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SLOVAK MINISTRY OF THE ECONOMY

# Proposal

# for an Integrated

# National

# Energy

# and Climate

# Plan

**BRATISLAVA DECEMBER 2018** 

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## Proposal for an Integrated National Energy and Climate Plan

## Part 1

## SECTION A: NATIONAL PLAN

## 1. OVERVIEW AND PROCESS FOR ESTABLISHING THE PLAN

#### 1.1. Executive summary

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

The Slovak Republic (SR) became a member of the Organization for Economic Cooperation and Development (OECD) in 2000, has been a member of the European Union (EU) since May 2004 and since 2007 has been a member of the International Energy Agency (IEA). In January 2009, the Slovak Republic adopted the joint European currency, the Euro.

In November 2014, the Slovak Government approved an Energy Policy (EP SR), which set targets and priorities for the energy sector up to 2035 with an outlook to 2050. The strategic objective of the EP SR is to achieve a competitive low-carbon energy industry sector ensuring the safe and efficient supply of all forms of energy at affordable prices, taking into account customer protection and sustainable development.

The EP SR is based on four basic pillars:

- energy security;
- energy efficiency;
- competitiveness;
- sustainable energy;

Among the priorities of the EP SR can be included:

- an optimal energy mix;
- increasing security of energy supply;
- development of energy infrastructure;
- diversification of energy sources and distribution routes;
- maximum use of transmission networks and transit systems passing through the Slovak Republic;
- energy efficiency and a reduction in energy intensity;
- a functioning energy market within a competitive environment;
- high-quality energy supply at affordable prices;
- protection for vulnerable customers;
- addressing energy poverty;

- an adequate pro-export balance in electricity;
- the use of nuclear energy as a carbon-free source of electricity;
- improving the safety and reliability of nuclear power plants;
- support for high-efficiency heat and power co-generation.

Sustainable development must secure 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 generation side and on the consumption side.

Building a competitive low-carbon economy is a long-term priority of the SR's energy policy. The building of a competitive, green economy in the Slovak Republic is considered key to achieving the transition to a low-carbon economy.

# To ensure an energy sector that is compatible with the principles of sustainable development, the following are high-priority:

- increasing the share of low-carbon and carbon-free electricity generation;
- the use of nuclear energy as the main carbon-free source of electricity;
- optimisation of the share of RES especially in heat generation;
- the use of natural gas as "the transition fuel" to a low-carbon economy, with decarbonised gases and hydrogen as fuels in the long run;
- supporting efficient centralised heat supply systems.

#### Measures to ensure environmental sustainability:

- improve the use of proceeds from the Kyoto mechanisms through the Green Investment Scheme;
- Securing financial mechanisms as well as using the proceeds of the SR from quota auctions under the Emissions Trading Scheme to support the energy sector, focusing on priority areas in line with the principles of sustainable development as outlined above;
- step up activities to reduce CO2 emissions, particularly in the transport sector;
- thoroughly assess the construction of new energy conversion resources in view of possible negative impacts through efficiency reduction;
- prepare measures to enable economic growth based on a low carbon and less energy-intensive economy;
- Develop an energy and climate national plan under the new Energy Union management system to achieve joint climate and energy targets by 2030, also taking into account 2050;
- ensure the timely implementation of the energy efficiency policy and measures;
- through appropriate and targeted regulatory measures, contribute to achieving the environmental sustainability of the objectives set.

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

The EP SR approved by the government in 2014 stipulates that its strategic objective is "to achieve a competitive low-carbon energy industry sector ensuring the safe and efficient supply of all forms of energy at affordable prices, taking into account customer protection and sustainable development."

#### Decarbonisation dimension (RES)

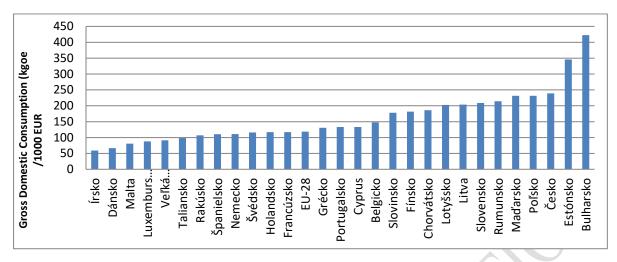
Building a competitive low-carbon economy is a long-term priority of the SR's energy policy. Building a competitive low-carbon economy is a long-term priority of the SR's energy policy. The building of a competitive, green economy in the Slovak Republic is considered key to achieving the transition to a low-carbon economy. The SR considers the optimal use of renewable energy sources and nuclear energy to be key to achieving a low-carbon economy.

When projecting use of renewables, account was taken of the principle of minimising costs in an integrated approach to renewable energy sources and reducing greenhouse gas emissions. This means that through a suitable combination of RES and low-carbon technologies the use of fossil fuels, and thereby greenhouse gas emissions, will be reduced. In the upcoming period, the use of RES for heat and transport will be a priority, while support for electricity will be limited.

In the coming years the heating sector, and in particular district heating, is important for energy transformation. Reducing the share of coal in heating to the benefit of renewables will improve the sustainability and security of heat supplies. The high degree of centralisation of heat supply creates good technical preconditions for the use of biomass, biomethane and geothermal energy. Due to the low-carbon mix of electricity generation, the gradual electrification in particular of public passenger transport and heat generation are a challenge.

#### Energy efficiency dimension

Energy efficiency is one of the main pillars of the Slovak Republic's energy policy. Energy efficiency contributes synergistically to reducing the energy intensity of the economy, contributes to increased energy security and also has an impact in the reduction of the operating costs of energy companies, and last but not least, the savings on primary energy sources contributes to the mitigation of energy impacts on the environment. In addition, the benefits of energy efficiency also contribute to other policies, as in the case of employment. Energy efficiency cuts across all dimensions of energy policy as well as this plan.





Source: Eurostat (2018)

Key:

Hrubá domáca spotreba / HDP	Gross Domestic Consumption (kgoe/1000			
(kgoe/1000EUR):	EUR)			
Irsko	Ireland			
Dánsko	Denmark			
Malta	Malta			
Luxemburg	Luxembourg			
Veľká (Británie)	United Kingdom			
Taliansko	Italy			
Rakúsko	Austria			
Španelsko	Spain			
Nemecko	Germany			
Švédsko	Sweden			
Holandsko	Netherlands			
Francúzsko	France			
Grécko	Greece			
Portugalsko	Portugal			
Cyprus	Cyprus			
Belgicko	Belgium			
Slovinsko	Slovenia			
Finsko	Finland			
Chorvátsko	Croatia			
Lotyšsko	Latvia			
Litva	Lithuania			
Slovensko	Slovakia			
Rumunsko	Romania			
Maďarsko	Hungary			
Polsko	Poland			
Česko	Czech Republic			
Estónsko	Estonia			
Bulharsko	Bulgaria			

The energy intensity of the Slovak Republic has decreased over the last 15 years. Significant progress in reducing energy intensity is evidenced by its development from 2000-2015, when according to

Eurostat data, the SR reduced its energy intensity by 50.8 %. From 2006-2012, energy intensity was reduced by more than 27 %, which represents the largest decrease in the EU-28 in the period in question. This positive development is, inter alia, a result of the successful restructuring of industry, the introduction of low-energy manufacturing processes in industry, and an improvement in building thermal and technical properties and the exchange of appliances for more energy-efficient ones. However, in spite of this fact the Slovak Republic has the seventh highest energy intensity in the EU-28 on a constant prices basis. This fact is mainly due to the structure of industry in the Slovak Republic, where the high energy intensity industry has a major share. The Slovak energy efficiency priority is a further reduction in the energy intensity of the SR economy with a view to achieving 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 its national strategic and legislative framework.

For energy efficiency the key implementation tools for 2020 are energy efficiency action plans that assess energy efficiency measures as well as setting out new measures to meet energy savings targets. This role shifts to the NECP after 2020 and two-year energy sector progress reports.

#### Energy security dimension

From the energy security point of view, the SR supports an efficient energy architecture that for the benefit and protection of the consumer creates the conditions for increasing energy self-sufficiency through the utilisation of domestic energy sources, a favourable environment for the construction of low-carbon sources in heat and electricity production with the option to export electricity and an optimal energy mix with low-carbon technologies in each sector.

Key areas are the diversification of transport routes and energy sources, decentralization, increased nuclear safety and reliability, and transport and operational safety.

#### Internal energy market dimension

The Slovak Republic will strive to maximise the use of existing infrastructure under the new conditions.

#### Research, innovation and competitiveness dimension:

The Implementation Plan of the Research and Innovation Strategy for Smart Specialisation of the Slovak Republic (IP RIS3) elaborates the procedures and processes for fulfilling the criteria in relation to thematic ex ante conditionality for the thematic objective entitled Strengthening research, technological development and innovation, and implementing the relevant investment priorities financed during the 2014-2020 programming period, as well as the measures to which the Slovak Republic is committed under the Operational Programme Research and Innovation (OP RandI).

As part of the EU's climate change research program, nearly  $\in$  6 billion is earmarked for research into non-nuclear energy for 2014-2020. In September 2015, the Commission adopted a Strategic Energy Technology Plan to help address the challenges needed to transform the EU's energy system. It focuses on measures that will help the EU to become the world leader in renewable energy and to develop energy efficient systems.

A technological lead in alternative energy and reducing energy consumption will create huge export and industrial opportunities. At the same time, it will support growth and jobs. Renewable energy sources will play an important role in the transition to a clean energy system.

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

#### Table 1: Key objectives, policies and measures

Strategy and policy	Key objectives	Measures
Strategic Transport Infrastructure Development Plan of the Slovak Republic until 2020 (Government Resolution No 311/2014), Strategic Transport Development Plan of the Slovak Republic until 2030 (Government Resolution No 13/2017)	A reduction in the negative environmental and negative socio- economic impacts of transport (including climate change) as a result of environmental monitoring, efficient infrastructure planning/implementation and a reduction in the number of conventionally-powered means of transport; that is, the use of alternative fuels.	Support for the use of alternative fuels and the building of related road and water transport infrastructure, refitting of obsolete ships' propulsion units, including auxiliary units, with low-emission replacements, will ensure the protection of waterways from pollution caused by discharges from vessels on the Slovak Republic section of the Danube, the replacement of the vehicle population with new vehicles, by motivating citizens through direct financial support by the state, or through tax instruments, or in the case of alternative-fuel freight vehicles, exemption from toll payments.
Strategy for the Adaptation of the Slovak Republic to Climate Change - Update (Administrator - the Ministry of the Environment, Government Resolution No 478/2018)		General Adaptation Guidelines and examples of specific adaptation measures in the transport, energy, industry and some other areas of business
Strategic Environmental Policy of the Slovak Republic until 2030 - Climate Change and Air Protection (Administrator - Ministry of the Environment)	Climate change and air protection objectives until 2030	Preventing climate change and mitigating its impacts (emissions quota trading, sustainable transport solutions, green infrastructure development, implementation of adaptation measures)

National indicative targets for energy efficiency 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 contribution to the EU target of 32.5 % in 2030	measures to increase energy efficiency, in particular buildings and industry. Chapter 2.2. energy efficiency dimension	
Preparation of the Low-Carbon Strategy of Development of the Slovak Republic (Administrator - Ministry of the Environment)	<ul> <li>The strategy's goals are:</li> <li>Provide a comprehensive long-term (30-year) strategic outlook for the transition to a low-carbon economy</li> <li>Ensure consistency with other strategic documents and action plans within the national economy (energy, industry, transport, agriculture and forestry, waste)</li> <li>Introduce binding and indicative targets for each area</li> <li>Ensure consistency with the objectives of the Paris Agreement, in particular as regards the carbon neutrality objective</li> <li>Offer a list of measures and their funding options</li> <li>Evaluate the impacts of the strategy and its measures on macroeconomic indicators</li> </ul>	They will be specified in the Low-Carbon Development Strategy of the Slovak Republic	
National Policy Framework for the Development of the Alternative Fuels Market (Government Resolution No 504/2016);	• to support the development of the market for alternative fuels in the transport sector and the development of the relevant infrastructure through the measures set out	The document defines measures to meet national objectives and the objectives of the national policy framework, measures to promote the deployment of alternative fuel infrastructure in public transport services as well as assessing the location of LNG filling stations in ports not belonging to the TEN-T core network and assessing the need to install at airports the power supply facilities for aircraft on stand.	

		policy framework are eligible for
		Union support measures and
		national support measures for
		alternative fuel infrastructure, in
		order to focus public support on
		the coordinated development of
		the internal market for mobility
		using alternative fuel vehicles as
		well as the full 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
		an alternative fuel
		infrastructure.
		Y
		The measures have the
	$\sim$	character of direct support for
		the purchase of highly
		eco-friendly low-emission
		vehicles, support for
Action Plan for the		infrastructure construction, as
Development of Electromobility	• promoting low-emission	well as the character of incentive
in the Slovak Republic (in	mobility	support, such as distinguishable
preparation)		vehicle designation, use of lanes
		restricted to public transport, or
		permitting access to low-
		emission zones or use of car
		parks for a restricted group of
		users.

## 1.2. Overview of current policy situation

*i*.

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

On 30 November 2016, the European Commission ('the EC') presented a proposal for a Regulation of the European Parliament and of the Council on the management of the energy union. The creation of an energy union is one of the ten political priorities of the EC, and this proposal is an important element in the strategic framework of the Energy Union.

The Energy Union strategy of 25 February 2015 expanded the scope of governance to all five dimensions of the Energy Union, which means it goes beyond the climate and energy policies framework for the period up to 2030.

The Ministry of Economy is the central authority of the state administration for energy, including the management of nuclear fuel and the storage of radioactive waste.

Within the scope of its competence, the Ministry may establish budgetary organisations and contributory organisations and may establish other legal entities than budgetary organisations or contributory organisations.

The priority of the Slovak Republic in the energy sector is to ensure synergy between sub-policies, cost efficiency, enforcement of the principles of sovereignty in the energy mix, preservation of competitiveness and energy security. In this context, we consider the development of renewable energy sources (RES) and measures to increase energy efficiency as a means of achieving emission targets. In Slovakia, as well as in several other Member States, safe and sustainable nuclear power will play a very important role in the transition to the low-carbon economy.

Energy is also very closely related to the competitiveness of industry, to which we are paying more attention in view of strong international competition and the emergence of the technologically revolutionary concept of Industry 4.0. We have committed ourselves to finding ways to reduce the end-user price of electricity for industrial customers.

The Slovak Republic constantly emphasises the strengthening of energy security and the security of energy supply, as evidenced by the continuation of work on individual Projects of Common Interest (PCI).

In the field of renewable energy sources (RES), efforts are being made to support forms that can replace fossil fuels in a way that ensures reliable electricity or heat generation without major additional costs. Conditions will be created for the optimal use of renewable energy sources in the energy mix in order to secure the objectives of the Slovak Republic deriving from EU legislation.

In October 2018, Parliament approved an amendment to the Renewable Energy Support Act in line with the philosophy of gradual reducing support from this source, with the priority being to ensure cost-effectiveness and to minimise the impact on final energy prices.

The use of existing gas infrastructure, due to the highly developed transport and distribution networks, provides the prerequisites for further decarbonisation of the economy.

The Ministry of the Environment of the Slovak Republic is the central authority of the state administration for the creation and protection of the environment. Within the scope of its competence, the Ministry shall establish special professional organisations, which are budgetary and contributory organisations, unless otherwise provided in a separate regulation, and shall establish other legal entities.

# *ii.* Current energy and climate policies and measures relating to the 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 commitments under the UNFCCC. All relevant policies and measures at EU level are being strengthened to meet the 2020 targets under the agreement in the Climate and Energy Package. This includes legislation introduced in the EU to reduce greenhouse gas emissions by at least 20 % by 2020 compared to 1990, with a conditional shift to a 30 % reduction provided that other developed countries commit themselves to comparable emission reductions. In addition, the EU has committed itself to achieving a 20 % share for renewable energy (as a share of gross final energy consumption in the EU) by 2020, complemented by a target of an at least 10 % share of renewable energy sources in the transport sector. In addition, the EU is committed to achieving a 20 % reduction in overall primary energy consumption by 2020 compared to projections in 2007.<sup>1</sup> As can be

<sup>&</sup>lt;sup>1</sup> The EU's 20% energy efficiency target was legally defined in the Energy Efficiency Directive, so that energy consumption in the EU (at that time the EU-27) in 2020 cannot exceed 1,474 Mtoe of primary energy consumption and 1,078 Mtoe of final energy consumption.

seen from the recent greenhouse gas inventory results, the Slovak Republic is well on track to meet its commitments.

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

**a)** The Europe 2020 Strategy - Europe 2020 is a ten-year growth strategy and builds on lessons learned from the Lisbon Strategy. The main objective of Europe 2020 is to ensure "smart, sustainable and inclusive growth" as a result of greater coordination between national and European policies. Three Europe 2020 priorities are outlined in the Europe 2020 Communication.<sup>2</sup> The strategy for smart, sustainable and inclusive growth includes:

- Smart growth, developing an economy based on knowledge and innovation.
- Sustainable growth, promoting a low-carbon, resource-efficient and competitive economy.
- Inclusive growth, fostering a high-employment economy delivering social and territorial cohesion.

**b)** Climate and energy package - In December 2008, the European Parliament and the Council agreed on the EU Climate and Energy Package, which for the first time provided an integrated and ambitious package of policies and measures to combat climate change together with renewable energy sources and energy efficiency elements. The Climate and Energy Package was formally adopted in 2009. It includes the following 20-20-20 goals:

- A cut of at least 20 % in greenhouse gas emissions (from 1990 levels), with a firm commitment to increase this target to 30 % if a satisfactory international agreement is reached;
- To achieve by 2020 20% renewable energy (as a share of total EU gross final energy consumption), complemented by a target of at least 10% share of renewable sources in transport;
- To save 20% of total primary energy consumption by 2020 compared to the unchanged reference scenario.

In order to meet the key objectives, the Climate and Energy Package includes four pieces of complementing legislation<sup>3</sup>:

- A Directive revising the EU Emissions Trading System (EU ETS), which covers some 40 % of EU greenhouse gas emissions;
- An "effort-sharing" Decision setting binding national targets for emissions from sectors not covered by the EU ETS;
- A Directive setting binding national targets for increasing the share of renewable energy sources in the energy mix;

<sup>&</sup>lt;sup>2</sup> COM (2010) 2020 Final

<sup>&</sup>lt;sup>3</sup> <u>http://europa.eu/rapid/press-release\_IP-09-628\_en.htm</u>

• A Directive creating a legal framework for the safe and environmentally sound use of carbon capture and storage technologies - the Carbon Capture and Storage Directive.

c) Climate and Energy Framework 2030 - This framework was agreed by EU leaders in October 2014 and is based on the Climate and Energy Package 2020 mentioned above.

#### d) Energy Union

The Energy Efficiency Regulation lists 5 dimensions: decarbonisation, energy efficiency, energy security, the internal energy market, and research, innovation and competitiveness.

It sets three main objectives for 2030:

- At least 40 % cuts in greenhouse gas emissions (from 1990 levels). To achieve this EU ETS sectors would have to cut emissions by 43 % (compared to 2005) to this end, the ETS is to be reformed and strengthened. non-ETS sectors would need to cut emissions by 30 % (compared to 2005) this needs to be translated into individual binding targets for Member States.
- At least 32 % of EU energy consumption from renewable energy sources.
- At least 32.5 % improvement in energy efficiency.

**e)** Roadmap 2050 - In 2011, the European Commission launched three plans on action to support the debate on a long-term framework for climate and energy policies in Europe:

- A Roadmap for moving to a competitive low carbon economy in 2050;<sup>4</sup>
- Roadmap to a Single European Transport Area Towards a competitive and resource efficient transport system;<sup>5</sup>
- 2050 Energy Roadmap.<sup>6</sup>

In February 2011, the European Council reaffirmed that the EU's goal is by 2050 to reduce greenhouse gas emissions in the EU by 80-95 % compared to 1990 levels as part of the developed countries' efforts as a group to reduce their emissions by a similar amount. Although the EU has already committed itself to reducing greenhouse gas emissions by at least 20 % by 2020 compared to 1990 levels as part of the Climate and Energy Package, longer-term policies are now needed to achieve an ambitious reduction target by 2050. The European Commission has therefore published a notice: "A Roadmap for Moving to a Competitive Low Carbon Economy in 2050", providing guidance on how the EU can decarbonise its economy.

<sup>&</sup>lt;sup>4</sup> COM(2011) 112 final.

<sup>&</sup>lt;sup>5</sup> COM(2011) 144 final.

<sup>&</sup>lt;sup>6</sup> COM(2011) 885/2.

**f) 7**<sup>th</sup> **Environmental Action Programme** - Since the 1970s, environmental action programmes have provided the basis for the development of EU environmental policy. The 6th Environmental Action Programme expired in July 2012. Political agreement on a new General Union Environment Action Programme to 2020 (entitled Living well, within the limits of our planet) was reached between the European Commission, the European Parliament and the Council in June 2013. The Seventh EAP,<sup>7</sup> as proposed by the European Commission in 2012, provides an overarching framework for environmental policy (without any specific climate policy objectives, as this policy is currently a separate policy area) over the next decade, identifying nine priority objectives for the EU and its Member States:

- •To protect, conserve and enhance the Union's natural capital.
- •To create a resource-efficient, green and competitive low-carbon economy from the Union .
- •To safeguard the Union's citizens from environment-related pressures and risks to health and well-being.
- To maximise the benefits of Union environment legislation by improving implementation
- To improve the knowledge and evidence base for Union environment policy
- To secure investment for environment and climate policy and address environmental externalities
- to improve environmental integration and policy coherence;
- •To enhance the sustainability of the Union's cities
- •To increase the Union's effectiveness in addressing international environmental and climate-related challenges.

#### Policy context at national level - climate

- a) The National Reform Programme is a national, regularly updated programme with the main objective of meeting the EU 2020 Strategy's structural policy objectives. It also contains an Action Plan with sector-specific target policies, including dedicated financial allocations.
- b) The Slovak Republic National Strategy for Sustainable Development approved 10 years ago by the Slovak Government and the National Council of the Slovak Republic, contains 16 principles, 40 criteria, 10 integrated objectives, 28 strategic objectives and 236 measures.
- c) **Draft National Priorities for Agenda 2030 Implementation** The purpose of government-approved material is to set national priorities for the implementation of Agenda 2030 for Sustainable Development, taking into account the context of the Slovak Republic. It contains six priority areas, two of which concern climate change: moving towards a knowledge and environmentally sustainable economy in the face of demographic change and a changing global environment; sustainable settlements, regions and landscape in the context of climate change.

<sup>&</sup>lt;sup>7</sup> Decision No 1386/2013/EU of the European Parliament and of the Council of 20 November 2013 on a General Union Environment Action Programme to 2020 'Living well, within the limits of our planet';

- d) **National Environmental Strategy** the Slovak Republic has had an environmental strategy for more than 20 years. Over time, policies and environmental objectives have evolved and therefore the Slovak Republic is preparing a new environmental strategy that will contain new principles, objectives and measures complemented by indicators.
- e) **Low-carbon Strategy** Given the need to develop long-term low-carbon strategies under the Paris Agreement, the Slovak Republic is currently preparing, in cooperation with the World Bank, its Low-Carbon Development Strategy with means of development to 2050.

#### f) Strategy for Adaptation of the Slovak Republic to Climate Change - Update

The main objective of the updated strategy is to improve Slovakia's preparedness to face the adverse impact 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 the effective implementation of adaptation measures at all levels and in all areas to improve general awareness of this issue.

#### Energy

g) Energy policy

The Energy Policy of the Slovak Republic (the Energy Policy) is a strategic document defining the primary objectives and priorities of the energy sector for the period up to 2035 with an outlook to 2050. The Energy Policy is part of the national economic strategy of the Slovak Republic, because securing sustainable economic growth is conditioned by a reliable supply of affordable energy. The Ministry of the Economy of the Slovak Republic is responsible for the completion of the Energy Policy. The aim of the 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 to its competitiveness. The priority from this point of view is to ensure reliability and stability of energy supply, efficient use of energy at optimal cost and to ensure protection for the environment. A properly functioning energy market with a competitive environment will be enhanced by implementation of the Energy Policy. As a result of this, the Energy Policy signals certain measures to reduce final electricity prices, including the phasing out of electricity tariffs for renewable electricity by 2020, focusing on the use of renewable energy sources for heat, electricity and transport, and on some changes in energy rates to increase efficiency and which apply to heat and power co-generation.

#### h) Economic Policy Strategy of the Slovak Republic to 2030

The main priorities and strategic objectives of Slovakia's development as an EU Member State are based on the integration and fundamental values on which the EU is based. The main priority of Slovakia's economic development with a vision to 2030 is therefore to ensure economic growth, which will allow for faster convergence and the elimination of differences in the quality of life of Slovaks compared to Western European countries. In the case of sustainability, one of the challenges for the SR industry is a gradual transition to a lowcarbon economy based on resource and energy efficiency. It is technology, research and innovation that is the most important tool to facilitate and achieve this transition. Modern industrial technologies and their innovations - if appropriately planned through market and policy incentives - make a major contribution to addressing environmental sustainability issues.

The ambition of the Economic Policy Strategy of the Slovak Republic until 2030 is to determine the strategic direction of economic policy with a view to 2030, which will provide an idea of the further development and development of the Slovak Republic's economy with an apolitical nature, thus permitting a long-absent conceptual attention to the issue beyond the political cycle, with the ambition of providing a basis for the current as well as future governments of the Slovak Republic.

The strategy identifies key measures that will lead to the achievement of the basic objective of competitive and sustainable economic growth. The strategy of economic policy is of a supraministerial nature; its defined scope also commits the Office of the Government of the Slovak Republic and the Office of the Deputy Prime Minister of the Slovak Republic for Investment and Informatisation to cooperation in its preparation, as well as the relevant ministries. The draft of the measures was drawn up in cooperation between the relevant ministries and institutions.

The energy intensity of the Slovak Republic has decreased over the last 15 years. Significant progress in reducing energy intensity is evidenced by its development from 2000-2015, when according to Eurostat data, the SR reduced its energy intensity by 50.8 % From 2006-2012, energy intensity was reduced by more than 27 %, which represents the largest decrease in the EU-28 in the period in question. This positive development is, inter alia, a result of the successful restructuring of industry, the introduction of low-energy manufacturing processes in industry, and an improvement in building thermal and technical properties and the exchange of appliances for more energy-efficient ones. However, in spite of this fact the Slovak Republic has the seventh highest energy intensity in the EU-28 on a constant prices basis. This fact is mainly due to the structure of industry in the Slovak Republic, where the high energy intensity industry has a major share. The Slovak energy efficiency priority is a further reduction in the energy intensity of the SR economy with a view to achieving the European average.

The goal of global environmental policies is to keep global warming below 2°C, which is still considered to be achievable in terms of environmental and human impacts. Slovakia will have to concentrate in particular in this area on the fulfilment of the Europe 2030 goals and in the foreseeable future also create the conditions for the period to 2050. For state energy and economic policy, this in particular means reducing greenhouse gases, reducing fossil fuel consumption, improving management of the use of natural resources in line with the fundamentals and principles of the Green Economy (e.g. exploiting the potential of forests for timber production as a renewable resource) and waste, implementing a circular economy and increasing the share of energy production from sources that reduce CO2 emissions and contribute to optimizing the energy mix not only in Slovakia but also within the region.

