of the assumed net import transmission capacity to the total expected installed capacity of electricity production facilities in the Slovak Republic, is shown in the graph below.

Figure 57 Objectives of indicative connectivity parameters

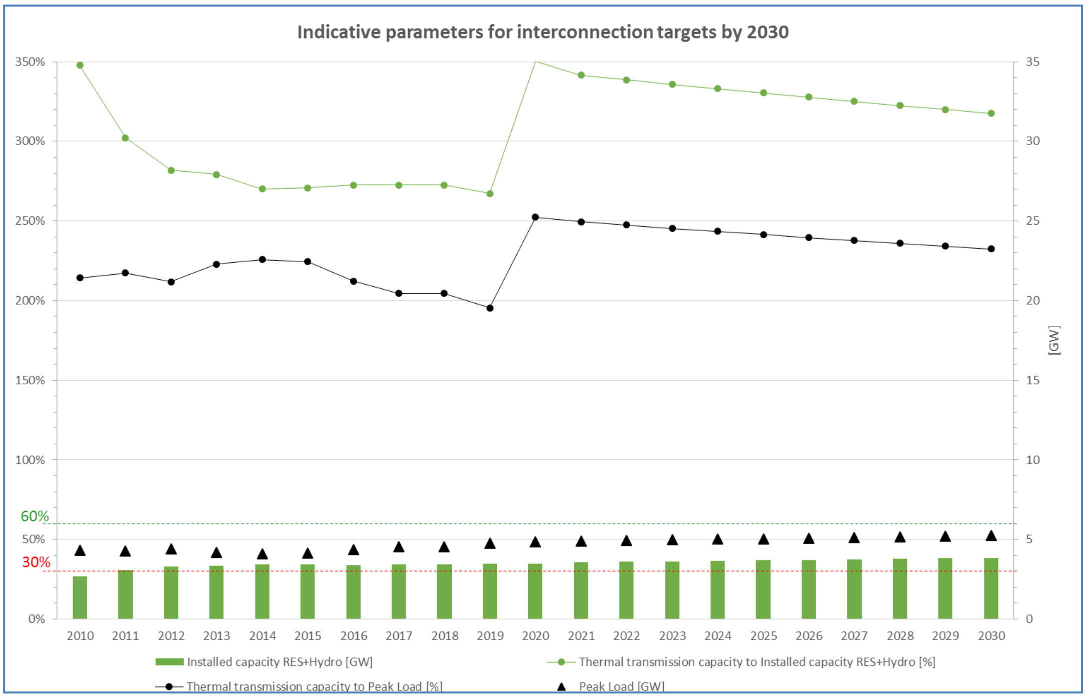


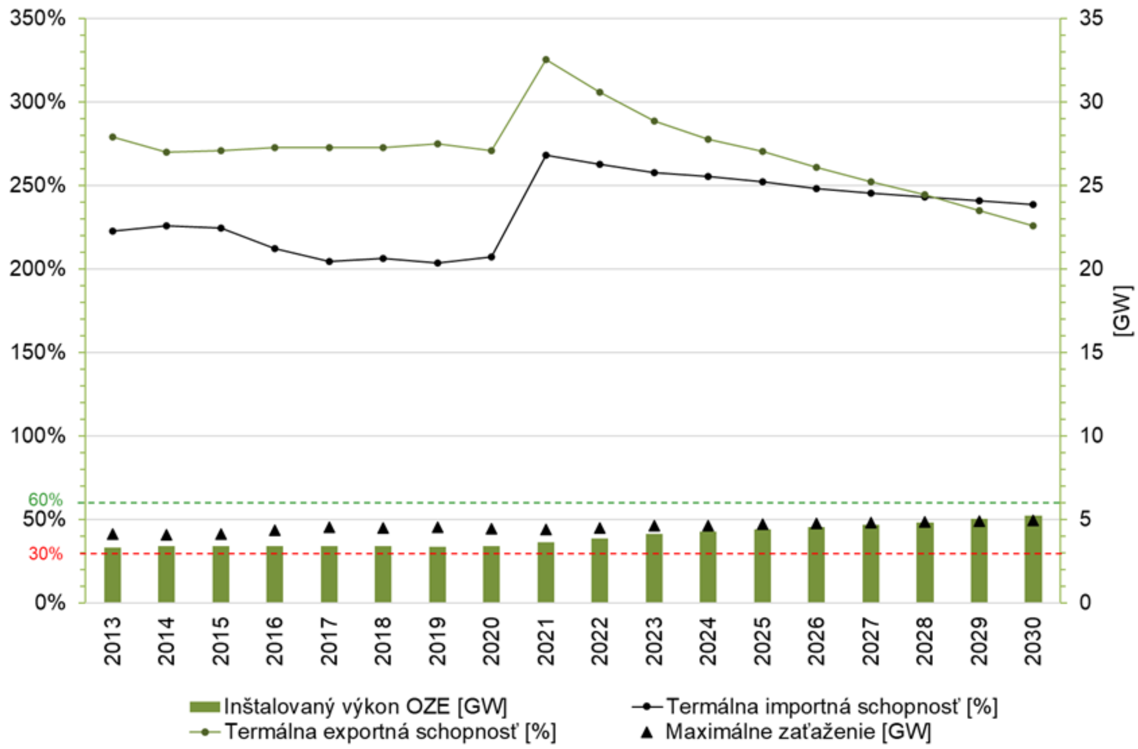


84 With reference to national network development plans and regional investment plans of TSOs

The expected evolution of the indicative interconnection parameters to reach a minimum level of 30 % of the expected maximum load import and 30 % level of exports of installed RES capacity, including hydropower plants, is shown in the graph below.

Figure 58 Estimated evolution of indicative connectivity parameters





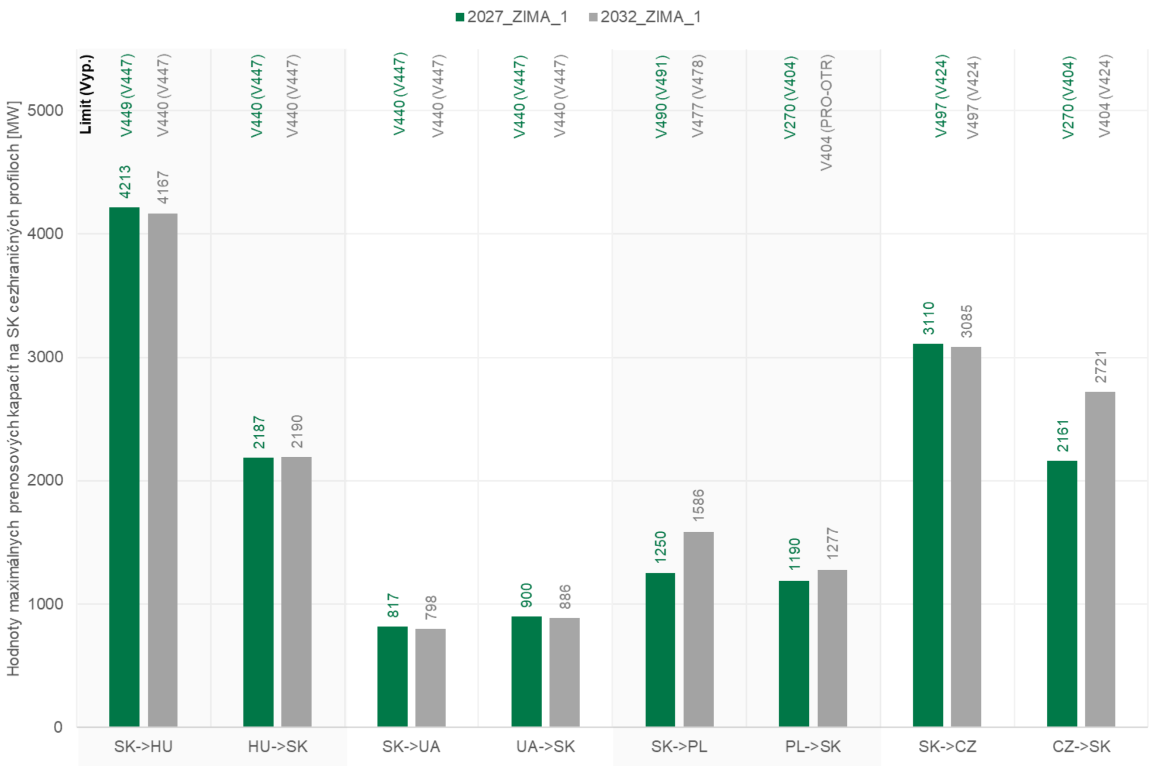
This shows that both the 15 % target for 2030 and the indicative parameters will be met. The price difference between trading zones will depend on the electricity market situation in 2030.

For the development horizons 2027 and 2032, the values of the maximum transmission capacities on the individual cross-border profiles of the PS SR were calculated for the import and export direction of power flows on 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 connection, location and deployment of power generation facilities, and on the maximum permissible current loads of PS lines.

The values of the maximum transmission capacities SK cross-border profiles are calculated for the baseline state of grid connection, deployment of electricity generation facilities and loads of the EC SR considered for each development time horizon (R+ 5 and R+ 10). The values of operational transmission capacities of SK cross-border profiles set for the current state, up to a maximum R+ 1, are also calculated taking into account the current network involvement, the deployment of electricity generation facilities (maintenance of electricity generation facilities and elements of the PS SR) and the load of the EC SR in a given calculated hour. Marketable transmission capacities are also established for the current situation or for the time horizons of R+ 1, which already take into account the necessary safety margins, so that even for unexpected events and for situations with large differences between commercial and real power flows, the so-called loop-flows, the PS operator is able to fulfil the essential security criterion N-1. Considering these stocks, 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 capacities.

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 to mention, on the basis of calculations, the disposal of 220 kV of the system in the region of central and western Slovakia, in particular the disposal of the last 220 kV of the cross-border line V270 P. Bystrica – Liskoovec on the SK-CZ profile. The shutdown of V270 will result in an increase of 26 % in the maximum transmission capacity on the CZ-SK profile in the import direction and an increase of the maximum transmission capacity on the SK-PL profile in the import direction by 7 % and in the export direction by 27 %. The closure of the V270 line from operation has a negligible impact on the other cross-border profiles analysed. Both options provided for the reconstruction of the cross-border line V404 Nošovice (CZ) – Varín (SK) and thus an increase in the maximum allowable current capacity from the original 1720 A to 2000 A, which is expected to be completed and put into commercial operation in the course of 2026.

Figure 11 Result values of maximum transmission capacities over selected time horizons



All the above considerations and assumptions on the development of the maximum transmission capacities of the individual cross-border profiles of the PS SR in the time horizons 2027 and 2032 are based on the analyses and assumptions of SEPS and ENTSO E. The stated values for the maximum transmission capacities analysed in the development horizons 2027 and 2032 should therefore be understood as indicative and non-binding annual values, which apply exclusively to the analysed variants of the development of the PS SR. The values of net tradable transmission capacities for the next period are or will be specified by the SEPS electricity dispatcher.

4.5.2. Energy transmission infrastructure

I. Key characteristics of the existing transmission infrastructure for electricity and gas85

Characteristics of the Slovak transmission system

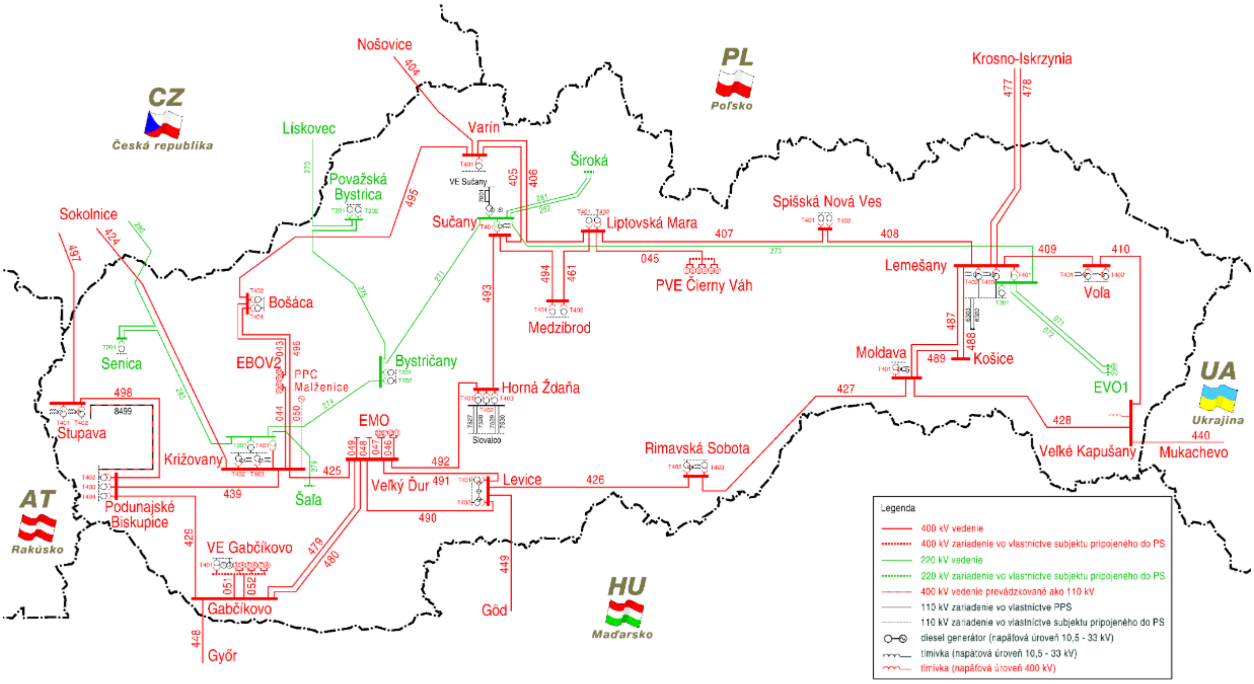
In particular, the Slovak Republic's transmission system is a set of galvanically interconnected technology facilities of 400 kV, 220 kV and selected 110 kV plants, through which electricity is transferred from its producers to individual customers from the Slovak transmission system (hereinafter referred to as 'the TSO') and cross-border transmission of electricity. These include, in particular:

- domestic and cross-border lines 400 kV, 220 kV and 110 kV selected;
- transformers 400/220 kV, 220/110 kV and 400/110 kV,

[85] With reference to overviews of existing transmission infrastructure by TSOs.

- 400 kV, 220 kV substations and selected 110 kV substations,
- compensation facilities.

Figure 12 Transmission system SR



The PS SR also includes relevant support, so-called secondary facilities, without which electricity transmission and management of the Slovak electricity system would not be possible. These are Control Information Systems (RIS), Business Measurement, Security and Automation Systems, Telecommunications Transmission Equipment, etc. Its users are also directly connected to the PS SR through their electricity installations, which are currently:

- three Regional Distribution System Operators (RSOs);
- five electricity consumers;
- four electricity producers.

In addition, the PS SR is also synchronously connected to neighbouring transmission systems to the following extent:

- two simple 220 kV interconnections and three simple 400 kV interconnections towards the Czech Republic (‘CZ’),
- one double 400 kV interconnection towards Poland (PL);
- one simple 400 kV connection to Ukraine (‘UA’),
- two simple 400 kV interconnections to Hungary (‘HU’).

Through these interconnections, the electricity system of the Slovak Republic (ES SR) is also synchronously connected to PSOs in Europe, whose operators, together with SEPS, are pooled in ENTSO-E.

When planning investments in the transmission and distribution system, care should be taken to ensure that investments lead to an integrated electricity system at the lowest possible overall 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 affordable costs at the end customer, the integration of RES is a major challenge for the electricity system and integrated planning is needed to successfully meet this challenge, which would allow identifying the most appropriate investments to achieve the above objective.

Power lines

The individual electricity stations ('ESt') in the PS SR are galvanically interconnected by means of forty-six 400 kV transmission lines for a developed length of 2 138 km, seventeen transmission lines of 220 kV for a total length of 826 km and seven transmission lines of 110 kV for a total length of 80 km. Of the total number of 400 kV and 220 kV transmission lines, the PS SR has eight 400 kV and two 220 kVs of cross-border power lines, together of a total length of approximately 444 km in Slovakia, which connect the PS SR with neighbouring transmission systems CZ, HU, PL and UA on the relevant cross-border profiles.

More information – for example, the number of pylons is published on the website of the PS SEPS operator(https://www.sepsas.sk/TechnickeUdaje.asp?kod=16).

Characteristics of the gas transmission system

The transmission network is characterised in law as: 'a network of compressor stations and a network, in particular, of high-pressure pipelines, which are interconnected and serve to transport gas in a defined territory, excluding upstream pipelines and storage and high-pressure pipelines primarily serving to transport gas to a part 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 Slovak Government's decision of 28 November 2012, the form of separation was determined in accordance with the requirements of European legislation using the ITO model.

In 2018, the total traffic amounted to 59.7 billion m of^3 natural gas. Thanks to the quantity transported, Eustream, a.s. continues to be one of the most important gas carriers based on the volume of gas transported within the EU.

The transmission network consists of parallel pipelines DN 1200 and DN 1400 in four to five lines, the total length of gas pipelines of the transmission network being almost 2 270 km. The transmission network includes 4 compressor stations (CGs) – Veľké Kapušany, Jablonov nad Turňa, Veľké Zlievce and Ivanka pri Nitre – which provide the pressure differential necessary for the continuous flow of gas with a total capacity of 600 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 passes through national discharge stations into the distribution system and is conveyed to final customers.

Slovakia's interconnection with neighbouring countries at transmission system level currently exists with Austria (Baumgarten border point), Czech Republic (Lanžhot border point), Hungary (border point Veľké Zlievce) and Ukraine (border point Veľké Kapušany and border point Budince).

Table 81 Capacities of Slovak and surrounding transmission network interconnections

Border point	Output fixed technical capacity (GWh/day)	Technical Input Fixed Capacity (GWh/day)
Large Kapušany [SK/UA]	0	1 913,6
Budince [SK/UA]	436,8	176,8
Baumgarten [AT/SK]	1 570,4	247,5
Lanžhot [CZ/SK]	447,2	1 560,0
Breeding [SK/PL]	173,9	144,5
Large Zlievce [SK/HU]	128,9	50,9

(state of play as at 1.6.2023)

II. *Projections of network expansion requirements at least until 2040 (including 2030 projection)86*

Until 2040, the operator of PS SEPS is definitely considering strengthening the SK-CZ profile by leading 1x400kV Ladce (SK) – Otrokovice (CZ). In accordance with the information in point 2.4.2 (ii), this is to minimise the impacts of the planned decommissioning of 220 kV PS on the SK-CZ profile and the PS SK and PS CZ respectively. It is realistic to assume that the preparation of this project will start after 2025 so that the line becomes operational around 2032, with both SEPS and ČEPS seeking to reduce this deadline as much as possible. To this end, both SEPS and ČEPS have signed a Memorandum of Cooperation, where both companies declare their willingness to coordinate cooperation on operational and development projects on the SK-CZ profile. In the perspective between 2030 and 2040, SEPS does not envisage the construction of further cross-border connections. In terms of considerations and potential intentions, there is a 2x400kV SK-Poland line and a fifth line between SK and Hungary. There are no ongoing discussions between SEPS and the concerned neighbouring PS operators on this topic.

After a prolonged break, contacts were made with the operator of PS in Ukraine, NPC 'Ukrenergo'. Slovakia – Ukraine's cross-border profile often represents a bottleneck (together with the profile to Hungary) in cross-border electricity transfers and causes operational and management problems also to the Slovak electricity dispatcher. The project "Renovation 400 kV of Mukacheve (UA) – Veľké Kapušany (SK)" was included in the PECI/PMI 2018 list approved by the Ministerial Council of the Energy Community (English. Energy Community) in November 2018. The estimated date for comprehensive rehabilitation of the V440 line in Slovakia is 2030. However, this must be definitely subject to separate calculations around 2023. At that time, Ukraine will finalise its intention to reconstruct this leadership on its side.

[86] With reference to national network development plans and regional investment plans of TSOs

Implementation of the investment intentions of the transmission system operator

Following the decision to phase out the 220 kV system, the development of the PS SR, from the point of view of transmission infrastructure (mainstreaming and transformation of PS/DS), is primarily aimed at developing the 400 kV system. Managed by the attenuation of 220 kV PS, a long-term, technological, temporal, organisational and cost-intensive project is necessary, which requires repairs of 220 kV PS installations to the extent necessary, maintenance activities or partial renovations to ensure that some of the 220 kV network installations are operational until or beyond the period around 2025, when they are already at or beyond the limits of their technical and moral life.

In particular, the development of new production capacities and a change in their structure both in Slovakia and in the surrounding countries have a significant impact on the development of PG 400 kV. Both factors have a direct or indirect impact on the load of the Slovak Republic's facilities, which implies the need to strengthen the infrastructure of the PS SR. In addition, Slovakia's strategic objective in electricity production is directed towards an export balance of the Slovak Republic (EMO 3.4, decentralised production and RES, also a new nuclear source around 2035), which has or will have an impact on the burden of export flows on cross-border profiles. The expansion and associated strengthening of 400 kV PBS is also subject, in addition to the abovementioned gradual depression of 220 kV PS, to no less significant effects, whether in the form of existing investment projects and potential new users of 400 kVBS or indirectly influenced by the lower voltage levels of the various distribution systems (particularly from the point of view of decentralised generation), as well as external influences such as transit flows typically from north to south. The PB operator has to react flexibly to these impacts at all times, resulting in the necessary planning and implementation of both domestic and cross-border investment projects in the light of the development intentions of the PS operator.