#### i) Energy Efficiency Concept and four Energy Efficiency Action Plans

Energy efficiency measures to 2020 are described in detail in the energy efficiency Action Plans drawn up in 2011, 2014 and 2017 for the detailed description and implementation of energy efficiency measures in Slovakia by 2020. These cross-sectional documents describe measures in all sectors of the national economy that deliver energy savings and thus contribute to national energy efficiency targets as well as to the EU's energy efficiency goals.

The Energy Efficiency Action Plan for 2017 - 2019 with a view to 2020 was approved on 26 April 2017 by Government Resolution No 200/2017. The Action Plan is in line with the fourth implementation measure of the Energy Efficiency Concept and follows on smoothly from the previous three plans.

Energy efficiency measures are broken down into energy-related measures (buildings, industry, public sector, transport, appliances), measures for energy conversion, transmission and distribution; and horizontal measures. From the point of view of the impacts and performance of the function, the measures can be divided into legislative and non-legislative.

Energy-saving measures achieve energy savings, which are reflected in a reduction in final energy consumption. These measures are broken down by sector (buildings, industry, public sector, transport, appliances). Measures are evaluated using the bottom-up method up to the level of individual projects.

Energy efficiency measures in the building sector are mainly focused on

- improving the thermal and technical properties of buildings through major or partial renovation,
- new construction of low-energy and ultra-low-energy buildings as well as nearly zero-energy buildings,
- energy saving measures for the technical equipment in buildings, implemented on the basis
  of the application of conceptual and strategic materials, legislative obligations or through
  energy services.

Energy efficiency measures in the industry sector are mainly aimed at reducing the energy intensity of industrial production through:

- support for innovation and technology transfers in industrial enterprises (production lines and technologies),
- support for energy-consumption measures in industrial enterprises (industrial energy),
- implementation of measures based on the results of mandatory energy audits and the use of supporting tools to reduce the energy intensity of industrial production.

Energy efficiency measures in the public sector are mainly focused on

- improving the thermal and technical properties of public buildings from their own budgets and from national and international programmes and funds, including the EU Structural Funds 2007-2013 and 2014-2020, and with the help of the energy services,
- modernisation of public lighting
- energy saving measures for the technical equipment in buildings through energy services,
- energy saving measures implemented on the basis of the application of conceptual and strategic materials, legislative obligations.

Energy efficiency measures in the transport sector are mainly focused on

- renewal and upgrading of railway rolling stock and the road transport fleet,
- building and upgrading of transport infrastructure, focusing on electromobility,
- support for the development of electromobility

Energy efficiency measures in the appliances sector are mainly focused on

- replacement of white goods
- efficient lighting
- replacement of household and office equipment.

The energy-saving measures contributed by the OP C&EG, which continue partially modified in the new programming period 2014-2020 in the OP QoE and are focused on the construction, reconstruction and

modernisation of heat distribution as well as on the construction, reconstruction and modernisation of the facilities for electricity and heat generation by high-efficiency co-generation with a maximum thermal input of up to 20 MW. The aim was to adapt the generation and supply of heat to the need for usable heat, which is gradually decreasing as a result of the progressive implementation of energy-saving measures on the consumption side. By optimising the production, distribution and consumption of heat, with an emphasis on the use of high-efficiency co-generation, it is possible to contribute to the reduction in primary energy sources and the development of efficient CZT systems.

Significant benefits in terms of energy savings have also been demonstrated in the area of gas transport and distribution, where there has been a significant reduction in own consumption over the period under review. The minimum efficiency of energy conversion in electricity and heat generation and in CHP plants is laid down in Slovak Ministry of the Economy Decree No 88/2015. This Decree also sets out methods for calculating the efficiency of the distribution operations for electricity and gas infrastructure, as well as for heat, oil pipelines, product pipelines, water pipelines, and sewerage systems. Planned measures of an investment character in the operation of energy infrastructure in electricity and gas are sent on the basis of the requirements of Act No 251/2012, on Energy, as amended and No 321/2014, on Energy Efficiency to the Operator of the Energy Efficiency Monitoring System, which is the SIEA.

#### Sectoral policies and measures in the climate area

#### a) The European Greenhouse Gas Emission Trading Scheme (EU ETS)

The EU ETS was established by Directive 2003/87/EC and underwent several revisions to strengthen its implementation during its three trading periods (2005-2007, 2008-2012 and currently 2013-2020).

The first phase (2005-2007) was a three-year pilot of learning in practical situations for preparations for the second phase, when the EU ETS was to work effectively to help ensure that the EU and its Member States meet their emissions targets under the Kyoto Protocol.

Before the start of the first phase, the Slovak Republic had to decide how many quotas to allocate to each EU ETS operation in its territory. This was done through the first National Allocation Plan. The Slovak Republic prepared and published the National Allocation Plan on 1 May 2004. The European Commission Decision on the 1<sup>st</sup> Phase of the National Allocation Plan of the Slovak Republic was approved on 20 October 2004. 1<sup>st</sup> phase statistics:

- 175 facilities
- 38 facilities closed their accounts;
- permit cancelled for 1 facility.

#### Table 2: Statistics from Phase I of the National Allocation Plan

Year	2005	2006	2007
Allocation	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 mandatory period of the Kyoto Protocol. The Decision of the European Commission on the 2nd 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.

2<sup>nd</sup> phase statistics:

- 193 facilities
- 30 facilities closed their accounts;
- permit cancelled for 1 facility.

#### Table 3: Statistics from Phase II of the National Allocation Plan

Year	2008	2009	2010	2011	2012
Allocation	32,166,094	32,140,581	32,356,123	32,617,164	33,432,258
Verified emissions	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 3<sup>rd</sup> phase of the EU ETS started on 1 January 2013 and introduced several changes to the EU ETS. It brought in harmonised rules for the free allocation of emission allowances, introduced auctions as the main instrument to meet the emission reduction target, added other sectors to its scope (inter alia civil aviation, aluminium) and set an annual reduction target of 1.74 %. The most affected was the electricity sector, which began to have the obligation to buy greenhouse gas emission allowances in full to meet its real needs. The Slovak Republic notified the Commission of the list of facilities covered by the Directive on its territory on 17 August 2012.

#### Table 4: Statistics from Phase III of the National Allocation Plan

Year	2013	2014	2015	2016
Allocation	16,466,336	15,821,315	15,029,434	14,522,533
Verified emissions	21,829,374	20,918,069	21,181,280	21,264,045

Source: Ministry of the Environment of the Slovak Republic

In July 2015, the Commission presented a legislative proposal for reform of the EU ETS for the post-2020 period (i.e. a 4<sup>th</sup> phase). This was followed by several consultations on this proposal, including expert meetings, to discuss the technical aspects of the proposed emission allowance free allocation rules and carbon leakage and independent stakeholder consultations on the newly proposed Innovation Fund.

Final agreement on the legislative proposal was reached in November 2017. The revised Directive was published in the Official Journal of the European Union in March 2018<sup>8</sup>. The main elements for the period 2021-2030 are: continued free allocation, continuation of safeguard measures to prevent carbon leakage,

<sup>&</sup>lt;sup>8</sup> Directive 2018/410

a linear reduction factor at -2.2 %, low-carbon support mechanisms (Innovation Fund, Modernisation Fund and exceptions for electricity generators) and a revision clause.

New Entrants Reserve

A maximum of 5 % of the volume of EU allowances for the period 2013 to 2020 will be reserved for new entrants. The Slovak Republic has so far registered three official requests.

New Entrants Reserve 300

No carbon capture and geological storage project or innovative renewable energy project from the Slovak Republic participated in the first or second call of the New Entrants Reserve 300 initiative.

Auction

The auction is a new way of allocating allowances in the third phase. Interim auctioning began in 2012 with an auction of 120 million EUA, of which the Slovak Republic's share was 1.8 million EUA. The auctions for the Slovak Republic are held on the European Energy Exchange (EEX) every Monday, Tuesday and Thursday. From 2015 onwards, the entire proceeds of the auction are income for the Environmental Fund of the Slovak Republic. For the 4th trading period starting in 2021, Slovakia has the option to use the funds obtained from the auctioning of the allowances in question to finance the transformation needs of the energy sector through the various financial mechanisms for which these allowances are primarily intended. It is essential for Slovakia to make use of this option and to make the greatest possible use of these funds to finance its priorities set out in the present Slovak National Climate and Energy Plan.

Period	2016	2015	2014	2013	2012		
	Data in EUR						
Revenue of the Slovak Republic (EUA)	64,991,430	84,312,060	57,590,625	61,702,620	12,193,290		
Revenue of the Slovak Republic (EUAA)	55,815	197,300	44,590	-	-		
Overall revenue - SVK	65,047,245	84,509,360	57,635,215	61,702,620	12,193,290		

Source: Ministry of the Environment of the Slovak Republic

#### Backloading

Backloading is a term used to describe the process whereby a larger number of auction allowances will be temporarily withdrawn in 2014-2016, and delivered to the Market Stability Reserve (MSR) in the years 2019 and 2020 in the volume of 300 and 600 million tons. The main objective is to eliminate the current surplus of emission allowances in the EU ETS and to ensure an increase in carbon prices in the market.

Linking the EU ETS to other greenhouse gas trading systems, i.e. interconnection

Directive 2009/29/EC sets out provisions that allow the EU ETS to be linked to other similar systems set up at regional or national levels outside the EU. Negotiations on the interconnection of the EU and Swiss systems are currently under way.

MSR

The Market Stability Reserve (MSR) was introduced as a long-term solution to combat existing quota surpluses within the EU ETS. This is an automated mechanism that will reduce the volume of auctioned allowances if there is a significant surplus of market allowances. If additional allowances are needed, the MSR will be used to increase the auction volume. The MSR will be operational from 2019 and all temporarily withdrawn allowances will become part of this reserve. The aim of this measure is to make the EU ETS the primary and key market instrument for the decarbonisation of the energy sector as well as of the whole EU economy.

Greenhouse gases affected: CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFC, PFC and SF<sub>6</sub>

Type of measure: regulatory

#### b) Effort Sharing Decision (ESD)

The Effort Sharing Decision<sup>9</sup> sets out the annual greenhouse gas emission targets of the Member States for the period 2013-2020 which are legally binding and cover only greenhouse gas emissions not covered by the EU ETS, i.e. transport (excluding aviation), buildings, agriculture (excluding LULUCF) and waste. Each Member State must define and implement national policies and measures, such as support for public transport, energy efficiency standards for buildings, more efficient farming practices and the conversion of animal waste to biogas, to reduce emissions of the greenhouse gases included in the Effort Sharing Decision. The emission limit values for the Slovak Republic are set at + 13 % by 2020 compared to 2005 levels.

According to trends in emissions developments and projections, the Slovak Republic could meet its individual 2020 targets for sectors not covered by the EU ETS with the current set-up of national policies and measures.

# Table 6: Progress made in meeting the SP targets under the Effort Sharing Decision (ESD) based on projections

2020 Target under ESD ( % vs. 2005)	+13.0 %
2015 ESD emissions ( % vs 2005)	-23.2 %
2020 ESD projections WEM ( % vs 2005)	-23.0 %
2020 ESD emissions WAM ( % vs 2005)	-26.0 %

Source: MEnv

Transport and domestic heating are the most addressed sectors covered and regulated by the ESD. Total aggregate GHG emissions in transport are at the same level as in the base year, although traffic intensity

<sup>&</sup>lt;sup>9</sup> Decision 406/2009/EC

has increased. Transport currently contributes 16.3 % to total GHG emissions (in  $CO_2$  equivalent) and its share of total emissions has increased since 1990. Therefore, it is necessary to pay constant attention to and implement effective policies and measures to manage and reduce road transport emissions in the Slovak Republic.

The Effort Sharing Decision, effective in promoting the stimulation of new national policies and measures, has led Member States to become more proactive in considering new measures, as well as to better coordination between national, regional and local governments. This positive progress led to a new legislative proposal on an Effort Sharing Regulation (ESR), which the European Commission presented in July 2016. The Regulation lays down binding annual targets for greenhouse gas emissions for Member States for the period 2021-2030, retaining binding annual greenhouse gas emission limit values for each Member State. Emission limit values will be set for each year in the 10-year period up to 2030 according to a decreasing linear trajectory. The main changes proposed by the current Decision include:

- flexible mechanisms under the Effort Sharing Decision will be retained and two new flexibilities added. They are:
  - one-off flexibility to transfer a limited volume of allowances from the EU ETS: it covers some emissions in non-ETS sectors with EU ETS allowances that would normally be traded in the form of an auction;
  - a new flexibility to transfer a limited volume of credits from land use, land use changes and forestry (LULUCF) sector: to stimulate additional measures in the land use sector;
- ensuring compliance countries will need to ensure compliance on an annual basis, but a full compliance check will take place every five years instead of the annual cycle;
- a safety margin is a new element in the ESR and takes into account the efforts already made since 2013 for Member States whose GDP per capita was below the Union average in 2013. The maximum volume of the safety margin is 105 million tonnes of CO<sub>2</sub> eq. and is established in the Union Registry and is the subject of Union objective fulfilment;
- the safety margin is to help Member States whose GDP per capita was below the Union average in 2013 and whose greenhouse gas emissions were lower than their allocated annual allocations in the period from 2013 to 2020 and which have difficulty reaching the 2030 targets in spite of making use of the other flexibilities provided in the Regulation.

Greenhouse gases affected: CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O and perfluorocarbons (PFCs)

Type of measure: regulatory

#### c) Biofuel use policy

Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC was adopted on 23April 2009. Directive (EU) 2015/1513 of the European Parliament and of the Council, amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources was adopted on 9 September 2015. The body responsible for the implementation of the two directives is the Ministry of Economy of the Slovak Republic. The Ministry of the Environment is

responsible for meeting the sustainability criteria for biofuels and bioliquids, for calculations to determine the impact of biofuels and bioliquids on greenhouse gas emission volumes and for the calculation of greenhouse gas emissions released during the life cycle of motor fuels under Art. 7a of Directive 2009/30/EC and Council Directive (EU) 2015/652 of 20 April 2015 laying down calculation methods and reporting requirements under Directive 98/70/EC of the European Parliament and of the Council relating to the quality of petrol and diesel fuels.

In relation to sustainability criteria, the Slovak Republic has implemented Articles 17, 18 and 19 of Directive 2009/28/EC and the essentially similar Articles 7b, 7c and 7d of Directive 2009/30/EC, Art. 7a of Directive 2009/30/EC, Directive 2015/652 and the relevant Articles of Directive 2015/1513 by Act No 309/2009, on the Promotion of Renewable Energy Sources and High-Efficiency Co-generation, as amended, and Decree of the Ministry of the Environment of the Slovak Republic No 271/2011, laying down sustainability criteria and targets for the reduction of greenhouse gas emissions from fuels, as amended. Given the fact that a new directive on the promotion of the use of renewable energy was adopted in 2018, new rules will need to be adopted in Slovak legislation by 30 June 2021.

This law deals inter alia with the core roles and responsibilities of the competent authorities and economic operators in a context that demonstrates the meeting of sustainability criteria for biofuels and bioliquids, which are the preconditions for meeting the national greenhouse gas reduction target as well as targets for renewable energy sources.

Decree of the Ministry of the Environment of the Slovak Republic No 271/2011, as amended, in force since 2011, establishes a national system for demonstrating compliance with the sustainability criteria for biofuels and bioliquids. This system is based on independent verifiers whose training is organised and who are subject to mandatory examination and registration by the Ministry of the Environment of the Slovak Republic. Decree of the Ministry of Agriculture and Rural Development No 295/2011, providing for a detailed declaration of the producer and supplier of biomass for the production of biofuels or bioliquids, has been in force since October 2011.

Greenhouse gases affected: CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O

Type of measure: regulatory

#### d) Taxation of energy products and electricity

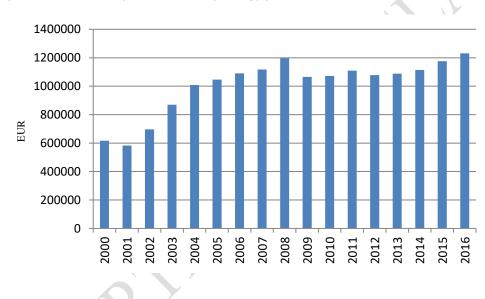
The tax on mineral oils is the most important tax revenue. Income from electricity, coal and natural gas is relatively low. The Slovak Republic generates a relatively low income from environmental taxes (Figure 1) and the implicit tax rate (Figure 2) on energy is low. There is considerable scope for tax reforms in respect of the environment. The highest share of total energy use and CO<sub>2</sub> emissions in the Slovak Republic is for heating and energy use in industrial processes. As a result, a more harmonised tax regime in these areas would increase tax revenues and provide incentives to mitigate CO<sub>2</sub> emissions. This could be achieved by raising taxes on all fuels used for heating and manufacturing at a standard rate per unit of energy for natural gas. Unit-linked consumption taxes could also be indexed for inflation in order to avoid a decline in environmental tax revenues in real terms over time. In addition, the Slovak Republic should consider abolishing the tax differential between petrol and diesel fuel. A gradual increase in diesel taxes could also be used to reduce the burden of direct taxes, although there may be limited scope for such an increase in the short term without similar increases in rates in neighbouring countries to avoid fuel tourism. Business cars should also be more effectively taxed as part of personal income tax. Finally, support for electricity generation from coal and lignite should be abolished. Instead, the tax on electricity consumption could be

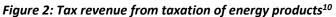
increased and exemptions from the electricity tax for households could be abolished in order to increase the incentive to use electricity more efficiently. Lower household income could be compensated by the government using targeted tax or support measures.

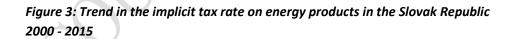
However, it is necessary to draw attention to the fact that any reform of the taxation of energy products and electricity must be fully in line with EU legislation. On the other hand, it is also necessary to realise that the introduction of a new tax or an increase in existing taxes may very likely lead to an increase in end-user electricity and heat prices, which is contrary to the priorities of the Slovak Energy Policy, namely to ensure accessible and affordable energy prices. The most appropriate instrument is the market-based functioning of the Emissions Trading Scheme (EU ETS), which aims not only to ensure decarbonisation of energy and the economy as such, but also represents revenue to the SR from auctioning CO<sub>2</sub> allowances, which can be used to meet the climate and energy targets of a given country.

#### Greenhouse gases affected: $CO_2$ , $CH_4$ and $N_2O$

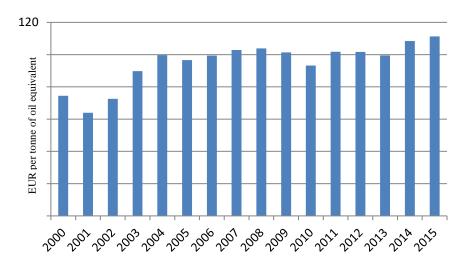
Type of measure: regulatory







<sup>&</sup>lt;sup>10</sup><u>http://ec.europa.eu/taxation\_customs/tedb/taxDetails.html?id=4148/1496928576#tax\_revenueTitle1</u>



Source: Eurostat

#### e) Carbon capture and storage

Directive 2009/31/EC on the geological storage of carbon dioxide was transposed into national legislation by Act No 258/2011 on the permanent storage of carbon dioxide in the geological environment and on an amendment and addition to certain laws. Suitable geological locations have been identified in the Slovak Republic.

#### Greenhouse gases affected: CO<sub>2</sub>

Type of measure: regulatory

#### f) National emission ceilings

The current Directive 2001/81/EC on national emission ceilings was replaced from 1 July 2018 by revised Directive 2016/2284 on NEC. Its main objective is to reduce the adverse impacts of air pollution on health, including reducing the annual number of premature deaths from air pollution by more than half. This revised Directive contains the national emission reduction commitments for each Member State for the period up to 2030 (with interim targets set for the period up to 2025) for six specific pollutants: NO<sub>x</sub>, SO<sub>2</sub>, NMVOC, NH<sub>3</sub>, PM<sub>2,5</sub> and CH<sub>4</sub> The NEC Directive is transposed into national legislation in Act No 137/2010, on the atmosphere and supplemented by Act No 401/1998, on air pollution charges.

Greenhouse gases affected: Air pollutants NO<sub>x</sub>, SO<sub>2</sub>, NMVOC, NH<sub>3</sub>, PM<sub>2,5</sub> and CH<sub>4</sub>

Type of measure: regulatory

#### g) Action Plan for the Transformation of the Upper Nitra Coal Region

In July 2017, within the framework of the "Clean Energy for All Europeans" initiative, and in connection with the provision of technical assistance for the decarbonisation of coal regions, a meeting of an expert team from the European Commission was held at the Office of the Government of the Slovak Republic with representatives of public administration and the private sector. The European Commission welcomed Slovakia's interest in participating in a pilot project to make use of the aid for the coal-mining region of Upper Nitra.

In October 2017, the Ministry of the Economy submitted an application for support under the Structural Reform Support Programme 2017-2020 (SRSP) for the coal-mining region of Upper Nitra, which was approved by the EC in March 2018 to the total amount of  $350,000 \in$ , with coordination of the individual components of the programme under the management of the Office of the Government of the Slovak Republic for Investment and Informatisation.

In December 2017, a Platform on Coal Regions in Transition was set up in Strasbourg, where the Upper Nitra region is one of the pilot projects and which provides scope for dialogue and a search for tools to address the issue of how to help coal-mining regions in Europe.

In February 2018, a meeting was held in Trenčín of representatives of the European Commission, the Government of the Slovak Republic, public administration and the private sector on the transformation of the Upper Nitra region under the title "Preparing for the transition from coal", where the EC JRC socio-economic study "Socio-Economic Transformation in Coal-Mining Regions" was presented.

On 26 and 27 February 2018 in Brussels, the first meeting of the Platform on Coal Regions in Transition was held, and strategies and projects were presented by the regions included in the pilot project, including the Trenčín self-governing Region.

In March 2018 a "Working Group for Preparation and Implementation of the Transformation Action Plan for the Upper Nitra Region" was set up under the administration of the Central Coordination Unit of the Office of the Deputy Prime Minister for Investment and Informatisation, which met at sessions on 27 March 2018 in Bratislava, on 9 April 2018 in Prievidza, on 14 May 2018 in Bratislava and on 17 October 2018 in Trenčín.

As priorities of the Transformation Action Plan for the Upper Nitra Region, the following were agreed:

- *Creating Sustainable Employment Opportunities* Companies and Jobs with Research and Innovation Measures;
- Accessibility transport and mobility transit and intra-regional transport
- Developing and stabilising a trained labour force training and quality of life;
- Remediation of environmental burdens and health impacts of mining and related activities;
- diversification of industry
- domestic production and consumption
- energy
- agriculture,
- tourism;
- infrastructure,
- health and social services.

An SRSS Template for Project Description with the requirements of the "Working Group for Preparation and Implementation of the Transformation Action Plan for the Upper Nitra Region" was completed and sent to Technical Co-operation and Services, resulting in the creation of a Transformation Action Plan for the Upper Nitra region. The EC chose PriceWaterhouseCoopers (PWC) as the provider.

Domestic production of brown coal and lignite is at 1800 kt/yr, consumption at 3,000 kt/yr. The deficit is covered by imports, mainly from the Czech Republic. Total mining in 2017 reached: 1,834 kt, a decrease over the last 10 years of 30 %.

The exclusive producers of brown coal and lignite in the Slovak Republic are Hornonitrianske bane Prievidza, a.s. (HBP a.s.), since Baňa Dolina, a.s., Veľký Krtíš terminated mining in 2015, and in 2016 HBP a.s. bought Baňa Čáry, a.s. and became 100 % owner of all coal-mining organisations in the Slovak Republic.

By its Resolution No 47/2010 the Slovak Government approved the production and supply volumes of electricity and heat from domestic coal under General Economic Interest (GEI). This measure ensured for the period up to 2020 and prospectively until 2035 an optimum level of coal mining, higher security of electricity supplies as well as reduced energy dependence for the Slovak Republic. This support also had a significant social dimension, through maintaining employment in the regions of Horná (Upper) Nitra, Veľký Krtíš and Záhorie.

With regard to the transformation of the Upper Nitra region, it is important to look for a modern highefficiency heat and power generation solution using existing infrastructure with a minimal environmental impact, that will be sustainable, cost-competitive and thus able to support the transformation and growth of the region.

### h) State research and development programme (SRDP) Energy Security of the Slovak Republic, emphasising multiple sourcing, energy efficiency and the environment.

The subject of the SRDP is research in three important areas that are the subject of research focus in Europe and elsewhere in the world. The area aimed at enhancing power grid security is, in the light of new trends, focused on researching technical solutions in the field of optimisation and design of new transmission system management procedures, increasing transmission capabilities and reducing losses. At the same time, it aims at increasing the life expectancy and reliability of electrical equipment operation, increasing the efficiency of diagnostics by using autonomous robotic systems. The field includes research and development into new methods for the assessment of diagnostic data and environmental impacts on equipment.

Smart grids, i.e. efficient energy management and energy supply systems under the changing operating conditions of energy systems, with the integration of renewable energy sources (RES) into distribution systems and active customers (or prosumers), are helping to achieve this strategic goal in line with the energy policy of the Slovak Republic and the EU. The area includes local electricity storage, electromobility infrastructure development, including the development and testing of new technologies and their impacts on the distribution system as well as the sustainable use of biomass as part of an optimal energy mix. It includes research into the potential for an energy self-sufficient community and autonomous networks for use in public transport and industry.

The nuclear power sector has a significant position among electricity sources in the Slovak Republic and focuses on the issues of safety, stability and performance flexibility of electricity supply within a wide range of nuclear power plants and the related issue of nuclear fuel use and storage.

# i) Knowledge for Prosperity - Research and Innovation Strategy for Smart Specialisation of the Slovak Republic RIS3 SK

The Slovak Republic is widely involved in international activities in the area of research, development and innovation through bilateral agreements on scientific and technical cooperation with both EU and non-EU countries. Slovakia is a member of the IEA, through HEIs and SADs it is involved in scientific and technical cooperation within the EU through the 7th Framework Programme of the EU (the EU FP7) and EURATOM. Support for science and research is one of the priorities of the EU 2020 strategy. The European Commission has adopted the strategic document "Strategic Energy Technology Plan" (SET Plan), which represents the technological pillar of the EU's energy policy. One of the industry initiatives concerns

nuclear power. Within this, the Slovak Republic is involved in the Allegro project, which is a cooperation project in the field of nuclear energy between Slovakia, Hungary and the Czech Republic and France.

# j) Implementation Plan of the Research and Innovation Strategy for Smart Specialisation of the Slovak Republic

Within the defined areas of intelligent specialisation, a basic set of priorities for smart specialisation was also defined - 5. Sustainable Energy Industry and Energy

#### k) Draft State R&D programmes for 2019-2023 with outlook to 2028 (material to MPK)

State R&D programmes address key development challenges and meeting society's needs. They specify areas of science and technology in which research and development are to be concentrated or intensified, with a view to increasing economic and social benefits and contributing to achieving a high level and international recognition.

The content of state R&D programmes is based on the R&D priorities, technological priorities and societal priorities defined in the document "Knowledge for Prosperity - Research and Innovation Strategy for Smart Specialisation of the Slovak Republic RIS3 SK". The aim is to further support the development of traditional and also promising areas of specialisation and development trends of the Slovak economy, which at the same time have adequate intellectual capital (human resources, technical infrastructure). The completion of R&D projects within the framework of SRDP will also create the conditions for the; wider involvement of leading research teams from Slovakia in EU research and development projects.

#### Focus of state research and development programmes:

- **State programme:** Energy security of the Slovak Republic, emphasising multiple sourcing, energy efficiency and the environment and the following sub-programmes:
  - Improving the transmission capabilities and security of the Slovak electricity grid
  - Smart grids and renewable energy sources
  - Nuclear
- State programme: Higher added-value materials and products based on effective recovery of domestic raw materials and waste and the following sub-programmes :
  - New construction materials and technologies for applications in transport, engineering, construction and power engineering

#### **I)** Incentives for research and development

The objective of providing incentives for R & D is supporting the growth of research and development in the business sector in Slovakia, supporting the growth of cooperation with the academic sector (universities, SAS organisations), supporting the growth of research and development cooperation between business sectors in the Slovak Republic and in the EU, with the aim of increasing the level of competitiveness of the Slovak business sector in international markets by enhancing product quality and applying all kinds of innovation in manufacturing and other business processes.

R&D incentives also encourage close cooperation between businesses and the academic sector, thus qualitatively increasing the leading-edge excellence of R&D. In this context, R&D incentives are perceived as supporting and developing the best outcomes of systematic creative work, to raise awareness and create new applications.

All this creates the conditions for the creation of new jobs for highly qualified employees, thus supporting the development of the research base, an improvement in the education system and the development of cooperation between academic workplaces and the business sector.

An important aspect of providing incentives for research and development is the expansion of existing research and development centres, creating new workplaces in companies, thus creating new jobs for highly qualified R&D staff. Under the terms of incentive conditions, these workplaces and related jobs must continue to be active for at least 5 years after the end of the incentives. Another important aspect is the fact that incentive beneficiaries are obliged to invest their own funds in research and development at a stipulated level and for at least the monitored five-year control period after the end of the incentives.

In the past, R&D incentives were provided to address projects in the field of materials and energy -Development of a technological complex for the processing of municipal waste for material and energy purposes and in the field of nuclear energy, namely nuclear decommissioning, entitled Conditional Release of Materials from Nuclear Decommissioning

In the upcoming period, the Ministry of Education, Youth and Sports of the Slovak Republic, within the framework of research and development incentives, will focus on supporting the following areas: Research and development of **highly efficient energy sources** and technologies for transport systems using Industry 4.0 principles and research and development of biodegradable plastics including composite materials using **renewable energy sources** for the automotive industry.

#### m) EURATOM

The EURATOM (European Atomic Energy Community) Treaty was created to help coordinate Member States' research programmes on the peaceful use of nuclear energy. It is currently one of the frameworks for sharing knowledge, infrastructures and for nuclear energy financing. It ensures the security of nuclear power supplies through a centralized monitoring system.

Since its main objective is also to bring together the nuclear industries of the Member States, it covers within its competence those entities (Member States, public and private institutions, enterprises and natural persons) who carry out their business or part thereof in one of the areas which the treaty regulates. And so, the areas of special fissile materials, raw materials and ores from which these raw materials are obtained. The powers of the EURATOM Treaty are exclusively for the civilian and peaceful uses of nuclear energy.

Specific EUROATOM missions include:

- developing research and ensuring the dissemination of technical knowledge,
- developing and ensuring the use of uniform safety standards to protect workers and the general public,
- simplifying access to investment and ensuring the construction of the basic facilities necessary for the development of nuclear energy in the EU,
- overseeing regularity and uniformity in the supply of users of ores and nuclear fuels in the EU,
- guaranteeing that that nuclear material is not misused for other purposes, in particular for military purposes,
- exercising title to the specific fissile materials assigned to it,
- contributing to progress in the peaceful use of nuclear energy in cooperation with third countries and international organisations,
- establishment of joint ventures.

Euratom is a complementary research programme for nuclear research and training under the Horizon 2020 programme. Its role is to contribute, in a safe and efficient manner, to the long-term decarbonisation plan for the energy system. As such, it strengthens three important priorities of Horizon 2020:

- scientific excellence,
- industrial leadership and
- societal changes

#### Two areas form the core of EURATOM

- nuclear fission and radiation protection,
- the development of magnetic nuclear fusion as an energy source

#### *iii.* Key issues of cross-border relevance

The Slovak Republic is highly dependent on imports of primary energy resources. Given the location of the Slovak Republic in Central Europe, it is necessary to diversify transport routes, especially for natural gas and oil. It is particularly necessary to strengthen north-south routes.

# *iv.* Administrative structure of implementing national energy and climate policies

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

The SR has a systematised mechanism for management, planning, monitoring and evaluation of energy efficiency, arising from the requirements of European and national strategic documents and legislation. The Ministry of Economy of the Slovak Republic is the general coordinator of the energy efficiency agenda, focusing primarily on energy savings in all sectors of the economy and has an interdepartmental working group for this purpose involving all relevant central state administration bodies.

The Ministry of the Environment of the Slovak Republic is responsible for the development of the national environmental policy and climate change and adaptation measures.

The main units dealing with climate change at the Ministry of Environment of the Slovak Republic are the Department of Climate Change Policy and the Department of Emissions Trading, which come under the section on Climate Change and Atmospheric Protection.

Based on Government Resolution No 821/2011, the Climate and Energy Package Commission was replaced at state secretary level by the Commission for Climate Coordination Policy (the Commission).

The Commission was set up on 15 January 2012 at state secretary level and is chaired by the State Secretary of the Slovak Ministry of the Environment. Other members are the state secretaries of the Ministry of Economy, the Ministry of Agriculture and Rural Development, the ;Ministry of Transport and Construction, the Ministry of Education, Science, Research and Sports, the Ministry of Health, the Ministry of the Interior, the Ministry of Finance, the Ministry of Foreign and European Affairs and the Chairman of the Network Regulatory Office.

The Commission's main objective is effective coordination in the development and implementation of mitigating and adaptation policies and the selection of appropriate measures to meet international commitments. The Commission plays the major role in inter-ministerial decision-making.

There are two special working groups under the Commission: one on the adaptation policy of the Slovak Republic (preparation and updating of the National Adaptation Strategy, addressing the problems of adaptation at the national level, co-ordination of activities with other ministries) and the second is responsible for the Slovak Republic's Low-Carbon Strategy.

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

#### *i.* Involvement of the national parliament

The relevant committees of the National Council of the SR have been dealing with the draft package "Clean Energy for All Europeans" since its publication. The regular preliminary opinion of the Slovak Republic on the draft regulation on the management of the energy union was the subject of an interdepartmental commentary procedure in May 2017, then was discussed by the National Council Committee on Economic Affairs (6 June 2017) and the National Council Committee on European Affairs (15 . June 2017).

Representatives of the Slovak Republic actively participated in the discussion of the draft regulation on the management of the energy union within EU units - as part of the Council's energy working group as well as within the Technical Working Group on National Energy and Climate Plans at the Commission. All interested state administration bodies were kept up to date on the progress and results of these negotiations.

### *ii.* Involvement of local and regional authorities

Local and regional authorities have the option to participate in the development of strategy papers in accordance with the procedures outlined in section 1.3. iii.).

For regional projects, involvement of regional and local authorities is usual in the preparatory phase. For example, the Upper Nitra Development Action Plan, for one of the three pilot regions of the new Platform for Coal-Mining Regions in Transformation launched by the European Commission, will be approved by the Slovak Government in April 2019. It is being 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 Towns and Municipalities of Upper Nitra and interested parties 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 for the preparation of materials for meetings of the Slovak Government, preparation includes discussions with all ministries and stakeholders as well as with the public. Within the standardised process for material submitted for discussion by the Government, an intra-departmental commentary procedure is then followed by an inter-ministerial commentary procedure (MPK). The material is published in the MPK via the publicly accessible website Slov-Lex, operated by the Slovak Ministry of Justice. On the website one may familiarise oneself with the proposed documents and, via an electronic form, comments may be raised on the submitted material not only by representatives of state and public authorities but also by natural persons or legal entities from the public. After a specified publication period (at least 15 days, for materials of a non-legislative nature this may be shortened to 5 days), the submitted relates to an activity for which a government advisory body has been established, it must be assessed in that advisory body prior to submission for discussion by the Government. Accepted comments of the government advisory body are incorporated by the submitter into the material; any failure to accept comments must be justified.

Under the current legislation, the approval of strategic materials is also subject to an evaluation process under Act No 24/2006 (Act on Environmental Impact Assessment and on changes and additions to certain laws)

If a strategic environmental assessment is required, the material is submitted for Government discussion after the former's public deliberations.

This procedure was used by the Slovak Government to discuss the documents mentioned in Chapter 1.2.ii.)

As part of the process of assessing the draft Energy Union Regulation, NECP content and preparation issues were also consulted with other ministries, and an inter-ministerial working group was set up which, in addition to reviewing the draft Regulation, mapped out the data sources needed to prepare the NECP across various ministries.

During discussion on the content of the Regulation on the Management of the Energy Union, the Slovak Ministry of the Economy cooperated with the major companies and professional associations in the energy sector. Inputs from some experts from these companies and associations have also been used in the discussions on the final version of the Regulation and hence on the content of the Integrated National Plan for Energy and Climate. Organisations dealing with the production and supply of electricity, petroleum products, distribution companies, heat supply companies and employers' associations were addressed.

### iv. Consultation of other Member States

The assessment of cross-border impacts is also included in the assessment process under Act No 24/2006 (the Act on Environmental Impact Assessment and on changes and additions to certain laws).

All cross-border connections are implemented in accordance with conventions with the relevant neighbouring Member States, international connections are on the current list of PCI projects.

#### v. Iterative process with the European Commission

Several consultations with relevant EU bodies were conducted during the preparations. Representatives of the Slovak Republic participated in the discussions of the Energy Working Group in preparation of the text of the Regulation on the Management of the Energy Union and in the discussions of the technical group for the preparation of the NECP, where aspects of the preparation process for the plans were discussed. Issues related to the preparation of NECPs were also the subject of bilateral and multilateral talks with representatives of the EC at various levels during their visits to Slovakia, more exactly, during meetings as part of international energy and climate conferences.

## 1.4. Regional cooperation in preparing the plan

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

On 20 November 2018, a joint meeting of experts from the V4 countries (the Czech Republic, Hungary, Poland and Slovakia) and Austria was held in Bratislava, where aspects of the preparation of NECPs in individual countries, as well as their basic objectives, policies on renewable energy, climate protection,

energy efficiency, the internal market and the security of energy supply were the subject of the discussions.

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

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

## 2. NATIONAL OBJECTIVES AND TARGETS

### 2.1. Dimension: decarbonisation

#### 2.1.1. GHG emissions and removal through sinks

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

Emissions of greenhouse gases from sectors outside the EU ETS are covered by the Effort Sharing Regulation (ESR). The ESR covers emissions from all sectors outside the EU ETS, except for emissions from international maritime transport, domestic and international aviation (incorporated into the EU ETS from 1 January 2012) and emissions and capture under land use, land use change and forestry (LULUCF). This includes a wide range of small pollution sources in a wide range of sectors: transport (cars and lorries), buildings (mainly in connection with heating), services, small industrial installations, fugitive emissions from the energy sector, fluorinated gas emissions from equipment and other sources, agriculture and waste. These sources make up about 55 % of total EU greenhouse gas emissions.<sup>11</sup>

The ESR target has been subdivided into national targets that have to be met by Member States individually. Under the Effort Sharing Regulation, national emissions targets for 2030 are set as a percentage change from 2005. For the Slovak Republic it is -12% compared to 2005. The maximum amount of greenhouse gas emissions for non-EU ETS sectors for each year from 2021 to 2030 is expressed in the quantity of annual emission allowances (AEA) allocated to each Member State for the year in question.

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

Addressing climate change as a global as well as a national problem requires the implementation of climate change mitigation and climate change adaptation measures. Preventing or at least minimising the risks and negative impacts of climate change can be achieved by combining measures to reduce greenhouse gas emissions with measures that reduce vulnerability and to increase the adaptive capacity of natural and man-made systems against the actual or expected negative impacts of climate change.

In 2014 the Slovak Republic adopted a Strategy for Adaptation to the Adverse Effects of Climate Change (NAS). The Strategy was updated and subsequently approved by the Slovak Government in October 2018 (Government Resolution No 478/2018)<sup>12</sup>. The main objective of the updated NAS is to improve Slovakia's preparedness to face the adverse impact of climate change, to provide the widest possible information on current adaptation processes in Slovakia and based on analysis of these, to establish an institutional framework and coordination mechanism to ensure the effective implementation of adaptation measures at all levels and in all areas. The National Adaptation Strategy, based on the latest scientific knowledge, combines scenarios and possible impacts of climate change on the widest possible range of sectors and sectors with proposals for appropriate adaptation measures. Achieving these goals requires effective implementation and monitoring of adaptation measures, the promotion of synergies between adaptation and mitigation measures, as well as raising public awareness and building a knowledge base.

<sup>&</sup>lt;sup>11</sup> 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

<sup>&</sup>lt;sup>12</sup> http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=27853

The updated National Adaptation Strategy applies the proactive principle of adaptation and is aimed at assessing the current state of adaptation and planned activities in key areas and sectors, defining a general vision of adaptation in selected areas, and updating the set of adaptation measures and frameworks to implement them. In implementing adaptation measures, the NAS supports the use of an ecosystem approach and proposes a set of adaptation measures in the following areas: mining and geology, soil environment, natural environment and biodiversity, the water regime within the country and water management, the residential environment, population health, agriculture, forestry, transport, energy, industry and some other areas of business, recreation and tourism. Adaptation measures will be further assessed and prioritised in the Adaptation Action Plan, which is currently in preparation.

#### 2.1.2. Renewable energy

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

The European Union's binding target for the share of energy from renewable sources in gross final energy consumption is at least **32**% by 2030. In order to achieve this binding target, Member States' contributions for 2030 to this target from 2021 are in line with the indicative trajectory of this contribution. The directional trajectory reaches a reference point of at least

a) 18 % by 2022

b) 43 % by 2025

c) 65 % by 2027

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

## *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

By 2030, the indicative trajectory shall reach at least the Member State's planned contribution. The indicative trajectory for Slovakia starts at 14 % in 2020.

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
RES-H&C ( %)	12.9	13.6	14.0	14.7	15.7	16.2	16.5	16.9	17.2	17.6
RES-E ( %)	22.3	23.1	23.5	23.6	24.4	25.1	25.2	25.3	25.2	25.0
RES-T ( %)	8.1	8.2	8.6	8.7	9.0	9.4	9.9	10.8	12.4	14.0
Overall RES share (%)	14.0	14.7	15.1	15.5	16.3	16.8	17.1	17.4	17.7	18.0

Table 7 Estimated trajectories

Source MoE of the Slovak Republic

The Slovak Republic has one of the lowest emission energy sectors in the EU due to the high share of nuclear in electricity generation and the high share of natural gas in the heating industry. The only scope for decarbonisation of the energy sector is now in the substitution of coal by low-emission sources, in energy efficiency measures and in the decarbonisation of transport. After replacing solid fossil fuels with renewable energy sources, we will have one of the lowest emission energy sectors in the whole of the EU (specifically the 7<sup>th</sup> least energy-intensive CO2 emissions across the EU in terms of the CO<sub>2</sub> intensity of electricity and heat generation) and therefore the potential for more robust RES implementation must be sought in countries where fossil fuels are used to a greater extent - there, the implementation of RES and decarbonisation will be much more cost-effective.

More ambitious Slovak targets for RES shares in the energy sector by 2030 (beyond the substitution of coal) will be expensive for the country. Moreover, the adoption of more ambitious targets for RES shares by 2030 significantly reduces a Member State's flexibility to reduce  $CO_2$  emissions in other sectors in an efficient way (both in terms of technology and the economy).

iii. **Estimated** trajectories by renewable energy technology that the Member State projects to use to achieve the overall and sectoral trajectories for renewable energy from 2021 to 2030 including expected total gross final energy consumption per technology and sector in Mtoe and total planned installed capacity (divided by new capacity and repowering) per technology and sector in MW

Table 8: Renewable energy contribution of each sector to final energy consumption (ktoe)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
(A) Expected gross final consumption of RES for heating and cooling	683	714	746	757	784	824	843	847	853	858	866
(B) Expected gross final consumption of electricity from RES	598	619	647	666	675	705	733	742	754	756	759
(C) Expected final consumption of energy from RES in transport	187	182	182	191	190	189	195	199	205	214	228
(D) Expected total RES consumption	1,468	1,514	1,575	1,614	1,649	1,718	1,771	1,788	1,811	1,829	1,852

Source: MoE

	20	20	20	21	20	22	20	23	20	24	20	25
	MW	GWh										
Hydro:	1,626	4,464	1,627	4,467	1,628	4,470	1,629	4,473	1,630	4,476	1,641	4,507
<1MW	35	102	36	104	37	107	38	110	39	113	40	116
1 MW – 10MW	60	168	60	168	60	168	60	168	60	168	70	196
>10 MW	1531	4195	1531	4195	1531	4195	1531	4195	1531	4195	1531	4195
Of which pumping:	916	300	916	400	916	400	916	400	916	400	916	400
Geothermal	0	0	0	0	4	28	4	28	4	28	4	28
Solar:												
photovoltaic	600	600	620	620	640	640	660	660	680	680	680	680
concentrated solar power	0	0	0	0	0	0	0	0	0	0	0	0
Tide, wave, ocean	0	0	0	0	0	0	0	0	0	0	0	0
Wind:							X					
Onshore	20	40	30	48	150	120	150	240	150	240	300	480
Offshore	0	0	0	0	0	0	0	0	0	0	0	0
Biomass:												
fixed	180	990	190	1045	200	1100	200	1100	200	1100	200	1100
biogas	110	858	130	1014	150	1170	160	1248	170	1326	180	1404
bioliquids		Ń										
TOTAL	2,536	6,952	2,597	7,194	2,772	7,528	2,803	7,749	2,834	7,850	3,005	8,199
of which in CHP facilities	290	1848	320	2059	350	2270	360	2348	370	2426	380	2504

# Table 9: Estimate of the total expected contribution (installed capacity, gross amount of electricity produced)of individual renewable energy technologies in the Slovak Republic for electricity generation in 2020-2030

	20	26	20	27	20	28	20	29	20	30
	MW	GWh								
Hydro:	1,731	4,754	1,742	4,785	1,753	4,816	1,754	4,819	1,755	4,822
<1MW	41	119	42	122	43	125	44	128	45	131
1 MW – 10MW	80	224	90	252	100	280	100	280	100	280
>10 MW	1610	4411	1610	4411	1610	4411	1610	4411	1610	4411
Of which pumping:	916	400	916	400	916	400	916	400	0	0
Geothermal	4	28	4	28	4	28	4	29	4	30
Solar:										
photovoltaic	680	680	680	680	700	700	730	730	750	750
concentrated solar power	0	0	0	0	0	0	0	0	0	0
Tide, wave, ocean	0	0	0	0	0	0	0	0	0	0
Wind:										
Onshore	300	480	300	480	350	560	350	560	350	560
Offshore	0	0	0	0	0	0	0	0	0	0
Biomass:										
fixed	200	1100	200	1100	200	1100	200	1100	200	1100
biogas	190	1482	200	1560	200	1560	200	1560	200	1560
bioliquids				Y						
TOTAL	3,105	8,524	3,126	8,633	3,207	8,764	3,238	8,798	3,259	8,822
of which in CHP facilities	390	2582	400	2660	400	2660	400	2660	400	2660

3

Source: MoE

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Geothermal (excluding low temperature geothermal heat in heat pump applications)	6	7	8	9	15	40	45	46	47	48	50
Solar:	10	11	13	15	17	19	21	22	24	26	28
Biomass:											
fixed	580	600	620	620	630	640	650	650	650	650	650
biogas	60	65	70	75	80	80	80	80	80	80	80
bioliquids										5	
Renewable energy from heat pumps:							1				
of which aerothermal	12	14	16	17	19	20	21	22	24	25	27
of which geothermal	10	11	12	13	14	15	16	17	18	19	21
of which hydrothermal	5	6	7	8	9	10	10	10	10	10	10
TOTAL	683	714	746	757	784	824	843	847	853	858	866

# Table 10: Estimation of total contribution (final energy consumption) expected from each renewable energy technology in the Slovak Republic in heat and cooling generation 2010-2020 (ktoe)

Source: MoE

Table 11: Estimation of total contribution expected from each renewable energy technology inSlovak Republic in transport

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Bioethanol/bio-ETBE	45	50	50	50	50	50	55	55	55	55	55
Of which: Biofuels 2G	13	13	13	13	13	18	20	20	25	30	3.
Of which imported	0	0	0	0	0	0	0	0	0	0	
Biodiesels	130	120	119	127	126	125	123	126	129	137	14
Of Which: Biofuels	0	0	0	0	0	0	0	5	10	30	4
Of which imported	0	0	0	0	0	0	0	5	10	0	
Hydrogen from renewables	0	0	0	0	0	0	0	0	0	0	
Electricity from renewable sources	12	12	13	14	14	15	16	17	18	18	1
Of which road transport											
Of which non-road transport											
Biomethane	0	0	0	0	0	0	1	1	3	4	
Total	187	182	182	191	190	190	195	199	205	214	22
Total biofuels II generation	13	13	13	13	13	18	20	25	35	60	-

Source: MoE

 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

Will be completed, in line with current status, in the final version of the national energy and climate plan.

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

Will be completed, in line with current status, in the final version of the national energy and climate plan.

# 2.2. Dimension: energy efficiency

- *i.* The elements set out in point (b) of Article 4
- the indicative national energy efficiency contribution to achieving the Union's energy efficiency targets of at least 32,5 % in 2030 as referred to in Article 1(1) and Article 3(5) of Directive 2012/27/EU, based on either primary or final energy consumption, primary or final energy savings, or energy intensity.

Member States shall express their contribution in terms of absolute level of primary energy consumption and final energy consumption in 2020, and *in terms of absolute level of primary energy consumption and final energy consumption in 2030, with an indicative trajectory* for that contribution from 2021 onwards. They shall explain their underlying methodology and the conversion factors used;

- the cumulative amount of end-use energy savings to be achieved over the period 2021-2030 under point (b) of Article 7(1) on the energy saving obligations pursuant to Directive 2012/27/EU;
  - the indicative milestones of the long-term strategy for the renovation of the national stock of residential and non-residential buildings, both public and private, the roadmap with domestically established measurable progress indicators, an evidence-based estimate of expected energy savings and wider benefits, and the contributions to the Union's energy efficiency targets pursuant to Directive 2012/27/EU in accordance with Article 2a of Directive 2010/31/EU;
- the total floor area to be renovated or equivalent annual energy savings to be achieved from 2021 to 2030 under Article 5 of Directive 2012/27/EU on the exemplary role of public bodies' buildings;

1. the indicative national energy efficiency contribution to achieving the Union's energy efficiency targets of at least 32,5% in 2030 as referred to in Article 1(1) and Article 3(5) of Directive 2012/27/EU, based on either primary or final energy consumption, primary or final energy savings, or energy intensity.

Member States shall express their contribution in terms of absolute level of primary energy consumption and final energy consumption in 2020, and in terms of absolute level of primary energy consumption and final energy consumption in 2030, with an indicative trajectory for that contribution from 2021 onwards. They shall explain their underlying methodology and the conversion factors used;

 Table 12: National indicative targets for energy efficiency for 2020 and national indicative contributions to

 the EU's energy efficiency target for 2030

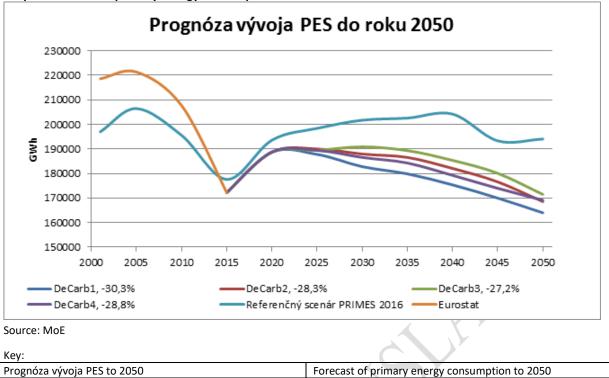
National indicative targets for energy efficiency and contributions to the European energy efficiency target	[Mtoe]	[PJ]	[ %]	]
Primary Energy Consumption in 2020	16.38	686		20 %
Final Energy Consumption in 2020	10.39 (Eurostat) SUSR 9.24	435 (Eurostat)	¢	23 %
Primary Energy Consumption in 2030	16.16			
Final Energy Consumption in 2030	10.78			

Source MoE of the Slovak Republic

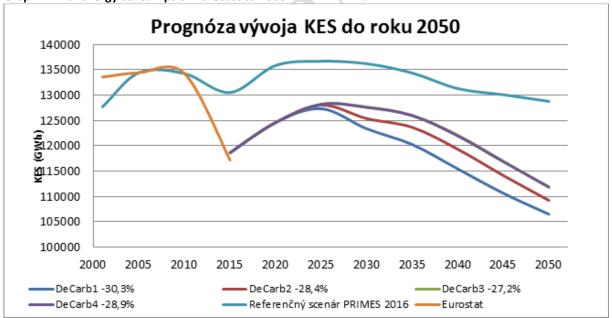
The primary source for determining the National Indicative Contribution to the Energy Efficiency Target for the Period 2021-2030 in Primary Energy Consumption is the PRIMES model, which was submitted to the Slovak Republic by the Commission in November 2016. The resulting forecast is a combination of the EUCO 27 and EUCO 33 variants, which calculate the PEC savings compared to the 2007 reference year at 27 % or 33 %, with the 3 % scenario being the closest scenario to the EU target of 32.5 % The major factor for the trend in primary energy consumption is the commissioning of Mochovce blocks 3 and 4. The forecast also includes the gradual decommissioning of coal-fired power plants. However, not all aspects with possible impact on this trend have been taken into account, such as, for example, GDP and others. The assessment of these impacts will be the final version of the NECP.

For the forecast of the final energy consumption trend for the period 2021 - 2030, a model developed by the World Bank was used. This model contains several scenarios, with the starting point being the so-called DCarb1, which estimates the PEC savings compared to the reference year 2007 at 30.3 % This level of savings is the closest to the level required by the EC - 32.5 % This model does not give a 32.5 % scenario. Given the projected trend of PEC savings, it is likely that the consumption trend will be adjusted in the next period.

Graph 1 Forecast of primary energy consumption to 2050



PRIMES 2016 Reference Scenario



Graph 2 Final energy consumption forecast to 2050

Referenčný scenár PRIMES 2016

Source: MoE

Kov.

icy.	
Prognóza vývoja PES to 2050	Forecast of final energy consumption to 2050
Referenčný scenár PRIMES 2016	PRIMES 2016 Reference Scenario

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

The cumulative volume of final energy savings from 2021 to 2030 is 55,205 GWh, 949.2 GWh per year. This target is calculated from the latest available statistics from 2014 to 2016 as required in the draft amendment to the Energy Efficiency Directive. Transport was not deducted. In the final version of the plan, the data for 2016 and 2017 will be taken into account, with 2015 data being added instead of the missing data from 2018.