Information on the investment plans of the PS operator shall be based every two years under the Ten-Year Transmission System Development Plan (the last valid document covers the years 2020-2029). Information on selected SEPS projects is also available in ENTSO-E's Ten Year Network Development Plan, the latest version of which is available at http://tyndp.entsoe.eu/.

Implementation of the investment plans of the distribution system operator

The continuous objectives are the reinforcement of critical grid sites, the restoration of the system in terms of its physical condition, the respect of quality standards, the reduction of losses in the distribution of electricity and the connection of new demand points. The investment activity shall reflect current needs for the development and quality of the distribution system, previous 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 network are aimed at achieving the expected quality of services and SSE-D is making 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 lines and other investments linked to the distribution activity.

NEW CONNECTIONS

Development actions for the construction of the distribution system have been addressed under this investment chapter due to the need to connect larger demand points at high voltage voltage (LV) voltage levels, such as industrial parks, polyfunctional objects and commercial premises, as well as the connection of new low-voltage (NN) demand points, such as standard delivery points (family houses, housing, smaller business and civic amenities). In this chapter, the CPR and NN 214 construction works were completed in 2017 and EUR 8.49 million were reinvested.

QUALITY AND INCREASE OF THE TRANSMISSION CAPACITY OF THE INSTALLATIONS

In terms of investment construction in the area of quality and increasing the transmission capacity of the installations, 178 constructions at the voltage level of VN/NN and 21 constructions at very high voltage (VL) voltage level in a total annual investment cost of EUR 23.74 million were carried out in 2017. The purpose of these investments was to ensure the reliability and continuity of electricity distribution. The continued priorities of this construction were the respect of quality parameters, the elimination of physical handicaps caused by external influences and the lifetime of the equipment, the reduction of malfunctioning, the upgrading of facilities, the deployment of elements with remote monitoring and control functions, and the improvement of electricity distribution possibilities. These contribute to the reduction of SAIDIP parameters, i.e. the scheduled time without running in clients, and AIFMIP, i.e. the planned frequency without running up in client failures.

MAIN ACTIVITIES AND INVESTMENTS IN THE DEVELOPMENT OF THE DISTRIBUTION SYSTEM

In order to ensure the development and stability of the distribution system, significant projects at the level of the IWN distribution system were implemented and prepared later in 2017. In particular, the start of the construction of the new TR 110/22 kV Nováky, which will ensure a secure and reliable supply of customers, taking into account the needs of Slovenské elektrárne, a. s., at the Elektrárne Nováky plants (capacity and self-consumption) and Fortischem a.s., Nováky (transmission system power supply), preparation of the European Commission’s regulations on the requirements for electricity generators (RfGs) in terms of access and connection to the distribution system; preparing the connection conditions for Liptovská Mara-Sučany and Liptovská Mara – Spišská Nová Ves node areas in order to ensure greater operational reliability of electricity distribution and others.

VSD operates an extensive distribution system consisting of almost 22 thousand km of lines at the voltage levels of VVN, VN and NN. At IWN level, the distribution system is supplied from four superior electricity stations of the 400 kV and 220 kV transmission network. At the level of IWT and R & D, the company operates a total of 57 electrical transformation and switching stations. The reliable and secure distribution of electricity to all customers of our company independently of the voltage connection level is ensured by VSD by setting up all internal processes such as grid restoration and development planning, setting and supervising compliance with technical standards on the quality of distribution reliability and increasing the overall efficiency of electricity distribution. The reliability level of electricity distribution Aj in 2017 VSD managed to maintain the distribution network reliability index at a favourable level of 99.96 % of ASAI (Average Service Availability Index), also taking into account weather effects and distribution disruptions caused by third parties. The programme for the systematic renewal and modernisation of networks in the territory of eastern Slovakia has also contributed significantly to this outcome, through which our society can ensure a high-quality distribution of electricity to new investors and a growing economy. Investments in the renewal and modernisation of the distribution system The long-term interest of VSD is the reliable and secure operation of the distribution system. In line with this basic objective, it directs its decisions in the draft investment plans. In 2017, VSD invested EUR 44.1 million in its network (2016: EUR 43.7 million), with the largest amount of money invested, as usual, to renovate the system with a view to further improving the quality of services to customers.

Investment in automation and innovative technologies is a necessary and natural endeavour of VSD to improve the quality of the service provided not only in electricity distribution but also in areas such as the provision of measured electricity values via the eVSD customer portal, but also for more convenient customer communication. In 2017, VSD invested in innovative communication and customer-driven data transmission technologies towards VSD information systems, focusing on communication technologies related to the operation of smart metering systems (Smart Metering), mainly in clouds: Lora – (Long Range Radio Communication) and PLC – (Power Line Carrier).

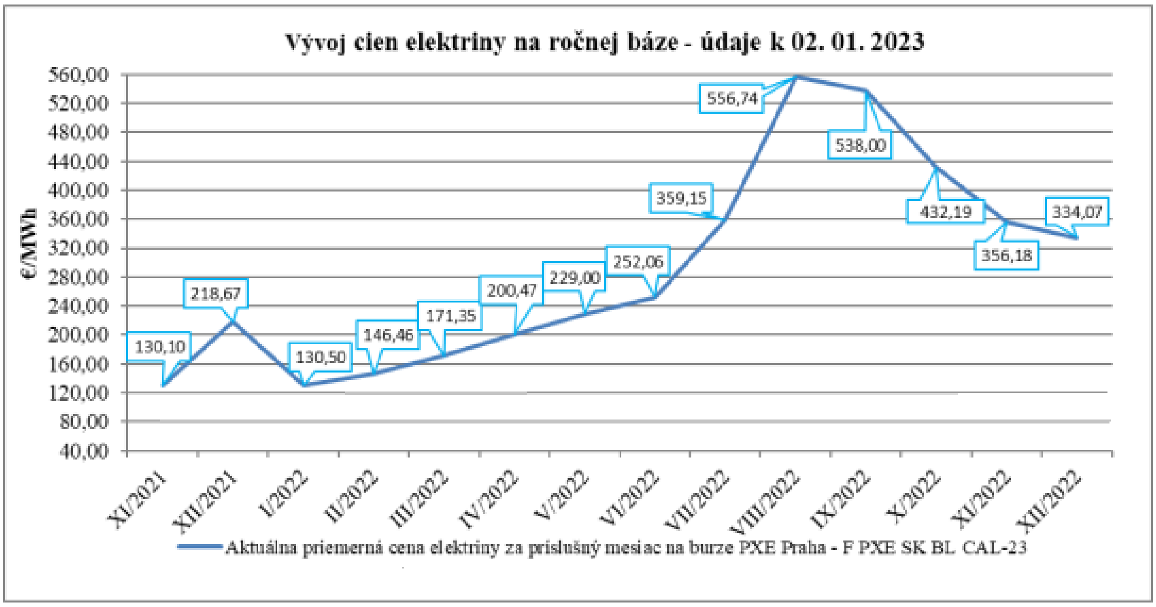
4.5.3. Electricity and gas markets, energy prices

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

Wholesale electricity markets in individual EU Member States remain a problem with significant distortions. It is also reinforced 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 in the pipeline in some countries. These but also other factors influence prices in EU markets, which also has a significant impact on the Slovak market. At the same time, the EU energy system as a whole suffers from the shutdown of conventional and flexible resource capacities and insufficient investment in new capacities.

Wholesale electricity prices have experienced a record increase and unprecedented volatility since summer 2021 and during 2022. In particular, European electricity prices have influenced gas prices, which, due to Russia's ticked supplies and the global energy crisis, were at a record cost. In particular, the price and energy crisis has highlighted the high dependence of electricity prices on the price of gas, as gas resources are often a marginal resource (last deployed to meet demand).

Figure 59 Evolution of the wholesale price of electricity on the exchange in 2017-2022



Source: PXE, ÚRSO

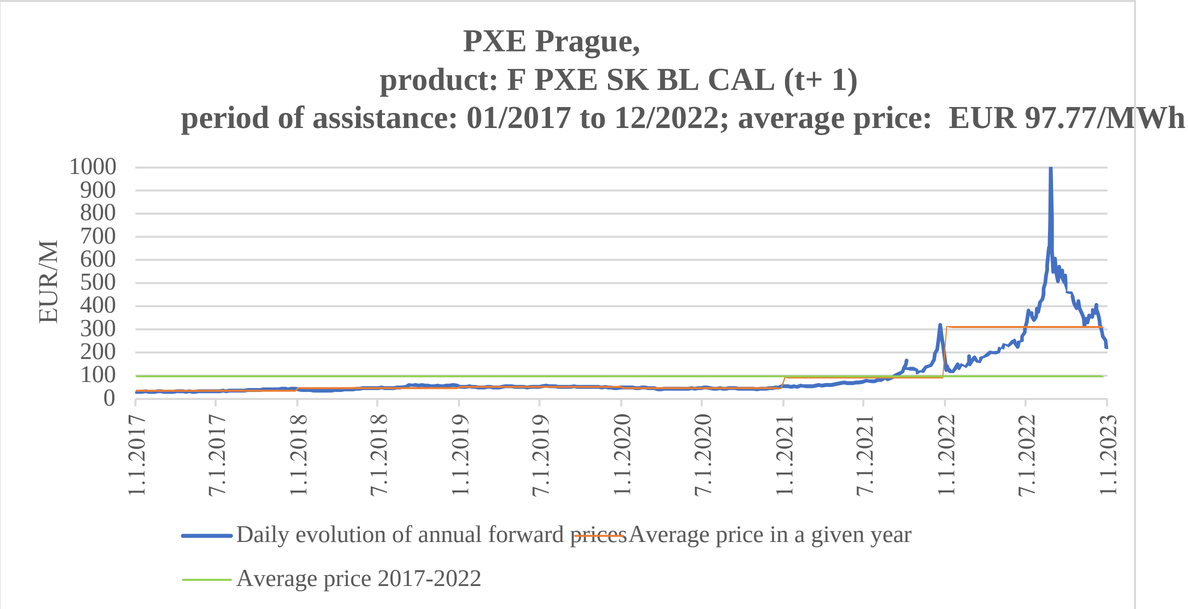
In response to exceptionally high and volatile electricity prices in the wholesale market in addition to the above-mentioned EU Council emergency regulations, the European Commission published a proposal for a structural reform of the EU electricity market design.

The EU electricity market design reform aims to enhance the stability and predictability of electricity prices and thus strengthen the EU's competitiveness. By proposing a reform of the electricity market design, the EC reacted inter alia to the energy crisis, which showed the limitations of the current electricity market set-up. The EC proposal builds on the efforts of the European Green Deal to increase European competitiveness through innovation and the transition to a climate-neutral economy, and is closely linked to the Commission's industrial roadmap in the context of the Green Deal. 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 competence of the national regulatory authority (the Office for Regulation in Network Industries – ÚRSO) is limited to creating legislative conditions and monitoring compliance.
Electricity on the wholesale market is traded freely within the EU, the wholesale electricity price being formed within the interconnected single European electricity market and does not reflect the actual cost of electricity production (EUR/MWh) in individual Member States (for example, Slovakia), but the electricity market prices published by the relevant power exchange for the product concerned (in the case of Slovakia and the Czech Republic, the determining factor in the PXE commodity exchange). Another factor causing extremely high wholesale electricity prices is the current electricity market model and the way the price is shaped in the EU's interconnected wholesale electricity market, which is highly dependent on current market prices for natural gas (whereas natural gas prices, due to its scarcity and due to the war conflict in Ukraine, were at extremely high levels during 2022 (around EUR 200/MWh). Therefore, the EU seeks to reduce the dependence of electricity prices on gas prices and thus reduce the wholesale price of electricity and, consequently, the price of electricity for end-users.

Figure 60 Evolution of the wholesale price of electricity on the exchange in 2017-2022



Source: PXE, ÚRSO

The chart shows that while the trend was relatively calm between January 2017 and mid-2021, there has been a period of turbulence and unpredictable increases in the overall price level since the summer of 2021.

Description and definition of electricity market participants

- electricity producers (Slovak elektrárne, a.s. – dominant producer, share 63.51 %),
- supported producers of electricity from RES and CHP;
- organiser short-term electricity market (OKTE, a.s.), the institution for evaluating and organising the short-term electricity market and ensuring the clearing, evaluation and settlement of imbalances on the territory of the Slovak Republic,
- the transmission system operator of the Slovak Republic (SEPS, a.s.), the exclusive holder of the electricity transmission permit, the transmission system operator, which also fulfils the tasks of energy dispatch (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 (LSOs), 142 MDS operators on the sites of both generation and non-production companies;
- electricity suppliers;
- electricity customers;
- electricity Purchaser.

Table 82: Number of delivery points in Slovakia in 2017-2022

Numbers OM	Total number of OMs in the Slovak Republic	Of the total number of OMs in the Slovak Republic:			Of the total number of OMs in the Slovak Republic			
		SEPS,a.s.	Cumulative SGBD	Cumulative MDS	Om at voltage level NN	Om at voltage level VN	Om at voltage level SG & D – Distribution	Om at voltage level IDR – transmission

2017	2 539 349	33	2 524 700	14 616	2 525 551	13 611	157	30
2018	2 566 529	33	2 550 947	15 549	2 552 649	13 692	158	30
2019	2 595 124	33	2 578 444	16 647	2 581 241	13 695	158	30
2020	2 623 880	33	2 605 323	18 524	2 609 941	13 749	160	30
2021	2 654 515	33	2 634 279	20 203	2 640 596	13 728	161	30
2022	2 682 543	33	2 660 106	22 404	2 668 669	13 685	159	30

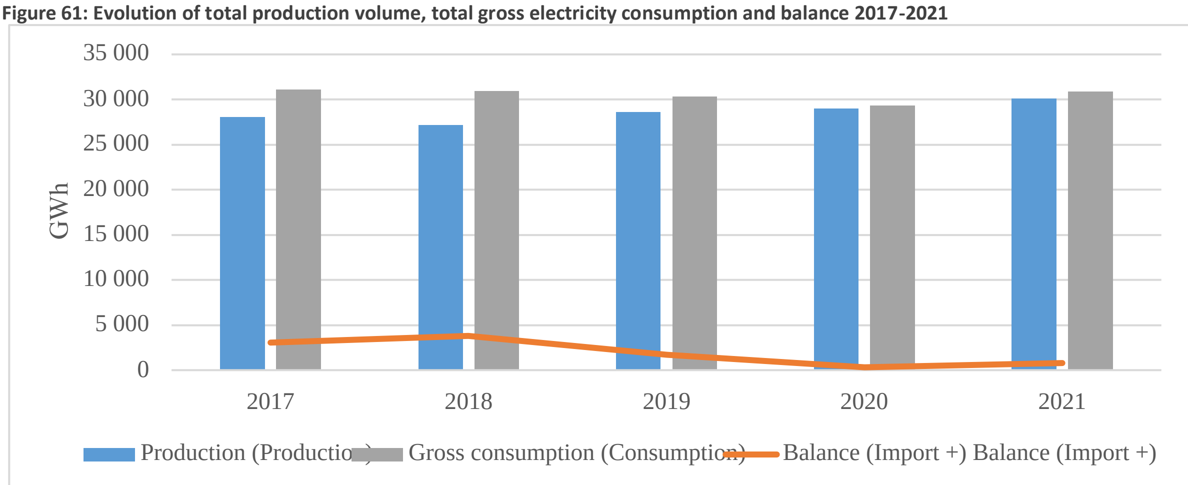
Source: OKTE, a.s.

Table 83: Number of delivery points according to more detailed specification in Slovakia in 2017-2022

Numbers OM	ZSDIS			SSD			VSD		
	NN	VN	IWT	NN	VN	IWT	NN	VN	IWT
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.

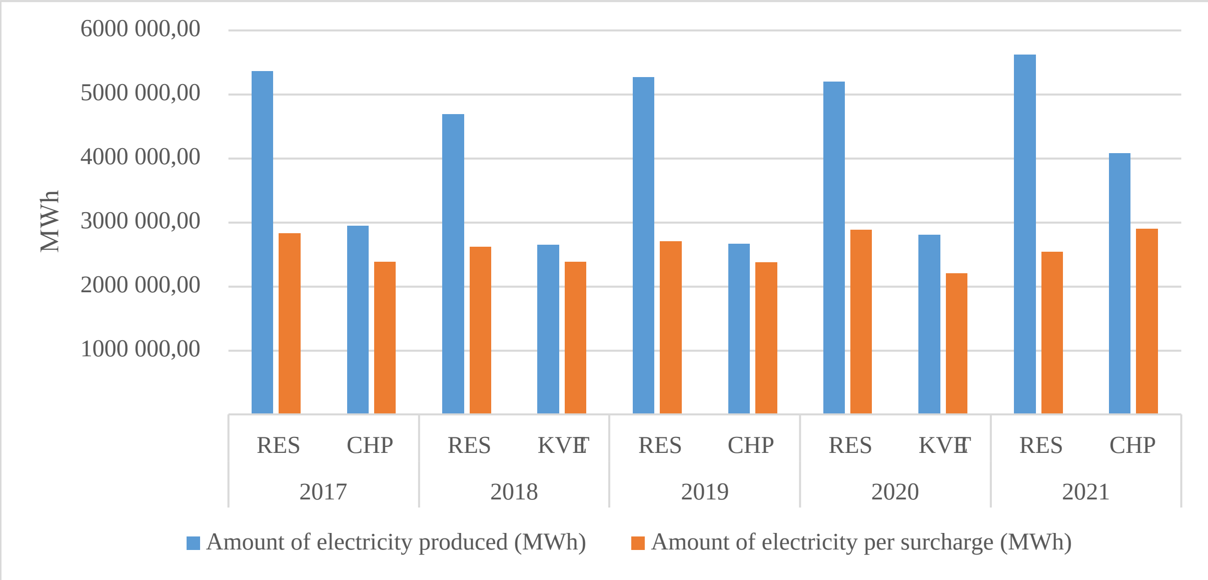
Figure 61: Evolution of total production volume, total gross electricity consumption and balance 2017-2021



Source: Slovak Electricity Transmission System (SEPS,a.s.). Available online:

Commentary on Graph 60:
Generation – data from measurements at the generator's terminals, supply to the grid, self-generation (or measurements at a designated transfer point).
Balance – measured cross-border exchanges, Import**(**+), Export (-).
Gross consumption – including consumption for pumped storage of pumped storage plants.

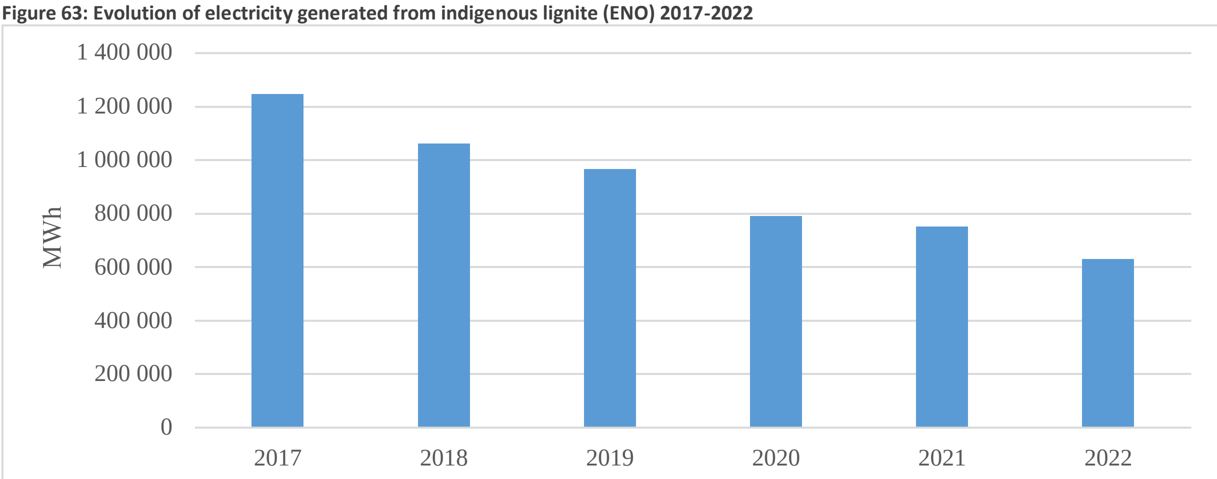
Figure 62: Evolution of total electricity generation from RES and CHP in 2017-2021



Source: ÚRSO internal conversions based on data from OKTE, a.s.

Commentary on Graph 61: The data relate only to 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.: 2022 data were not available at the time of processing.

Figure 63: Evolution of electricity generated from indigenous lignite (ENO) 2017-2022



Source: Slovak Power Plant, 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, namely household customers and small enterprises.