Voor				Cumulative	energy sav	ings 2021 -	2030 (GWh	)			Total
Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
2021								_		949.2	949.2
2022			949.2	1898.4							
2023						-		949.2	949.2	949.2	2847.6
2024					-		949.2	949.2	949.2	949.2	3796.8
2025				-		949.2	949.2	949.2	949.2	949.2	4746.0
2026			-		949.2	949.2	949.2	949.2	949.2	949.2	5695.1
2027		-		949.2	949.2	949.2	949.2	949.2	949.2	949.2	6644.3
2028	-		949.2	949.2	949.2	949.2	949.2	949.2	949.2	949.2	7593.5
2029		949.2	949.2	949.2	949.2	949.2	949.2	949.2	949.2	949.2	8542.7
2030	949.2	949.2	949.2	949.2	949.2	949.2	949.2	949.2	949.2	949.2	9491.9
Σ	949.2	1898.4	2847.6	3796.8	4746.0	5695.1	6644.3	7593.5	8542.7	9491.9	52205.5

#### Table 13: Cumulative energy savings 2021 - 2030 (GWh)

Source: MoE

Based on a data analysis of the 2014-2016 measures with a life cycle beyond 2020, it was concluded that Slovakia will be able to cover about 30 % of the cumulative target in the 2021-2030 period. In the case of a positive trend in energy savings by 2020, Slovakia will cover with these measure all the permitted 35 %, but at the same time it appears that a significant part of the savings from these measures cannot be taken into account at all across the whole lifetime of the measure.

At this stage, it is clear that there is no need to use any other exceptions in Art. 7 to use the 35 % exception. These would be used by Slovakia if these early actions cannot be included. In that case, savings of up to a maximum of 35 % of the target would be used in particular by programme measures from 2018 to 2020 and still in use after 2020, production, transmission and distribution measures, ETS measures and measures from heating and district heating and other energy sector sectors that cannot be included in the basic scheme of Article 7 of the Directive. If necessary, savings from the installation of RES on buildings will also be included.

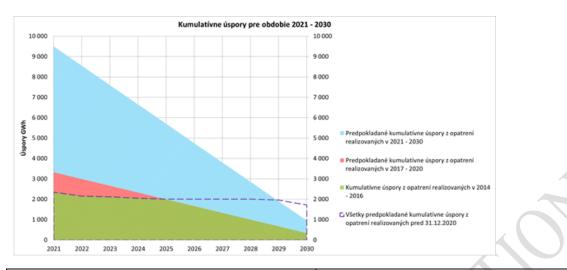


Figure 4: Current state of fulfilment of the cumulative target through existing measures

Key:	
Kumulativne úspory pre obdobie 2021 - 2030	Cumulative savings for the period 2021 - 2030
Úspory GWh	Savings GWh
Predpokladané kumulativné úspory z opatreni	Estimated cumulative savings from measures
realizovaných v 2021 - 2030	implemented in 2021-2030
Predpokladané kumulativné úspory z opatreni	Estimated cumulative savings from measures
realizovaných v 2017 – 2020	implemented in 2017-2020
Kumulativné úspory z opatreni realizovaných v 2014 –	Cumulative savings from measures implemented in
2016	2014-2016
Všetky predpokladané kumulativné úspory z opatreni	All expected cumulative savings from measures
realizovaných pred 31.12.2020	implemented before 31.12.2020

Graph 3 Cumulative savings 2021 - 2030 Source: MoE

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

The long-term strategy will be developed in line with Art. 46 of the Regulation.

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

The energy savings target for buildings in 2021-2030 will be set as part of the long-term recovery strategy developed under Article 46 of the Regulation.

The basis for calculating the 2020 target for the needs of the alternative approach under Article 5(6) of Directive 2012/27/EU on energy efficiency was a non-residential building database containing data for individual categories of state- and local authority-owned non-residential buildings, in accordance with the Interpretative Note to Article 5 of the Directive.

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

Text will be submitted in accordance with Art. 46 of the Regulation

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

Other national objectives	Key objectives/measures
National Traffic Information System	Using a unified system environment for collecting, processing, sharing, distributing and using traffic information in specific information, control and telematics applications to create the conditions for reducing negative environmental impacts and reducing the energy intensity of transport.
Transgeer Project	Planning of large-scale infrastructure projects as well as nature protection. An integrated approach to the development of a safe transport system in the Carpathian region that is environmentally friendly
Working Group on Biodiversity	Updating the set of indicators and the biodiversity protection status for the SR, fulfilling the tasks of the Biodiversity Action Plan
Methodological guide on assessing the impacts of climate change on large projects in the transport sector	Analysis of climate change scenarios, possible impacts on individual monitored areas as presented in the present strategy
Working Group on the Low-Carbon Development Strategy of the Slovak Republic	Emissions planning (ENVISAGE, CGE, TREMOVE and COPERT models)
Strategy for Adaptation of the Slovak Republic to Climate Change - Update	General Adaptation Guidelines and examples of specific adaptation measures in the construction, transport, energy, industry and some other areas of business, increasing the resilience of these sectors.

Table 14: Other national objectives

Interdepartmental commission to ensure implementation of the Framework Convention for the Protection and Sustainable Development of the Carpathian Mountains (Carpathian Convention)	Implementation of the Carpathian Convention in the Slovak Republic, implementation of the Protocol on the Conservation and Sustainable Use of Biological and Landscape Diversity
Low-emission zones working group	Preparing legislation to define low-emission zones in cities
Circular economy working group	Creating conditions for the functioning of the circular economy, implementing the Carpathian Convention
Membership of EIONET (European Environment Information and Observation Network)	Providing background information when preparing environmental reports in Europe, updating information and commentary on materials
Membership of IPBES (Intergovernmental Science- Policy Platform on Biodiversity and Ecosystem Services)	Commentaries on regional assessments of biodiversity and ecosystem services
A material guarantor for scientific and research tasks	Processing of monitoring and analysis of the environment in transport, transition from the Kyoto Protocol to the Paris Agreement and its specifics for the transport sector in the Slovak Republic

Source MoE of the Slovak Republic

# 2.3. Dimension: energy security

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

Note: The Regulation under draft COM (2016) 862, on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC, is not yet in force and is expected to be adopted in 2019.

At present, the obligations and responsibilities for safeguarding the security of the electricity supply in the Slovak Republic are set out in the Energy Act.

The main state authority for supply security policy is the Slovak Ministry of the Economy. In accordance with Article 88 of the Energy Act, the Ministry of the Economy ensures the monitoring of the security of the electricity supply; it determines the application of measures to ensure the security of the electricity supply if the safety and reliability of the electricity system is compromised.

Current legislation on the security of the electricity supply is based on the transposition of the EU's Third Energy Package, which consists of Directive 2009/72/EC (Article 4) and Directive 2005/89/EC (Article 7).

National procedures for the prevention and management of emergencies are included in the Energy Act of 2012 (Act No 251/2012, on Energy) and in the Decree of the Slovak Ministry of the Economy No 416/2012, laying down details on the procedure for a state of emergency on electricity and a crisis in the gas sector ("Decree 416/2012").

The ENTSO-E Operational Handbook (Operation Handbook RG CE, in particular Policy 5 – Emergency Operations, serves as a reference ("legislation") for the operation of the system by the national SEPS transmission system operator.

The TS operator has available measures to deal with states of emergency or to prevent them. The TS operator has a defence plan for the prevention of major malfunctions, measures for emergency

changes of frequency and voltage, as well as a plan to restore the system after any full or partial state without voltage (so-called blackout status).

If during operation a change occurs in the system to cause a sudden overload, in order to remove the overload the TS operator

- a) activates purchased support services,
- b) shall use contractually agreed emergency reserves,
- c) shall change the connection of electrical power equipment in the transmission and distribution systems.

Great attention is paid by the TS operator to the issue of safety and reliability. To safeguard these, the following are performed within the Electricity System of the SR:

- preventive measures analysis of network performance calculations and short circuit calculations, protection set-up, optimisation of the switch-off plan, regular maintenance of transmission equipment and processing of emergency response measures. Furthermore, there are measures against the spread of large system failures and measures to eliminate consequences following the occurrence of major system failures (the Defence Plan), measures on operational preparations, and measures to optimise TS maintenance and development,
- dispatching measures emergency assistance, discontinuation of work on TS equipment in coordination with distribution system (DS) operators, use of PPS and system services, use of emergency response measures, TS reconfiguration,
- technical measures protection settings, use of PpS, frequency characteristics impact and automatic voltage regulation.

In addition to the aforementioned emergency measures and their removal, restrictive measures are laid down in the legislation:

- reduction of consumption plan,
- emergency switch-off plan,
- frequency cut-off plan.

The electric power dispatching of the TS operator annually updates the Frequency Cut-off Plan in accordance with RG CE ENTSO E Standards and Recommendations.

Future plans and procedures for security of the electricity supply in relation to preparedness to deal with situations of limited or interrupted electricity supply in line with the forthcoming Regulation [COM (2016) 862 on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC] will result inter alia from the implementation of this Regulation after its entry into force, including the responsibility of the competent authority to prepare a risk-preparedness plan after consultation with stakeholders in order to ensure a common approach to crisis prevention and management.

In gas supply security, the obligations of market participants are addressed in the Energy Act, in Regulation (EU) No 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 ("the Regulation"). Other documents in this area are the Preventive Action Plan and the Emergency Plan, the 2nd revision of which was approved in April 2017.

Decree 416/2012 is national secondary legislation

The energy act also laid down the conditions for managing gas networks. The distribution network in the defined territory of Slovakia is managed by the "gas supply controller", which is responsible for the operative management of the distribution network. The function of gas supply control in the defined

territory is performed on the basis of a decision of the Ministry by the distribution network operator - SPP – distribúcia, a.s.

Gas supply control performs these function in the defined territory of Slovakia:

- a) operatively manages its own distribution network and distribution of gas to the connection points of connected distribution networks,
- b) manages interconnected transmission networks and distribution networks on a defined territory in a crisis in the gas industry and in activities that immediately prevent an occurrence,
- c) it technically manages the allocation of gas sources at entry points to connected distribution networks,
- d) declares and recalls a crisis in the gas industry and its level according to the Regulation,
- e) declare and recalls restrictive measures in the gas industry pursuant to Section 21 of the Act,
- f) lays down measures aimed at the elimination of a crisis in the gas sector,
- g) submits to the Ministry weekly for the period from 1 November to 31 March and daily in the event of a crisis: for each day a calculation of the capacity of other infrastructure in case of a disruption to the separate major gas infrastructure, including a calculation taking into account appropriate market measures on the consumption side in accordance with a special regulation.

A crisis situation in the gas industry and its level in a defined territory or part of a defined territory is announced and revoked by a distribution network operator who, on the basis of a decision of the Ministry, fulfils the tasks of gas dispatching in the defined territory, in public mass media and using the resources of dispatching management. This distribution system operator shall immediately notify the Ministry

- a) of any declaration and recall of a crisis and its level,
- b) of information on any restrictive measures it intends to take,
- c) on request, of further information regarding the declared crisis and its level or any restrictive measures,
- d) information on whether a crisis may result in a request for assistance from the European Union and its Member States.

A distribution network operator, which, following a decision of the Ministry, fulfils the tasks of gas dispatching on a defined territory, is obliged, at the request of the Ministry, to recall a crisis without delay.

If a crisis has been declared, gas market participants are required to take part in eliminating its causes and consequences.

In connection with the application of the Regulation, a working group was set up under the aegis of the Slovak Gas and Oil Association and the Slovak Gas Agency, the members of which were representatives of the Slovak Ministry of the Economy; the Network Regulation Office; SPP, a.s.; SPP - distribúcia, a.s.;

NAFTA, a.s.; eustream, a.s. The aim of the working group was to propose the application of solidarity measures under Article 13.

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

#### Oil

Oil deliveries to Slovakia and transit across its territory take place reliably and smoothly in line with the volumes agreed in contracts concluded between Slovak and Russian companies. Continuity of oil supplies is ensured in accordance with the Agreement between the Government of the Slovak Republic and the Government of the Russian Federation on cooperation in the field of long-term supplies of crude oil from the Russian Federation to the Slovak Republic and the transit of Russian oil through the territory of the Slovak Republic, which entered into force on 1 January 2015 and expires on 31 December 2029.

Pursuant to the provisions of Council Directive 2009/119/EC of 14 September 2009, Member States are required to maintain minimum stocks of oil and/or petroleum products of at least 90 days of average daily net imports or 61 days of average daily domestic consumption, whichever is the higher. The SR implemented it by Act No 218/2013, on emergency stocks of oil and petroleum products and on the resolution of oil supply crises, and on a change and additions to certain laws.

Further to the aforementioned the Slovak Republic currently maintains emergency stocks of oil and petroleum products in accordance with the valid legislation. 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; these stocks are currently maintained at 100.8 days of average daily net imports. Total emergency stocks are approximately 883 thousand tonnes (63 % in the form of oil, 37 % in the form of petroleum products by category).

The Agency owns emergency stocks of oil and petroleum products, arranges their procurement, maintenance and exchange and is responsible for the protection of the state in this segment in accordance with the requirements of Council Directive 2009/119/EC. Emergency stocks must be continually ready for prompt issue to resolve emergencies.

The emergency stocks minimum limit for the particular calendar year is determined by the Administration of State Material Reserves of the Slovak Republic on the basis of data obtained within the state statistical survey. Emergency oil stocks are held within the Slovak Republic. The Administration of State Material Reserves cooperates with the European Union and the International Energy Agency on the prevention and management of oil emergencies.

The Petroleum Security Commission (NESO) is responsible for the security of oil and oil products supply and is an advisory body to the Chairman of the Administration of State Material Reserves. The Commission acts in accordance with the applicable legislation of the Slovak Republic and international agreements binding on the Slovak Republic. It monitors and analyses: the state of the oil market, the state of oil security and any imminent or acute state of oil emergency. Members of the NESO Commission are, in particular, important representatives of the petroleum industry, of the competent authorities in the state administration, as well as the Emergency Oil and Petroleum Products Agency.

The European Commission (EC) may, in coordination with the Member States, assess the emergency preparedness of individual EU Member States and, if deemed appropriate by the EC, verify the level of emergency stocks. In preparing such assessments, the EC takes account of the work carried out by other

institutions and international organisations and consults the Oil Coordination Group set up to prevent crises. In the event of a serious interruption of supplies, a special meeting of this working group may be convened at short notice, or may take place as an on-line consultation.

#### Natural gas

The Slovak Republic is an important transit country gas moving for east-west and west-east. There is a need to complete connections in the north-south direction in order to preserve the position of the Slovak Republic. Development of underground gas storage.

In order to secure gas supplies, both the state and the gas companies are taking steps to better prepare the Slovak Republic for potential gas supply problems in order to avoid any repeat of a situation that meant limiting gas supplies to Slovak consumers. These measures address the options for transporting emergency gas supplies from other directions/countries, including securing auxiliary supplies of gas through reverse flow from the Czech Republic and Austria. These medium-term and long-term measures are mainly aimed at building interconnections between transport networks, providing opportunities for diversification of gas supplies and building, or more exactly, expanding gas reservoirs in Slovakia in the suitable geological structures currently available.

Since 2009, the Slovak Republic has clearly declared its support for specific projects with an impact on an increased level of gas supply security, or more exactly, for attempts to try to find a solution for the interconnection of Slovak networks with the networks of neighbouring countries in those cases where such an interconnection does not yet exist. Discussions have also been held to make maximum use of EU funds.

Slovakia has supported interconnection projects with Hungary as well as reverse-flow projects from the Czech Republic and Austria (these are being implemented only on the territory of the Member States referred to, but have the direct impact of the possibility of using the reverse gas flow in Slovakia). It has also supported the project of technical adjustments to enable reverse flow in the Slovak transport network operated by eustream, a.s. and the NAFTA a.s. project, which will permit an increase of the volume of gas supplies from the reservoir to the transport network in times of crisis.

Within the interconnection project between Slovakia and Hungary, after successful construction and test operations, the gas pipeline was placed on a standard commercial footing on 1 July 2015.

#### Diversification of natural gas routes and sources

#### "Polish-Slovak interconnection of gas networks" project

This project is part of the North - South Gas Corridor and forms an important element in the transit pipeline chain linking up eastern Europe from the Polish LNG terminal at Świnoujście to the planned Croatian LNG terminal on the island of Krk. The Innovation and Network Executive Agency (INEA), GAZ-SYSTEM S.A. and eustream, a.s. signed a grant agreement in December 2017 for the Poland-Slovakia interconnection pipeline, of which approximately 106 kilometres will be in Slovakia. The grant agreement will enable the Polish and Slovak network operators to obtain financial support from the European Union from the Connecting Europe Facility (CEF) to a total of  $\pounds$ 107.7 million ( $\pounds$ 55.2 million for eustream, a.s. and  $\pounds$ 52.5 million for GAZ-SYSTEM S.A.).

#### The "Eastring" project

The Eastring pipeline should pass through Slovakia, Hungary, Romania and Bulgaria. On 20 September 2018, eustream, a.s. the Slovak TSO, presented the results of the feasibility study for the Eastring gas pipeline, for which it received a grant from the CEF Fund amounting to 50 % of the eligible costs up to 1 million EUR. Based on this, a 1,208 km long pipeline route between the Veľke Zlievci (Slovakia/Hungary border) and Malkoçlar (Bulgaria/Turkey border) was evaluated as the optimal route for a gas pipeline.

In September 2018, the construction of the Slovak and Polish interconnection was launched on the basis of the respective agreements of the transmission system operators - eustream, a.s. and GAZ-SYSTEM S.A., and should be commissioned in 2021. The project is part of the "Priority Corridor of the North-South Gas Pipeline Interconnection in Central Eastern and South-Eastern Europe (NSI Gas East)" and is a PCI project.

The Eastring gas pipeline project in terms of the concept of interconnection of Western European markets with the countries of south-eastern Europe in particular is a solution to achieve the strategic goal of maintaining or even increasing the volume of gas transported through the Slovak transport network. Implementation of the project would contribute to a significant extent to an increase in the importance of Slovakia's role as a crossroads for gas connections and its ability to ensure gas transport by reverse flow throughout the region. The pipeline, which is designed to be bi-directional, can therefore be considered as a path for new potential suppliers, especially from the Caspian region, or from the possible Turkish gas hub, to access European markets and to increase the level of security in terms of diversification of sources.

The Eastring project is included in the list of projects of common interest under point 6.25 "Infrastructure for the transport of new gas to Central and South-Eastern Europe for diversification".

# *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

Will be completed, in line with current status, in the final version of the national energy and climate plan.

*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

It is necessary to create an appropriate environment for the flexibility of the storage operators and energy storage. It is necessary to take full advantage of the advantages of underground storage in the Slovak Republic and the centralised heat supply system.

The development of energy storage will ensure the integration of variable RES into the system. Such a system allows the storage of locally produced energy and to consume it independently of demand. Integrating local energy storage in storage appliances, energy stores and electric vehicles or in the gas distribution network with its storage capabilities is therefore an important element of the smart grid. In addition to energy storage, local power consumption management concepts are being developed based on good mapping and analysis of the ratios in the system so that electricity at the production site is not transformed to a higher voltage and then back to a lower voltage at the remote location. Ensuring a flexible, low-carbon and sustainable structure of the source of electricity generation requires an increase in storage capacity by building a new pumping hydroelectric power plant.

There will be support for efficient district heating systems with RES heat, waste heat from industrial processes making economic cost-intensive use of RES, especially locally available biomass/biomethane and waste, including support for multi-fuel systems, will consider the option to create the conditions for the use of CHP plants for the supply of electricity in emergencies. District heat plants with combined generation of electricity and heat will be preferred over generation of fossil-fuelled electricity without the use of heat and arrange their operations so that they can be used to a maximum for the provision of regulatory electricity. It is necessary to use heating plant infrastructure in the construction of energy recovery facilities for municipal waste.

# 2.4. Dimension: internal energy market;

# 2.4.1. Electricity interconnectivity

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

The SR fulfils the 10% target for EU Member States' transmission interconnection level by 2020 adopted by the EU Council in 2002, as well as the 15% target of the 2030 level of interconnectivity set by the EU Council in 2014 as a share of net import transmission capacity to total installed electricity generation capacity in the Member State. Based on the Commission communication on Strengthening Energy Networks<sup>13</sup>, the Slovak Republic achieved 43% transmission system interconnection level in 2017, and in 2020, according to the 2016 ten-year pan-European network development plan (TYNDP 2016), it will reach a 59% interconnection level in 2020. In 2030, according to the TYNDP 2016 assumptions, the level of SR interconnection will decrease to 52%, mainly due to the projected increase in installed electricity generation capacity.

The Slovak Republic also fulfils the indicative indicators of the target for interconnection of the transmission systems of the Member States of the European Union to 2030, according to the Commission report<sup>14</sup> of November 2017, according to which nominal transmission capacity, i.e. the thermal capacity of a Member State's cross-border interconnection, should amount to at least 30 % of the maximum load in the import direction, 30 % of installed renewable energy output in the export direction and the average annual difference in the marginal cost of trading zones should be no greater than  $2 \notin /MWh$ . According to the document, based on the TYNDP 2016 calculations, the SR should be able to import 199-212 % of the assumed maximum load in 2030 and should also be able to export 170-218 % of the projected installed RES output.

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<sup>&</sup>lt;sup>13</sup> <u>https://ec.europa.eu/energy/sites/ener/files/documents/communication\_on\_infrastructure\_17.pdf</u>

https://ec.europa.eu/energy/sites/ener/files/documents/report of the commission expert group on electricity interconnection target s.pdf

This is also confirmed by the current TYNDP 2018 analysis<sup>15</sup>, according to which the Slovak Republic, in the first two criteria, achieves a level of interconnection of more than 60 % for all scenarios considered, i.e. a thermal import capacity at 230-250 % of the assumed maximum load and a thermal export capacity at the level of 160 - 282 % of the projected installed RES output. The difference between the average annual marginal cost and the neighbouring trading zones except the Czech Republic is more than 2  $\notin$ /MWh. The average annual marginal cost in trading areas represents the variable cost of the end power plant, and thus is dependent on the variable costs of the Member State's source mix. The price difference in neighbouring areas indicates the degree of market deformity caused by restricted transmission. If there is sufficient capacity on all profiles, the average annual marginal price difference should not be higher than 2  $\notin$ /MWh.

According to the TS Operator (SEPS) analyses listed in the Transmission System Ten-Year Plan<sup>16</sup> by implementing the projects mentioned in point 2.4.2., by 2030 there will be an increase in the maximum transmission capacities in the Slovak-Hungarian profile compared to the present day, in the export direction of approximately 100 %, and in the import direction of approximately 50 % The reduction of transmission capacity by about 10 % on the Slovak-Czech profile by shutting down the 220 kV cross-border interconnection will be eliminated by the reconstruction of the 400 kV line Nošovice (CZ) - Varín by 2030, as stated in point 2.4.2.

# 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**

For electricity transmission infrastructure, the priority of the Slovak Republic is to complete 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)). On the Slovak side, both lines are at the procurement of contractor stage, and the construction permits for both projects have been issued. In co-operation with the Czech TS operator (ČEPS), the TS operator (SEPS) is considering submitting a request for the inclusion of a planned connection 1x400kV Ladce (SK) - Otrokovice (CZ) to the list of projects of common interest (PCI). This is a link that would replace the 220kV transmission system (TS) which is gradually being replaced on both sides of the SK/CZ border. This strengthening also includes a planned increase in the transmission capacity of the V404 Varín (SK) - Nošovice (CZ) line as part of planned renewal at both SEPS and ČEPS.

For gas transport infrastructure, the Slovak Republic's priority projects are the completion of the Slovak-Polish interconnection, which was started in September 2018 and implementation of the Eastring gas pipeline, which is part of the third list of projects of common interest and for which the results of a feasibility study giving its optimal route were presented in September 2018.

# 3.16.1 Line 2 x 400 kV Gabčíkovo (SK) - Gönyű (HU) - Veľký Ďur (SK)

The subject of this project is the construction of a 2x400 kV line between the Gabčíkovo (SK) – Gönyű (HU) - Veľký Ďur (SK) power stations, from the Veľký Meder locality where the existing 2x400 kV line Gabčíkovo - Veľký Ďur will be dismantled, creating a cross-border interconnection 2x400 kV Gabčíkovo (SK) - Gönyű (HU) - Veľký Ďur (SK)).

<sup>15</sup> 

https://tyndp.entsoe.eu/Documents/TYNDP%20documents/TYNDP2018/consultation/Main%20Report/TYNDP2018 Executive%20Report.p df

<sup>&</sup>lt;sup>16</sup> https://www.sepsas.sk/Dokumenty/ProgRozvoj/2018/07/DPR\_PS\_2018\_2027.pdf

The aim of the project is to increase transmission capacity between the transmission systems of Slovakia and Hungary as well as to increase the security and reliability of the operation of the transmission system of the Slovak Republic on the highly exposed cross-border transmission profile within the eastern region of central Europe.

The justification and importance of construction of the project was demonstrated by the acquisition of PCI status. The implementation of PCI projects is governed by the provisions of Regulation No 347/2013 of the European Parliament and of the Council, on guidelines for trans-European energy infrastructure.

At the request of SEPS, a.s., at the beginning of 2016, the project was awarded a financial contribution from the Connecting Europe Facility of 50 % of the requested amount for design and project activities for that part of the line being executed in the Slovak Republic.