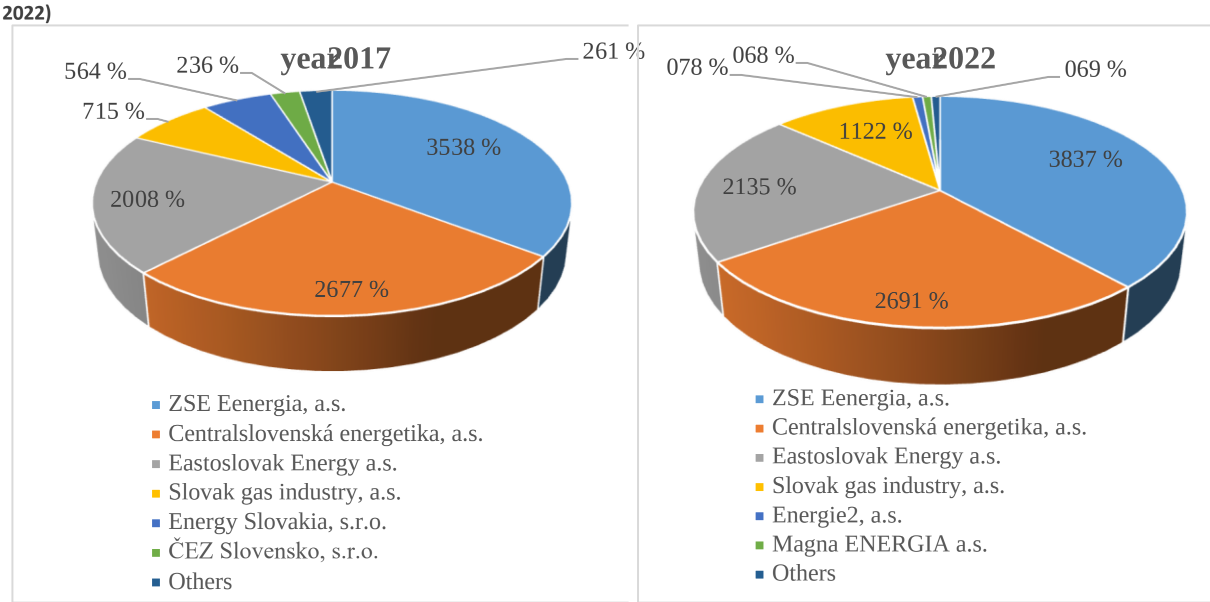
The following shall be subject to price regulation in the supply of electricity:

- electricity supply to households;
- supply of electricity to small businesses;
- supply of electricity to suppliers of last resort.

Electricity supply to households

The maximum prices for the supply of electricity to households shall be bi-component and shall consist of a monthly payment per delivery point and a price for electricity collected in low or high bands. The supply of electricity to households is divided into eight tariffs.

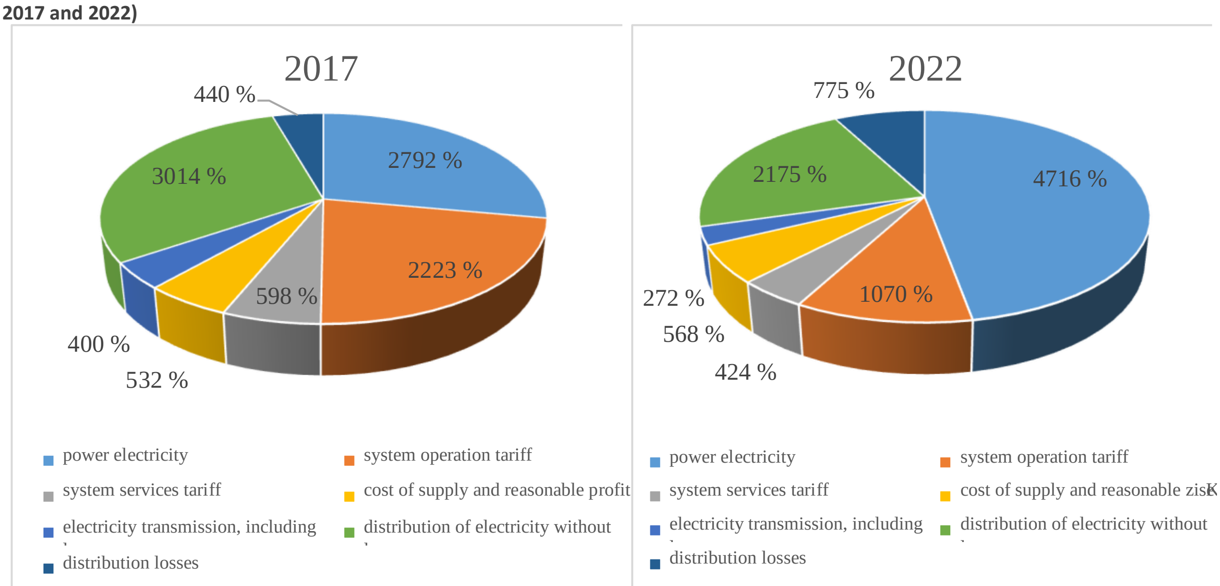
Figure 64: Share of suppliers in the supply of electricity to households at the beginning and end of the 5th regulatory period (2017 and 2022)



Source: ÚRSO internal conversions.

Commentary on Graph 65: The supplier ČEZ Slovensko, s.r.o. ceased operating in the regulated segment (the portfolio sold to another supplier) following a shareholder decision during the 5th regulatory period. SLOVAKIA ENERGY, s.r.o. lost its capacity to supply electricity in autumn 2021 and its portfolio was mainly taken over by suppliers of last resort.

Figure 65: Structure of the price for the supply of electricity to households at the beginning and end of the 5th regulatory period (in 2017 and 2022)

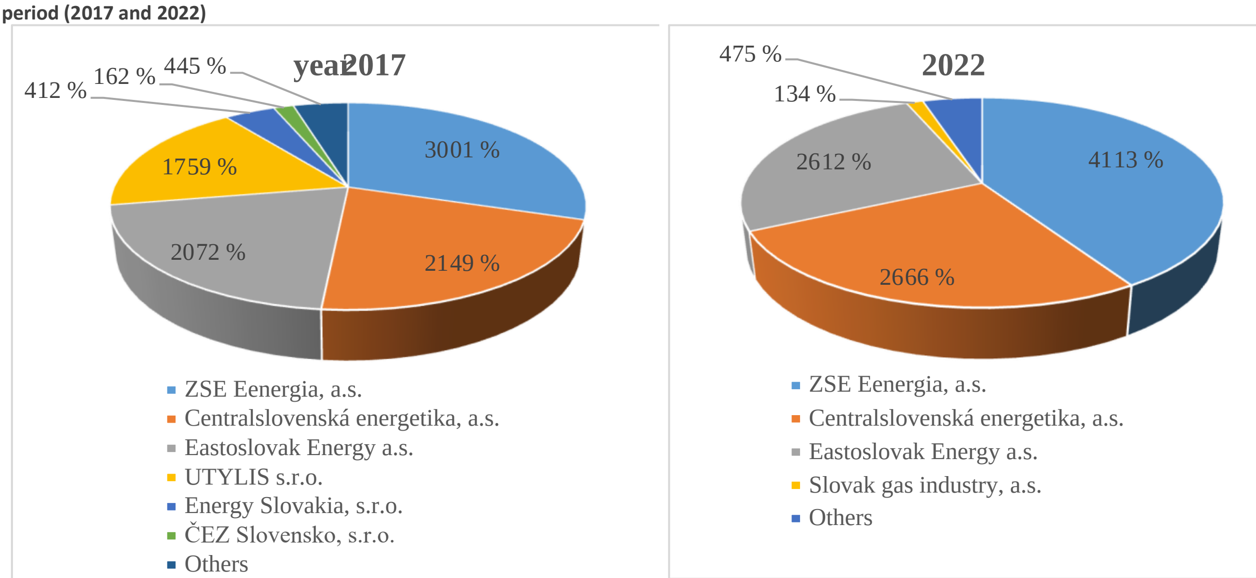


Source: ÚRSO internal conversions.

Supply of electricity to small enterprises

A final electricity customer with an annual electricity consumption of no more than 30 000 kWh per year preceding the year of submission of the price proposal shall be considered a small enterprise. The supply of electricity to small undertakings was divided into 11 tariffs.

Figure 66: Share of suppliers in the supply of electricity to regulated small enterprises at the beginning and end of the 5th regulatory period (2017 and 2022)



Source: ÚRSO internal conversions.

Commentary on Graph 66: The supplier ČEZ Slovensko, s.r.o. ceased operating in the regulated segment (the portfolio sold to another supplier) following a shareholder decision during the 5th regulatory period. SLOVAKIA ENERGY, s.r.o. lost its capacity to supply electricity in autumn 2021 and its portfolio was mainly taken over by suppliers of last resort.

Switching electricity supplier

To assess the level of liberalisation of the electricity and gas markets, a percentage factor, called switching, is used, which reflects the ratio of the number of demand points with a change of electricity or gas supplier to the total number of demand points in that year.

Table 84: 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: ÚRSO internal conversions.

Table 85: Cumulative data on the supply of electricity to customers in last resort mode 2017-2022

	2017	2018	2019	2020	2021	2022
Number of delivery points concerned (total)	0	23	0	0	176 959	4 922
Number of suppliers that have lost their capacity to carry out the supply activity	0	2	0	0	3	3

Source: Statistics compiled according to data provided by designated suppliers of last resort

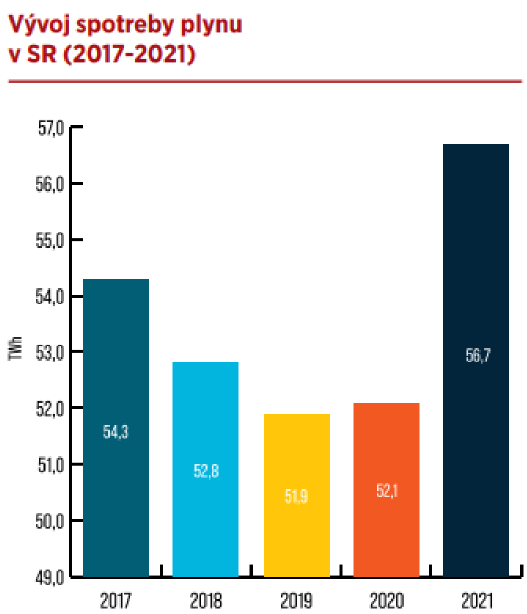
Voice over:
During the 5th regulatory period, the following electricity suppliers lost their capacity to supply:

In 2018: Lumius, spol. s r.o.; Energy Europe, SE.
In 2021: Energy Slovakia, s.r.o.; BCF ENERGY, s.r.o.; Smart Energy Contractor SEC, a.s.
In 2022: A.En. Slovakia s.r.o.; TWINLOGY s.r.o.; GEON, a.s.

Gas market

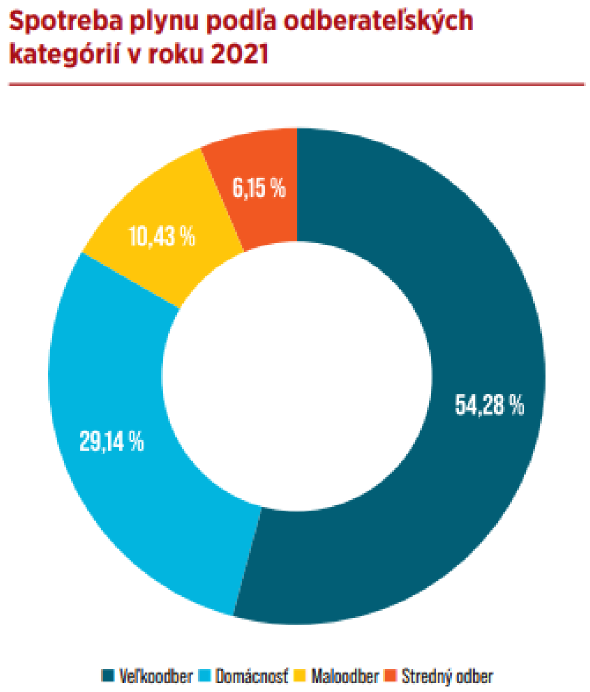
The gas sector in the Slovak Republic is particularly specific to the extent of gas networks and the associated high degree of gasification and transit use of the transmission network.

Figure 67 Gas consumption 2017-2021



Source: Annual Report 2021, Office for the Regulation of Network Industries

Figure 68 Gas consumption in 2021 broken down by customer categories



Source: Annual Report 2021, Office for the Regulation of Network Industries

The highest share of final gas consumption in Slovakia is traditionally held by industrial customers in tariff groups for which the annual consumption of gas at the point of delivery amounted to 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 system 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,
- purchase of gas on commodity exchanges;
- by purchasing gas from another trader – gas supplier
- trading at the virtual trading point of the transmission system operator;
- trading or changing ownership of gas stored in underground storage facilities.

End-user market

The maximum gas supply prices for vulnerable customers were composed of two components, a maximum amount of a fixed monthly tariff and a maximum tariff for withdrawn gas. Until 2023, consumer tariffs were divided into six tariff groups 1 to 6 according to annual gas consumption; from 2023, ÚRSO sets tariffs for 8 tariff groups. A vulnerable gas customer under the Regulation Act is a household and a small gas customer (so-called small enterprise). A small gas customer within the meaning of the Regulation Act is the final customer of natural gas with an annual consumption of natural gas at all delivery points of no more than 100 thousand kWh in the preceding year and belongs to the group of vulnerable customers.

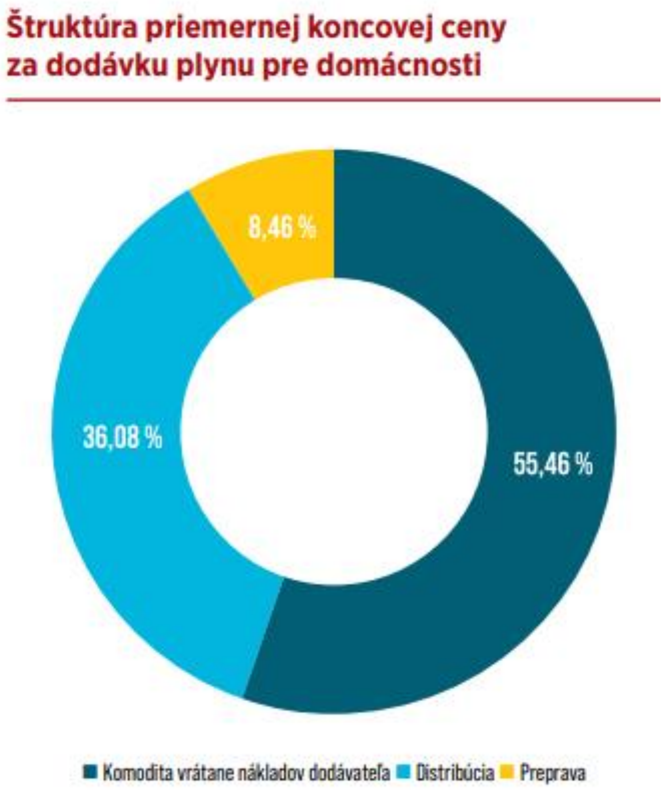
The following shall be subject to price regulation in the field of gas supply:

- supply of gas to households;
- supply of gas to small customers;
- supply of gas to suppliers of last resort.

In 2022, during the energy crisis, non-household customers were also included as vulnerable customers, namely:

- a non-household gas customer with a total annual gas consumption of the preceding year of no more than 100 000 kWh;
- a non-household customer purchasing gas for the operation of a social service facility registered in the Social Services Register;
- a non-household gas customer who receives gas for the operation of a child and social guardianship facility;
- non-household gas customers who purchase gas for the operation of a multi-apartment building with 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 rented dwellings within the framework of state-supported rental housing pursuant to special legislation;
- a group of final gas customers who are owners of apartments and non-residential premises in a multi-apartment building, extracting gas for the production of heating and domestic hot water, legally represented by a natural person or a legal person managing a common heater supplying a multi-apartment building and domestic hot water.

Figure 69 Structure of the average final price for gas supply to households 2021



Source: Annual Report 2021, Office for the Regulation of Network Industries

Table 86 Delivery points structure and switching

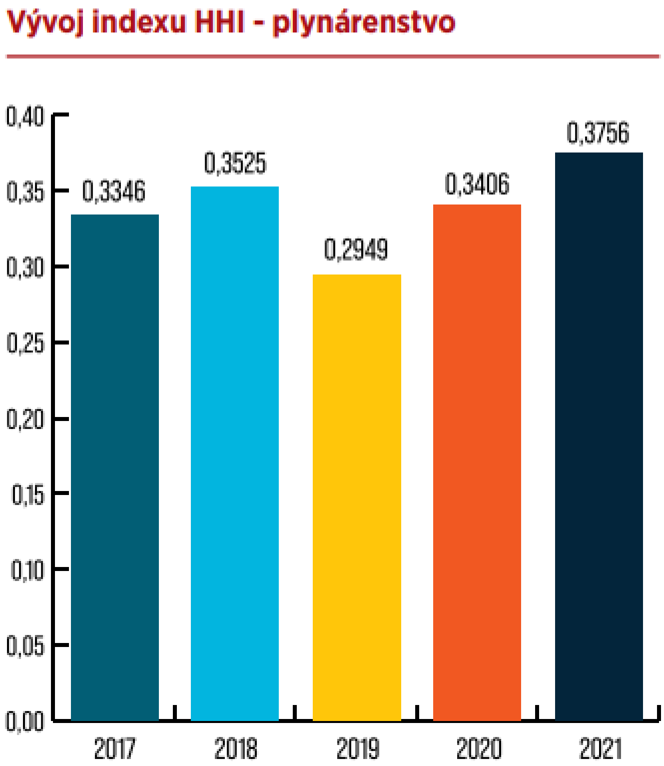
Switching – plynárenstvo (2017-2021)

Kategórie odberných miest odberateľov	počet odberateľov plynu so zmenou dodávateľa plynu					switching (%)				
	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
veľkoodberateľ	93	71	90	179	145	12,72	9,69	10,22	25,03	20,86
stredný odberateľ	322	314	284	478	415	11,44	11,30	8,99	17,05	15,52
maloodberateľ	4 743	4 765	3 687	5 093	5 151	6,21	6,23	4,82	6,64	6,59
domácnosti	43 670	36 627	48 000	48 481	67 067	2,98	2,54	3,32	3,35	4,28
spolu	48 828	41 777	52 061	54 231	72 778	3,16	2,74	3,41	3,55	4,41

Source: Annual Report 2021, 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.

Figure 70 Herfindahl-Hirschman Index 2017-2021



Source: Annual Report 2021, Office for the Regulation of Network Industries

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

It is expected to stagnate rather than a slight increase in gas consumption in the near term. In accordance with energy legislation, various companies have been issued certificates for the construction of energy installations or, where appropriate, undertakings have made public their intentions in this area (new sources of electricity and heat production from gas). However, the actual realisation of investment intentions is a decision of individual companies and decisions are influenced by a number of factors such as the market price of electricity, the market price of gas as an input commodity, etc.

Other factors influencing consumption levels include the average annual temperature as well as the continuation of various energy efficiency measures, e.g. insulation of buildings or advanced technological 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 operating on the market can play a positive role in terms of prices.

Table 87 Presumption of natural gas consumption with a view to 2023

Year	2019	2020	2021	2022	2023
Total consumption [bn m^3]	4,8	4,9	5,0	5,0	5,0

Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

From the point of view of electricity production, Slovakia supports nuclear energy and also cost-effective RES with a view to achieving the targets set for 2030 and thereby meeting Slovakia's priorities in this area, as stated at the beginning of this document.

Future energy price developments remain unpredictable. While falling wholesale electricity and gas prices are good news, energy prices are very likely not to return to their pre-2020 levels, which may have a negative impact on 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. In this respect, reducing the energy consumption of every consumer is crucial.

4.6. Dimension: research, innovation and competitiveness

I. Current situation of the low-carbon-technologies sector and, to the extent possible, its position on the global market (that analysis is to be carried out at Union or global level)

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 targets for global greenhouse gas emission reductions.

In 2016, Slovakia, the first country from Central and Eastern Europe, became a member of the IEA *Solar Heating & Cooling Programme* (SHC). The Slovak Republic's participation in this programme will allow 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 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 reports on R & D funding also in low carbon technologies for 2015-2017.

III. Breakdown of current price elements comprising 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 consumers in industry, as well as data on market shares, sales conditions and pricing schemes. Providing prices to household consumers is voluntary.

Gas 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 according to the annual consumption bands. For industrial consumers, price information is collected for a total of 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.

TheEuropean Commission Decision (2007/394/EC) of 7 June 2007 amendingCouncil Directive (90/377/EEC) with regard to the methodology to be used for the survey of gas and electricity prices charged to industrial end-users constitutes the legal basis for the survey of natural gas prices charged to industrial consumers. 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 as defined in 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 is the sum of three main components:

‘energy and supply’, ‘network’ (transport and distribution) and component covering taxes, levies and charges. The following items are included in each component:

Gas

Energy and supply 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 network 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 operating costs and meter rental and metering costs.

Taxes, duties and levies shall comprise the sum of all taxes, duties and levies.

Electricity

Energy and supply shall include the following costs: electricity generation, storage, balancing energy, costs of energy supplied, customer service, after-sales management and other supply costs.

The network price must include the following costs: transmission and distribution tariffs, transmission and distribution losses, network charges, after-sales service costs, system operating costs and meter rental and metering costs.

Taxes, duties and levies shall comprise the sum of all taxes, duties and levies.