Časový a vecný harmonogram realizácie 2x400 kV vedenia	Hlavné	mitniky				-			-						Dĺžka	trvani	a činno	sti												
lokalita Veľký Meder - štátna hranica SK/HU	Predpokladaný			2014			201				016			201				2018				2019			202				021	
	začiatok činnosti	ukončenie činnosti	1. 1	II. II	II. IV.	1.	11.	III. IV.	. 1	. 11.	10.	IV.	- I	- 11.	ш.	IV.	1.	II.	III. IN	/. 1	. 11		IV.	1.	н.	III. IV	/. I.	н.	ш.	IV.
Získanie záverečného stanoviska MŽP SR o posudzovaní	25.6.2014	29.10.2015																												
vplývov na životné prostredie (EIA)	25.6.2014	29.10.2015								_																				
Oznámenie o začatí povoľovacieho konania v zmysle	8.3.2016	7.4.2016																												
nariadenia 347/2013	8.3.2016	7.4.2016																												
Obstarávanie a výber zhotoviteľa projektových a	29.3.2016	31.8.2016							Т																					_
inžinierskych činností	29.3.2016	31.8.2016																												
Kanania wasala di kananiké da wasania angla sasiadania 247/2012	1.10.2016	28.2.2017							Т																					
Konanie verejnej konzultácie v zmysle nariadenia 347/2013	1.10.2016	28.2.2017																												
Vennessenia delumentésia pre étamot konstit	1.10.2016	16.5.2017																												
Vypracovanie dokumentácie pre územné konanie	1.10.2016	16.5.2017																												
Územné konanie a získanie právoplatného územého																														_
rozhodnutia	12.6.2017	21.7.2017																												
	16.5.2017	23.2.2018							Т																					
Vypracovanie dokumentácie pre stavebné povolenie	16.5.2017	23.2.2018																												
Stavebné konanie a získanie právoplatného stavebného	23.2.2018	31.5.2018																												
povolenia	23.2.2018	31.5.2018																												
Manada Kabuka Karata a sati sa shekarati ku disha																														_
Verejné obstarávanie a výber zhotoviteľa diela	1.4.2019	31.12.2019																												
																				T			_							_
Výstavba a uvedenie diela do prevádzky	1.1.2020	31.12.2020																												
									+																_	_				_
Kolaudačné konanie a získanie kolaudačného rozhodnutia	1.1.2021	30.4.2021																												
																			Zroi	: Slo	vens	ská e	lekt	rizačn	á pr	enos	ová s	ústa	va. a	s.
																									- P				12.20	
																											Stav	к э.	12.20	τQ

#### Graph 4 Line Timeline 2 x 400 kV Gabčíkovo-Gönyű-Veľký Ďur

Kow

Key:	
Časový a vecný harmonogram realizácie 2x400kV vedenia lokalita Veľý Meder – štátná hranica SK/HU	Time and item schedule of implementation of 2x400kV line - location Veľký Meder - state border
vedenia lokalita very weder – statila manica skyrio	SK/HU
Hlavné miľniky	Principal milestones
Predpokladaný začiatok činnosti	Estimated activity start
Predpokladané ukončenie činnosti	Estimated activity finish
Dlžka trvania činnosti	Activity duration
Zdroj: Slovenská elektrizačná prenosová sústava, a.s. Stav k 5.12.2018	Source: Slovenská elektrizačná prenosová sústava, a.s. Balance at 05.12.2018
Získanie záverečného stanoviska MŽP SR o	Obtaining the final opinion of the Ministry of
posudzovani vplývov na žlvotné prostredie (EIA)	Environment of the Slovak Republic on impact assessment (EIA)
Oznámenie o začati povoľovacieho konania v zmysle nariadenia 347/2013	Notice of initiation of an authorisation procedure under Regulation 347/2013
Obstarávanie a výber zhotoviteľa projektových a Inžinierskych činností	Procurement and selection of contractor for project and engineering activities
Konanie verejnej konzultácie v zmysle nariadenia 347/2013	Public consultation within the meaning of Regulation 347/2013
Vypracovanie dokumentácie pre územné konanie	Preparation of documentation for territorial proceedings
Územné konanie a získanie právoplatného územého rozhodnutia	Territorial proceedings and obtaining a lawful territorial decision
Vypracovanie dokumentácie pre stavebné povolenie	Drawing up documentation for construction permit
Stavebné konanie a získanie právoplatného	Construction proceedings and obtaining a valid
stavebného povolenia	construction permit
Verejné obstarávanie a výber zhotoviteľa diela	Public procurement and contractor selection
Výstavba a uvedenie diela do prevádzky	Construction and commissioning of the work

Kolaudačné konanie a získanie kolaudečného	Use approval proceedings and obtaining a use
rozhodnutie	approval decision

#### 3.17 Line 2 x 400 kV Rimavská Sobota (SK) - Sajoivánka (HU)

The subject of the project is the construction of 2 x 400 kV lines between the Rimavská Sobota (SK) and Sajoivánka (HU) power stations. As the line on the Hungarian side will be fitted temporarily with only one branch, there will one branch of the double line on the Slovak side before entering field No 3 at the Rimavská Sobota sub-station and on the last anchor mast connected to the second branch.

The aim of the project is to increase transmission capacity between the transmission systems of Slovakia and Hungary, as well as to increase the security and reliability of the operation of the transmission system of the Slovak Republic on the highly exposed cross-border transmission profile within the eastern region of central Europe.

The justification and importance of construction of the project was demonstrated by the acquisition of PCI status. The implementation of PCI projects is governed by the provisions of Regulation No 347/2013 of the European Parliament and of the Council, on guidelines for trans-European energy infrastructure.

At the request of SEPS, a.s., at the beginning of 2016, the project was awarded a financial contribution from the Connecting Europe Facility of 50 % of the requested amount for design and project activities for that part of the line being executed in the Slovak Republic.

Časový a vecný hramonogram realizácie 2x400 kV vedenia	Predpokladaný	Predpokladané	Dĺžka trvania činnosti																									
Rimavská Sobota - štátna hranica SK/HU	začatok činnosti	ukončenie činnosti		2014			201				2016			201				2018			2019			2020			2021	
			- I	н. ш	. IV.	- I	п.	ш. т	V. I	I. II.	III.	IV.	- I. –	н.	- 111 1	IV.	I.	II. I	II. IV.	- L	н. н	I. IV.	L.	II. II	I. IV.	- L I	II. III.	IV.
Získanie záverečného stanoviska MŽP SR o posudzovaní vplývov na životné prostredie (EIA)	26.5.2014	29.10.2015																										
Oznámenie o začatí povoľovacieho konania v zmysle nariadenia 347/2013	8.3.2016	7.4.2016																										
Obstarávanie a výber zhotoviteľa projektových a inžinierskych činností	29.3.2016	31.8.2016																										
Konanie verejnej konzultácie v zmysle nariadenia 347/2013	1.10.2016	28.2.2017																										
Vypracovanie dokumentácie pre územné konanie	1.10.2016	31.3.2017																										
Územné konanie a získanie právoplatného územého rozhodnutia	20.4.2017	21.6.2017																										
Vypracovanie dokumentácie pre stavebné povolenie	12.4.2017	9.1.2018																										
Stavebné konanie a získanie právoplatného stavebného povolenia	18.1.2018	31.5.2018																										
Verejné obstarávanie a výber zhotoviteľa diela	1.4.2019	31.12.2019																										
Výstavba a uvedenie diela do prevádzky	1.1.2020	31.12.2020																										
Kolaudačné konanie a získanie kolaudačného rozhodnutia	1.1.2021	30.4.2021																										
																		Zr	oj: Sl	ovens	ská e	lektri	začná	prei	nosov	/á sús	tava,	a. s.

#### Graph 5 Timeline 2 x 400 kV Gabčíkovo-Gönyű-Veľký Ďur

S	tav	k	5.	12	2.2	0	18

Key:	
Časový a vecný harmonogram realizácie 2x400kV vedenia	Time and item schedule of implementation of 2x400kV line -
Rimavská Sobota – štátná hranica SK/HU	Rimavská Sobota - state border SK/HU
Predpokladaný začiatok činnosti	Estimated activity start
Predpokladané ukončenie činnosti	Estimated activity finish
Dlžka trvania činnosti	Activity duration
Zdroj: Slovenská elektrizačná prenosová sústava, a.s. Stav k	Source: Slovenská elektrizačná prenosová sústava, a.s.
5.12.2018	Balance at 05.12.2018
Získanie záverečného stanoviska MŽP SR o posudzovani	Obtaining the final opinion of the Ministry of Environment
vplývov na životné prostredie (ElA)	of the Slovak Republic on impact assessment (EIA)
Oznámenie o začati povoľovacieho konania v zmysle	Notice of initiation of an authorisation procedure under
nariadenia 347/2013	Regulation 347/2013
Obstarávanie a výber zhotoviteľa projektových a	Procurement and selection of contractor for project and
lnžinierskych činností	engineering activities
Konanie verejnej konzultácie v zmysle nariadenia 347/2013	Public consultation within the meaning of Regulation
	347/2013

Vypracovanie dokumentácie pre územné konanie	Preparation of documentation for territorial proceedings
Územné konanie a získanie právoplatného územého	Territorial proceedings and obtaining a lawful territorial
rozhodnutia	decision
Vypracovanie dokumentácie pre stavebné povolenie	Drawing up documentation for construction permit
Stavebné konanie a získanie právoplatného stavebného	Construction proceedings and obtaining a valid construction
povolenia	permit
Verejné obstarávanie a výber zhotoviteľa diela	Public procurement and contractor selection
Výstavba a uvedenie diela do prevádzky	Construction and commissioning of the work
Kolaudačné konanie a získanie kolaudečného rozhodnutie	Use approval proceedings and obtaining a use approval
	decision

#### **10.4 ACON smart grid project**

The main objective of the ACON (Again Connected Networks) cross-border smart grid project between the Slovak Republic and the Czech Republic is to strengthen the integration of the Czech and Slovak electricity markets and to effectively unify the behaviour and activities of the users of the electricity systems in order to create an economically advantageous, sustainable electricity system with small losses and high quality and security of supply.

In November 2017, the project was included in the third list of EU Projects of Common Interest (PCI). The project implementer for the SR is Západoslovenská distribučná, a.s., and on the Czech side E.ON Distribuce, a.s. The estimated project costs are 221 mil. EUR and the expected implementation period is 2018-2024.

The ACON project has several smart and innovative features and is one of the first smart grid projects on the PCI list. Intelligent technologies will complement new communication features as well as intelligent load management with automatic algorithms, which will increase awareness, ensure better interconnection, and allow future use of distribution systems for wider deployment of renewable resources as well as access to digital infrastructure.

Work on the ACON project will involve several activities, namely: a new cross-border 22kV connection between Holič and Hodonin; a new electrical transformer station and modernisation of existing transformer stations; cabling; and installation of IT equipment and smart solutions.

#### Figure 4a Layout of the ACON project



Source: https://www.mhsr.sk/energetika/medzinarodna-spolupraca/projekty-spolocneho-zaujmu-pci

#### 6.2.1 Slovak-Polish gas interconnection

At present, the most important cooperation point between the Slovak Republic and the Republic of Poland in the energy sector is the implementation of an interconnection between their gas transmission networks. This joint project of the transmission system operators, eustream, a.s., and GAZ-SYSTEM S.A. was included on 14 October 2013 for the first time on the List of projects of common interest in accordance with the Regulation of the European Parliament and of the Council No 347/2013, on guidelines for trans-European energy infrastructure. In November 2014, the project received financial support for the implementation of studies worth 4.6 million EUR from the CEF - linking Europe financial mechanism of the European Union. The project has confirmed its importance by being included on the second list of projects of common interest published by the European Commission on 18 November 2015.

The project envisages a transfer capacity of about 5.7 billion m<sup>3</sup>/year towards the Republic of Poland and 4.7 bn. m<sup>3</sup>/year towards the Slovak Republic. The total length of the interconnection should be 165 km (in Slovakia a maximum of 106 km and in Poland 59 km). The project involves building a compressor station in Strachocine, Poland, and modifying an existing compressor station in Veľké Kapušany. This project represents a major part of the North-South Gas Corridor, linking LNG terminals in Poland and Croatia. Its implementation will contribute to increased security of supply and will support market integration through diversification of sources and routes not only in the Slovak Republic and the Republic of Poland, but also in the whole region of Central and South-Eastern Europe.

#### 6.25.1 Eastring

Eastring is a project for a new gas pipeline for central and south-eastern Europe, which represents an important step towards achieving a single European gas market, a common vision of the European Union. Eastring is a project for a two-way gas pipeline between the Slovak Republic and the south-east European border (Black Sea or more exactly Turkey) with an annual capacity of 208,000 GWh to 416,000 GWh (about 20 billion to 40 billion cubic m<sup>3</sup>). Eastring will connect existing gas infrastructure across Slovakia, Hungary, Romania and Bulgaria.

# *ii.* Where applicable, main infrastructure projects envisaged other than Projects of Common Interest (PCIs)<sup>17</sup>

The phase-out of the 220kV transmission system (TS) by about 2026 is the long-term strategic objective of the TS operator. New TS equipment is already being built at a voltage of 400kV. The phased-out 220kV equipment is cancelled either without replacement or is replaced with new 400kV equipment - depending on the agreement with the DS operator. Major 220kV TS phase-out projects include the replacement of 220/110kV transforming in the Senica, Bysričany and Považská Bystrica sub-stations as well as the creation of a 400/110kV connection at the Sučany sub-station.

Current	information	is	available	at
https://www.sepsas.sk/I	Dokumenty/ProgRozvoj	/2018/07/DPR_PS_3	2018_2027.pdf.	

Regarding the construction of new power stations, or the reconstruction of the existing 400kV distribution stations, the TS operator is switching to a uniform concept for the technical solution, including the transition to sub-station remote control without the presence of a permanent operator. The major projects until 2030 include the reconstruction of R400kV Sučany, Varín and Liptovská Mara (including switching to remote control and, if necessary, replacement of transformers) and replacement of end-of-life transformers with a possible increase to their installed capacity (in agreement with the respective DS operator).

Current information is available at

https://www.sepsas.sk/Dokumenty/ProgRozvoj/2018/07/DPR\_PS\_2018\_2027.pdf.

# 2.4.3. Market integration

i.

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

The national plans of the Slovak Republic in connection with building the **single electricity market** within the EU are primarily determined by directly applicable European legislation (i.e. the relevant market network regulations and regulations). Within the time frames of the **daily and intraday market** this is

<sup>&</sup>lt;sup>17</sup> 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).

mainly about the full integration of the Slovak Republic as part of a unified solution, based on the principles of the implicit allocation of inter-area capacities, Single Day Ahead Coupling (SDAC) and unified interconnection of intra-day markets based on the principle of continuous allocation of inter-area capacities, Single Intraday Coupling (SIDC).

In terms of capacities calculation, the main input is the regional flow-based methodology, which will reflect the physical capabilities of electricity transmissions having regard to network topology, resource and consumption distribution, and thus optimise available tradable transmission capacity. This approach is particularly important in the case of networks with a high degree of transmission interdependence, in particular for the CORE region defined by ACER Decision No 06/2016. The goal of the Slovak Republic for the 2020-2025 time horizon is to implement a coordinated capacity calculation at regional level with a unified, central and fully harmonised allocation.

With regard to **balancing markets**, it is assumed that at the turn of 2021/2022, the Slovak Republic will become an integral part of the unified centralised European platforms for the provision of performance equilibrium services. The involvement of the Slovak Republic in these platforms, whose establishment arises from current European legislation, is a response to the needs for increased flexibility in managing the interconnected electricity system, for increased liquidity of the balancing market and for transparent pricing for performance equilibrium services. Under the appropriate conditions set by the relevant legislation, it is possible to anticipate an increase in the liquidity of European platforms through supporting new technology and entities delivering performance equilibrium services.

Looking ahead, by 2030 continuous development and adaptation of the implemented solutions is envisaged, reflecting the requirements of market participants and European legislation.

ii. Where applicable, national objectives related to the non-discriminatory participation of renewable energy, demand response and storage, including via aggregation, in all energy markets, including a timeframe for when the objectives are to be met

Will be completed, in line with current status, in the final version of the national energy and climate plan.

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

**The Network Regulatory Office,** as the governmental authority for the regulation of network industries with pan-Slovak competence, handles comments from electricity, gas, heat and water consumers, mainly concerning compliance with the rights and obligations of suppliers and operators of distribution networks and systems. A proposal for an alternative dispute resolution may also submitted to the Office, the purpose of which is to conclude an agreement between customer and supplier that is acceptable to both parties to the dispute.

**The Slovak Trade Inspectorate** (STI) is the authority for the state control of the internal market in consumer protection matters with a pan-Slovak jurisdiction. In fulfilling this role, the STI supervises the sale of products and services to consumers, provides state supervision and control of the energy business under special regulations and market surveillance according to a special regulation.

The legal regulation defining the competencies of the STI is Act No 128/2002, on state inspection of the internal market in consumer protection matters and on a change and additions to certain laws, as amended. This law defines the rights and obligations of the STI on a general level, but also in relation to specific rules governing consumer protection in specific areas.

In 2018 the European Commission presented a comprehensive package of measures for the benefit of European consumers, enabling Europeans to better cope with modern-day challenges and be better protected from widespread fraud or unfair commercial practices.

Intelligent Networks  $(IN)^{18}$  are a very topical theme of EU energy policy. Promoting and developing IN is one of the key directions that should contribute to meeting the Europe 2020 objectives for the EU's energy and climate-energy targets (20-20-20).

The smart grid can be characterised as a modernised electrical network complemented by two-way digital communication between supplier and customer, intelligent measurement of production and consumption, and monitoring and control systems.

Intelligent measuring systems are an essential part of intelligent networks. Smart grids are bringing about changes to help strengthen the position of the customer, facilitate greater integration of renewable energy sources into distribution systems, enable and support the development of electromobility and electricity storage, increase energy efficiency and reduce losses, while also making a significant contribution to environmental protection, supporting technological development and creating new job opportunities. These networks are able to manage direct interaction and communication between consumers (households and businesses), network operators, energy producers and suppliers. An intelligent network can flexibly respond to the distribution of electricity production and consumption, even in environments where electricity flows in both directions. As a result of better and more targeted management, the network is characterised by higher operational safety, higher efficiency, lower losses and lower operating costs.

IN deployment is expected to optimally and more accurately manage distribution networks, allowing multiple consumers to join without the need to invest in new network construction. Input of electricity into the electricity system from a large number of decentralised production sources through different distribution systems cannot be regulated without the use of modern telecommunication technologies, which make operation more efficient.

An intelligent network, continuously monitored by the IMS, should at all times be able to respond optimally to the current distribution of production and consumption capacities. Experience from European IMS-enhanced European countries, which is the cornerstone for building smart grids, shows that the scale of interruptions in electricity supply to the customer has diminished and that system losses have also fallen.

Another topic on how to safely integrate green energy into the system is the development of energy storage. Such a system allows the storage of locally produced energy and to consume it independently of demand. Integrating local energy storage in storage appliances, energy stores and electric vehicles with their storage capabilities is therefore an important element of the smart grid. In addition to energy storage, local power consumption management concepts are being developed based on good mapping and analysis of the ratios in the system so that electricity at the production site is not transformed to a higher voltage and then back to a lower voltage at the remote location.

It is anticipated that a detailed understanding of the consumption will lead to a change in the behaviour of IMS-enabled customers and, together with the development of IN, will become a tool for more efficient consumption management, which should lead to a general benefit and to a smoothing of the system load

<sup>&</sup>lt;sup>18</sup> 'Smart Grid' means an upgraded energy network to which two-way digital communication between the supplier and consumer, smart metering and monitoring and control systems have been added;

diagrams, with an impact on the variation and volume of support services needed to regulate the uncompensated balance of electricity production and consumption.

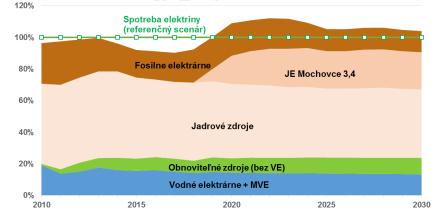
An important prerequisite for the solution of intelligent networks support is the standardisation of suitable technologies for Slovak conditions and the option for interchangeability of its main components, in order to allow the integration of solutions and equipment from different manufacturers.

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 shall be met

The Slovak Republic's goals and plans for securing the adequacy of the electricity system are defined by the Slovak Energy Policy (see point 1.2 ii.).

To ensure the **adequacy of the electricity system**, or more exactly, to secure safe and reliable operation of the system of each Member State, an appropriate and balanced source mix both in terms of sufficient production capacity (quantity) and electricity generation (quality) is an important prerequisite. It is the intention of the SR to create the conditions for ensuring the adequacy of the electricity system in meeting climatic and energy objectives and respecting the conditions of the single European market.

By 2030, the SR expects the export balance of the system to be 5-10 % of the projected electricity consumption<sup>19</sup> assuming the Mochovce NPP (Mochovce NPP - EMO 3,4) is started up, operation of the Malženice gas-steam power plant (PPP Malženice) and the possibility of terminating operations at the Nováky thermal power plant (TE Nováky - ENO). In this development scenario, the SR will not have no difficulty in covering the assumed load. In order to ensure the availability of support services (PpS), based on current knowledge, there may be on rare occasions a power shortfall of 17-26 % that the TS operator is able to import from abroad if the required power and transmission infrastructure are available at that moment.



Graph 6: Forecast of ratio of available electricity generation to electricity consumption of the SR in %

Key:

Vodné elektráne + MVE	Hydro plants
Obnoviteľné zdroje (bez VE)	Renewables (without hydro)
Jadrové zdroje	Nuclear
Fosilíne elektrárne	Fossil fuel plants

<sup>19</sup> <u>https://www.mhsr.sk/uploads/files/TZINde4d.pdf</u>

JE Mochovce 3, 4	Mochovce NPP 3,4
Spotreba elektriny (referenčný scenár)	Electricity consumption (reference scenario)

Measures to increase PpS availability made by the TS operator over the last few years have been directed to the search for reserves that can be activated by modifying the rules for providing PpS (virtual blocks) and the ability to procure some PpS types from abroad (PRVs). During 2018, the Strategy for securing a sufficient volume of support services for the provision of system services and the safe and reliable operation of the SR ES for 2019 to 2021 (the "Strategy") was completed, and subsequently underwent a public consultation. Based on the Conclusions and Recommendations of the Strategy, a multi-annual tender was conducted, in which all types of PpS were procured for 2019 to 2021. After evaluating the results of the multi-annual tender, we can say that for 2019 and 2021 the required PpS volumes are secured at an average level of more than 70 % During the multi-annual tender, no PpS bids for TRV3MINand TRV10MIN- were submitted for 2019 and 2020 but we expect these to be procured in other tenders (annual, monthly, and daily). The TS operator identifies other options to ensure the availability of regulatory reserves in creating space for the emergence of "virtual blocks" consisting of several small sources and consumption points that behave as a single source to the transmission system operator's dispatching management system, thereby expanding the supply of regulatory reserves. Under international cooperation, the TS operator is also seeking technical and commercial solutions for the provision of PpS abroad. International cooperation on PpS is the subject of a number of international projects, but there is a need to highlight a significant number of issues to be resolved (cross-border capacities, joint platforms), with solutions which are time-consuming. At the same time, it should realised that within international cooperation it is possible to procure PpS abroad, but on the other hand, PpS providers within the Slovak Republic will be able to supply their regulatory reserves abroad.

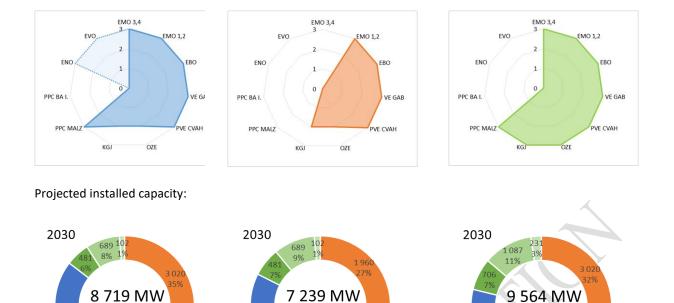
In line with the forthcoming Parliament and Council Regulation on the internal electricity market<sup>20</sup> each Member State must have in place **a reliability standard** deployed in the application of the capacities mechanism, which shall transparently state the required level of security of the electricity supply. For the purpose of establishing a reliability standard, national regulatory authorities should, on the basis of the ACER-approved ENTSO-E methodology, set an estimate of the **Value of Lost Load** (VoLL) in  $\notin$ /MWh. The reliability standard is to be expressed as the **estimated energy not served** (ENS) in MWh/year, which should, inter alia, be taken into account when assessing the adequacy of resources.

According to the currently valid European legislation (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 crossborder exchanges in electricity, preparation of a ten-year European Network Development Plan (TYNDP ENTSO-E) includes evaluation of adequacy based on probable access. Evaluation of adequacy on a medium-term basis (Mid-Term Adequacy Forecast (MAF)) is carried out in an annual cycle based on ENTSO-E transmission system operators' data, focusing on sensitivity analyses of the impacts of sudden changes in fluctuating RES production, climate conditions, market conditions (commodity and emissions pricing) et sim.

The probability processing of the pan-European adequacy outlook<sup>21</sup> also includes the indicatively calculated reliability standard, already-mentioned, the Energy Not Served (ENS) in MWh/year and Loss of Load Expectation (LLE) in h/year. Non-zero values in the results indicate a problem with the adequacy of the Member State's system.

#### Graph 7: Source mix trends according to transmission system operator assumptions

<sup>&</sup>lt;sup>21</sup> https://docstore.entsoe.eu/Documents/SDC%20documents/MAF/2018/MAF%202018%20Executive%20Report.pdf



5 251 MW

Fotovoltické

Photovoltaic

816

26,1 TWh

-10,3 TWh

Vodné

Hydro

36,4 TWh 15 75

🛛 Fosílne

Fossil

🔳 nové Fosílne

new Fossil

ostatné OZE

2030

16%

3 3 5 8

13%

EMO 3.4

EMO 3,4

other RES

435

Veterne

Wind

Maximálne zaťaženie

2030

4 2 8 9

4 636

13%

Celková spotreba

Total consumption

429

36,6 TWh

36,4 TWh

+0,2 TWh

Max. load

5 251 MW

855

19%

Celkový inštalovaný výkon

Total installed capacity

Celková výroba

Total Generation

5 251 MW

Nuclear

2030

5 021

14%

OZE

Source: SEPS, a.s.

RES

1855

21%

Fossil

Projected electricity consumption:

816

35,6 TWh

36,4 TWh

-0,8 TWh

nové OZE

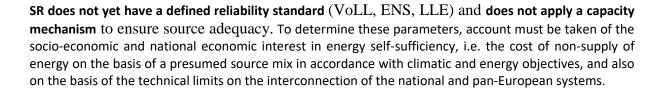
new RES

Hydro

3 660

Jadrové

nuclear



The SR, in the case of establishing a national supply reliability standard (following the application of a capacity mechanism) in accordance with the European legislation in preparation the Slovak Republic may in the future, set or update its strategic objectives for ensuring the adequacy of the electricity system and the flexibility of the SR energy system in relation to production from RES in accordance with the climatic and energy targets, more exactly, ensuring that the system has sufficient import capacity (in which case it is necessary to take into account the risk of lack of production in the surrounding systems and also an interest in ensuring an adequate level of security of supply on its own territory).

In terms of ensuring the **flexibility of the energy system**, one of the Slovak Republic's objectives is to provide sufficient **flexibility** for market participants, primarily for entities with variable production sources, such as, for example, renewable energy sources. The basis for this flexibility is trading as close as possible to the moment of physical supply as variable production cannot be accurately planned over an extended period of time. Attention will therefore be paid to the development of trading opportunities and their rules, particularly through intra-day and balancing markets.

In connection with increasing the flexibility of the electricity system, it is the intention of the Slovak Republic, in line with the aforementioned European legislation, to create conditions for the provision of support services which, on the basis of clearly defined rules, allow the **aggregation** of collection facilities, energy storage facilities and electricity generating facilities for the purpose of offering regulatory services. Also, rules and appropriate conditions will be established for the owners of the collection facilities, third parties and owners of conventional and renewable energy sources, as well as the owners of energy storage units, to become regulatory service providers. The aim is to ensure full and equal access for all technologies and suppliers, including renewable sources, to balancing markets. At the same time, the Slovak Republic is interested in supporting a shortening of the currently used **trading intervals** on daily, intraday and balancing markets. By shortening trading intervals, it will be possible to contribute to better management of the interconnected electricity system as well as to the integration of a higher proportion of intermittent sources in total production. From the point of view of system power regulation, the Slovak Republic supports a shortening of the activation period of balance support services in the time horizon up to 2023, which will lead to an increased management dynamic and flexibility of the grid.

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

Will be completed, in line with current status, in the final version of the national energy and climate plan.

# 2.4.4. Energy Poverty

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

Directive 2009/72/EC of the European Parliament and of the Council concerning common rules for the internal market in electricity requires Member States to take measures to protect end-users and in particular to ensure that there are sufficient safeguards to protect vulnerable customers. In this context, each Member State, i.e. the Slovak Republic, must define the concept of vulnerable customers that will be used for energy poverty.