IV. Description of energy subsidies, including for fossil fuels

Envirofond

The Environmental Fund is primarily set up for the purpose of implementing state support for environmental care and the creation of the environment on the basis of sustainable development. The main mission of the Fund is to provide finance to applicants in the form of grants or loans to support projects in the framework of activities aimed at achieving national environmental policy objectives at national, regional or local level. In addition, the Fund also provides funding for other activities and activities referred to in Paragraph 4(1) of the Fund Act. (http://www.envirofond.sk/sk/o-nas)

Overview of the funding provided in the form of a grant from the Environmental Fund (http://www.envirofond.sk/sk/prehlady/dotacie/rozhodnute):

Call for the development of *energy* services at regional and local level OPKZP-PO4-SC441 – 2019-53

Call for Reducing energy intensity and increasing the use of renewables in enterprises – OPKZP-PO4-SC421-2018-46

OPKZP-PO4-SC441 – 2019-53 – Development of energy services at regional and local level

OPKZP-PO1-SC111-2019-51 – Recovery of biodegradable waste – Construction of biogas stations used for combined heat and power generation

IROP-PO1-SC121-2019-48 – Enhancing the attractiveness and competitiveness of public passenger transport

UPDATED CALL: OPKZP-PO1-SC111-2016-16 – Preparation for re-use and recovery of non-hazardous wastes

OPKZP-PO4-SC421-2018-46 – Reducing energy intensity and increasing the use of renewable energy sources in enterprises

UPCOMING CALL: Electricity and heat generation installations for high-efficiency cogeneration up to 20 MW

OPKZP-PO1-SC141-2015-7 – Reduction of emissions from stationary air pollution sources

UPCOMING CALL: Development of energy services at regional and local level

UPCOMING CALL: Recovery of BROs – construction of biogas stations used for combined heat and power generation

UPCOMING CALL: Reducing the energy intensity of public buildings

Information programmes on adverse impacts of climate change and possibilities for proactive adaptation

Green Households

Support scheme for the construction of alternative fuels infrastructure (de minimis aid scheme) – DM – 6/2019

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

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 implemented under 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 on the revenue budget account of the chapter of the Ministry of the Economy of the Slovak Republic and are paid into 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 details of the amount of the levy on electricity supplied to final customers and the method of its collection for the National Nuclear Fund.

State 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 Addendum No 1 (scheme No SA.51172 (2018/N))

State aid scheme to promote international cooperation in industrial research and experimental development as amended by Addendum No 1 (scheme No SA. 427653)

State aid scheme for a loan facility to promote the energy efficiency of buildings (residential houses) (scheme No SA.48640)

State aid scheme for granting aid in the form of reductions in environmental taxes as amended by Addendum No 1

The Ministry of the Economy is working on updating the State aid scheme to provide **compensation for the tariff for operating the system to authorised energy-intensive businesses**, meeting the criteria laid down in Act No 309/2009 under the amended rules under the 2022 Guidelines on State aid for climate, environmental protection and energy.

Table 88 Tax measures

Measures	**Legal basis**	**From**	**To (if specified)**
Exemption from excise duty on mineral oil – air transport	Act No 98/2004	24 May 2004	
Exemption from excise duty on mineral oil – Waterborne transport on the Danube	Act No 98/2004	24 May 2004	
Exemption from excise duty on mineral oil – electricity production	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	24 May 2004	
Reduced rate of excise duty on mineral oil – Motor spirit containing biogenic substance	Act No 98/2004	24 May 2004	
Reduced rate of excise duty on mineral oil – Gas oil containing biogenic substance	Act No 98/2004	24 May 2004	
Exemption from excise duty on electricity – RES	Act No 609/2007	July 2008	
Exemption from excise duty on electricity – CHP	Act No 609/2007	July 2008	
Exemption from excise duty on electricity – energy-intensive industry	Act No 609/2007	July 2008	
Exemption from excise duty on electricity – transport	Act No 609/2007	July 2008	
Exemption from excise duty on electricity – households	Act No 609/2007	July 2008	
Exemption from excise duty on coal – electricity generation	Act No 609/2007	July 2008	
Exemption from excise duty on coal – CHP	Act No 609/2007	July 2008	
Exemption from excise duty on coal – rail and river transport	Act No 609/2007	July 2008	
Exemption from excise duty on coal – households	Act No 609/2007	July 2008	

Exemption from excise duty on coal – all types of exemption	Act No 609/2007	July 2008	
Exemption from excise duty on natural gas – electricity generation	Act No 609/2007	July 2008	
Exemption from excise duty on natural gas – CHP	Act No 609/2007	July 2008	
Exemption from excise duty on natural gas – households	Act No 609/2007	July 2008	
Exemption from excise duty on natural gas – rail transport	Act No 609/2007	July 2008	
Exemption from excise duty on natural gas – all types of exemption	Act No 609/2007	July 2008	
Reduced air pollution charge (for particulate emissions – large and medium indigenous lignite sources)	Act No 401/1998	5 May 2001	
Reduced air pollution charge (for sulphur oxide emissions – large and medium indigenous lignite sources)		5 May 2001	
Reduced air pollution charge (for nitrogen oxide emissions – large and medium indigenous lignite sources)		5 May 2001	
Reduced air pollution charge (for carbon nitrogen monoxide emissions – large and medium indigenous lignite sources)		5 May 2001	
Reduced air pollution charge (for emissions of organic substances in the gaseous phase – large and medium indigenous lignite sources)		5 May 2001	
Reduced air pollution charge (for emissions of other pollutants/Class 1 – large and medium indigenous lignite sources)		5 May 2001	
Reduced air pollution charge (for emissions of other pollutants/Class 2 – large and medium indigenous lignite sources)		5 May 2001	
Reduced air pollution charge (for emissions of other pollutants/Class 3 – large and medium indigenous lignite sources)		5 May 2001	
Reduced air pollution charge (for emissions of other pollutants/Class 4 – large and medium indigenous lignite sources)		5 May 2001	
Landfill fee – municipal waste after sorting of 5 components	Act No 17/2004	13 February 2004	

Landfill fee – municipal waste after sorting – all reduced rates	Act No 17/2004	13 February 2004	
Contribution to the National Nuclear Fund	Government Regulation No 426/2010	January 2011	
Max. amount of the levy to the National Nuclear Fund for the 1 electricity end-user	Government Regulation No 426/2010	January 2014	
Dedicated grant to the National Nuclear Fund	Act No 238/2006	July 2006	
System operation tariff – RES	Decree of ÚRSO providing for price regulation in the electricity sector and certain conditions for carrying out regulated activities in the electricity sector (current Decree No 18/2017 Coll. in wordings No 207/2018 and No 178/2019)	August 2007	annual update
System operation tariff – CHP		August 2007	annual update
System operating tariff – electricity generation from indigenous coal		August 2007	annual update
System operating tariff – OKTE		August 2007	annual update
System operation tariff – total		August 2007	annual update
Reduced system operation tariff – stable off-take		July 2011	annual update
Reduced tariff for system services – stable off-take		August 2007	annual update
Regulated prices for the supply of natural gas – households	Act No 250/2011	January 2005	
Regulated prices for the supply of natural gas – small enterprises	Act No 250/2011	September 2012	
Regulated prices for the supply of electricity – households	Act No 250/2011	January 2005	
Regulated electricity supply prices – small enterprises	Act No 250/2011	September 2012	
Allowance for thermal insulation of a single-family house	Act No 555/2005	January 2016	
Soft loans for insulation of multi-apartment and single-family houses	Act No 150/2013	January 2004	
Soft loans for insulation of social services homes	Act No 150/2013	September 2007	
Subsidies for the purchase of small RES (green households)	SIEA	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 OF THE SLOVAK REPUBLIC	November 2016	June 2018

Allowance for the purchase of electric car II.	MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC	2019	
Colour-distinguished vehicle number plates for electric vehicles (for use of dedicated lanes and parking areas)	MINISTRY OF THE ECONOMY, MINISTRY OF THE INTERIOR OF THE SLOVAK REPUBLIC	from 2020 at the latest	
Exemption from motor vehicle tax – electric car	Act No 361/2014	January 2015	
Reduced tax on motor vehicles – hybrids, CNG and hydrogen	Act No 361/2014	January 2015	
Subsidies to Envirofond, Area A – Protection of the Earth's air and ozone layer	Act No 587/2004 Coll.		
Subsidies to Envirofond, Area C – Development of waste management	Act No 587/2004 Coll.		
Subsidies to Envirofond, Area J – Electromobility	Act No 587/2004 Coll.		
Subsidies to Envirofond, Area L – Enhancing energy efficiency of existing public buildings, including insulation	Act No 587/2004 Coll.		
Public economic interest – electricity generation from indigenous coal	Government resolution (end of EEZ No 336/2019)	2005	completion by end 2023 at the latest

State aid SA.52687 – Slovakia – Electricity production in Slovakia from indigenous coal

The notified measure is a financial compensation granted by the Slovak Republic to Slovenská elektrárne a.s. for the performance of a public service obligation in order to ensure the safety and reliability of the electricity system in the Bystričany system node until the investments in the transmission network are completed. The termination of state aid is within the meaning of the Slovak Government Resolution in force by the end of 2023 at the latest.

The Slovak Power Plant, a.s. owns and operates the Nováky thermal power plant located in Zemianské Kostoľanoch. The Nováky power plant uses lignite as a fuel, which is mined in Slovakia and is essential to ensure security of supply in the Bystričany system node. Nováky will generate and supply the electricity grid with a minimum of 870 GWh and a maximum of 1 100 GWh of electricity from indigenous coal per year. For this public service obligation, Slovenské elektrárne, a.s. will receive compensation representing the difference between their revenues from the sale of electricity and other services and its production costs. These costs are compensated by Slovenské elektrárne, a.s. on the basis of the mechanism established by the Office for the Regulation of Network Industries on the basis of the Decree establishing price regulation in the electricity sector. Slovakian elektrárne, a.s. is entitled to a fixed price for each MWh of electricity supplied to the system which has been demonstrably produced from indigenous coal. The total volume of electricity generated and supplied (870-1 100 GWh) represents approximately 0.5-0.6 % of the total expected primary energy demand in Slovakia. Depending on real and transparently published costs and taking into account the polluter-pays principle, an amount of approximately EUR 100 million per year is envisaged.

State aid SA.39096 (2014/N) and SA.49270 (2017/N) – Slovakia - Aid to cover the exceptional costs of the Cigeľ mining field of Hornonitrianske Bane Prievidza a.s. The aid is intended to cover exceptional costs which are linked to the closure of the Cigeľ mining field of Hornonitrianske Bane Prievidza a.s. and is unrelated with current production, such as exceptional expenditure on workers arriving or coming its employment, subsurface safety work resulting from the closure of coal production units, costs of surface remediation and other costs pursuant to Article 4 of Council Decision 2010/787/EU of 10 December 2010 on State aid to facilitate the closure of uncompetitive coal mines was notified by Commission Decision No SA.39096 (2014/N). The closure of the EUR 6 million State aid will be by 2020.

State aid to facilitate the closure of the coal mines Baňa Handlová and Baňa Nováky of Hornonitrianske Bane Prievidza a.s., pursuant to Council Decision 2010/787/EU of 10 December 2010, is being notified in connection with Resolution No 580 of the Government of the Slovak Republic of 12 December 2018 on the proposal for the transformation of the Upper Nitra region in connection with the proposal of general economic interest to ensure security of electricity supply and Slovak Government Resolution No 336 of 3 July 2019 on the Action Plan for the Transformation of the Upper Nitra Coal Region. The closure of the State aid following the closure of Bane Handlová and Bane Nováky is foreseen by the end of 2027 at the latest.

Table 89 Taxes, exemptions, charges and tariffs

Name of tax		**Payer, sector** (if only the selected heading is applicable)	**From**	**Up to (if applicable)**
Excise duty on mineral oil (motor spirit)	Act No 98/2004		24 May 2004	
Reduced rate of excise duty on mineral oil (petrol)	Act No 98/2004		January 2011	
Excise duty on mineral oil (motor spirit)	Act No 98/2004		24 May 2004	
Excise duty on mineral oil (medium oil)	Act No 98/2004		24 May 2004	
Excise duty on mineral oil (gas oil)	Act No 98/2004		24 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		24 May 2004	
Excise duty on mineral oil (liquefied gaseous hydrocarbons)	Act No 98/2004		24 May 2004	
Excise duty on mineral oil (liquefied gaseous hydrocarbons)	Act No 98/2004		24 May 2004	
Excise duty on mineral oil	Act No 98/2004		January	

(lubricating oils and other oils)			2012	
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	24 May 2004	
Exemption from excise duty on mineral oil	Act No 98/2004	business enterprise sector	24 May 2004	
Exemption from excise duty on mineral oil	Act No 98/2004		July 2008	
Excise duty on electricity	Act No 609/2007		July 2008	
Excise duty on coal	Act No 609/2007		July 2008	
Excise duty on natural gas	Act No 609/2007		July 2008	
Excise duty on natural gas	Act No 609/2007		July 2008	
Exemption from excise duty on electricity	Act No 609/2007		July 2008	
Exemption from excise duty on electricity	Act No 609/2007	industry	July 2008	
Exemption from excise duty on electricity	Act No 609/2007	business enterprise sector	July 2008	
Exemption from excise duty on electricity	Act No 609/2007	households	July 2008	
Exemption from excise duty on coal	Act No 609/2007		July 2008	
Exemption from excise duty on coal	Act No 609/2007	business enterprise sector	July 2008	
Exemption from excise duty on coal	Act No 609/2007	households	July 2008	
Exemption from excise duty on natural gas	Act No 609/2007		July 2008	
Exemption from excise duty on natural gas	Act No 609/2007	households	July 2008	
Exemption from excise duty on natural gas	Act No 609/2007	business enterprise sector	July 2008	
VAT on mineral oils	Act No 222/2004		April 2004	
VAT on petrol				

VAT on intermediate oil				
VAT on gas oil (diesel)				
VAT on fuel oil				
VAT on liquefied gaseous hydrocarbons				
VAT on lubricating and other oils				
VAT on electricity				
VAT on coal				
VAT on natural gas				
Air pollution charge (for particulate emissions – large and medium sources)	Act No 401/1995		January 2000	
Air pollution charge (for sulphur oxide emissions – large and medium sources)	Act No 401/1995		January 2000	
Air pollution charge (for nitrogen oxide emissions – large and medium sources)	Act No 401/1995		January 2000	
Air pollution charge (for carbon monoxide emissions – large and medium sources)	Act No 401/1995		January 2000	
Air pollution charge (for emissions of organic substances in the gaseous phase – large and medium sources)	Act No 401/1995		January 2000	
Air pollution charge (for emissions of other pollutants/Class 1 – large and medium sources)	Act No 401/1995		January 2000	
Air pollution charge (for emissions of other pollutants/Class 2 – large and medium sources)	Act No 401/1995		January 2000	
Air pollution charge (for emissions of other pollutants/Class 3 – large and medium sources)	Act No 401/1995		January 2000	
Air pollution charge (for emissions of other pollutants/class 4 – large and medium sources)	Act No 401/1995		January 2000	
Reduced air pollution charge (for particulate emissions – large and medium indigenous lignite sources)	Act No 401/1995		5 May 2001	

Reduced air pollution charge (for sulphur oxide emissions – large and medium indigenous lignite sources)	Act No 401/1995		5 May 2001	
Reduced air pollution charge (for nitrogen oxide emissions – large and medium indigenous lignite sources)	Act No 401/1995		5 May 2001	
Reduced air pollution charge (for carbon nitrogen monoxide emissions – large and medium indigenous lignite sources)	Act No 401/1995		5 May 2001	
Reduced air pollution charge (for emissions of organic substances in the gaseous phase – large and medium indigenous lignite sources)	Act No 401/1995		5 May 2001	
Reduced air pollution charge (for emissions of other pollutants/Class 1 – large and medium indigenous lignite sources)	Act No 401/1995		5 May 2001	
Reduced air pollution charge (for emissions of other pollutants/Class 2 – large and medium indigenous lignite sources)	Act No 401/1995		5 May 2001	
Reduced air pollution charge (for emissions of other pollutants/Class 3 – large and medium indigenous lignite sources)	Act No 401/1995		5 May 2001	
Reduced air pollution charge (for emissions of other pollutants/Class 4 – large and medium indigenous lignite sources)	Act No 401/1995		5 May 2001	
Landfill fee – inert waste	Act No 17/2004		13 February 2004	
Landfill fee – other non-hazardous waste	Act No 17/2004		13 February 2004	
Landfill fee – municipal waste after sorting of less than 4 components	Act No 17/2004		January 2014	
Landfill fee – municipal waste after the sorting of four components	Act No 17/2004		13 February 2004	
Landfill fee – municipal waste after sorting of 5 components	Act No 17/2004		13 February	

			2004	
Landfill fee – hazardous waste	Act No 17/2004		13 February 2004	
Landfill fee – other waste	Act No 17/2004		13 February 2004	
Landfill fee – hazardous waste	Act No 17/2004		January 2014	
Payment for gas storage – natural gas	Government Regulation No 50/2002 Coll.		January 2008	
Payment for mining space – coal	Act No 44/1988 Coll.		January 1992	
Payment for excavated minerals – coal	Government Regulation No 50/2002 Coll.		January 2008	
Tariff for the use of hydropower potential of watercourses (between 100 kW and 1 000 kW)	ÚRSO Decree No 0002/2008/V		may 2016	
Tariff for the use of hydropower potential of watercourses (1 001 kW to 10 000 kW)	ÚRSO Decree No 0002/2008/V		may 2016	
Tariff for the use of hydropower potential of watercourses (above 10 000 kW)	ÚRSO Decree No 0002/2008/V		may 2016	
Max. amount of contribution to the National Nuclear Fund for 1 electricity end-user	Government Regulation No 426/2010	industry	January 2014	
Contributions from authorisation holders to operate nuclear installations – fixed component	Government Regulation No 312/2007		July 2007	
Contributions from authorisation holders to operate nuclear installations – variable component	Government Regulation No 312/2007		July 2007	
Contributions from authorisation holders to operate nuclear installations – total	Government Regulation No 312/2007		July 2007	
Tax on nuclear installation – municipalities within 1/3 of the radius of the threat area	Act No 582/2004		December 2009	
Tax on nuclear installation – municipalities between 1/3 and 2/3 of the radius of the threat area	Act No 582/2004		December 2009	

Tax on nuclear installation – municipalities beyond 2/3 of the radius of the threat area	Act No 582/2004		December 2009	
Registration fee for a vehicle with an engine power below 80 kW/up to 86 kW/up to 92 kW/up to 98 kW/up to 104 kW/up to 110 kW/up to 121 kW/up to 132 kW/up to 143 kW/up to 154 kW/up to 165 kW/up to 176 kW/up to 202 kW/up to 228 kW/up to 254 kW/over 254 kW	Act No 145/95 Coll.		February 2017	
Reduced electric car registration fee	Act No 145/95 Coll.		October 2012	
Motor vehicle tax – by engine capacity (up to 150 cm$^{3/up}$to 900 cm^{3}/up to 1 200 cm $^{3/up}$to 1 500 cm 3/up^{to}2000 cm 3/up to^{3000} ^{cm}3/above 3 000 cm^{3}	Act No 361/2014	business enterprise sector	January 2015	
Exemption from motor vehicle tax – electric car	Act No 361/2014	business enterprise sector	January 2015	
Reduced tax on motor vehicles – hybrids, CNG and hydrogen	Act No 361/2014	business enterprise sector	January 2015	
System operation tariff – RES	Decree of ÚRSO laying down price regulation in the electricity sector and certain conditions for carrying out regulated activities in the electricity sector (current Decree No 18/2017, as amended by No 207/2018 and No 178/2019)		August 2007	annual update
System operation tariff – CHP			August 2007	annual update
System operating tariff – electricity generation from indigenous coal			August 2007	annual update
System operating tariff – OKTE			August 2007	annual update
System operation tariff – total			August 2007	annual update
Reduced system operation tariff – stable off-take	Decree of ÚRSO laying down price regulation in the electricity sector and certain conditions for carrying out regulated activities in the electricity sector (current Decree No 18/2017 Coll. in wording No 207/2018	industry	July 2012	annual update

	Coll. and No 178/2019 Coll.)			
Reduced tariff for system services – stable off-take	ÚRSO Decree No 225/2011; and ÚRSO Decree No 18/2017 as amended by No 207/2018 and No 178/2019	industry	July 2012	annual update

5. IMPACT ASSESSMENT OF PLANNED POLICIES AND MEASURES87

5.1. Impacts of planned policies and measures described in section 3 on energy system and GHG emissions and removals, including comparison to projections with existing policies and measures (as described in section 4).

I. Projections of the development of the energy system and GHG emissions and removals as well as, where relevant of emissions of air pollutants in accordance with Directive (EU) 2016/2284 under the planned policies and measures at least until ten years after the period covered by the plan (including for the last year of the period covered by the plan), including relevant Union policies and measures.

The effects of the 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 the previous chapter 4.1.1.ii).

This chapter follows, in its entirety, by sector of the national economy, Chapter 4.1.1.ii (WEM scenario), which provides descriptions of the models, methodologies and implemented PAMs used to prepare GHG emission projections, including a description of the sectors (parameters, activity data, data sources, etc.).

III-a Description of the scenario with additional measures

WAM – The scenario with other measures (the so-called decarbonisation scenario) is identical to the DCarb2 scenario. The adopted 'Clean Energy for All Europeans' policy package presented by the European Commission in November 2016 was also taken into account when designing the WAM scenario. The PRIMES modelling scenarios, named the EUCO scenario, by 2030 and 2050 supported the evaluation of the impact of the measures and targets proposed by the European Commission. Other PRIMES scenarios of the EUCO 2030 and 2050 scenario supported the assessment of the measures and targets proposed by the European Commission.

The WAM scenarios include ways to achieve different combinations of ambitious targets for energy efficiency, renewables and emission reduction targets in 2030. The WAM scenario analyses the possibility of achieving the EU's 2050 emission reduction targets (carbon neutrality). The scenario includes Slovakia's participation in the EU ETS after 2020 and medium targets for renewables and energy efficiency, construction of new nuclear power generation capacity, maintaining its key role in the production mix.

The new governance process restricts Member States' freedom to adopt national targets for renewables, energy efficiency and overall greenhouse gas emission reductions. As regards an objective which is not part of the EU ETS, there is no freedom, but the specification of that objective by category

87 Planned 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.

is at the discretion of the Member State. As a substantial part of the emissions not covered by the EU ETS are not related to energy production, it is possible to make cross-sectoral choices.

- In order to shape the Slovak Republic's possible contributions to the achievement of the EU's 2030 targets, an overview of possible contributions has been prepared using a number of variant scenarios that have been quantified for Slovakia using the PRIMES model (Table 90).

Table 90 Objectives achieved in each scenario

	Ref.	Decarb1	Decarb2	Decarb3	Decarb4	EUCO
Total CO_2 combustion emissions (% change since 2005)	—27,81	—39,02	—40,80	—40,59	—41.48	—38.94
Primary energy savings (%)	—24,91	—30,32	—28.36	—27,25	—28,88	—26.93
Total RES (%)	14,34	16,33	18,91	19,83	21,85	19,0
RES- Heating and Cooling (%)	14,04	16,89	20,65	22,07	19,55	22,0
RES – Electricity (%)	21,28	22,62	24,81	25,32	36,79	23,4
RES – Transport (%)	10,20	11,49	11,74	11,80	13,12	11,4

III-b The description of the different models – Compact Primes, Envisage Slovakia was used to prepare the projections of greenhouse gas emissions in the WAM scenario. The details are described in Chapter 4.1.1.ii. For national reporting purposes, DCarb2 was used in the WAM scenario.

III-c Emissions in the energy sector (excluding transport) – Energy sector emits greenhouse gas emissions from the combustion and conversion of fossil fuels. 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 categorisation of GHG emissions, therefore the model results had to be adjusted to the applicable GHG inventory. The specification of the WAM scenario depends on the design logic of the EU scenarios and in particular on the EUCO30 scenario88, which sets targets for 2030 at EU level as follows:

- Reducing greenhouse gas emissions by 40 % in 2030 and by 80-85 % in 2050 compared to 1990;
- A 43 %$_{reduction}$ in CO2 emissions in the EU ETS in 2030 and 90 % in 2050 compared to with 2005, however, as shown by the carbon price trajectories in the EU ETS as a result of EU ETS market regulations, including the market stability reserve, as adopted;

[88] In 2016, the European Commission developed two baseline policy scenarios, EUCO27 and EUCO30, using the PRIMES model, based on the EU 2016 Reference Scenario. The EUCO scenarios include the achievement of the 2030 energy and climate targets and the 27 % or 30 % energy efficiency target. www.ec.europa.eu/energy/en/data-analysis/energy-modelling

- 30 % reduction of greenhouse gas emissions in non-EU ETS sectors in 2030 compared to 2005 with country-specific obligations;
- The share of RES is 27 % of gross final energy consumption in 2030;
- Energy efficiency expressed as a 30 % reduction in primary energy consumption (1321 Mtoe – excluding non-energy consumption of energy products) in 2030 compared to the 2007 baseline.

In addition to the above, the PAMs scenario also includes the following national policies:

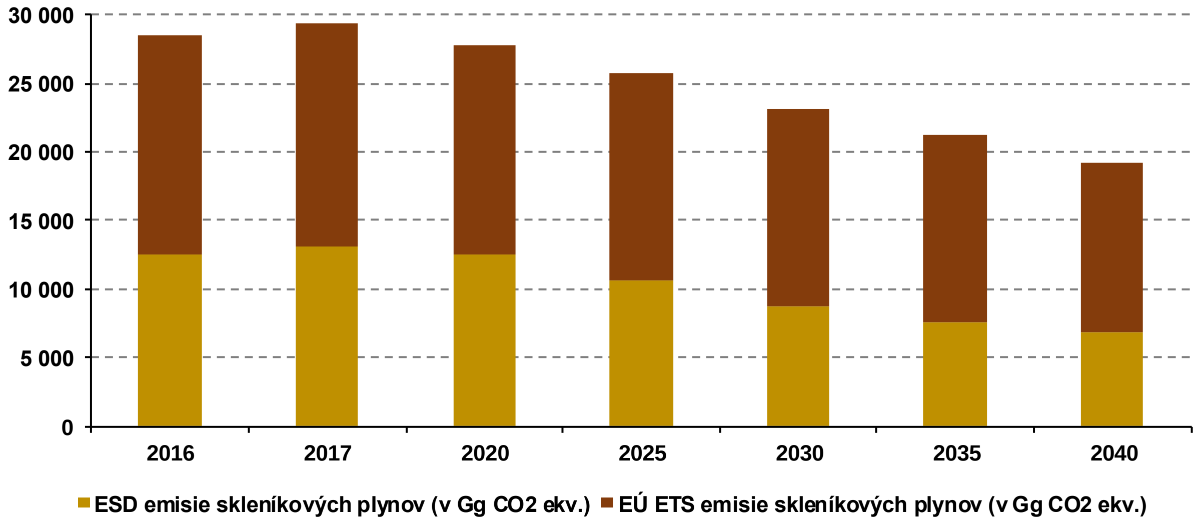
- Early decommissioning of power plants using solid fuels. The decommissioning of Vojany and Nováky is foreseen in 2025 and 2023 respectively.
- Support scheme for RES in electricity generation with foreseen RES technologies such as solar PV, onshore wind turbines and biomass. The scenarios foresee 50 MW support in the period 2021-2025, followed by an additional 500 MW based on auctions.
- Further development of nuclear energy is foreseen on the basis of economic optimality.
- Carbon capture and storage is excluded.

The evolution of projections of greenhouse gas emissions in terms of$_{CO2}$ equivalent under the decarbonisation scenario with other measures (WAM-DCarb2) from the energy sector (transport projections are described in more detail in Chapter 4.1.1.iii-f) are shown in the following table and graph.

Table 91 Greenhouse gas emissions projections from the energy sector under the WAM scenario

Total GHG emissions (Gg CO_2 eq.)							
Year	**2016**	**2017**	**2020**	**2025**	**2030**	**2035**	**2040**
Total emissions excluding LULUCF	**42 154**	**43 316**	**42 355**	**42 046**	**41 399**	**39 526**	**38 521**
Total emissions with LULUCF	**35 427**	**36 727**	**36 210**	**37 006**	**36 965**	**35 370**	**34 290**
1. Energy	28 483	29 442	27 845	25 802	23 152	21 320	19 261
1.A.1. Energy industry	7 540	7 487	7 118	5 634	4 444	3 986	4 211
1.A.2 Manufacturing industry	6 710	7 136	6 823	6 342	5 435	4 731	3 739
1.A.3 Transport	7 536	7 660	6 878	7 070	7 097	6 907	6 152
1.A.4 Other	4 942	5 357	5 387	5 304	4 851	4 626	4 194
1.A.5 Other	66	66	66	61	52	49	48
1.B. Fugitive emissions from fuels	1 689	1 737	1 573	1 390	1 273	1 021	918

Figure 71 Projections of greenhouse gas emissions from the energy sector split into the EU ETS and ESD under the WAM scenario



Source: SHMÚ, 2016 and 2017 data are realistic

III-d Projections of fugitive CH4 and CO2 emissions from coal mining following mining activities – projections of fugitive CH4 and CO2 emissions have been calculated on the basis of the following data and assumptions:

- Data on coal mining in 2017 were obtained from individual underground mines from official sources – from companies: HBP, a.s. and the Statistical Office of the Slovak Republic
- The envisaged end of state subsidies for coal mining in the mining company HBP, a.s. is expected in 2023;
- A gradual reduction in coal production is also observed in the context of the closure of the Cígeľ mine (HBP, a.s) in 2017.

The emission factors and methodology specified in Chapter 4.1.1.ii -d were used to calculate fugitive methane and CO2 emissions. The table below shows the projected volume of coal production between 2017 and 2040 under the WAM scenario. The possible continuation of indigenous coal production after 2023 will depend on its economic profitability after the end of the state subsidies.

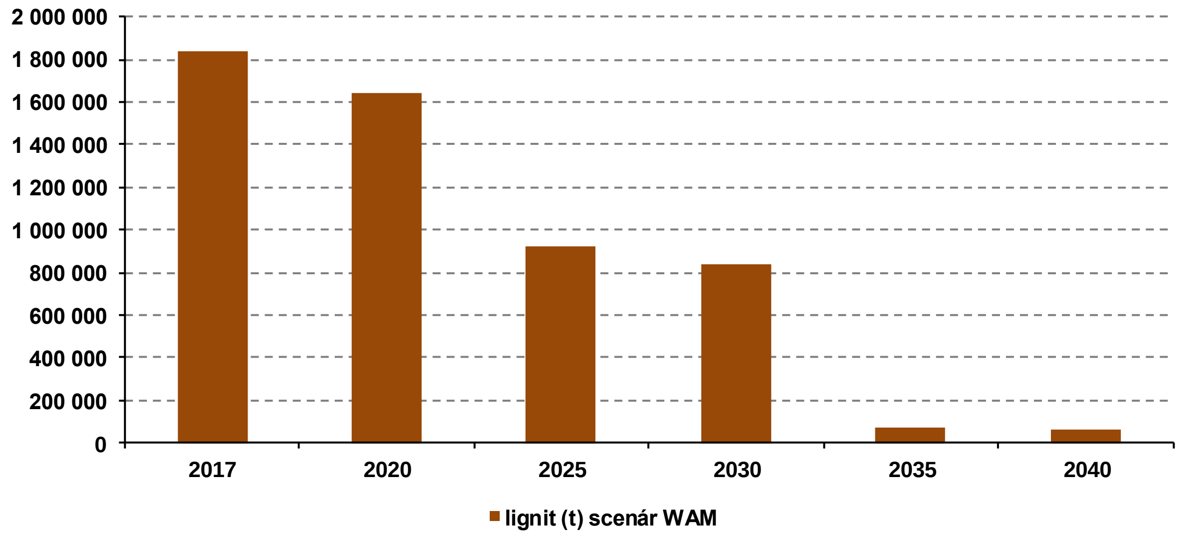
Table 92 Planned coal mining in Slovakia until 2040 under the WAM scenario

Mines	Unit	2017*	2020	2025	2030	2035	2040
HBP, a.s.	kt	1 779	1 189	424	341	0	0
Cigeľ	kt	180	0	0	0	0	0
Handlová	kt	173	0	0	0	0	0
Nováky	kt	1 426	1 189	424**	341**	0	0
BD, a.s.	kt	0	0	0	0	0	0
BČ, a.s.	kt	56	450	500**	500**	73	62
Total output	**kt**	1 834	1 639	924	841	73	62

*real values; Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

***The model foresaw declining mining until 2030, but according to the Slovak Government Resolution of July 2019, the notification of State aid to end the closure of uncompetitive coal mines in Upper Nitra foresees the end of support for coal mining by 2023.*

Graph 72 Planned coal mining 2017*-2040 under the WAM scenario



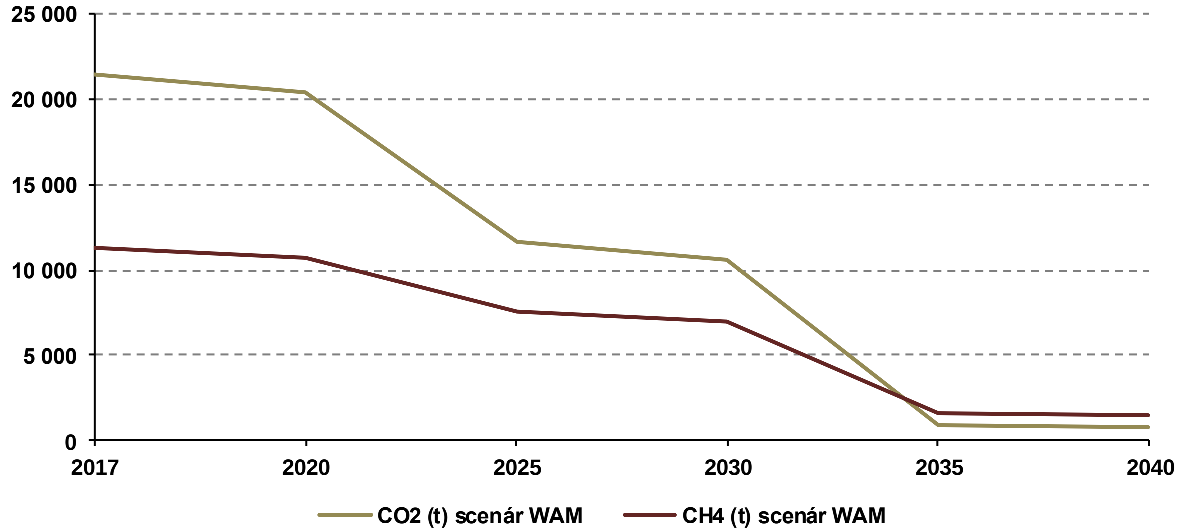
*real values; Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC

Table 93 Projections of fugitive methane and CO2 emissions from coal mining and mining activities in the Slovak Republic until 2040 under the WAM scenario

Year	Lignite	CH_4	CO_2	Co_2 eq.
	tonnes			
2017*	1 834 000	11 297	21 398	303 823
2020	1 639 067	10 758	20 433	289 383
2025	924 341	7 524	11 622	199 722
2030	840 804	7 023	10 589	186164
2035	73 258	1 624	935	41 535
2040	62 061	1 431	792	36 567

*real values; Source: MoE SR and SHMÚ

Figure 73 Projections of fugitive methane and CO_2 emissions from coal mining and mining activities in the Slovak Republic by 2040 under the WAM scenario



2017 are real values; Source: SHMÚ

III-e) Projections of fugitive greenhouse gas emissions from the extraction, transport and distribution of natural gas and oil in Slovakia for the period 2017-2040 were prepared on the basis of the following data and assumptions:

- Statistical Office of the Slovak Republic;
- CPS model;

Emission factors from the following sources were used to calculate fugitive emissions (and projections) of methane from the extraction, transport and distribution of natural gas and oil in the Slovak Republic:

- 2006 IPCC Guidelines for National Greenhouse Gas Inventories – Chapter 4: Fugitive emissions (IPCC 2006 GL);
- IPCC Guidelines on good practices and uncertainties for national greenhouse gas inventories (IPCC 2000 GPG).

Projections for fugitive methane emissions from the extraction, transport and distribution of natural gas and oil in the Slovak Republic were estimated on the basis of the following assumptions:

- After 2020, oil production in the Slovak Republic will end;
- Natural gas production will only slowly decline. Consumption/distribution of natural gas and oil in Slovakia will be unchanged;
- The redirection of natural gas supplies via the Nord Stream pipeline will reduce the amount of gas transported to other countries by pipelines in Slovakia, resulting in a reduction in fugitive CH_4 emissions.

Table 94 Projections of activity data for the preparation of projections for 2017-2040 under the WAM scenario

Activity	Units	2017*	2020	2025	2030	2035	2040
Oil production	T	8 000	10 254	0	0	0	0
Oil processing	T	5 587 000	5 749 078	5 664 604	5 621 146	5 458 604	5 282 346
Transport of oil over long distances	T	9 582 252	9 727 295	9 454 590	9 181 885	8909 180	8 636 475
Production of natural gas	10^6 m^3	140,000	110,605	114,095	100,413	85,417	75,361
Transport of natural gas over long distances	10^6 m^3	64 200,00	56 000,00	51 000,00	46 000,00	41 000,00	36 000,00
Distribution of natural gas	10^6 m^3	5 248,000	4 871,149	5 556,479	5 466,016	5 267,342	5 355,552

***real values; Source: MINISTRY OF THE ECONOMY OF THE SLOVAK REPUBLIC**

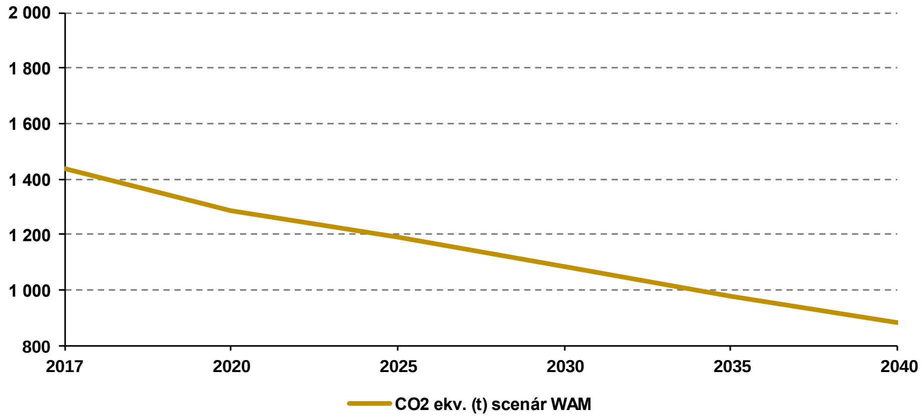
In addition to the projections for fugitive CH_4 emissions from the transport and distribution of natural gas and oil in Slovakia, the projections for CO_2, NMVOC and N_2O have been calculated, but their relevance to the overall projections of greenhouse gas emissions is negligible. The same methodology and the same conditions were used in the calculations, but the results of the negotiations on Directive 2018/2001 on the promotion of energy from renewable sources were not taken into account.

Table 95 Projections of fugitive oil and gas emissions for 2017-2040 under the WAM scenario

Year	CH_4	CO_2	NMVOC	N_2O
		tonnes		
2017*	57 543	1 317	8 747	0,0116
2020	51 280	1 296	8 896	0,0126
2025	47 582	879	8 672	0,0037
2030	43 434	808	8 527	0,0032
2035	39 606	727	8 527	0,0028
2040	35 212	677	7 914	0,0024

***real values; Source: SHMÚ**

Figure 74 Projections of fugitive greenhouse gas emissions from oil and natural gas by 2040 in the Slovak Republic under the WAM scenario



2017 are real values; Source: SHMÚ

III-f Emissions from transport – based on the energy model and its layout as described in the previous chapter 4.1.1.ii. Projections of CO_2 emissions under the scenario with other measures in category 1.A.3.b – Road transport have been prepared under the DCarb2 scenario (WAM). According to the calculated projections, there is a clear downward trend in CO_2 and N_2O emissions until 2040, but CH_4 emissions are increasing compared to the WEM scenario in the WAM scenario. The most likely reason is the increasing trend in the consumption of natural gas and biogas in road transport and its increasing share of fuel consumption included in the WAM scenario.

The Slovak Republic as well as other countries are implementing various policies and measures to reduce the environmental burden in the transport sector. All policies and measures described in Chapter 3 for the transport sector are in line with the prepared low-carbon study of the Slovak Republic. Of those PAMs, only those for which the emission reduction potential could be calculated and which relate to the Dcarb2 scenario (WAM) were assessed and used for the preparation of projections.