In any case, these must be comprehensive approaches, because energy poverty is not only a financial problem, but also has its human dimension, which affects with all areas of society and significantly influences the whole social atmosphere. Therefore, any solutions must be preceded by a debate across the whole of society and a quantification of impacts, since proposed solutions should not unduly burden

other energy market participants. Subsequently, an appropriate combination of proposed measures and a regular evaluation of their effectiveness can be adopted in order to optimise them so as to reduce the energy poverty limit while minimising the number of people affected by this phenomenon.

Measures taken by all interested parties must be directed towards meeting the goals of combating energy poverty, but they must in any way discriminate against other parts of the population or cause distortion of the liberalised energy market. The principle of solidarity must be applied, as in other cases, but must be acceptable not only for the beneficiaries but also for providers. Specific measures taken against poverty and already implemented in Slovakia, are, for example, housing allowance, family home insulation allowance, the provision of subsidies to eliminate system failures residential housing blocks, or the creation of employment programmes, including the provision of investment incentives to increase employment.

The objectives of the Office also include the creation of conditions for the introduction of credit measurement systems where this is economical and will also contribute to addressing energy efficiency and energy poverty.

Resolving energy poverty is itself a long-term process of adopting inter-ministry measures, and this process is ongoing and will continue. There are already a number of measures currently in the SR that contribute to the fight against energy poverty. There is, for example, a system to promote the insulation of residential blocks and family homes, the implementation of a uniform new tariff structure, a housing allowance, state employment programmes and others.

In 2014, pursuant to Section 9(3)(f) of Act No 250/2012, on Regulation in Network Industries, and in cooperation with the Slovak Ministry of the Economy, the Slovak Ministry of Finance and the Slovak Ministry of Labour, Social Affairs and the Family, ÚRSO elaborated a document entitled "A concept for protecting consumers who meet the conditions of energy poverty".

However, the competences of the Office do not cover the whole scope (e.g. social policies or improving energy efficiency in the housing sector) of the energy poverty issue. The concept therefore strictly distinguishes between possible tools for a solution at governmental level and those at the level of the national energy regulator, as the creator of possible energy sector price measures intended for socially vulnerable groups in the population. It explicitly states the impossibility of addressing energy poverty solely from the position of the national energy regulator as an isolated state administration body and emphasises the necessity of addressing this social issue by an integrated approach from all the public authorities concerned, which could be coordinated at government level.

# 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

The Slovak Ministry of Education, Youth and Sports annually performs an In-depth Analysis of the Energy Technology Development, Development and Innovation in the Slovak Republic for the International Energy Agency, working with the OECD.

In order to obtain relevant information on the financing of energy research in Slovakia, the Ministry of Education, Youth and Sports approaches relevant institutions (the Slovak Academy of Sciences, the Research and Development Agency, the Research Agency, the Slovak Innovation and Energy Agency, the Statistical Office of the Slovak Republic, the Slovak Ministry of the Economy, the Ministry of the Environment, Horizon 2020, etc.), which have up-to-date information on R & D projects financed from the state budget, from European Union sources and from private sources.

The analysis of other years shows that within the Slovak Republic, 20.351 million EUR were spent on research and development in 2014; 2015 - 2.944 million EUR; 2016 - 18.451 million EUR; and in 2017 - 1.02 million. The evaluation of R&D funding for 2018 for the energy sector will not be available until 2019.

#### Draft State R&D programmes for 2019-2023 with outlook to 2028 (material to MPK)

The proposal assumes funding for R&D in key areas of the Slovak economy, which include the following areas: Improving the transmission capabilities and security of the Slovak electricity grid; Smart grids and renewable energy sources and nuclear energy. In the 2019-2023 time-scale, R&D support for these areas is indicated at the table below:

State programm	e: Energy securit	ty of the Slovak R	epublic, empha	sising multiple	sourcing,	
	energy efficie	ency and the envir	onment (mil. E	UR*)		
year	2019	2020	2021	2022	2023	Total*
State Budget	17.9	21.0	21.6	18.9	4.6	84.1
of which current expenditure	5.7	13.4	21.6	18.9	4.6	64.2
of which capital expenditure	12.2	7.7	0.0	0.0	0.0	19.9
indicatively non-budget resources	6.0	7.3	7.5	6.5	1.6	28.8
total eligible expenditure	23.9	28.3	29.0	25.4	6.2	112.8

#### Table 15: Energy security of the Slovak Republic

Source Ministry of Education, Science, Research and Sports of the Slovak Republic

The attached table shows as assumption of indicative extra-budgetary resources of approx. 28.8 mil. EUR for 2019-2023 as a result of private sector R&D investments in the area concerned, with additional research and development expenditure indicated in the 2024-2028 outlook as indicated in the following table:

#### Table 16: Indicative additional R&D expenditure

Year	2024	2025	2026	2027	2028	Total
State Budget	16.819	17.155	17.498	17.848	18.205	87.525

Source Ministry of Education, Science, Research and Sports of the Slovak Republic

#### **OP Ral - Operational Programme: Research and innovation**

Intermediate body: Slovak Ministry of the Economy

Declared and current closed calls to promote innovation through industrial research and experimental development within the domains:

## - Means of transport for the 21<sup>st</sup> century

OPVaI-MH/DP/2017/1.2.2-11 entitled "Call for Applications for Non-refundable financial contribution to support innovation through industrial research and experimental development within the domain Transport for the 21st Century" with the amount of EU funding earmarked for the call EUR 48,000,000

#### Industry for the 21<sup>st</sup> century

OPVaI-MH/DP/2017/1.2.2-12 entitled Call for Proposals for "Non-repayable financial contribution to support innovation through industrial research and experimental development within the domain Industry for the 21st century" with the amount of EU funding earmarked for the call EUR 82,000,000

#### Healthy food and the environment

OPVaI-MH/DP/2017/1.2.2-13 entitled Call for Proposals for "Non-repayable financial contribution to support innovation through industrial research and experimental development within the domain Healthy food and the environment" with the amount of EU funding earmarked for the call EUR 34,000,000

#### Population health and medical technology

OPVaI-MH/DP/2018/1.2.2-16 entitled Call for Proposals for "Non-repayable financial contribution to support innovation through industrial research and experimental development within the domain Population health and medical technology" with the amount of EU funding earmarked for the call EUR 12,000,000

Digital Slovakia and the creative industries

OPVaI-MH/DP/2018/1.2.2-17 entitled Call for Proposals for "Non-repayable financial contribution to support innovation through industrial research and experimental development within the domain Digital Slovakia and the creative industries" with the amount of EU funding earmarked for the call EUR 24,000,000

Drawdown at the level of projects that are planned to be contracted under the above calls will also cover the period 2012-2030.

#### Slovak Research and Development Agency

In 2017, the SRDA launched a public call for applications to address R & D projects in individual groups of science and technology fields. The agency's primary objective is to increase the quality of R&D through competition from all applicants in a competitive environment, taking into account the priorities of the government-approved R&D Strategy "Knowledge for Prosperity - Research and Innovation Strategy for Smart Specialisation of the Slovak Republic".

The total amount of funding earmarked for the entire period of projects supported under this call is 33 million EUR. These funds were allocated according to the requirements of individual groups of science and technology fields. The total value of funds provided by the Agency to address any one project is limited to a maximum of EUR 250,000 for the whole period.

Information on approved R&D projects in individual areas as well as information on the value of the subsidy granted for R&D projects in the energy sector is available at: http://www.apvv.sk/grantove-schemy/vseobecne-vyzvy/vv-2017.html?tab=promoted\_projects

## Draft State R&D programmes for 2019-2023 with outlook to 2028

National objectives including long term targets (2050) for deployment of low-carbon technologies, including for decarbonising energy- and carbon-intensive industrial sectors and, if applicable, for related carbon transport and storage infrastructure

The objectives of the R&D programmes for 2019-2023 and their sub-programmes are also: to strengthen applied research and development in order to strengthen "Industry leadership - modern manufacturing and processing", including inter alia manufacturing processes and materials for low carbon technologies and greater energy efficiency (e.g. better use of renewable resources in production, flexible production technologies with increased energy and material efficiency while concurrently reducing waste, efficient use of inputs and ensuring the recycling of industrial production)

The strategic objective of the EP SR is to achieve a competitive low-carbon energy industry sector ensuring the reliable, safe and efficient supply of all forms of energy at affordable prices, taking into account consumer protection and sustainable development. Electricity has priority status due to its versatility. Implementation of smart grids, i.e. efficient energy management and energy supply systems under the changing operating conditions of energy systems, with the integration of renewable energy sources (RES) into distribution systems and active customers (or prosumers), are helping to achieve this strategic goal in line with the energy policy of the Slovak Republic and the EU.

Another goal is to safely and reliably use nuclear energy in such a way as to be an economically efficient and environmentally acceptable source of electricity. To ensure the nuclear safety of all operating nuclear facilities and create the prerequisites for the construction of possible new nuclear power plants. The individual tasks of the sub-programme lead to the further development of existing scientific knowledge and the creation of personnel capacities to address nuclear safety issues.

In the upcoming period, more ambitious goals can be expected within European energy policy, as well as in the area of climate change policy and the transition to a low-carbon economy. Research should be focused on the hydrogen economy with ambitions to affect the energy and transport sectors. The development of hydrogen technologies and their practical application is still in its infancy. Besides hydrogen production by electrolysis or natural gas reforming, it would be interesting to supplement this issue by linking hydrogen production to nuclear energy. 4th generation nuclear reactors could play an important role, where the concept for a number of them is based on hydrogen production. The use of fuel cells and hydrogen technologies in the transport sector is a good path to alternative technologies. Further research could be aimed at increasing the efficiency and effectiveness of renewables used.

# National Centre for RES Research and Application

In the field of RES there is a National Centre for RES Research and Application at the Slovak Technical University ("STU"). The Slovak Technical University has received support for this from the European Regional Development Fund under the Operational Programme Research and Development. Four STU faculties are involved in the project of the National Centre for RES Research and Application: The Faculty of Chemical and Food Technology, the Faculty of Electrical Engineering and Informatics, the Faculty of Mechanical Engineering, the Faculty of Civil Engineering. The focal points of the National Centre's research are biomass, solar energy and hydropower

## Intelligent Network Research Laboratory

There is interest in managing a nationwide pilot project following on from the pilot project of the network companies. The role of the laboratory would be testing new network, consumption, production and interoperability technologies. The laboratory should also be a representative centre for public awareness.

# Research and development targets

The priority of research and development in the energy sector is to ensure sustainable energy in Slovakia.

The objectives of energy research and development are in line with the "Research and Innovation Strategy for Smart Specialisation of the Slovak Republic." (2013).

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

- exploration of domestic deposits of energy raw materials, geo-thermal energy and their efficient use;
- development of technologies for the generation of electricity and heat from RES (water, sun, wind, biomass);

- nuclear energy research focusing on safety and the disposal of spent fuel;
- research into fourth-generation reactors and the problems of nuclear fusion (participation of SR in the global ITER and DEMO projects);
- development of new energy transmission systems (power cables without dispersive electrical and magnetic fields);
- development of technologies to increase energy efficiency and reduce energy intensity.
  - 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

Will be completed, in line with current status, in the final version of the national energy and climate plan.

## iii. Where applicable, national objectives with regard to competitiveness

The aim is to reduce the costs of high energy-intensive businesses in relation to electricity payments that are used to finance the production of electricity from renewable sources.

#### 3. POLICIES AND MEASURES

#### 3.1. Dimension: decarbonisation

#### 3.1.1. GHG emissions and removals

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

#### 1. Sectoral policies and measures - Energy

An important role, in addition to the legislative instruments on the trading of greenhouse gas emission allowances, is played by Act No 137/2010, on Air Protection, as amended. This Act is supplemented by Act No 401/1998, on air pollution charges, which serve to control and regulate emission limits for basic air pollutants. Monitoring and reporting of emissions from stationary sources of air pollution as well as the charging system which is mandatory for operators of medium and large air pollution sources have had a positive effect on the reduction of greenhouse gas emissions and have contributed to the separation (greenhouse gas emissions do not track GDP growth) of the emission trajectory in the Slovak Republic since 1997.

All of the above policies and measures were assessed in scenarios of emission projection modelling in the Slovak Republic up to 2040. The synergistic effects of policies and measures were reflected in the modelling.

Introduction of Euro 6 emission standards - Transport policy of the Slovak Republic to 2015

Introducing stricter Euro 6 emission standards for new vehicles, significantly higher emission limits for basic pollutants and particles from traffic. Fuel consumption is expected to reduce due to higher engine and production efficiency, and a reduction in greenhouse gas emissions is anticipated.

Greenhouse gases affected: CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>

Type of measure: regulatory and economic

Condition: in force since 2005

Implemented in Scenario: WEM

# Act No 309/2009 on the promotion of renewable energy sources and high-efficiency cogeneration and amending certain acts

A continued increase in the share of bio-components in motor fuels, retention of the current shares of existing biofuels. The Act provides for the introduction of a compulsory share of advanced biofuels.

Greenhouse gases affected: CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>

Type of measure: regulatory and economic

Condition: in force since 2010

## Decree No 271/2011, laying down "long-term sustainability criteria and targets for the reduction of greenhouse gas emissions from fuels

It defines the rules for fuel suppliers, i.e. requirements for a higher proportion of biofuels in petrol and mineral oils, and the obligation to provide information on the proportion of biofuels in total petrol and diesel consumption in transport.

#### Greenhouse gases affected: CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>

Type of measure: regulatory and economic

Condition: in force since 2010

Implemented in Scenario: WEM

# Trading in greenhouse gas emission allowances, allocation of civil aviation allowances - Act No 414/2012, on the trading of emission allowances and on a change and addition to certain laws

The measure stipulates a reduction in greenhouse gas emissions from civil aviation through the EU-ETS (cap-and-trade) greenhouse gas emission allowance trading scheme.

Greenhouse gases affected: CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>

Type of measure: regulatory and economic

**Condition:** in force since 2012

Implemented in Scenario: WEM

### Strategy for the development of electromobility in the Slovak Republic and its impact on the national economy of the Slovak Republic

Electromobility brings about a significant improvement in driving conditions in terms of their environmental impact. The Strategy for the development of electromobility in the Slovak Republic is concerned with support for electric vehicles.

Greenhouse gases affected: CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>

Type of measure: regulatory and economic

Condition: in force since 2015

Implemented in Scenario: WEM

#### Impact of European legislation - EU White Paper on Transport

Commitment from the EU White Paper on the switch of long distance freight transport from road freight to rail: at present, 30 % of goods are transported a distance of more than 300 km by road. Under this measure, goods are to be transported by rail.

Greenhouse gases affected: CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>

Type of measure: regulatory and economic

Condition: in force since 2011

#### 2. Sectoral policies and measures: Industry

## 2.1 Nitric acid manufacture - Act No 414/2012 on emission allowance trading, amending certain laws;

Nitric acid production is a major source of  $N_2O$  emissions. Nitric acid is produced at two plants. In 2014, improved technology with a secondary catalyst was used in both facilities. This led to a reduction in  $N_2O$  emissions.

#### Greenhouse gases affected: N<sub>2</sub>O

Type of measure: regulatory and economic

Condition: in force since 2013

Implemented in Scenario: WEM, WAM

### 2.2 Aluminium manufacture - Act No 414/2012 on emission allowance trading, amending certain laws;

Implementation of the Act makes it possible to check the efficiency of aluminium production. The technology was changed from the Söderberg technology to pre-combustion technology in 1996. The change resulted in a significant reduction in CO<sub>2</sub> and PFC emissions. Production improvements led to a further reduction in PFC emissions after 2009. A further improvement in the process of managing electrolytic cell performance was achieved in 2013. CO<sub>2</sub> emissions from incineration of volatile coal tar and combustion furnace material were first calculated in 2013 (in line with IPCC 2006 GL) and the resulting implied emission factor for the aluminium produced was estimated.

#### Greenhouse gases affected: PFCs

Type of measure: regulatory and economic

Condition: in force since 2013

Implemented in Scenario: WEM, WAM

# 2.3 Cement manufacture - Act No 414/2012 on emission allowance trading, amending certain laws;

Implementation of the Act may cause a partial change on the raw materials used. The use of carbon-free raw materials for cement production will begin after 2020 (e.g. ground granular blast-furnace slag). 5 % is assumed, measured at the furnace inlet.

#### Greenhouse gases affected: CO2

Type of measure: regulatory and economic

Condition: estimated after 2020

#### Implemented in Scenario: WAM

## 2.4 Lime manufacture - Act No 414/2012 on emission allowance trading, amending certain laws;

Implementation may cause dolomitic lime production to be reduced and replaced by the production of burnt lime. There may be a decrease in the number of or the closure of dolomitic limestone quarries after 2020.

#### Greenhouse gases affected: CO<sub>2</sub>

#### Type of measure: regulatory and economic

Condition: estimated after 2020

#### Implemented in Scenario: WAM

#### 2.5 HFC gases (hydrofluorocarbons) with low GWP

The increase in HFC (hydrofluorocarbon) emissions will be less dynamic due to a significant increase in the use of refrigerants with new HFCs (with a lower GWP) after 2020 and sustained HCFC refrigerant replacement with "natural refrigerants".

Greenhouse gases affected: HFCs

Type of measure: regulatory and economic

Condition: in force since 2015

Implemented in Scenario: WEM

#### New mandatory parameters for fluorinated gases

In addition to the parameters described in the WEM scenario for fluorinated gases, foams containing HFCs will be banned, and high GWP refrigerants will also be limited. Increased use of fluorinated gases that are not covered by the IPCC (such as heavy oils (HFO)) will begin to a significant extent after 2025. The use of fluorinated gases with a lower GWP in aerosols and extinguishing agents will be mandatory.

Greenhouse gases affected: HFCs

Type of measure: regulatory and economic

Condition: in force since 2017

Implemented in Scenario: WAM

#### Lower N<sub>2</sub>O content in aerosol containers

Reduction of  $N_2O$  content in aerosol canisters after 2020.

Greenhouse gases affected: N<sub>2</sub>O

Type of measure: regulatory and economic

Condition: in force since 2010

Implemented in Scenario: WEM

Further reduction in N2O content in aerosol containers

Further reduction of  $N_2O$  content in aerosol canisters after 2025.

Greenhouse gases affected: N<sub>2</sub>O

Type of measure: regulatory and economic

Condition: in force since 2017

#### Best available techniques (BAT) when servicing electrical equipment

Stable emission factors for  $SF_6$  from electrical equipment due to the use of BAT in the servicing of electrical equipment.

#### Greenhouse gases affected: SF<sub>6</sub>

Type of measure: regulatory and economic

Condition: in force since 2015

Implemented in Scenario: WEM

#### Electrical equipment serviced only using BAT-level techniques

Servicing of electrical equipment will be possible only at the level of BAT and only in "lifetime sealed" systems.

Greenhouse gases affected: SF<sub>6</sub>

Type of measure: regulatory and economic

Condition: in force since 2017

Implemented in Scenario: WAM

#### 3. Sectoral policies and measures: Agriculture

Decree from the Slovak Ministry of Agriculture and Rural Development No 362/2010.

#### 3.1 Common Agricultural Policy

The Common Agricultural Policy (CAP) is the European Union's agricultural policy. It introduces a system of agricultural subsidies and other programmes. It was introduced in 1962 and has since gone through a number of cost-cutting changes (from 71 % of the EU budget in 1984 to 39 % in 2013) and also includes rural development within its objectives.

Greenhouse gases affected: CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>

Type of measure: regulatory and economic

Condition: in force since 2010

Implemented in Scenario: WEM

#### **Nitrates Directive**

The Nitrates Directive (1991) aims to protect water quality throughout Europe by preventing agricultural nitrates from polluting groundwater and surface water as well as encouraging the use of appropriate farming practices. The Nitrates Directive forms an integral part of the Water Framework Directive (WFD) and is one of the key instruments in the protection of waters against agricultural impact.

Greenhouse gases affected: N<sub>2</sub>O,

Type of measure: regulatory and economic

Condition: in force since 2010

# Rural Development Programme of the Slovak Republic for the programming period 2014-2020

The programme increases the competitiveness of agriculture and forestry (by supporting investment on 1,250 farms and 400 food businesses). It ensures appropriate management of natural resources and promotes climate-friendly farming practices. Approximately 20 % of agricultural land will be farmed in a way that protects biodiversity, the soil and/or water resources. The programme of the financial support system for selected rural development thematic priorities contains 56 framework objectives for specific policies and measures in this sector with positive environmental impacts. The contribution of the supported policies and measures to sustainable development will serve as a horizontal criterion for support.

Greenhouse gases affected: CH<sub>4</sub>, N<sub>2</sub>O, CO<sub>2</sub>

Type of measure: regulatory and economic

Condition: in force since 2015

Implemented in Scenario: WEM

#### Agricultural Development Concept of the Slovak Republic for 2013 - 2020

The Agricultural Development Concept plans to increase the number of animals in 2013-2020. Under the Concept, the Slovak Republic is seeking to ensure that self-sufficiency in important agricultural commodities reaches the 80 % level by 2020. This leads to support for primary production of animals in the Slovak Republic, which is also closely related to employment policy in the agricultural sector.

Greenhouse gases affected: CH<sub>4</sub>, N<sub>2</sub>O

Type of measure: regulatory and economic

Condition: in force since 2013

Implemented in Scenario: WEM

# Handling of manure - Slovak Government Regulation No 342/2014, laying down rules for the granting of agricultural aid in connection with the separate direct payments schemes

Measures for handling and processing of manure in the category of enteric fermentation. Measures to implement better technologies for the handling and processing of manure in the category of enteric fermentation.

Greenhouse gases affected: CH<sub>4</sub>, N<sub>2</sub>O

Type of measure: regulatory and economic

Condition: in force since 2014

#### New measures for handling of manure - Slovak Government Regulation No 342/2014, laying down rules for the granting of agricultural aid in connection with the separate direct payments schemes

New measures concerning the handling and processing of manure and, in addition, introducing a new policy on animal feed.

Greenhouse gases affected: CH<sub>4</sub>, N<sub>2</sub>O

Type of measure: regulatory and economic

Condition: in force since 2015

Implemented in Scenario: WAM

Agricultural land - Slovak Government Regulation No 342/2014, laying down rules for the granting of agricultural aid in connection with the separate direct payments schemes

Effective use and appropriate timing of use of nitrogen fertilisers.

Greenhouse gases affected: N<sub>2</sub>O

Type of measure: regulatory and economic

Condition: in force since 2014

Implemented in Scenario: WEM

Agricultural land after 2015- Slovak Government Regulation No 342/2014, laying down rules for the granting of agricultural aid in connection with the separate direct payments schemes

Effective use and appropriate timing of use of nitrogen fertilisers after 2015.

Greenhouse gases affected: N<sub>2</sub>O

Type of measure: regulatory and economic

**Condition:** in force since 2016

Implemented in Scenario: WAM

Reduced number of dairy cows - Slovak Government Regulation No 342/2014, laying down rules for the granting of agricultural aid in connection with the separate direct payments schemes

Reduction in the number of dairy cows.

Greenhouse gases affected: CH<sub>4</sub>

Type of measure: regulatory and economic

Condition: in force since 2014

#### Implementation of a new policy on animal feed - Slovak Government Regulation No 342/2014, laying down rules for the granting of agricultural aid in connection with the separate direct payments schemes

Reducing the number of dairy cows, intensive feeding with active substances.

#### Greenhouse gases affected: CH<sub>4</sub>

Type of measure: regulatory and economic

Condition: in force since 2016

#### Implemented in Scenario: WAM

# 4. Sectoral policies and measures: land use, land use changes and forestry (LULUCF)

- Rural Development Programme for 2014 2020 (under the provision in para. 4.5.3)<sup>22</sup>
- Concept for Agricultural Development of the Slovak Republic for 2013 2020 (according to the provisions of paragraph 4.5.4)<sup>13</sup>

#### **Forestry Strategy / Forestry Action Plan**

The Forestry Action Plan contains a number of key climate change mitigation measures: support for the use of forest biomass for energy production, compliance by the EU with the UNFCCC and the Kyoto Protocol and protection of EU forests.

#### Greenhouse gases affected: CO2

Type of measure: regulatory with direct impact on emissions

Condition: in force since 2006

Implemented in Scenario: WEM

#### Forestry management measures under the rural development policy

Forestry is an integral part of rural development, promoting sustainable, environmentally friendly use of land should include the development of forest areas and sustainable forest management.

Greenhouse gases affected: CO<sub>2</sub>

Type of measure: regulatory and economic

Condition: in force since 2015

Implemented in Scenario: WEM

#### LULUCF accounting

Provides the basis for the formal incorporation of the LULUCF sector and provides a harmonised legal framework for reliable data collection through reliable counting and standardised reporting.

<sup>22</sup> 3<sup>rd</sup> Biennial Report:

http://unfccc.int/files/national\_reports/biennial\_reports\_and\_iar/submitted\_biennial\_reports/application/pdf/72450391\_s lovakia-br3-1-3br\_svk.pdf

#### Greenhouse gases affected: CO<sub>2</sub>

Type of measure: economic

Condition: in force since 2002

Implemented in Scenario: WAM

#### 5. Sectoral policies and measures: wastes

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

This Act emphasises the sorting of packaging and recyclable materials. Also, the funding scheme for separate collection is changing from the State Recycling Fund to the Producer Responsibility Organisation . The impact of this change is not yet known. Waste disposal is permitted only at authorised managed landfills (Section 13). This Act prohibits the disposal of garden waste and requires separate collection of kitchen waste, but these rules have not yet been fully implemented (Section 80).

Greenhouse gases affected: CH<sub>4</sub>, and N<sub>2</sub>O

Type of measure: regulatory and economic

Condition: in force since 2015

#### Implemented in Scenario: WEM

#### Waste Management Programme of the Slovak Republic for 2011 - 2015

The Waste Management Plan 2011-2015 includes several key climate change mitigation goals: a 35 % increase in the waste recycling rate by 2015, a reduction of the rate of disposal of biodegradable waste in line with the Landfill Directive (reduction to 50 % by 2013, reduction to 45 % by 2015 and reduction to 35 % by 2020, compared to 1995 levels), introduce separate collection of biodegradable waste and increase the proportion of application of stabilised sludge from waste water to land. The Waste Management Plan 2011-2015 includes several key climate change mitigation goals: a 35 % increase in the waste recycling rate by 2015, a reduction of the rate of disposal of biodegradable waste in line with the Landfill Directive (reduction to 50 % by 2013, reduction to 45 % by 2015 and reduction to 35 % by 2020, compared to 1995 levels), introduce separate collection of biodegradable waste in line with the Landfill Directive (reduction to 50 % by 2013, reduction to 45 % by 2015 and reduction to 35 % by 2020, compared to 1995 levels), introduce separate collection of biodegradable waste and increase the proportion of stabilised sludge from waste water to land.

Greenhouse gases affected: CH<sub>4</sub>, and N<sub>2</sub>O

Type of measure: regulatory and economic

Condition: in force since 2015

Implemented in Scenario: WEM, WAM

#### Strategy for limiting the deposit of biodegradable waste to landfill 2010

The strategy was put in place to implement the Landfill Directive. The aim of the measures is to increase the sorting of recyclable waste, composting and the manufacture of refuse-derived fuel (RDF).

#### Greenhouse gases affected: $\mathsf{CH}_4$ and $\mathsf{N}_2\mathsf{O}$

Type of measure: regulatory

Condition: in force since 2015

Implemented in Scenario: WEM, WAM

#### Act No 309/2009 on the promotion of renewable energy sources and highefficiency cogeneration and amending certain acts

Promotion of electricity generation from landfill gas and biogas in sewage treatment plants.