Table 96 Projected fuel consumption in the transport sector for 2017-2040 under the WAM scenario

Fuel	unit	2017*	2020	2025	2030	2035	2040
Petrol	TJ	22 034,4	21 747,6	21 186,0	21 142,8	19 090,8	14 986,8
Diesel fuel	TJ	74 694,6	56 314,8	57 020,4	56 844,0	50 464,8	35 082,0
LPG	TJ	1 944,1	3 506,4	3 204,0	3 358,8	3 168,0	3 834,0
Natural gas	TJ	223,2	752,4	784,8	1 080,0	1 400,4	1 638,0
Biogas	TJ	0,0	3,6	25,2	111,6	169,2	421,2
Conventional biofuels	TJ	6 481,6	7 437,6	7 326,0	7 938,0	3 214,8	2 836,8
Advanced biofuels	TJ	0,0	0,0	0,0	10,8	7 146,0	17 337,6
Kerosene	TJ	45,0	2 268,0	2 768,4	3 394,8	3 556,8	3 247,2
Hydrogen	TJ	0,0	0,0	0,0	10,8	327,6	2 365,2
Electricity	GWh	0,2	707,0	870,0	1 056,0	1 301,0	2 276,0

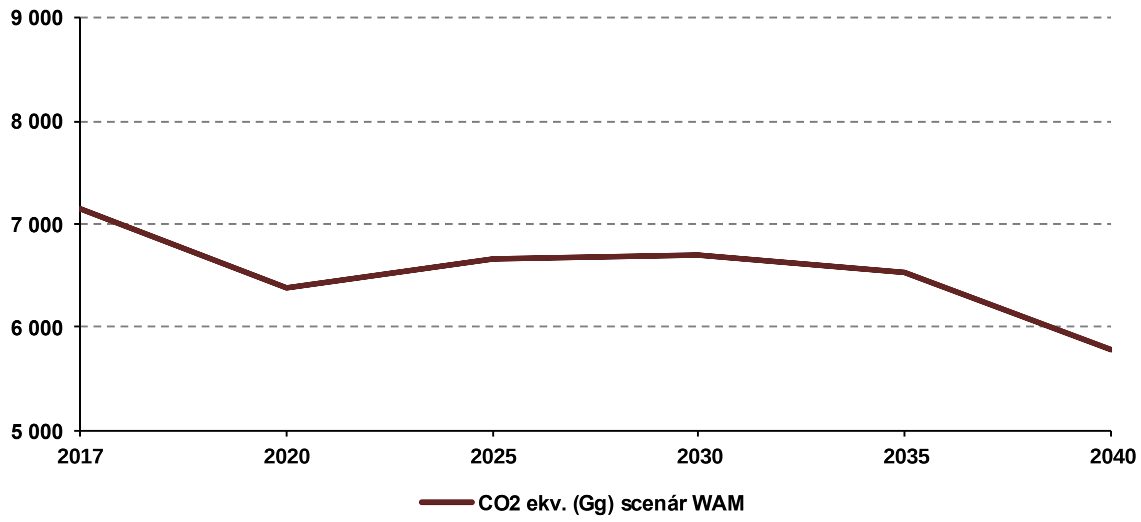
*real values; Source: SHMÚ

Table 97 Road transport GHG emissions projections for 2017-2040 under the WAM scenario

Year	CO_2	CH_4	N_2O
	kt	tonnes	
2017*	7 151,18	318,34	262,02
2020	6 377,67	180,36	230,74
2025	6 657,64	148,84	263,71
2030	6 695,72	130,75	275,51
2035	6 523,17	119,64	272,11
2040	5 788,15	120,49	231,81

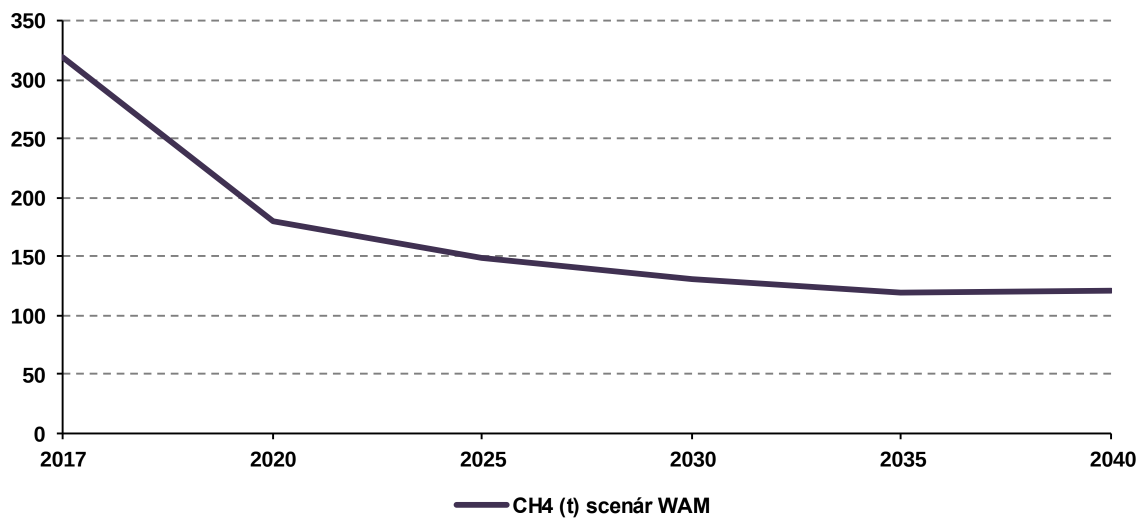
*real values; Source: SHMÚ

Figure 75 Projections of 2040 greenhouse gas emissions in road transport under the WAM scenario



2017 are real values; Source: SHMÚ

Figure 76 Projections of 2040 methane emissions in road transport according to the WAM scenario



2017 are real values; Source: SHMÚ

In addition to projections of greenhouse gas emissions in road transport, projections for non-road transport emissions in the Slovak Republic have been calculated, but their share of total transport emissions is minimal. Non-road emission projections have been calculated in a simpler way using AutoRegressive Integrated Moving Average (ARIMA) modelling. Only a WEM scenario that is identical to the WAM scenario (Chapter 4.1.1.ii) was prepared for these projections.

III-g Emissions projections from the industrial processes and product use (IPPU) sector – a description of scenarios and methodology is given in Chapter 4.1.1.ii. Projections of emissions from the IPPU sector included in the EU ETS (large industrial enterprises) have been modelled together with energy projections (DCarb2 scenario), and projections for emissions from the IPPU sector that are not included in the EU ETS have been modelled by taking into account the trend of value added and the effect of the measures by production category.

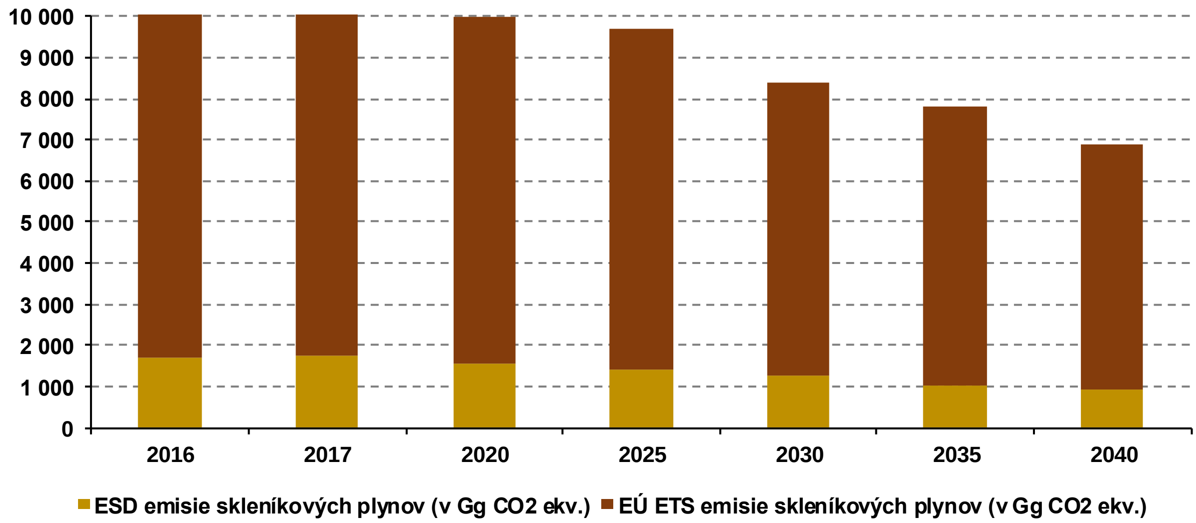
The evolution of GHG emission projections in terms of CO2 equivalentaccording to the Measure scenario (WAM-DCarb2) from the sector industrial processes, including F-gases, is shown in Table 79 and Graph 62*.*

Table 98 Projections of greenhouse gas emissions from the sector industrial processes including F-gases under the WAM scenario

Total GHG emissions in the industrial processes sector (in Gg CO_2 eq.)							
Year	**2016**	**2017**	**2020**	**2025**	**2030**	**2035**	**2040**
Total emissions excluding LULUCF	**42 154**	**43 316**	**42 355**	**42 046**	**41 399**	**39 526**	**38 521**
Total emissions with LULUCF	**35 427**	**36 727**	**36 210**	**37 006**	**36 965**	**35 370**	**34 290**
2. Industrial processes*	9 378	9 647	9 417	9 245	7 456	7 009	6 159
2.A Manufacture of cement and lime	2 183	2 277	2 023	1 992	1 636	1 544	1 343
2.B Chemical industry	1 471	1 535	1 509	1 518	1 348	1 333	1 281
2.C Manufacture of metal	4 851	4 906	4 914	4 849	4 185	3 949	3 367
2.D Non-energy use of fuels	124	113	114	112	111	108	103
2. E e Industry	NO	NO	NO	NO	NO	NO	NO
2.F Use of F-gases	673	739	785	704	116	21	21
2.G Manufacture of products and their use	75,25	76,76	71,40	68,82	60,98	52,88	45,02

- Small differences in the total may be due to rounding.

Figure 77 Projections of greenhouse gas emissions from the sector industrial processes including F-gases broken down into EU ETS and ESD by WAM scenario



Source: SHMÚ, 2016 and 2017 data are realistic

III-h Emissions projections F-gases – projections of emissions of F-gases in category 2.F under the WAM scenario were prepared in accordance with EP and Council Regulation 517/2014, on the condition that all refrigerants must be supplied from gases with low GWP (or complementary gases). Projections of SF_6 emissions in category 2.G under the WAM scenario have been prepared in accordance with the condition of a ban on the use of SF_6 gas in new installations. Table 79 shows the total aggregated data on projections of emissions of technological gases and F-gases in the sector industrial processes under the WAM scenario.

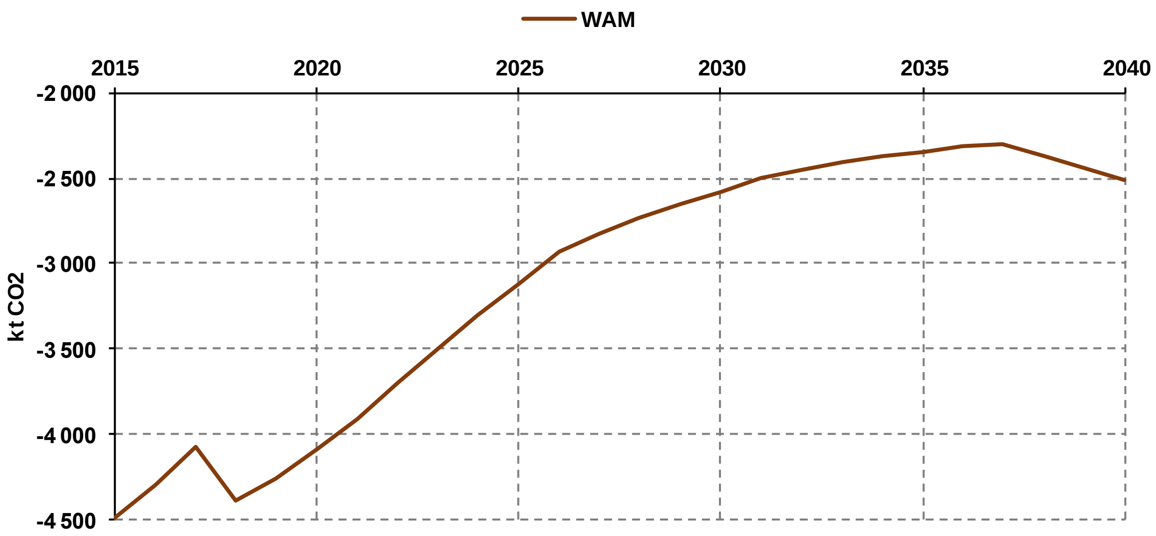
III-i Emissions projections in the agriculture sector – only one scenario has been prepared in this sector, which is described in detail in Chapter 4.1.1.ii.

Projections of emissions in the sector, land use change and forestry (LULUCF) – projections of emissions and removals in the LULUCF sector were based on the sectoral strategy document of the Slovak Republic's Rural Development Programme 2007-2013 and 2014-2020, taking into account the adopted National Forestry Programme (NLP) of the Slovak Republic as well as the NLP Action Plans for 2009-2013 and 2015-2020.

The WAM scenario shows the evolution of emissions with afforestation of 23 000 ha grassland by 2040 and grassland of 50 000 ha of arable land after 2016. Based on this assumption, the scenario shows an increase in CO_2 sinks in forests and arable land and a slight decrease in grassland and pasture areas, as well as an increase in emissions from inhabited and other land categories.

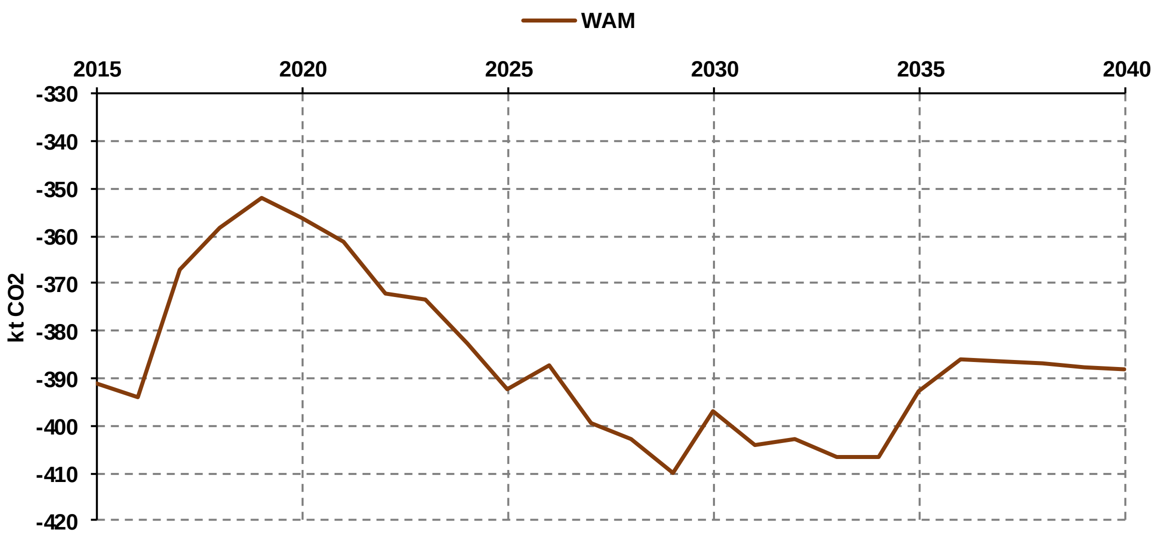
The WAM scenario includes measures planned after 2016. The RDP (2014-2020) was adopted as a continuation of the previous document and no new specific measures were introduced. The WAM scenario took into account afforestation of agricultural land of 23 000 ha for the period 2020-2040. The calculation of GHG emissions was based on the methodological procedures and mathematical relationships defined in the 2003 IPCC Guidance on Good Practice for the LULUCF Sector (IPCC GPG LULUCF). The values of emission factors and conversion/expansion factors used for the projections are consistent with the 2016 LULUCF GHG inventory. They are also published in the National Inventory Report of the Slovak Republic 2018.

Graph 78 Projections of CO2 emissions and removals (in Gg) in category 4.A.1 – Forest land that remained forest land under the WAM scenario until 2040



2015 are real values; Source: SHMÚ

Graph 79 Projections of CO2 emissions and removals (in Gg) in category 4.A.2 – Land converted to forest (afforestation) under the 2040 WAM scenario



2015 are real values; Source: SHMÚ

Table 99 presents the results from the modelling of projections of CO2 emissions and removals from the LULUCF sector. The WAM scenario shows the evolution of emissions with afforestation of 23 000 ha of grassland by 2040 and grassland of 50 000 ha of arable land after 2016. Based on this assumption, the scenario shows an increase in CO_2 sinks in forests and arable land and a slight decrease in grassland and pasture areas, as well as an increase in emissions from inhabited and other land categories.

Table 99 Emissions and removals of CO2 emissions and removals in the LULUCF sector (in Gg) under the 2040 WAM scenario

WAM	2017*	2020	2025	2030	2035	2040
Land use, land-use change and forestry	**—6,642,32**	**—6,208,50**	**—5 122,03**	**—4 533,63**	**—4 272,30**	**—4 360,09**
Forest land	—4 448,84	—4 443,98	—3 508,66	—2 974,27	—2 734,49	—2 903,00
Forest land remaining forest	—4 079,85	—4 087,74	—3 116,28	—2 577,32	—2 341,87	—2 514,99
Land conversion to forest parcels	—368,99	—356,24	—392,38	—396,95	—392,61	—388,01
Arable	—1 142,66	—1 056,47	—1 050,48	—1 027,52	—1 005,19	—984,83
Grassland	—165,25	—117,53	—83.96	—115,33	—155,41	—163,48
Headquarters	98,38	102,65	111,08	103,86	101,85	102,25
Other land	92,98	132,74	143,03	146,52	132,43	133,19
Harvested Wood Products	—1 076,92	—825,92	—733,04	—666,88	—611,49	—544,22

*** fair values; Source: SHMÚ**

The same procedure has been used when modelling emissions from forest fires. The outputs from projections of $CH4_{emissions}$ from forest fires are shown in the table below.

Table 100 Emissions projections of LULUCF CH4 and N2O emissions from forest fires (in Gg) under the WAM scenario until 2040

			CH_4			
WAM	**2017***	**2020**	**2025**	**2030**	**2035**	**2040**
Land use, land-use change and forestry	**0,85**	**0,70**	**0,73**	**0,75**	**0,76**	**0,8**
Forest land	0,85	0,70	0,73	0,75	0,76	0,8
Forest plots remaining forest plots	0,85	0,70	0,73	0,75	0,76	0,8
			N_2O			
Land use, land-use change and forestry	**0,12**	**0,10**	**0,11**	**0,11**	**0,11**	**0,11**
Forest land	0,05	0,04	0,04	0,04	0,04	0,04
Forest plots remaining forest plots	0,05	0,04	0,04	0,04	0,04	0,04

*** fair values; Source: SHMÚ**

Slovakia has not yet defined emissions and removals from the wetland category, there is a lack of active data to model emission and abstraction projections over the reporting period.

III-j Emissions projections in the waste sector – projections of emissions from the waste sector by 2040 under the WAM scenario focus on municipal waste disposal and urban waste water treatment. These two main emission sources account for more than 80 % of the estimated emissions in the sector. Emissions from composting, waste incineration, industrial waste disposal and industrial waste water treatment are estimated over the previous 10 years (2007-2017), for municipal waste composting only a constant value of 2017 over the whole period 2018-2040.

Description of the WAM scenario – For the waste water sector only the WEM scenario is prepared. For the period 2018-2040, there are no quantified targets to define alternative scenarios. The 2019-2025 waste prevention programme evaluates the specific objectives of the predecessor programmes and concludes that most of those targets have not been achieved. Therefore, the new programming document 2019-2025 defines new quantified targets for municipal waste that have been included in the WAM scenario:

- reduce residual municipal waste by 50 % by 2025 compared to 2016 levels by 2025;
- reduce biodegradable waste in residual municipal waste by 60 % by 2025 at the latest;
- Reduce landfilling to 10 % of total municipal waste by 2035.

In order to achieve the above objectives, it was expected that existing incineration plants would continue to increase their operation continuously to full capacity, i.e. 285 kt/year (Kiceney 70-80 kt/year and Bratislava 135 kt/year). The model provided for the generation of additional incinerators and a capacity for mechanical biological treatment of waste of 560 kt/year.

III-k Emissions in international transport – these emissions are not included in the national balance. The data in Table 101 show that the projected GHG emissions also for WAM from these categories account for a negligible share of total emissions.

Table 101 Aggregated data on projections of greenhouse gas emissions from international transport under the WAM scenario (in Gg CO2 eq.) up to 2040

WAM	**2017***	**2020**	**2025**	**2030**	**2035**	**2040**
International transport	**185,06**	**185,06**	**185,06**	**185,06**	**185,06**	**185,06**
Aviation	166,39	166,39	166,39	166,39	166,39	166,39
River transport	18,67	18,67	18,67	18,67	18,67	18,67

*** fair values; Source: SHMÚ**

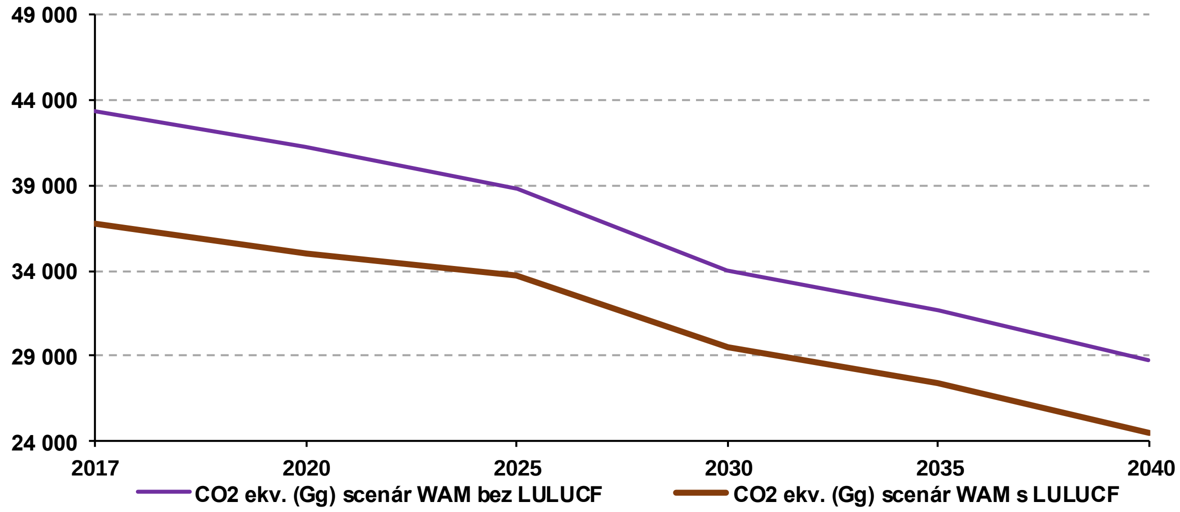
III-j Projections of total GHG emissions in the WAM scenario – Table 102 shows trends in projections of GHG emissions up to 2040 under the WAM scenario with and without removals from LULUCF.

Table 102 Projections of total greenhouse gas emissions (in Gg CO2 eq.) under the WAM scenario up to 2040 s and excluding LULUCF

WAM	**2017***	**2020**	**2025**	**2030**	**2035**	**2040**
Total excluding LULUCF	**43 316,44**	**41 202,63**	**38 761,08**	**34 019,06**	**31 684,66**	**28 750,82**
Total including LULUCF	**36 726,75**	**35 042,78**	**33 688,87**	**29 536,29**	**27 463,07**	**24 443,36**
1. Energy	29 442,34	27 845,20	25 801,56	23 151,76	21 320,05	19 260,82
2. Industrial processes	9 646,59	9 417,17	9 244,52	7 456,03	7 008,62	6 159,37
3. Farming	2 546,79	2 376,24	2 390,66	2 419,79	2 497,09	2 570,24
4. LULUCF	—	—	—	—	—	—
5. Wastes	1 680,72	1 564,01	1 324,34	991,49	858,90	760,40

* fair values; Source: SHMÚ

Figure 80 Projections of aggregated greenhouse gas emissions (in Gg CO2 eq.) by WAM scenario with and without LULUCF by 2040



2017 are real values; Source: SHMÚ

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

Slovakia intends to minimise the risk of stranded costs in existing energy installations. Therefore, the completion of built-in electricity sources, the gradual replacement of polluting fossil fuel sources by reducing consumption and constructing RES-based sources remains a priority.

In the area of heat supply, priority is given to making maximum use of existing CZT systems and gradually transforming them into an efficient CZT, with the possibility of changing the fuel base towards RES, taking into account decreasing heat consumption and for reasons of thermal energy.

In order to optimise the decision-making and permitting processes, account must therefore be taken of the interplay between ETS policy, pricing, taxation, regulatory policy and environmental burden reduction requirements. Aligning individual policies with investment objectives is a challenge for better regulation. Predictability and transparency of the decision-making process play an important role in this. That practice minimises the possibility of frustration of investment and stranded costs.

III. Assessment of interactions between existing policies and measures and planned policies and measures, and between those policies and measures and Union climate and energy policy measures

Slovakia is a leader in the production of electricity using low-carbon technologies. Nuclear energy accounts for thelargest share, which contributes not only to decarbonisation but also to the security of electricity supply, and therefore the safe use of nuclear energy is a fundamental safety concern of the Slovak Republic. The Slovak Republic intends to use existing resources 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 restrictive interms of meeting the EU's RES objectives, but it delivers better results in terms of meeting the decarbonisation objectives.

Natural gas is widely used for heat production, where Slovakia is steaming to the countries with the largest supply coverage. The gradual increase in the share of biomethane is in synergy with EU measures.

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 follows, in its entirety, by analysed national economy sectors (energy, industry, energy efficiency, transport) Chapter 4 (WEM scenario), which presents the descriptions of the energy and macroeconomic model (CPS, Envisage Slovakia) prepared for Slovakia to address issues on EU climate and energy policies. These analytical models differ in nature in terms of coverage and approach. On the other hand, the evaluation of climate policies and the display of the impact of different policy packages together constitute a powerful tool. Both models draw on multiple data sources and are based on the information used by the EU to develop scenarios (described in the introduction to Chapter 4).

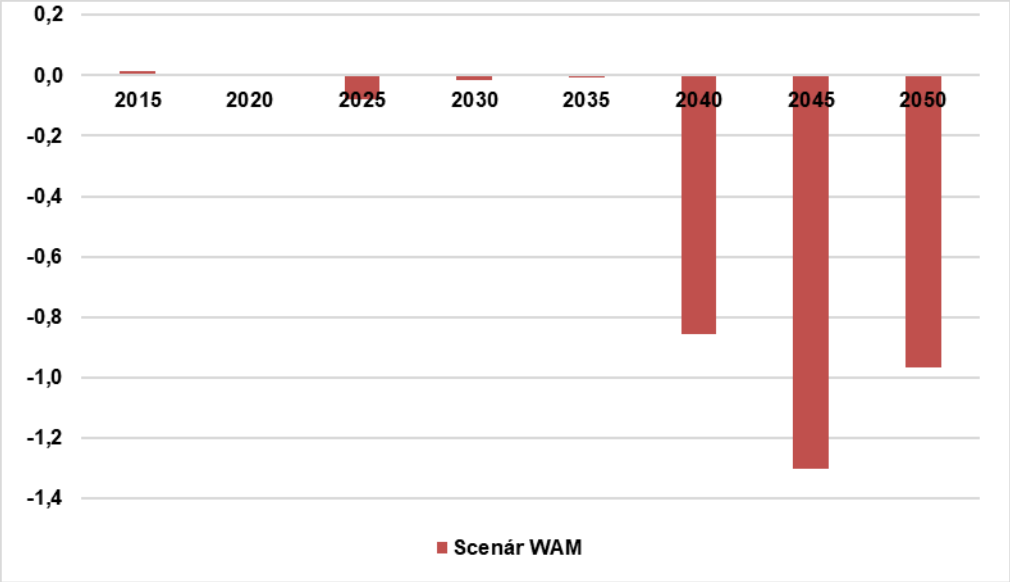
The macroeconomic model for Slovakia, which complements the energy model, uses the detailed results of the energy system from the CPS model and assesses the impacts across the economy. It has all the characteristics of the standard model of general economic equilibrium, but it contains further details on energy, electricity production and emissions, so it is also useful for assessing climate policies. The macroeconomic model is tailor-made to reflect the specific characteristics of the Slovak economy. Importantly, the demand for energy commodities in households and firms is price sensitive and captures different options for electricity generation. Emissions are explicitly modelled. Using the Slovak-CGE model, various mitigation policies can be analysed. Compared to the CPS energy model, the Slovak-CGE model aims to simulate the wider economic impacts of the shift towards a low-carbon economy.

5.2.1 WAM scenario macroeconomic analysis – employment

Based on the results of the WAM scnerner, changes in the structure of the economy will lead to a reallocation of labour across different sectors of industry. It can be expected that the sectors in which growth is expected (mainly the export-oriented industry and those providing goods for investment) will need additional labour, while those sectors that are expected to decline (mainly consumables) will free up labour. However, not all workers who become redundant can find jobs in new growing sectors, which can lead to rising unemployment. Overall, the structural change of the economy in response to decarbonisation policies (Dcarb 2 scenario) appears to be negative due to aggregate labour demand. From a short-term perspective (also due to delayed wage adjustments), reduced labour demand will mainly affect lower employment. From a long-term perspective, this will offset the pressure on lower wages, in particular towards 2050.

Chart 81 and 82 illustrate these developments.

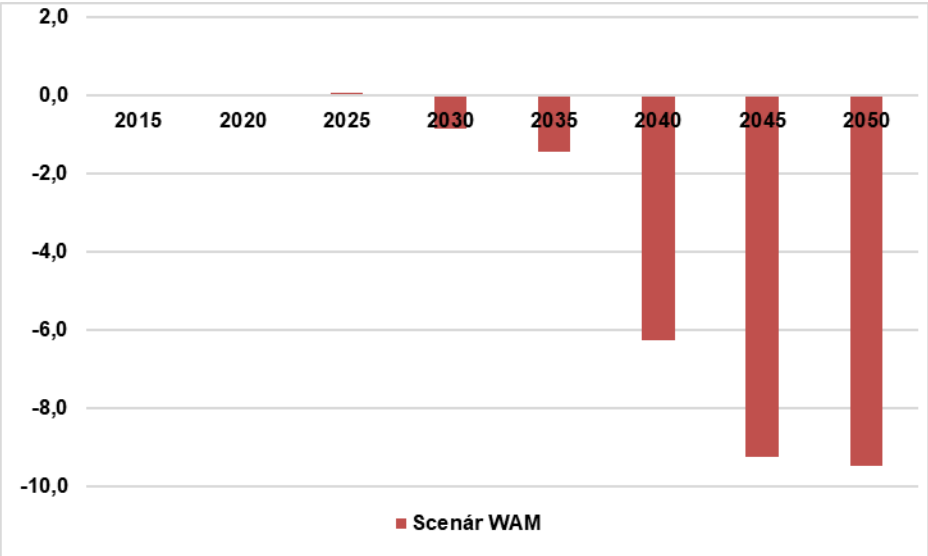
Figure 81 Total employment, by policy scenario, 2015-2050; % change from reference scenario



Source: Results of the Slovak CGE model

Wages fall in the long term in parallel with labour market adjustment

Figure 82 Real wages, by policy scenario, 2015-2050, % change from reference scenario



Source: Results of the Slovak CGE model

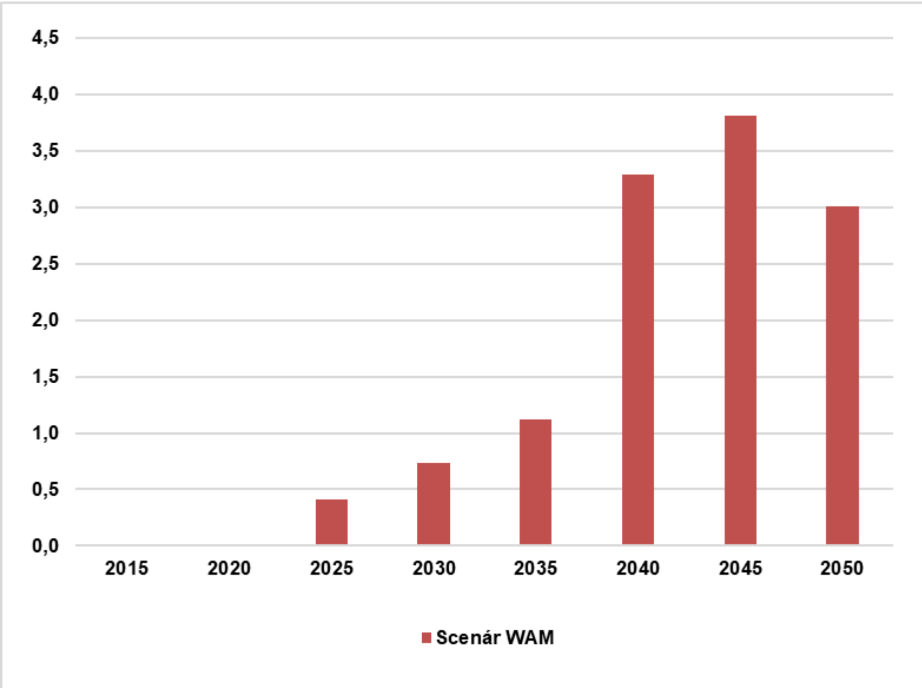
5.2.2 WAM scenario macroeconomic analysis – impact on GDP

The transition to a low-carbon economy can potentially boost GDP growth in the long term, but on the other hand may lead to lower household consumption.

Investments in energy efficiency reduce energy costs and lead to long-term gains in the productivity of the economy. These investments need to be financed in the short to medium term. In industry and tertiary sectors, these investments in energy efficiency will be passed on to consumers in the form of higher prices of products and services. Households will effectively finance the renovation of their buildings through energy savings. Households will also face the cost of electrification in the transport sector, but this will not lead directly to a reduction in consumption. Households are expected to gradually replace their ICE vehicles with alternative or hybrid powered vehicles. However, household consumption will be affected by higher prices of products and services passed on by businesses for the purpose of recovering the costs of energy efficiency investments, in particular investments in electricity generation. Based on the results of the WAM scenario, GDP growth by around 0.5 % to 1.0 % in 2025-2035 and 3-4 % in 2040-2050 can be expected (see Chart 83) and a fall in household consumption by 0.7 % to 1.02 % between 2025-2035 and by 5-6 % between 2040 and 2050 (see Chart 84).

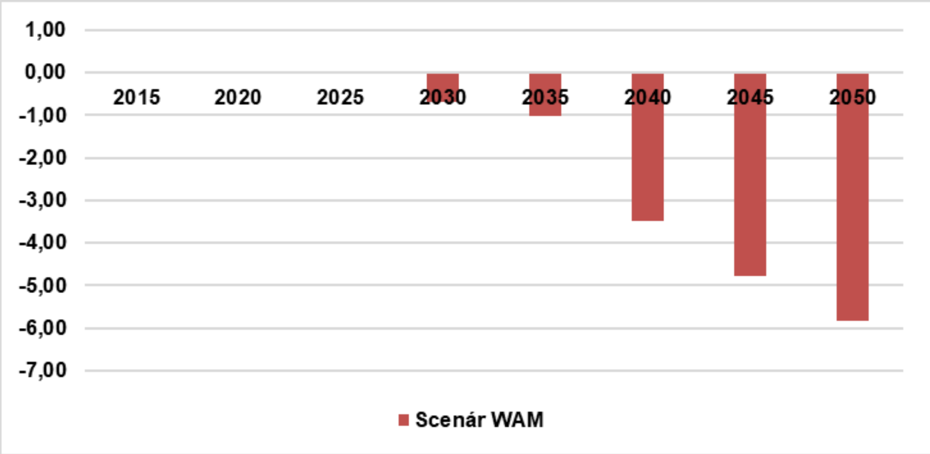
According to the following Chart 82, the impact of GDP in the long term can be said to be favourable for the Dcarb2 scenario (WAM).

Chart 83GDP, by policy scenario, 2015-2050, % change from reference scenario



Source: Results of the Slovak-CGE model

Graph 84 Private consumption, by policy scenario, 2015-2050, in % change from reference scenario



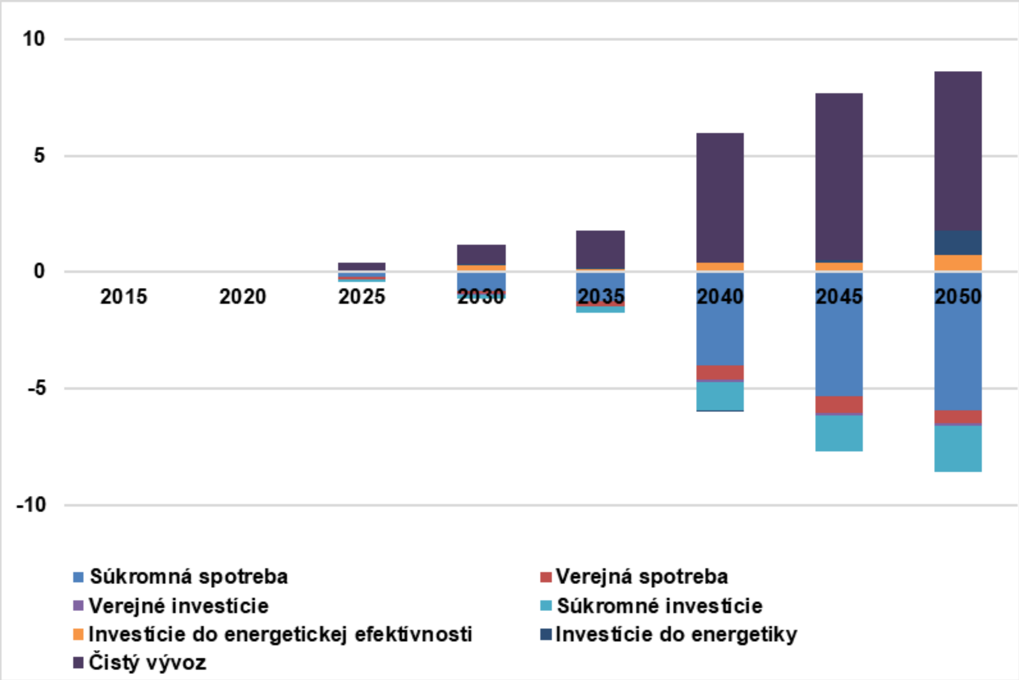
Source: Results of the Slovak-CGE model

According to MŽP, the reduced demand for fossil fuels will reduce Slovakia’s import expenditure, but on the other hand, modelling results in deteriorating trade conditions. Deteriorating trade conditions mean that, from a macroeconomic point of view, more factors need to be used for export activities to exchange for a given quantity of imported goods. Subsequently, imports continue to decline while exports are rising. The increase in net exports, in a context of trade deterioration, “consumps” GDP gains from productivity improvements (energy efficiency) and contributes to a decline in private consumption.

If Slovakia focuses on investing in decarbonisation, there may be some crowding out of non-energy investments. Investments in energy efficiency and the energy sector are significant, ranging from 0.3 to more than 2.0 per cent of GDP in all years. Price increases due to compensation of firms’ costs to invest in energy efficiency will reduce Slovakia’s competitiveness and affect firms’ profitability. In addition, the decline in household consumption will reduce demand, thus also hampering profitability. The decline in profitability will deter foreign investors from investing in the Slovak economy. Similarly, investing in electricity generation will crowd out some non-energy investments.

As shown in the graph below, the shares of net exports are growing more in the long term than the level of compensation for reduced consumption.

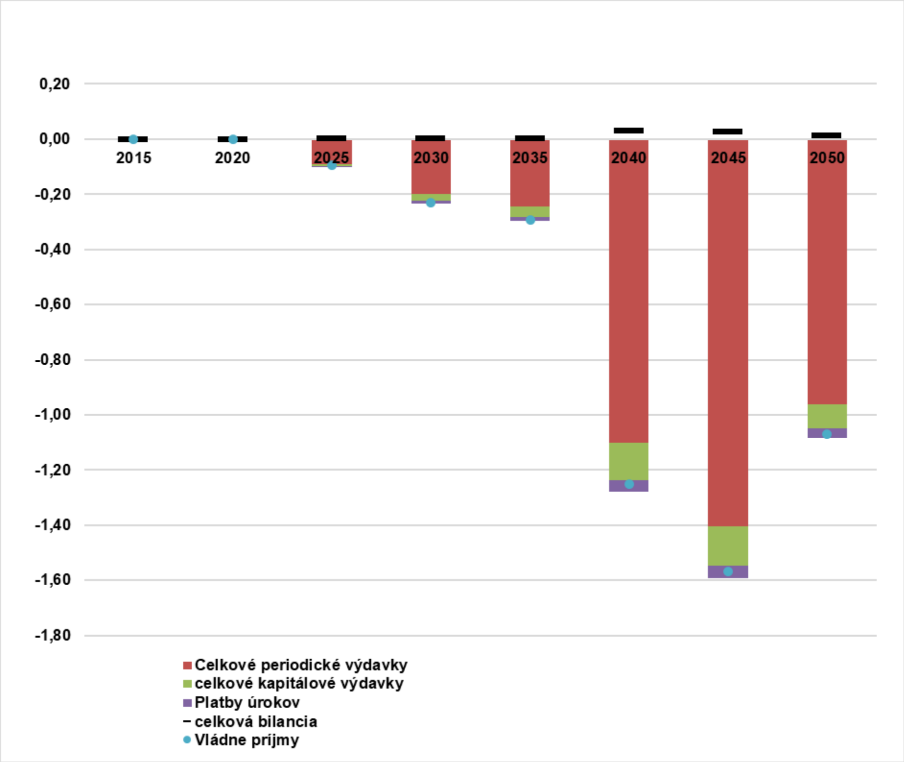
Graph 85 Expenditure shares in GDP, by policy scenario, 2015-2050, % change from reference scenario



Source: Results of the Slovak-CGE model

The government is also expected to increase taxes or reduce transfers to ensure the sustainability of the government budget during the transition to a low-carbon economy. As a result, the general government budget balance remains broadly unchanged in all scenarios. Another option for the government would be to finance any deficit through deficits, but this option was not modelled. In any event, the increase in public debt would ultimately have to be repaid through higher taxation or lower expenditure. The transition to a low-carbon economy leads to lower revenue collection from indirect taxes (e.g. VAT) and direct taxes (including social security contributions). The collection of indirect taxation revenues is decreasing as a result of the reduction in household consumption, while direct tax revenues fall due to lower wage levels. The model does not define what specific change in taxation or transfer system is introduced to neutralise the budgetary impact, except that it is (or is almost) an undistorted instrument (flat-rate amount). (Figure 86)

Graph 86 Government budget balance by budget components and policy scenario (Dcarb2 (WAM)), 2015-2050, in % of GDP change from reference scenario



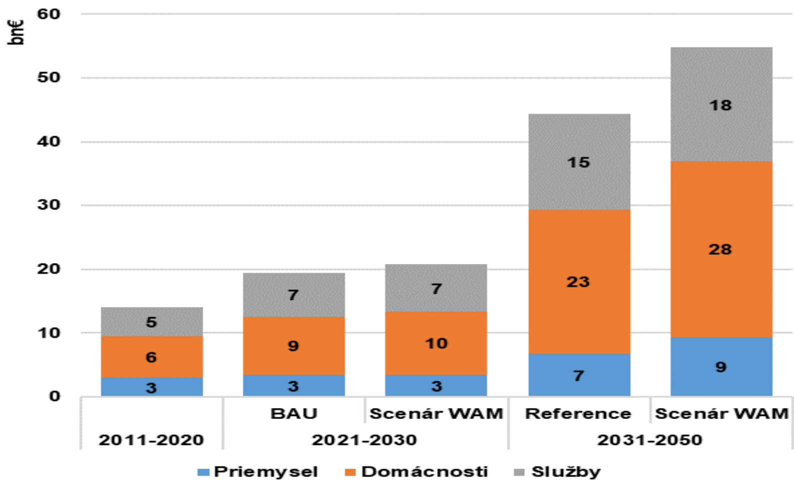
Source: Results of the Slovak-CGE model

5.3. Overview of investment needs

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

The increase in energy efficiency and the large-scale development of RES will lead to higher investment expenditure, by shifting consumers towards more efficient energy products, equipment, appliances and vehicles. According to the graph below, investments in energy efficiency by households and businesses will increase rapidly after 2030.