Greenhouse gases affected: CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>

Type of measure: regulatory and economic

**Condition:** in force since 2009

Implemented in Scenario: WEM, WAM

#### *ii.* Where relevant, regional cooperation in this area

Will be completed, in line with current status, in the final version of the national energy and climate plan.

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

#### Financing measures from EU funds

#### Quality of the Environment Operational Programme (OP QoE)

The OP QoE is the SR programming document for drawing assistance from the EU Structural Funds and the Cohesion Fund in the programming period 2014-2020 for the sustainable and efficient use of natural resources, ensuring environmental protection, active adaptation to climate change and promoting an energy efficient low-carbon economy.

**The global objective of the OP QoE** is to promote the 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 objection, three core thematic objectives were included in the investment strategy of the OP QoE, 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 devoted to climate change and energy:

Priority axis 2: Adaptation to the adverse impacts of climate change with a focus on flood protection (419.3 mil. EUR from the Cohesion Fund, 13.36 % of the OP QoE allocation)

a. supporting investment for adaptation to climate change including ecosystem-based approaches Priority axis 3: Promoting risk management, emergency management and resilience to exceptional events affected by climate change (260.9 mil. EUR from the European Regional Development Fund, 8.31 % of the OP QoE allocation)

a. promoting investment to address specific risks, ensuring disaster resilience and developing disaster management systems

Priority axis 4: Energy-efficient low-carbon economy in all sectors (EUR 938.88 million from the European Regional Development Fund, 29.92 % of the OP QoE allocation)

#### 4.1 1

#### Financing measures from other funds

#### a) SlovSEFF III

The SlovSEFF III programme is a credit line to promote the development of energy efficiency and renewable energy sources in Slovakia. The programme is aimed at supporting projects:

- which include the purchase and installation of equipment, systems and processes using renewable energy sources for the production of electricity and/or heat and/or cooling and/or any other form of energy replacing 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 related to the production of goods or the provision of services related to industry;
- in residential buildings, which are comprehensive, large projects for the reconstruction of the thermal ratios of apartment buildings, consisting of the thermal insulation of the external casing (external 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 AAUs to Spain.

**b**) State Environmental Protection Aid Scheme for the Reduction of GHG and Pollutants in the Manufacturing Industries

The State aid scheme was prepared in accordance with Commission Regulation (EU) No 651/2014 of 17 June 2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty. The purpose of the aid is to encourage undertakings, as part of their activities, and in compliance with 36(2)(a) of the Block Exemption Regulation to increase the level of environmental protection by going beyond the applicable Union standards, by supporting projects aimed at reducing greenhouse gas emissions and pollutants to air by introducing the best available technologies.

The scheme was approved by the Slovak Competition Office by letter No 104/2017/OŠP-3471/2017 of 7 July 2017 and was published on 17 July 2017 in Official Journal 135/2017 under number G000019. On 11 August 2017, the scheme was also registered in SANI2 under number SA.48924. The scheme is valid until 2020, the implementation of projects is possible up to the end of 2023. The scheme is funded from funds raised from the sale of emission allowances at auction.

c) State aid scheme for undertakings in sectors and subsectors deemed to be exposed to a significant risk of carbon leakage due to EU ETS allowance costs passed on in electricity prices

The state aid scheme has been prepared in accordance with the Commission Notice - Guidelines on certain State aid measures in the context of the greenhouse gas emission allowance trading scheme post-2012. The objective of the State aid is to prevent a significant risk of carbon leakage due to greenhouse gas allowance costs passed on in electricity prices borne by the beneficiary, if its competitors from third countries do not face similar  $CO_2$  costs in their electricity prices and the beneficiary is unable to pass on those costs to product prices without losing significant market share.

State aid is intended to compensate for the rise in electricity prices in connection with the passing on of greenhouse gas emission costs to those prices following the introduction of the EU ETS. The scheme was approved by Commission Decision C (2015) 9479 final of 14 December 2015 (case SA.43509 (2015/N) - Compensation of indirect  $CO_2$  -related costs in Slovakia).

The scheme was published in the European Commercial Bulletin on 22 April 2016, as well as in the Commercial Bulletin of the Slovak Republic No 74/2016 issued 19 April 2016 under G000007. The scheme is valid until 2020, the compensation can still be provided in 2021 (for 2020). The scheme is funded from funds raised from the sale of emission allowances at auction.

The proceeds from CO<sub>2</sub> allowance auctions after 2021 should primarily be used for investments in the electricity and heat sector to meet the required targets to 2030.

After 2021 we anticipate a further use of the ESIF to fund decarbonisation.

#### 3.1.2. Renewable energy

i. Policies and measures to achieve the national contribution to the binding 2030 Union target for renewable energy and trajectories as referred to in point (a)(2) Article 4, and, where applicable or available, the elements referred to in point 2.1.2, including sector- and technology-specific measures<sup>23</sup> 

#### Table 17: Overview of policies and measures

Con No	Name and	Tune of	Evin a stard	Torgotod anous	Fricting	Start and
Seq. No		Type of	Expected	Targeted group	Existing	1
	reference of the	provision	outcome	and/or activity	(E) or	end dates of
	measure			7	planned	the measure
					(P)	
	Mandatory					
	blending of bio-		Maintaining a			
	components into		share of 7 % of	manufacturers of		
1.	transport fuels	regulatory	biofuels from	motor fuels	Е	
			food crops after	motor ruers		2006 -
			2020			2000
	Mandatory					
	, blending of					
	advanced					
	biofuels into		Achieving 3.5 %	manufacturers of		
2.	transport fuels	regulatory	of advanced	motor fuels	E	
			biofuels by 2030			2019 -
						2013
	Promoting					
	electricity					
	production		New sources -			
	through	legislative,	electricity			
3.	redemption	regulatory	generation 1TWh	investors	Е	
	prices (up to		in 2020-2030		-	2009 - 2030
	500kW)		2020 2000			

<sup>23</sup> When planning those measures, Member States shall take into account the end of life of existing installations and the potential for repowering.

4.	Promoting electricity production through the auction system	legislative	Support for electricity generation 1 TWh in 2020-2030	investors	E	2019 - 2030
5.	Support for decentralised electricity generation	legislative	New sources - electricity generation 0.5 TWh in 2020-2030	investors	Ĕ	2019 -
6.	Support for business use of renewable energy	financial	RES heat and electricity generation	investors	E	2014 -
7.	Support for household use of RES	financial	Increasing the use of renewable energy sources	households	E	2015 -
8.	Mandatory quantity of RES in centralised heat supply systems	regulatory	RES heat production	Heat producers in CZT	Р	2021
9.	Support for the renovation of heat distribution pipes	financial	energy saving, promotion of district heating	investors	E	2014 -

10.	Support for cultivation of fast-growing trees	legislative and regulatory	increase supply of biomass	farms	E	2011
	and of managements					4

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

Will be completed, in line with current status, in the final version of the national energy and climate plan.

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

Will be completed, in line with current status, in the final version of the national energy and climate plan.

*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/... +

Will be completed, in line with current status, in the final version of the national energy and climate plan.



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

Will be completed, in line with current status, in the final version of the national energy and climate plan.

OJ: please enter COD 2016/0382 (energy from renewable sources).

Summary of the policies and measures under the enabling framework Member States have to put in place pursuant to Article 21(6) and Article 22(5) of Directive (EU) 2018/... <sup>+</sup>to promote and facilitate the development of selfconsumption and renewable energy communities

Will be completed, in line with current status, in the final version of the national energy and climate plan.

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

Will be completed, in line with current status, in the final version of the national energy and climate plan.

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

Will be completed, in line with current status, in the final version of the national energy and climate plan.

#### 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

Will be completed, in line with current status, in the final version of the national energy and climate plan.

#### *ii.* Policies and measures to achieve other national targets, where applicable

Will be completed, in line with current status, in the final version of the national energy and climate plan.

*iii.* Policies and measures to achieve low emission mobility (including electrification of transport)

Will be completed, in line with current status, in the final version of the national energy and climate plan.

iv.

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

Will be completed, in line with current status, in the final version of the national energy and climate plan.

#### 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

OJ: please enter COD 2016/0382 (energy from renewable sources).

instruments (also of a financial nature) to promote the energy performance of buildings, in particular with regard to the following:

#### *i.* Energy efficiency obligation schemes and alternative 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

Having regard to all aspects, the Slovak Republic decided to implement energy savings exclusively through policy measures (i.e. through the alternative approach under Article 7(9) of Directive 2012/27/EU), i.e. without introducing mandatory schemes. The most significant influence in this decision was from the projected increase in end-energy prices, which would ultimately have a negative impact on the business environment, which would then have reduced the competitiveness of the economy as well as possible increasing unemployment.

For the purpose of achieving energy savings in line with Art. 7 of the Directive, alternative policy measures are applied. The energy efficiency measures contributing to the achievement of the objective of Article 7 of Directive 2012/27/EU are for 2014-2016 and 2017-2020. The most important energy efficiency policy measures that have contributed and continue to contribute to the fulfilment of the objective under Art. 7 of Directive 2012/27/EU include:

- The obligations on energy efficiency laid down by generally binding legislation beyond the obligations imposed by EU regulations
- Operational Programme 'Competitiveness & Economic Growth' (SF 2007-2013)
- Operational Programme 'Health' SF 2007-2013
- Operational Programme Transport SF 2007-2013
- Regional Operational Programme SF 2007-2013
- Operational Programme 'Research & Development' (SF 2007-2013)
- State Housing Development Fund Insulating residential housing
- Operational Programme 'Quality of the Environment' ESIF 2014-2020
- Operational Programme 'Integrated Infrastructure' ESIF 2014-2020
- Integrated Regional Operational Programme SF 2014-2020
- Slovseff III programme
- Subsidies under MoE
- Environmental Fund
- Subsidy for insulation of family homes
- Voluntary agreement
- New operational programmes promoting energy efficiency under the New Financial Perspective in 2021-2027

### Table 18: Overview of the most important policy measures to achieve the objective of Art. 7 of Directive 2012/27/EU

Source of financing	Measures
Own resources of the obligated entities	<ul> <li>Mandatory hydraulic regulation of the heat and hot water distribution system including the provision of hot water distribution with appropriate thermal insulation in buildings with a total</li> </ul>
entities	floor area greater than 1000 m $^2$ (Act No 476/2008, and Act No 321/2014, on energy efficiency)
Own resources of the obligated entities	<ul> <li>The obligation to monitor, evaluate and provide consumption data to the operator of the energy efficiency monitoring system for central government authorities, municipalities, higher territorial units, organisations in their jurisdiction and building owners/administrators with a total floor area of more than 1000 m<sup>2</sup> (Act No 476/2008, and Act No 321/2014, on energy efficiency)</li> </ul>

<ul> <li>Innovation and technology transfer in industrial plants.</li> </ul>
<ul> <li>Increasing the energy efficiency of industrial production,</li> </ul>
- Improving the thermal characteristics of public buildings — hospitals and health facilities
- Renewal and upgrading of the vehicle park,
- Building and upgrading transport infrastructure
- Improving the thermal characteristics of public buildings — schools and educational
establishments, social services facilities, cultural establishments, etc.
- Improving the thermal characteristics of public buildings — schools and educational
establishments
- Energy efficiency in buildings, industry, transport, the service sector and households, energy
efficiency measures in the energy sector and in the heat industry.
- Improving the thermal and technical characteristics of residential housing
- Ensuring energy audits in SMEs and implementing measures from energy audits,
- Improving the energy efficiency of public buildings
<ul> <li>Development, approval and implementation of plans for sustainable energy and reduction of greenhouse gas emissions</li> </ul>
- Introduction of energy management systems, including energy audits and environmental
management
- Support for energy services development at regional and local level
- Construction, renovation and upgrading of heat distribution pipes
- Construction, renovation and upgrading of installations for the production of electricity and heat
through high-efficiency cogeneration with a maximum thermal input of 20 MW
- Raising the awareness of children and young people in the field of energy efficiency
- Information campaign focusing on energy efficiency
<ul> <li>Monitoring and Information System – interconnection with most energy efficiency support mechanisms</li> </ul>
- Renewal and upgrading of the vehicle park,
<ul> <li>Building and upgrading transport infrastructure</li> </ul>
<ul> <li>Promoting the development and use of public passenger transport, including support for the creation of integrated transport systems</li> </ul>
- Support for the development of non-motorised transport, especially cycling
- State Housing Development Fund - Insulating residential housing using EU funds (see
above),
- Improving the thermal characteristics of residential housing.
- Improving energy efficiency in industry
<ul> <li>Implementation of energy efficiency measures from energy audits in SMEs in Bratislava region</li> </ul>
<ul> <li>Increasing the energy efficiency of heat distribution in Bratislava region,</li> </ul>
<ul> <li>Improving the thermal and technical characteristics of public buildings</li> </ul>
- Improving the thermal and technical characteristics of residential housing.
- Implementing energy efficiency measures for entities, particularly in industry and the energy
sector, in order to reach agreed energy savings or provide information.
- The following will be defined later

Some of the aforementioned support programmes, which will generate further measures until 2023, also fall into 2021-2030. This applies in particular to the following measures

- Operational Programme 'Quality of the Environment' ESIF 2014-2020
- Operational Programme 'Integrated Infrastructure' ESIF 2014-2020
- Integrated Regional Operational Programme SF 2014-2020

Further measures are continuous and will continue throughout the period 2021-2030

- The obligations on energy efficiency laid down by generally binding legislation beyond the obligations imposed by EU regulations
- State Housing Development Fund Insulating residential housing
- The Green Slovseff III programme and its successor
- Subsidies under MoE
- Environmental Fund
- Subsidy for insulation of family homes
- Voluntary agreement
- New EU fund measures from the New Financial Perspective in 2021-2027

<u>Action Plan 2021 to 2030</u> by sector to meet the energy saving end-user target (Article 7 target). The plan also includes an updated Energy Efficiency Action Plan from 2019 onwards.

#### 1. Buildings

The buildings sector will continue to be a very important sector after 2020 in terms of the potential for achieving energy savings. New legislation will introduce new requirements for building renovation and energy efficiency measures. Digital technologies and building energy management will be used more. Requirements for electromobility and communication with the electricity network are new parameters for the functioning of a building in relation to the electrical sector. The system of energy certification for buildings will be improved.

Support for the use of electricity, heat and cold generated from renewable energy sources located in a building or near a building will increase, but at the same time will be equivalent to the energy from RES delivered remotely. The changing climatic conditions observed in the last ten years in Slovakia and across the EU will result in higher cooling and ventilation requirements for buildings, which will also be reflected in changes in energy consumption patterns in buildings. Measures in the buildings sector apply exclusively to privately owned buildings, that is, only to non-state and non-public buildings. Measures relating to state and public buildings are described in the chapter "Planned measures in the public sector". Private sector buildings and horizontal measures for private sector buildings.

#### Private sector buildings

#### Improving the thermal and technical characteristics of family homes

The measure is a continuation of measures to renovate family homes. The proportion of renovated family homes is currently around 38 % in Slovakia, with renovations almost entirely privately funded. Aid in the form of a state subsidy for family home heat insulation was introduced only in 2016. This support is regularly reviewed and the volume of funds provided and the range of areas being supported are increasing. The introduction of further new financial mechanisms to promote renovation are very likely to lead to an acceleration in the rate of renovation. The Update to the Residential and Non-Residential Building Renovation Strategy states that, at the current renovation rate, all family homes will have been restored by 2043. By creating new financial mechanisms and the value of funding. Within the Eurofunds, technical equipment of buildings in family homes was subsidised in the form of a subsidy for the installation of a renewable energy source in a family home.

Family homes and apartment blocks can apply for support in the form of a voucher for the installation of small installations for the use of renewable energy sources, thanks to a national project of the Slovak Innovation and Energy Agency (SIEA) called Zelená domácnostiam (Green for Households). This national SIEA project is funded by the Operational Programme Quality of the Environment, managed by the Slovak Ministry of the Environment. The support is for small installations for the production of electricity up to 10 kW and for heat generating equipment covering energy consumption in a family house or apartment block. In addition to energy efficiency, there is also considered of whether the equipment meets the emission limits. Households can use the services of nearly 1000 eligible contractors. In the new programming period, it is planned to continue the Zelená domácnostiam project, also in connection with the objective of increasing the share of renewable energy sources in heating and allowing the energy savings achieved in this way to be set against the 35 % exemption from the energy efficiency target under Art. 7:

A key measure until 2030 will continue to be improvements in the thermal and technical properties of family homes, which will be financed mainly privately and through the commercial banks. However,

Measure No	Name	Specification	Financial mechanism Source	period
1.1.1	Improving the thermal characteristics of buildings	Family houses	Own funds	2014-2020 2021-2030
1.1.2	Improving the thermal characteristics of buildings	Family houses	Subsidy for insulation of FH	2014-2020 2021-2030
1.4.1	New construction to low- energy standard	Family houses	Own funds, commercial banks	2014-2020 2021-2030
1.5.1	New build exceeding the minimum legal requirements	Apartments, family houses	Own funds, commercial banks	2014-2020 2021-2030
1.6	New construction to a building standard with near zero energy needs	Apartments, family houses	Own funds, commercial banks Subsidies for family houses	2014-2020 2021-2030 2019 - 2030
ххх	Zelená domácnostiam	Family houses and residential buildings	Eurofonds, national project	Existing resources 2014- 2023, new period 2021- 2030
xxx	New measure xxx			
ххх	Short-term measures to support target achievement by 2020			2019-2020

financial incentives remain an essential part of funding, as the main incentive tool for continued renovations.

#### Improving the thermal and technical characteristics of residential buildings

This category of measures is a continuation of the measures to renovate apartment blocks. The proportion of renovated apartment blocks in Slovakia at the end of 2016 is more than 58 % of the total. The Update to the Residential and Non-Residential Building Renovation Strategy 2017 shows that with the current renovation rate, all apartment blocks where renovation is possible will have been upgraded by 2029. Therefore, it is important to continue to support the renovation of apartment blocks at least the same rate in the upcoming period. However, it is necessary to take into account the fact that apartment blocks renovated more than twenty years ago will need to be renovated again, in view of the lifetimes of the building materials and structures used.

The most important financial mechanism contributing to the renovation of apartment blocks is the State Housing Development Fund in combination with the use of structural funds. Its continuation into 2021 - 2030 is also expected to be a key factor for meeting energy efficiency targets to 2030. Other important support programmes are Slovseff and Munseff and support for project preparation through the Jessica projects.

Within the Eurofunds, technical equipment of buildings in apartment blocks was subsidised in the form of a grant for the installation of a renewable energy source in an apartment block. In the new programming period, as with family homes, it is planned to continue the Zelená domácnostiam project.

Measure No	Name	Specification	Financial mechanism Source	period
1.2.1	Improving the thermal characteristics of buildings	Residential buildings	ŠFRB (State Housing Development Fund)	2014-2020 2021-2030
1.2.2	Improving the thermal characteristics of buildings	Residential buildings	ŠFRB-JESSICA	Existing measure 2014-2023 The use of Jessica could continue in the next financial period 2021-2030
1.2.3	Improving the thermal characteristics of buildings	Residential buildings	IROP 2014-2020	2014-2020 2021-2023
1.2.4	Improving the thermal characteristics of buildings	Residential buildings	Own funds	2014-2020 2021-2030
1.2.6	Improving the thermal characteristics of buildings	Residential buildings	SlovSEFF III	2014-2020 2021-2030

1.2.7	Improving the thermal characteristics of buildings	Residential buildings	Munseff	2014-2020 2021-2030
1.4.2	New construction to low- energy standard	Residential buildings	Own funds, commercial banks	2014-2020 2021-2030
1.5.1	New build exceeding the minimum legal requirements	Apartments, family houses	Own funds, commercial banks	2014-2020 2021-2030
1.6	New construction to a building standard with near zero energy needs	Apartments, family houses	Own funds, commercial banks	2014-2020 2021-2030
ххх	Zelená domácnostiam	Family houses and residential buildings	Eurofonds, national project	Existing resources 2014- 2023, new period 2021-2030
ххх	New measure xxx			
ххх	Short-term measures to support target achievement by 2020			2019-2020

#### Improving the thermal and technical characteristics of commercial buildings

Non-residential buildings in the private sector are supported by various financial mechanisms. European funds are important for this type of building. Renovation measures have the greatest potential, in particular, for the renovation of those buildings that show the lowest energy efficiency. In this context, this particularly concerns hospitals and medical facilities. The potential of the measure lies also in the possibility of accelerating renovation for those categories of buildings that have financed their renovation exclusively from their own resources. These are mainly shops, wholesalers, hotels and restaurants. The introduction of a suitable form of support for this category of buildings will certainly be one of the decisive factors in the issue of the renovation of buildings, whether it be for owners or investors. Determining a realistic projected value for the potential energy savings depends directly on the value of the aid.

The guaranteed energy service can also make a significant contribution to achieving energy savings in this category, especially given the fact that it is a mechanism that, in most cases, does not count on investment on the part of building owners. Since these are private sector buildings, the basic rules for the use of the guaranteed energy service set out in the Energy Efficiency Act can be used.

Measure No	Name	Specification	Financial mechanism Source	Period
1.3.1	Improving the thermal	Office buildings (except public	Own funds	2014-2020
21012	characteristics of buildings	buildings)	0	2021-2030
1.3.2	Improving the thermal	Schools and educational	Own funds	2014-2020
1.5.2	characteristics of buildings	establishments	Own fullus	2021-2030
1.3.3	Improving the thermal	Hospitals and healthcare	Own funds	2014-2020
1.5.5	characteristics of buildings	facilities	Own fullas	2021-2030
1.3.4a	Improving the thermal	Hotels and Restaurants	Own funds, OP Rural	2021-2023 for SF
1.5.4d	characteristics of buildings	Hotels and Restaurants	Development	2021-2030
1.3.5	Improving the thermal	Wholesale and retail trade	Own funds, commercial	2014-2020
1.3.5	characteristics of buildings	wholesale and retail trade	banks	2021-2030
1.3.6	Improving the thermal	Sports halls and other	Own funds, commercial	2014-2020
1.3.0	characteristics of buildings	buildings intended for sports	banks	2021-2030
1.5.2	New build exceeding the	Office buildings (except public	Own funds, commercial	2014-2020
1.5.2	minimum legal requirements	buildings)	banks	2021-2030
1.5.3	New build exceeding the	Schools and educational	Own funds, commercial	2014-2020
1.5.5	minimum legal requirements	establishments	banks	2021-2030
1.5.4	New build exceeding the	Hospitals and healthcare	Own funds, commercial	2014-2020
1.5.4	minimum legal requirements	facilities	banks	2021-2030
1.5.5	New build exceeding the	Hotels and Restaurants	Own funds, commercial	2014-2020
1.5.5	minimum legal requirements	Hotels and Restaurants	banks	2021-2030
1.5.6	New build exceeding the	Sports halls and other	Own funds, commercial	2014-2020
1.5.0	minimum legal requirements	buildings intended for sports	banks	2021-2030
1 5 7	New build exceeding the		Own funds, commercial	2014-2020
1.5.7	minimum legal requirements	Wholesale and retail trade	banks	2021-2030

A list of measures for the period 2021-2030 in the area of private sector non-residential buildings.

1.7	Provision of energy services in buildings	Private sector commercial buildings	Supplier's own funds, GES provider	2014-2020 2021-2030
ххх	New measure xxx			
ххх	Short-term measures to support target achievement by 2020			2019-2020

Horizontal measures applicable to buildings

Energy efficiency measures relating to buildings in general and applicable across the board to each building or a specific part of a building. These measures are specifically geared to energy savings.

Measure No	Name	Specification	Financial mechanism Source	Period
1.7	Provision of energy services in	Private sector commercial	Supplier's own funds, GES	2014-2020
1.7	buildings	buildings	provider	2021-2030
1.8	Application of legislative	Hot water piping insulation in	Own funds, commercial	2014-2020
1.8	measures - Act No 321/2014	RBs with heat supply	banks	2021-2030
	Application of legislative	Hydraulic regulation of		2014-2020
1.9	measures - Act No 555/2014 and Act No 321/2014	distribution, insulation of pipelines	Own funds, commercial banks	2021-2030
1 10	Application of legislative	Energy certification of	Own funds, commercial	2014-2020
1.10	measures - Act No 555/2005	buildings	banks	2021-2030
1.11	Application of legislative	Regular inspection of heating	Own funds, commercial	2014-2020
1.11	measures - Act No 314/2012	and air-conditioning systems	banks	2021-2030
	Application of legislative	Installation of individual heat		2014-2020
1.17	measures - Act No 321/2014 and Act No 657/2004	metres and radiator meters		2021-2030
	"Major building renovation"		Slovak Ministry of Transport	2014-2020
1.18	information campaign		and Construction, SIEA budget	2021-2030
	MoE, SIEA information campaign			2014-2020
1.19	with an impact on the behaviour of the building user		MoE, SIEA budget	2021-2030
		Monitoring system (change of	7	2014-2020
1.20	Building consumption monitoring	behaviour, information		2021-2030
		campaigns), duration 2 years		
		Household electricity		2014-2020
1.21	Application of legislative measure	suppliers' information	Own funds	2021-2030
		campaign		
xxx	New measure xxx			
xxx	Short-term measures to support target achievement by 2020			2019-2020

The new building requirements will require more funding to meet the set objectives. With an anticipated 20 % share of energy savings from the total estimated savings from the measures implemented in the period 2021 - 2030, this represents an amount of 1.97 billion €, but this may not be the final value.

#### 2. Planned actions in industry

The most important sector in terms of achieving energy savings through measures implemented from 2021 will be industry. The projected share of energy savings in total savings generated by measures implemented from 2021 is almost 58 %, which represents 362 GWh per year. This potential consists mainly of medium-term return measures and partly of long-term return measures.

The common denominator of the key actions proposed for 2021-2030 is to strengthen the incentive for industrial enterprises to implement measures to the extent necessary to ensure fulfilment of the target in Art. 7 of the Energy Efficiency Directive.

The means to achieve the target will be to set up an incentive system that, when providing different forms of support, takes account of the stakeholder engagement in energy saving. An important aspect will be the promotion of the interest of industrial enterprises to exchange among themselves selected kinds of information on energy-saving projects implemented. At the same time, this system should support the implementation of cross-sectional technological measures and also look for additional possibilities to

generate energy savings, not only in investment projects, but also in operations, maintenance and other business areas.