Figure 87 Investments in energy efficiency by sector, by policy scenario, 2011-2050, in billion. EUR



Source: E3-Modelling, CPS Technical Report

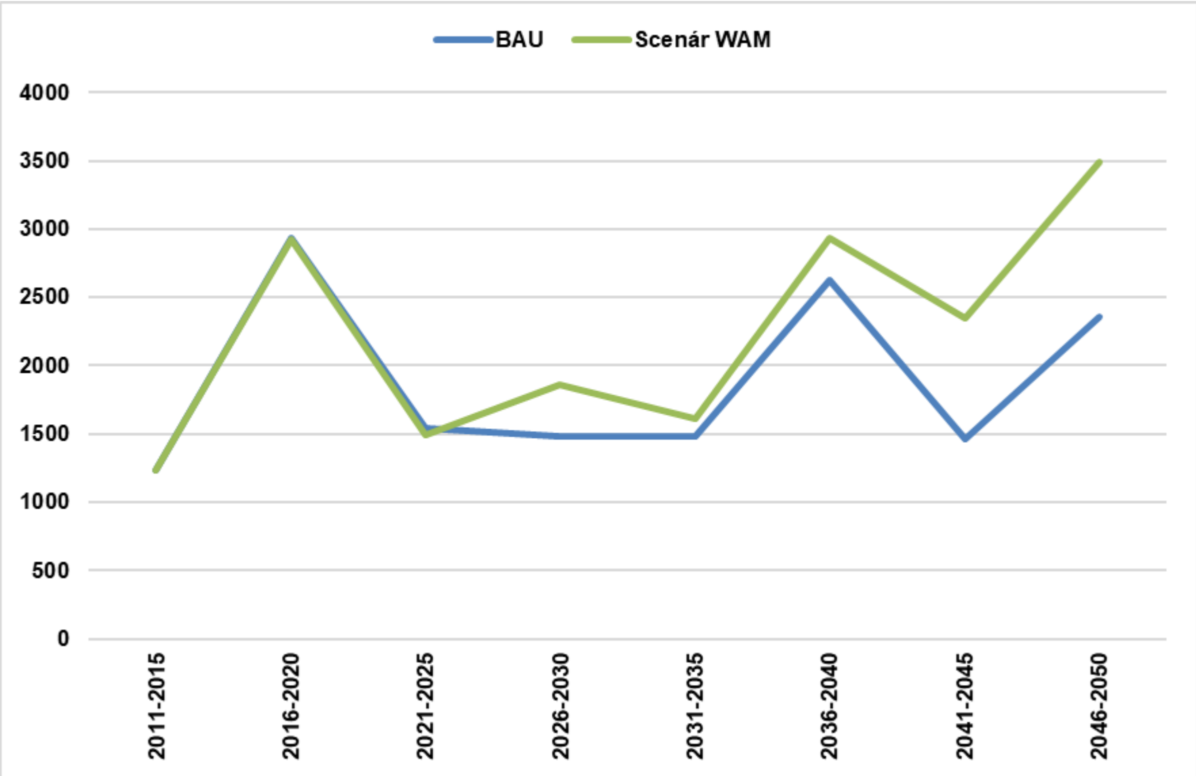
As already noted above, the analysis identified a positive impact on GDP, especially in the long term, namely that the decline in consumption is largely driven by emission mitigation policies outside Slovakia. The GDP pattern mirrors the size of investment in energy efficiency, where higher investments in energy efficiency lead to lower consumption, but ultimately to higher overall GDP. This impact is incentivised by crowding out private investments in energy efficiency. Lower private investment distorts the core capital of the economy, leading to lower overall production. Household consumption is lower as households reduce consumption to pay for energy efficiency investments, in particular building renovations. Investments in energy efficiency are growing. Towards the end of the period, investments in electricity generation are growing as Slovakia is building a new nuclear power plant in the model scenario. Exports are shrinking due to loss of competitiveness as the cost of efficiency investments is passed on to consumers, also due to lower production capacity of the economy due to lower core capital. Importantly, the macroeconomic impact on Slovakia is not only due to its domestic policies, but more than half of the decline in consumption is due to decarbonisation policies in the rest of the EU (which is modelled as a carbon tax in both ETS and non-ETS sectors). Policies in the rest of the EU lead to lower imports from Slovakia. For example, only around 50-60 per cent of the drop in consumption in Slovakia between 2040 and 2050 will be driven by domestic policies (including the pricing of ETS emissions in Slovakia), the balance being due to lower demand from the rest of the EU due to a deterioration in trade conditions.

The following table and graph show the necessary investments in the industrial sector by industry sector (in EUR million over a period of 5 years).

Table 103 Investments needed in the industry sector

INVESTMENT EXPENDITURE (IN EUR MILLION OVER A PERIOD OF 5 YEARS)								
Industrial sector	**2011-2015**	**2016-2020**	**2021-2025**	**2026-2030**	**2031-2035**	**2036-2040**	**2041-2045**	**2046-2050**
Steel industry	514,73	1114,75	820,15	872,17	914,30	1826,69	1501,54	2076,10
Non-ferrous metals	59,64	146,28	95,70	160,11	87,34	88,92	37,46	61,13
Chemical Industry	53,66	489,76	58,15	87,02	81,75	100,48	117,40	138,23
Building materials	34,00	98,75	65,33	108,30	97,05	102,50	141,99	156,77
Paper industry	428,17	689,13	170,21	213,08	133,89	341,11	234,01	591,49
Manufacture of food, beverages and tobacco	25,61	66,85	68,32	129,03	76,25	135,45	93,01	129,17
Mechanical engineering	59,18	153,09	123,50	142,64	121,36	224,03	124,78	173,81
Textile Industry	6,74	8,62	7,11	8,08	6,82	15,87	8,40	11,70
Other industries	54,46	155,62	87,78	140,17	92,63	100,91	93,43	155,92
Together,	1236,18	2922,85	1496,23	1860,60	1611,39	2935,96	2352,02	3494,32

Chart 88Total investment in the industry sector



Source: E3-Modelling, CPS Technical Report

The following table shows the necessary investments to be made per sector of the national economy and Table 86 shows the need for investment for the policies and measures analysed:

Table 104 Investments by sub-sector or type, under scenarios, 2015, 2030 and 2050 (in EUR million and thousands of vehicles)

	2015	2030		2050	
		Reference scenario	Dcarb2 scenario (WAM)	Reference scenario	Dcarb2 scenario (WAM)
Investments (Million EUR)					
Heat recovery	—	EUR 114,76	EUR 291,82	EUR 125,60	EUR 984,23
Processing	EUR 969,61	EUR 1 555,49	EUR 1 470,10	EUR 1 956,95	EUR 2 196,82
Equipment and appliances	EUR 3 429,05	EUR 7 811,45	EUR 7 855,16	EUR 9 811,00	EUR 9 698,20
Renovation of buildings by households	—	EUR 205,25	EUR 829,09	EUR 222,76	EUR 2 794,54
Renovation of buildings in the services sector	—	EUR 257,14	EUR 832,00	EUR 285,45	EUR 1 510,87
Passenger cars (thousand vehicles)					
Electric cars	—	37	56	211	1 646
Fuel cell cars	—	0	0	73	350
Plug-in hybrid cars	—	69	99	2623	370
Internal combustion engine cars	1 754	2 409	2 357	2 561	1 211

Source: E3-Modelling, CPS Technical Report

Table 105 Investments by selected (analysed) policies and measures

Policy title, measures	Estimated costs (EUR)			Description (supplement) of estimates in the calculation of costs
	Absolute cost per year	Year(s) for which the investments have been calculated	Reference year for setting the price	
Increasing energy efficiency	2 247 000 000,00	2020-2035	2015	Cost of capital (annual equivalent)
Implementation of the Winter Package	1 171 000 000,00*	2035	2015	Total cost of electricity generation (energy supply)
National Renewable Energy Action Plan, Slovak Government Resolution 677/2010	1 483 000 000,00	2030	2015	Investment expenditure for power plants
Implementation of the European scheme for greenhouse gas emission allowance trading	61 000 000,00*	2035	2015	Investment expenditure only for power plants (five-year period)
CO2 emission standards$_{for}$ cars and vans, efficiency standards for lorries, together with electrification of transport	34 561,00	2020-2035	2015	Cost of capital (annual equivalent)
Increasing energy efficiency in industry	544 000 000,00	2035	2015	Cost of capital (annual equivalent)
Optimisation of district heating	103 000 000,00	2035	2015	Investment expenditure related to the installation of cogeneration units with combined heat and power (CHP) in district heating systems. (five-year period)
Restructuring of the heat plant after 2025	109 572 219,00*	2019-2027	2015	Closure and destruction costs of Handlová and Nováky mines
Increasing carbon prices in the EU ETS	74.00*	2035	2015	EU ETS carbon price (EUR/tonneCO_2)
Decarbonisation of electricity generation	1 051 000 000,00	2035	2015	Investment expenditure related to the penetration of RES in electricity generation (only for power plants, in particular photovoltaic power plants)
Increasing the share of nuclear energy in the Slovak energy mix	5 190 000 000,00*	2020	2015	Investment expenditure but construction of new nuclear reactors in Mochovce (five-year period)
Continued reduction of final energy consumption in all sectors	30 000 000,00	2035	2015	Income-related (tonnes$_{CO}$2/EUR)

Source: CPS Energy Model – E3Modelling * absolute costs

When processing the estimated costs related to the achievement of the originally planned target of 19.2 % of the RES share in 2030, the Ministry of the Economy calculated the costs of investment expenditure related to the decarbonisation of electricity generation (RES) at EUR 180000000 and the decarbonisation of heat (RES) production at EUR 250000000 per year.

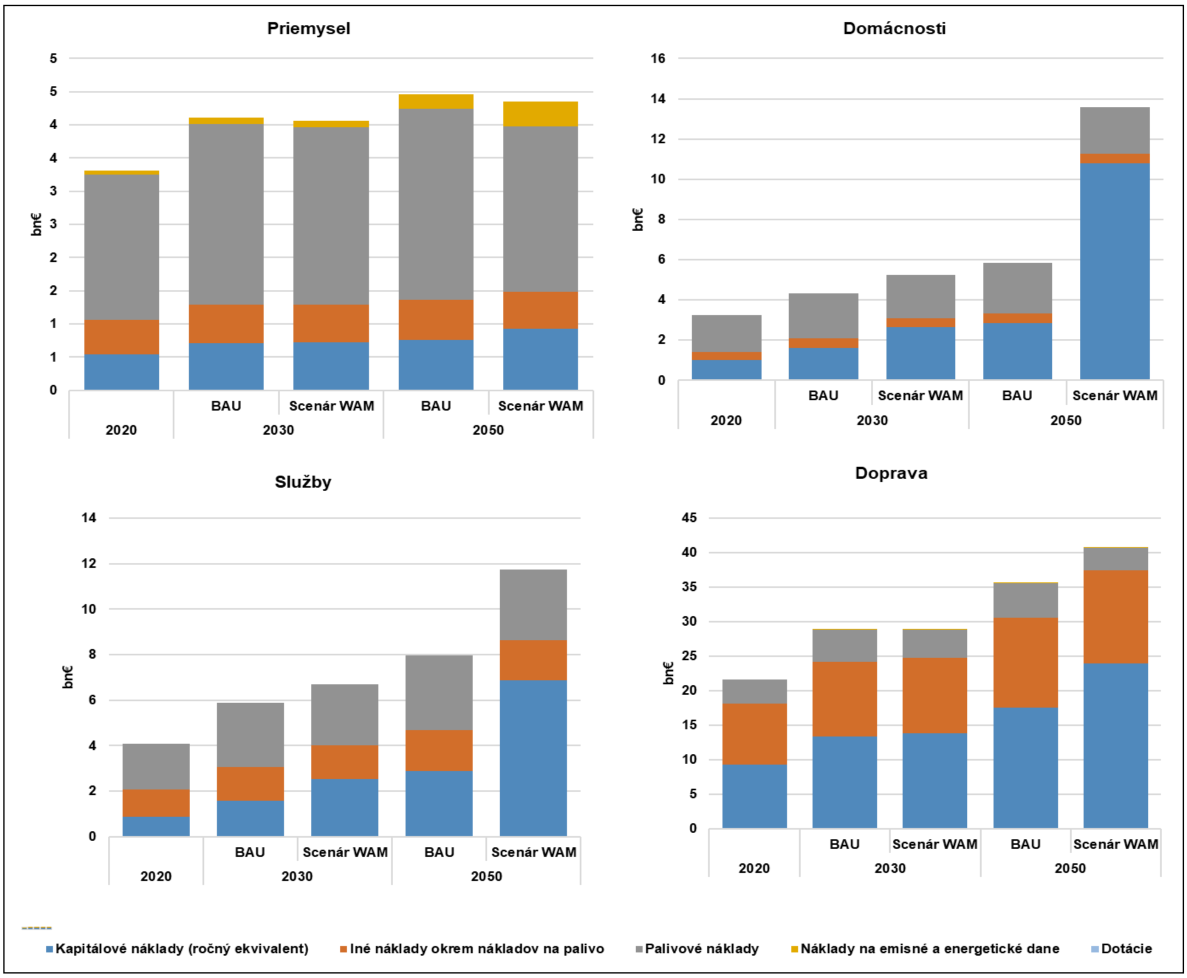
Table 106 Investments in the transport sector (by type)

	2015	2020	2025	2030	2035	2040	2045	2050
Investment costs (million euro)	**28 948**	**55 315**	**56 684**	**64 804**	**72 980**	**100 671**	**114 241**	**113 127**
Passenger traffic	**24 838**	**47 592**	**50 157**	**58 163**	**66 096**	**92 533**	**106 468**	**104 807**
Public road transport	840	1 628	1 357	1 302	1 254	1 998	1 581	1 409
Individual road transport	20 687	40 661	43 329	50 791	59 538	84 753	98 963	97 006
Rail transport	2 644	3 814	4 001	4 150	3 618	3 716	4 064	4 110
Air transport (e.g. international)	667	1 488	1 470	1 920	1 685	2 066	1 859	2 281
Inland payment	—	—	—	—	—	—	—	—
Freight transportation	**4 110**	**7 723**	**6 528**	**6 641**	**6 884**	**8 137**	**7 773**	**8 320**
Road transport	3 112	5 650	4 665	4 733	5 224	6 663	5 694	6 289
Railway	960	1 969	1 770	1 810	1 570	1 396	1 991	1 904
Inland payment	38	104	93	97	89	79	88	127
International freight transport	—	—	—	—	—	—	—	—

Source: CPS Energy Model – E3Modelling

The graph below presents the estimated investments across all sectors analysed (transport, industry, services, households) in terms of costs

Figure 89 Estimated investment in industry, transport, services and households by policy scenario, 2020-2050, in billion. EUR



Source: E3-Modelling, CPS Technical Report

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

For future economic development in this area, it is important to develop sector-specific measures, as it is very difficult to develop a successful universal industrial or scientific research policy at a time of specialisation. This increasingly concerns e.g. the promotion of scientifically excellent teams and their cooperation with practice and relevant sectors, the promotion of the practicalisation of education, and the streamlining and significant reduction of administrative complexity.

The high level of energy intensity of industry, as well as the share of industry in the country's GDP, poses a key challenge for economic policy in the future, linked to the digital transformation and innovative technologies.

In the field of research and innovation, the problem is fragmented and, in particular, undercapitalised manufacturing. Expenditure on business R & D is low in Slovakia. In innovation, cooperation between universities and businesses on R & D is poorly evaluated. The lack of incentives for researchers to continue to work in Slovakia is also a problem. Further progress in this area requires the creation of specific conditions for the procurement of these objectives.

Slovakia's ambition in the area of competitiveness is to promote value-added investment, with a focus on business research and innovation. The low share of public investment in addition to the European Structural and Investment Funds is limiting.

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

As an EU Member State, Slovakia accepts strengthening the strategic approach in cohesion policy in order to further develop a coordinated and harmonised implementation of Union funds to be implemented under so-called 'general – shared management', namely for the European Regional Development Fund ('ERDF'), the European Social Fund Plus ('ESF+'), the Cohesion Fund, measures financed under shared management for the European Maritime, Fisheries and Aquaculture Fund ('EMFAF'), the Asylum and Migration Fund ('AMIF'), the Internal Security Fund ('ISF') and the Border Management and Visa Instrument ('BMVI'), simplifying and defining five clear cohesion policy objectives for the period 2021-2027:

1. A smarter Europe – innovative and smart economic transformation.
2. A greener, low-carbon Europe.
3. A more connected Europe – mobility and regional ICT connectivity.
4. A more social Europe – implementing the European Pillar of Social Rights.
5. Europe closer to citizens – sustainable and integrated development of urban, rural and coastal areas through local initiatives.

This simplification will allow synergies and flexibility between the different components under a given objective and eliminate artificial differences between different policies contributing to the same objective, while providing the basis for thematic concentration for ERDF and ESF+. At the same time, synergies between the different EU instruments will be supported 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, LIFE, Erasmus+, Slovakia's Recovery and Resilience Plan, and the Modernisation Fund.

5.4. Impacts of planned policies and measures described in section 3 on other Member States and regional cooperation at least until the last year of the period covered by the plan, including comparison to projections with existing policies and measures

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

The interconnections listed below contribute to increasing energy security and reliable supply in all States concerned.

In particular, bilateral cooperation at the level of the PS operators concerned takes place to support the preparation and implementation of cross-border investment projects 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 taking place in ENTSO-E in the System Development Committee.

In the field of electricity transmission infrastructure, Slovakia's priority was to complete the construction of new Slovak-Hungarian cross-border interconnections (2x400 kV Gabčíkovo (SK) – Gönyű (HU) – Veľký Ďur (SK) and 400 kV R. Sobota (SK) – Sajóivánka (HU)). Both lines became operational in 2021, with building permits for both projects issued.

In cooperation with the Czech operator PS (ČEPS), the operator of the PS (SEPS) is considering submitting an application to include the planned link 1x400kV Ladce (SK) – Otrokovice (CZ) on the list of projects of common interest (PCI). This is an interconnection that would replace the successively shut down 220 kV transmission system (PS) on both sides of the SK/CZ border. This reinforcement includes the planned increase in transmission capacity of the V404 Varín (SK) – Nošovice (CZ) line as part of the upcoming renovation on both the SEPS and ČEPS sides.

In order to ensure gas supply, steps are being taken both by the State and by the gas companies to make the Slovak Republic better prepared for any gas supply problems. The Slovak Republic supported interconnection projects with Poland, Hungary as well as reverse flow projects from the Czech Republic and Austria.

As part of the Slovakia-Hungary interconnection project, the gas pipeline was put into standard commercial operation on 1 July 2015, following the successful completion of construction and testing operations.

The Slovak-Polish gas interconnection project is part of the North-South gas corridor and constitutes an important element in the transit pipeline chain connecting Eastern Europe from the Polish LNG terminal Świnoujście to the planned Croatian LNG terminal on Krk.

The strategic geographical location of the Slovak Republic and the relatively large transport capacity of the Druzhba pipelines on Slovak territory create real conditions for connecting it to European transit routes.

The Druzhba-Adria project addresses the issue of oil transport by pipeline from the Russian Federation through the territories of Belarus, Ukraine, Slovakia, Hungary and Croatia. In 2015, the extension of the Adria – Friendship 1 pipeline section between the Slovak city of Šahy and the Hungarian city of Százhalombatta was completed and put into operation. This extension and reconstruction implies an increase of the original transport capacity to almost double. This project was included in the original 'first PCI list'.

II. Effects on energy prices, grid industries and energy market integration

The decisive starting point for regulatory policy is binding European Community legislation. These translate into the setting of reasonable energy prices for consumers, so as to maintain transparent and non-discriminatory regulatory principles. Energy prices are expected to rise due to higher demand, grid costs, deregulation, implementation of European measures, as well as increased environmental costs. 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 system of coordinated governance to build a functioning single European gas and electricity market in terms of energy security and reliability across 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 enshrined in the regulatory policy developed by the Regulatory Board (the ÚRSO body), which defines regulatory policy priorities for the relevant regulatory period, with the ambition of applying regulatory tools and methods that ensure transparent and non-discriminatory performance of activities in network industries, including monitoring mechanisms through which compliance with competition rules can be monitored, transparency obligations, possible abuses of market dominance, and, last but 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 the efficient implementation of EU policies stemming primarily from the ‘Clean Energy for All Europeans’ legislative package (4th energy package), but also from the upcoming ‘Fit for 55’ and ‘Gas Package’ packages.

III. Where relevant, effects on regional cooperation

When forecasting future developments, the transmission system operator Eustream also follows long-term trends and estimates of gas consumption across the EU. Thus, when considering whether projects are suitable for implementation, it takes into account the needs of security of supply not only for the Slovak Republic but also for regions at risk, such as, in particular, south-east Europe and Ukraine. Another criterion to be taken into account is to contribute to the integration of gas markets in the most efficient way, in particular by using existing infrastructure to the greatest extent possible. A positive example can be the implementation of the TRU service connecting the Austrian and Czech gas markets through Eustream’s existing transmission infrastructure. This service puts into practice the European Union’s efforts to integrate markets in a simple and cost-effective way without unnecessary investment.

Part 2

List of parameters and variables to be reported in Section B of the national plan89 90 91 92

The list of parameters and variables to be reported in Section B of the NECPs are set out in the Annexes:

Annex 1 Table with data and variables used in the development assumptions (original version to be updated by the deadline for submission of the final update of the document)

Vlastný materiál príloha 1.docx

Annex 2a Methodological tables for energy efficiency measures by sector for 2021-2030

Príloha 2a_metodické tabuľky pre opatrenia

Annex 2b Cumulative energy savings plan and additional information on energy efficiency measures

Príloha 2b_prognóza vývoja úspor energie

Annex 2c Energy Efficiency Monitoring System (MSEE)

Príloha 2c_monitorovanie a s

[89] In the roadmap for the period from 2021 to 2030: For each parameter/variable in the list, trends over the years 2005-2040 (2005-2050 where appropriate) including for the year 2030 in five year intervals shall be reported both in section 4 and 5. A parameter based on external assumptions against the output of the modelling shall be provided.

[90] As far as possible, reported data and projections shall build on and be consistent with EUROSTAT data and methodology used for reporting European statistics in the relevant sectorial law, as European statistics are the primary source of statistical data used for reporting and monitoring, in accordance with Regulation (EC) No 223/2009 on European statistics.

[91] Note: all projections are to be performed on the basis of constant prices (2016 prices used as base year)

[92] The Commission will provide recommendations for key parameters for projections, at least covering oil, gas, and coal import prices as well as EU ETS carbon prices.