Measure No	Name	Specification	Financial mechanism Source	period
5.1.3	Innovation and technology transfer in industrial plants		OP R&I 2014-2020	2014-2020 2021-2023
5.2.3	Increasing the energy efficiency of industrial production		SlovSEFF III	2014-2020 2021-2030
5.3.1	Implementation of energy efficiency measures from energy audits	PO 2. Promoting energy efficiency and use of RES in enterprises (b)	OP QoE 2014-2020	2014-2020 2021-2023
5.3.2	Implementation of energy efficiency measures from energy audits in SMEs, Bratislava region		Subsidy under MoE	2014-2020 2021-2030
5.4	Support for energy audits for SMEs in Bratislava region		Subsidy under MoE	2014-2020 2021-2030
5.5	Application of legislative measures		Mandatory energy audits in industrial enterprises, including management	2014-2020 2021-2030
5.6	Voluntary agreement on energy savings	Contractual relationship with Slovak Ministry of the Economy	Own funds	2021-2030
5.7	Support for the introduction of EN ISO 50001 energy management systems		Own funds, OP QoE 2014- 2020	2014-2020 2021-2023
5.8	Establishment of an energy manager in undertakings		Own funds of undertakings	2014-2020 2021-2030
5.9	Incentives for industry		State Budget	2014-2020 2021-2030
5.10	Analysis - energy saving in industry		MoE budget	2014-2020 2021-2030
ххх	Support for projects with a significant impact on the reduction of the energy intensity of a company			
ххх	"Share and win"			
ххх	Raising awareness of GES in SMEs, supporting the implementation of measures			
ххх	Develop a model of voluntary energy savings agreements			
ххх	Measures from new EU funds			2021-2027
ххх	Short-term measures to support target achievement by 2020			2019-2020

A list of existing measures with a proposal for their retention into 2021-2030

Reaching ambitious targets in industry will inevitably be associated with an increase in overall costs. This is due to the fact that cost-effective measures have already been implemented in most cases and, in the future, the implementation of medium- and long-term return measures is envisaged. With an increase in the investment cost associated with the implementation of medium- and long-term measures aimed at reducing energy intensity as well as the energy savings potential of these categories, the total value of investments for the period 2021-2030 for industry is estimated at 2.47 billion. €.

#### 3. Planned public sector measures

The projected share of energy savings in the public sector to total savings generated by measures implemented from 2021 will be around 9 % in the public sector. A significant change in this sector may be brought about by the increase in guaranteed energy services. This projection is based on the fact that more recently, the key barriers that prevented the use of energy services in the public sector have been eliminated to a large extent. The largest contribution from guaranteed energy services is expected in the Bratislava region, i.e. in a region where structural funds cannot be used. As regards public sector areas for achieving energy savings, public buildings and public lighting are key.

These measures need to be broadened in particular with a further expansion of GES in the public sector in connection with the new Eurostat guidelines, the option for technical assistance to state and public authorities, training requirements for experts, in particular in GES provision, public procurement and the development of energy audits for the renovation of public buildings and public lighting, as well as information programmes for state and public administration bodies, including simple conversion tools to quickly identify suitable projects.

From an analytical point of view and in terms of monitoring energy savings, it is necessary to establish coherent and interconnected lists of state and public buildings with information on their condition, options for renovation and options for using GES or other funds or a combination thereof for these buildings. This information should also be extended to public lighting, which is also a not insignificant part of the public sector.

Key measures for reducing energy intensity in the public sector in 2021-2030:

#### Provision of energy services for the public sector

Reducing energy consumption is achieved by implementing guaranteed energy service projects implemented by a provider of guaranteed energy services for the public sector under an energy efficiency contract with guaranteed energy savings for the public sector. Repayment of the investment is assumed from sources that the GES beneficiary would use to cover energy costs in the future.

The concept of the development of guaranteed energy services in the public sector, elaborated by the Slovak Ministry of Finance in cooperation with the Slovak Ministry of the Economy and related legislative, conceptual and support measures for public sector entities, i.e. state and public administration, can be considered as a significant incentive in this respect. Guaranteed energy services can be used primarily for the renovation of public buildings and the renovation of public lighting.

The opening up of the options of using the guaranteed energy service for the public sector has been made possible by the Eurostat methodological guidelines of 27 September 2017 and the methodological guide to these guidelines, issued on 8 May 2018. Based on these, Slovakia is preparing a model contract for the public sector, which should be assessed by Eurostat in order to meet the parameters necessary for the use of guaranteed energy service in the public sector without any impact on state public debt.

#### Improving the thermal characteristics of public buildings

The measure is a continuation of existing measures aimed at renovating public buildings through investment. The most important financial mechanisms that have contributed to the growth in public building renovation are Envirofond, Munseff and the structural funds. In order to ensure the continuity of energy savings through the renovation of public buildings, it is necessary to continue with the existing funding possibilities but, in particular, to set up new financial mechanisms that could adequately cover the financial requirements for the renovation of public buildings and the fulfilment of the public buildings renovation target.

According to the Annual Energy Efficiency Report, more efforts are needed on renovating public buildings, as the 3 % annual floor area renovation target for public buildings (state administration buildings) is not being met on an annual basis, although the cumulative target from 2014 to 2017 was met. The Slovak Republic has set the energy savings target indicated in the Notification Report in the alternative way in line with Article 5(6) of Directive 2012/27/EU, on energy efficiency, in line with the interpretative note of the Directive for Article 5.

In 2019 and 2020, the goal is to achieve the required 3 % renovation in the full amount of the target, or more exactly, the equivalent in energy units. This target also applies to the years 2021 to 2030 and the Slovak Republic will continue to fulfil this objective.

#### Modernisation of public lighting

#### Promotion of green public procurement

#### A list of existing measures with a proposal for their retention into 2021-2030

Measure No	Name	Specification	Financial mechanism Source	Period
3.1.2.	Improving the thermal characteristics of public buildings	Health facilities	Public resources	2014-2020 2021-2030
3.6	Improving the thermal characteristics of public buildings	Administrative buildings, school buildings and school facilities, medical facilities	OP QoE 2014-2020	2014-2020 2021-2023
3.7.1	Improving the thermal characteristics of public buildings	Administrative buildings of state administration (relevant)	State administration budget chapters	2014-2020 2021-2030
3.7.2a	Improving the thermal characteristics of public buildings	Administrative buildings of state administration (state administration directly without relevant ones)	Own resources budget headings	2014-2020 2021-2030
3.7.2b	Improving the thermal characteristics of public buildings	Administrative buildings of organisations within the scope of state administration	Own resources budget headings	2014-2020 2021-2030
3.9	Improving the thermal characteristics of public buildings	Ekofond	Ekofond	2014-2020 2021-2030
3.10	Improving the thermal characteristics of public buildings	Munseff	Munseff	2014-2020 2021-2030
3.11	Improving the thermal characteristics of public buildings	Activity L3: Increasing the energy efficiency of existing public buildings, including insulation	Envirofond	2014-2020 2021-2030
3.12	Implementation of the energy efficiency principle in public procurement			2014-2020 2021-2030
3.13.2	Modernisation of public lighting		Munseff	
3.13.4	Modernisation of public lighting		Municipality and town funds	2014-2020 2021-2030
3.14	Provision of energy services for the public sector		Supplier own funds	2014-2020 2021-2030
3.15	E2 training programme in state administration – SIEA		SIEA budget	2014-2020 2021-2030
3.16	Support for the construction of nearly zero-energy buildings in the public sector			2014-2020 2021-2030
3.17	Supporting documents for the leading role of the public sector			2014-2020 2021-2030
3.18.1	Development, approval and implementation of plans for sustainable energy and reduction of greenhouse gas emissions	Priority axis	OP QoE 2014-2020 (outside Bratislava region)	2014-2020 2021-2023
3.18.2	Development, approval and implementation of plans for sustainable energy and reduction of greenhouse gas emissions	Priority axis	Subsidy under MoE (Bratislava)	2014-2020 2021-2030
3.19	Introduction of systems for energy management, energy audits and environmental management	Priority axis	OP QoE 2014-2020 (outside Bratislava region)	2014-2020 2021-2023
3.20	Support for energy services development at regional and local level	Priority axis	OP QoE 2014-2020 (outside Bratislava region)	2014-2020 2021-2023
3.23	Energy audits of selected central government buildings		Own resources budget headings	2014-2020 2021-2030
3.24	Extension of surveying under Green Public Procurement by the quantification of annual energy		MEnv	2014-2020 2021-2030

	savings and financial resources incurred			
	Support funding from EU-funded			2014-2020
3.25.2	public-private partnership projects			2014-2020
	Improving the thermal			2014-2020
3.26.1	characteristics of public buildings	Health and social facilities	IROP 2014-2020	2014-2020
	Improving the thermal	Schools and educational		2014-2020
3.26.2	characteristics of public buildings	establishments	IROP 2014-2020	2021-2023
3.26.3	Improving the thermal characteristics of public buildings	Kindergarten, elementary schools, social and community facilities	OP BK 2007-2013, measure No 1.1	completed
3.27	Improving the thermal	Kindergartens and community	OP Human Resources, Priority	2014-2020
3.27	characteristics of public buildings	centres	axis 6	2021-2023
3.28	Improving the thermal	Research infrastructure	OP R&I 2014-2020	2014-2020
3.28	characteristics of public buildings	facilities:	UF NQI 2014-2020	2021-2023
3.30	Change in user behaviour		SIEA budget	2014-2020
5.50	(monitoring system)	Public buildings only		2021-2030
3.29	New build exceeding the minimum	Administrative buildings (public	Own funds	2014-2020
5.25	legal requirements	only)	Own funds	2021-2030
3.31	Improving the thermal	Schools and educational	Own funds, commercial banks	2014-2020
5.51	characteristics of public buildings	establishments	own runus, commercial banks	2021-2030
3.32	Improving the thermal		Own funds, commercial banks	2014-2020
5.52	characteristics of public buildings	Health facilities	own runus, commercial banks	2021-2030
3.33	Improving the thermal	Administrative buildings (public	Own funds, commercial banks	2014-2020
5.55	characteristics of public buildings	only)	own runus, commercial banks	2021-2030
ххх	Concept of GES development in the public sector			2018-2030
	Technical Assistance for state and			2019-2030
XXX	public administration			
VVV	Training of experts specialising in			2014-2020
XXX	public administration projects			2021-2030
xxx	List of buildings in state and public			
***	administration			
VVV	Information and support activities			
XXX	for state and public administration			
ххх	Public sector performance			2017-2030
ххх	Short - term measures to support target achievement by 2020			2019-2020

#### Other energy efficiency in buildings sector

The most important energy efficiency measures in buildings (including public buildings) include:

- Support programmes and other fiscal incentives support for the renovation of buildings from national funds, (State Housing Development Fund, state premiums for building saving, insulation of family houses), sources of structural funds (e.g. ROP, OP R&D, OP Health, IROP, Munseff I, II, Slovseff I, II, III and other initiatives).
- Legislative measures the obligation to ensure hydraulic balancing of the building's heating system after each intervention in its thermal protection or technical system, to ensure the regulation of the heat supply in the building, to ensure and maintain hydraulically regulated hot water distribution (buildings above 1000 m<sup>2</sup>), to equip heat and hot water piping with thermal insulation (buildings over 1000 m<sup>2</sup>), the obligation to provide regular inspection of heating systems and air-conditioning systems.
- Further support measures in the building sector include information campaigns of the Slovak Ministry of Transport and Construction, SIEA, and advice from the "Live Energy" programme.

The current measures and funds for the renovation of public buildings and the fulfilment of the objective are not sufficient. Support programmes and new funding sources (such as GES) are necessary to further increase the renovation of public buildings. The total estimated amount of funds for measures in the public sector *for the period 2021 - 2030 is 1.24 billion EUR* 

#### 4. Planned transport measures

With regard to the design of measures to reduce energy intensity, it is important that these measures reflect as far as possible the objectives defined in the Strategic Roadmap for Transport Development to 2030. Such objectives include in particular:

- an increase in the share of public passenger transport, in particular passenger rail transport, by transferring journeys from individual passenger transport,
- increasing the share of rail freight by transfer from road freight,
- improving the efficiency of rail transport operations.

The main measures to achieve these objectives continue to be the modernisation of transport infrastructure including intermodal freight terminals, the modernisation of vehicles for public passenger transport and the improvement of public transport coordination by enhancing the role of rail transport as a carrier as well as by building integrated transport transfer terminals and intermodal terminals.

The Slovak Ministry of Transport and Construction will implement these measures in particular through the Integrated Infrastructure Operational Programme (OPII), which supports the construction and reconstruction of energy-efficient infrastructure and public passenger transport through the purchase of energy efficient public transport vehicles. According to the Energy Efficiency Action Plan for 2017-2020, cumulative savings of 2 2254.71 TJ (sic) will be achieved by implementing these measures. Subsequently, the new operational programme for 2021-2027 will be continued.

Through OPII, the following in particular are being implemented:

- support for the completion of a comprehensive network of road infrastructure (motorways and roads that are part of TEN-T), II. and III. class roads,
- modernisation of the major TEN-T railway routes,
- elimination of bottlenecks and critical accident blackspots,
- promoting the creation and deployment of integrated transport systems
- promoting the development of non-motorised transport in accordance with the National Strategy for Cycling and Cycling Tourism Development in the Slovak Republic,
- promoting vehicles with lower unit fuel consumption and lower CO<sub>2</sub> emissions,
- promoting a progressive reduction in road freight (charging for road infrastructure).

As part of the renewal of the OPII railway vehicle park, 21 new diesel trains and 25 electric units are being manufactured, which will be gradually deployed on lines from May 2019 until the end of 2020. Urban public transport projects in Bratislava and its surroundings, Košice and surroundings, Prešov, Žilina and Banská Bystrica and the construction of integrated passenger transport terminals are also being implemented.

In Košice, a project for the modernisation of 7.9 km of tram track is being implemented and 13 modern tram sets are being purchased as part of the reconstruction of city transport. In Prešov 5 new solo trolleybuses and 10 articulated trolleybuses are being purchased. Trolleybus purchase is also the focus of a project in Žilina: the purchase of 12 articulated low-floor (easy access) trolleybuses and 3 solo low-floor trolleybuses. In Bratislava, 15 uni-directional tram sets are being purchased. In addition, development of 8 integrated passenger transport terminals (Bratislava and surroundings, Trebišov) is under way. In addition, the Slovak Ministry of Transport and Construction is also working with the regions on the preparation and approval of Regional Integrated Territorial Strategies that constitute an IROP NFC Implementation Document for the preparation of Sustainable Mobility Plans, as well as the

implementation of the harmonisation and coordination of public passenger transport between suburban bus and rail transport, reinforcing the role of rail transport as a carrier.

As part of the support for electromobility, the Slovak Ministry of the Economy is preparing an Action Plan for the Development of Electromobility in the Slovak Republic, based on the National Policy Framework for the Development of Alternative Fuels (Government Resolution No 504/2016). The Action Plan is a package of support measures which aims to ensure that consumers perceive low-emissions mobility as unproblematic, while accelerating the deployment of the relevant infrastructure. The measures have the character of direct support for the purchase of highly eco-friendly low-emission vehicles, support for infrastructure construction, as well as the character of incentive support, such as distinguishable vehicle designation, use of lanes restricted to public transport, or permitting access to low-emission zones or use of car parks for a restricted group of users.

In 2019-2020, the Slovak Ministry of the Economy plans to continue in its support for renewal with loweremission cars and to provide subsidies for electric cars and plug-in hybrids where energy efficiency is projected to increase. In addition, as part of the amendment to Act No 71/2013, on the provision of subsidies within the competence of the Slovak Ministry of the Economy, the Ministry is preparing a call to promote the construction of publicly available charging stations for electric cars for municipalities and local authorities. Additional funds for infrastructure construction can be drawn down as part of the Connecting Europe Facility, used, for example, to build filling stations for CNG and LNG (SPP a.s.) and charging stations (Západoslovenská energetika a.s., Greenway a.s.).

As part of the promotion of non-motor transport, strategic and conceptual projects are being implemented in support of cycling, the National Platform for Support of Non-Motor Transport, National Cycling Strategy, a study of cycling development, etc. Specific projects include Bike sharing in Slovak cities, the Going to Work by Bicycle programme, etc.

The average investment intensity in transport is 10,000 €/MWh.

Key planned transport measures

- Renewal and upgrading of the vehicle park,
- Building and upgrading transport infrastructure
- •

A list of existing measures with a proposal for their retention into 2021-2030

	Name	Specification	Financial mechanism Source	Period
(	Renewal and upgrading of the vehicle park	Railway transport	OPT 2007-2013	completed
4.1.1b	Renewal and upgrading of the vehicle park	Railway transport	IROP 2014-2020	2014-2020 2021-2023
4.1.1c	Renewal and upgrading of the vehicle park	Replacement of vehicle fleet — bus /trolleybus transport	OP Env 2007-2013, IROP 2014-2020	2014-2020 2021-2023
4.1.1d	Renewal and upgrading of the vehicle park	Replacement of vehicle fleet — bus transport	IROP 2014-2020, VÚC	2014-2020 2021-2023
4.1.2	Renewal and upgrading of the vehicle park	Bus transport	OP Env 2007-2013, IROP 2014-2020	2014-2020 2021-2023
4.2	Building and upgrading transport infrastructure (contd.)		OPT 2007-2013, IROP 2014-2020	2014-2020 2021-2023
4.3	Promoting the development and use of public passenger transport, including support for the creation of integrated transport systems		OPII 2014-2020, IROP 2014-2020	2014-2020 2021-2023
4.4.	Support for the development of non- motorised transport, especially cycling		IROP 2014-2020	2014-2020 2021-2023
4.5.1.	Public transport — renewal of trolleybuses in Žilina		Munseff	2014-2020 2021-2030

4.5.2.	Public transport — renewal of trolleybuses	 IROP 2014-2020	2014-2020 2021-2023
ххх	Intermodal terminals		
ххх	Supporting the development of rail transport as a carrier		
ххх	Trains free of charge		
ххх	Support for the development of electric vehicles, action plan to support electromobility		
ххх	Electric vehicles sales support		1.1.2017- 30.6.2018
ххх	Directive 2018/844/EU on the energy performance of buildings - electromobiles		~
ххх	Sustainable mobility plans		
ххх	Bike sharing		
ххх	Going to Work by Bicycle		
ххх	Short - term measures to support the achievement of the 2020 target		2019-2020
ххх	Action Plan for the Development of Electromobility in the Slovak Republic (in preparation)		2019-2020
ххх	Subsidies for the purchase of electric cars and plug-in hybrids	MoE budget	2019-2020
xxx	Subsidies to support the building of publicly available charging stations for electric cars	MoE budget	2019-2020

Current measures and funds to support energy efficiency measures lag behind the rapid pace of transport development. Therefore, the transport sector is the only sector in which energy consumption is rising in the long term. To reverse this trend, we still need to take a number of measures and systemically set up support for energy efficiency measures in transport. It is also necessary to determine which transport development measures also bring about energy savings and thus savings in emissions. These measures must be in line with the basic principles and prerequisites defined for the development of transport in coming years, especially for 2021-2030. Reducing the burden on the environment will be key for this sector. From the financial point of view, sufficient funds will need to be earmarked to change the trend in transport consumption, which will require a major effort in the future, supported by adequate funding. The estimated value of this for 2021-2030, with an estimated share of energy savings of 6.1 % against total savings to be generated from measures implemented after 2020, is based on preliminary analyses at about 3.86 billion.  $\in$ .

#### 5. Planned appliance measures

The basic measures for appliances are a change in white goods technology and the promotion of energy-saving lighting. Information and promotion campaigns for energy labelling need to be put in place, in line with the requirements of the Energy Labelling Regulation.

In the appliances sector, the change in white goods technology, the installation of energy-saving lamps and a tightening of the minimum technical requirements on the part of the EC in the framework of the ecodesign and labelling legislation are expected to continue. In the future, the Slovak Ministry of the Economy and SIEA, in cooperation with CECED, plan to monitor other types of appliances in the white goods segment (i.e. not just refrigerators and freezers, but also washing machines, vacuum cleaners, dishwashers, etc.). It will also be necessary to introduce monitoring of other appliances (e.g. electrical goods) and support for the monitoring of discarded appliances for energy efficiency purposes.

A list of existing measures with a proposal for their retention into 2021-2030

Measure No	Name	Specification	Financial mechanism Source	period
2.1	Replacement of white goods		Own funds	2014-2020 2021-2030
2.2	Energy-saving lighting - voluntary agreements		Own funds	2014-2020 2021-2030
2.3.	Replacement of electrical and electronic equipment in private households		Own funds	2014-2020 2021-2030
2.4.	Renewal of office equipment		Own funds	2014-2020 2021-2030
2.5.	Application of legislative measures	Energy labelling, Ecodesign	MoE, SIEA, AppliA budget	2014-2020 2021-2030
2.6	Information campaigns focusing on efficient appliances	APPLiA, consumer associations, traders, MoE, SIEA	MoE, SIEA, AppliA budget	2014-2020 2021-2030
2.7	Introduction and operation of a system to monitor the replacement of white goods and other appliances and equipment on the market	APPLIA	MoE, SIEA, AppliA budget	2014-2020 2021-2030

Implementation of the aforementioned measures with an emphasis on meeting energy efficiency targets for the SR from the Energy Efficiency Directive will be associated with total costs of about 342 mil. € for the period 2021 - 2030. These costs should generate energy savings of around 512 GWh, representing an approximate 8 % share of total energy savings for Art. 7 of the Energy Efficiency Directive achieved by measures implemented from 2021 onwards.

#### Measures from the 35 % exemption for Art. 7

#### 6. Planned measures in the energy transforming, transmission and distribution ('TTD') sectors

The planned measures are described in the chapter "Description of measures to develop measures to utilise energy efficiency potentials of gas and electricity infrastructure"

#### 7. Planned heating measures

Planned actions:

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- Construction, renovation and upgrading of heat distribution pipes
- The construction, reconstruction and upgrading of electricity and heat production plants with high efficiency cogeneration with a maximum heat input of up to 20 MW to reduce the consumption of primary energy sources for electricity and heat generation
- "Greening" of heat generation and promoting the introduction of renewable energy sources in the heat mix, with the aim of converting to a low-carbon economy and reducing the share of greenhouse gas and pollutant emissions

Long-term renovation strategy to support the renovation of the national stock of residential and non-residential buildings, both public and private<sup>24</sup>, including policies, measures and actions to stimulate cost-effective deep renovation and policies and actions to target the worst performing segments of the national building stock, in accordance with Article 2a of Directive 2010/31/EU

The fundamental conceptual and strategic document which has been prepared in order to define the investment possibilities of the reconstruction of the building stock in the Slovak Republic and the financing options, is the Strategy for the Renovation of the Residential and Non-Residential Buildings

Stock in the Slovak Republic (approved by Government Resolution No 347/2014). On the basis of the requirement under Directive 2012/27/EU, Act No 321/2014, as well as task C.2. resulting from Government Resolution No 398/2014 on this Act, the Slovak Ministry of Transport and Construction has prepared an update, which was approved by Government Resolution No 230/2017.

iii. Description of policy and measures to promote energy services in the public sector and measures to remove regulatory and non-regulatory barriers that impede the uptake of energy performance contracting and other energy efficiency service models<sup>25</sup>

Since 1 December 2014, energy services have legislative support in the Energy Efficiency Act. This law introduced, in Sections 15 to 20, an entire system for the definition and support of energy services. Energy services are divided into support energy services and guaranteed energy services - energy services with guaranteed energy savings, which are further specified when it is a guaranteed energy service for the public sector.

#### Support energy service

A support energy service is specified in Section 16 and its subject is in particular advice, education and provision of a similar kind of services in order to improve energy efficiency.

#### Guaranteed energy service

Energy services as such have since 1 December 2014 legislative support under Act No 321/2014, on Energy Efficiency and on a change and addition to certain laws ("Act No 321/2014 on Energy Efficiency"). This law introduced, in Sections 15 to 20, an entire system for the definition and support of energy services. On its website<sup>26</sup> the Slovak Ministry of the Economy maintains GES provider lists as well as a list of professionally qualified persons performing a guaranteed energy service. The method for enrolling on the list is dealt with in the form of Decree No 99/2015 of the Slovak Ministry of the Economy, on providers of support and guaranteed energy services. GES is an energy service provided under an energy efficiency contract with guaranteed energy savings, i.e. energy efficiency contracts. The providing of an energy service with guaranteed energy savings is a regulated trade. The Act also lays down the mandatory content of an Energy Efficiency Contract if the provision of the energy service relates to the public sector. The Slovak Innovation and Energy Agency also promotes public awareness of the development of the energy service. It also provides training and update training for a professionally qualified person to provide a guaranteed energy service and advises a public entity on the options for implementing measures to improve energy efficiency within its competence, in particular on the use of an energy service to finance energy efficiency improvement measures and improve energy efficiency over the long term. Energy service providers are required to send energy service data for the preceding calendar year to the energy efficiency monitoring system.

GES is a contract between a GES provider and GES beneficiary, as defined by Act No 321/2014, on Energy Efficiency.

<sup>&</sup>lt;sup>26</sup> <u>http://www.economy.gov.sk/energetika/energeticka-efektivnost/poskytovanie-energetickej-sluzby</u>

#### Table 19: Energy savings achieved through energy services in the Slovak Republic

Energy savings achieved through energy services	2014	2015	2016	2017
	[נד]	[נד]	[נד]	[נד]
Provision of energy services in the buildings sector (except public buildings)	5.67	4.22	70.61	22.23
Provision of energy services for the public sector	22.64	40.64	14.93	1.1

Processed according to: Energy Efficiency Monitoring System, SIEA 2018

#### **Obstacles and barriers:**

In 2012-2014, barriers to the development of energy services in the Slovak Republic were identified, such as poor awareness of GES, a low level of confidence in GES providers and the lack of a basic regulatory framework. Some of these barriers were removed by Act No 321/2014, on Energy Efficiency, which introduced the basic system for the provision of an energy service, established the institution of a professionally competent person for the provision of a guaranteed energy service and the content of the energy efficiency contract for the public sector, as well as information obligations for the Slovak Innovation and Energy Agency. The fundamental political and regulatory barriers to energy services have thus largely been removed.

#### A major barrier to the development of the energy service in the past

One of the key barriers to GES was the issue of private sector capital expenditure on public buildings under a GES contract, which, according to the interpretation until recently of Eurostat, increased public debt. Any financing secured by a GES provider was thus counted as a loan provided to the public sector, thereby increasing public debt and the deficit. In the context of assessing the priorities that can be financed within the limits of public sector debt, GESs have generally been put to the back of the queue. This was not a specific just of the SR; the same problem also applied to other EU Member States. As a result of discussions at European Commission level, to which Slovakia has also contributed significantly, Eurostat's methodological guidance of 19 September 2017 was published, which allowed for a system of energy service use in the public sector that does not lead to an increase in public debt. In the user manual of 8 May 2018, Eurostat, in co-operation with the European Investment Bank, subsequently detailed requirements to be met by GES contracts in order for them to be recorded outside the public finance sector, i.e. without any impact on public debt.

#### Policies and Measures (PaMs)

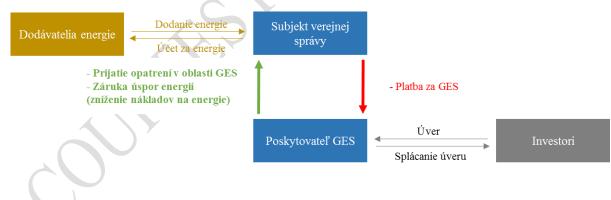
The new methodology and user manual have significantly improved the conditions for the use of GES in the public sector. Based on this, a Concept of Development of Guaranteed Energy Services in the Public Administration of the Slovak Republic, which was approved by the Government of the Slovak Republic on 10 July 2018, was created.

Thereafter, a modification was prepared to the legislative framework, allowing the use of GES according to Eurostat rules. The amendment to Act No 321/2014, on Energy Efficiency, approved by the Slovak National Council on 6 December 2018 contains the necessary adjustments for the use of GES in the public sector in accordance with the Eurostat methodological manual and amendments to other related legislation concerning the management of state, municipalities and towns and local authority assets. A model contract, which will be approved by Eurostat, is under preparation. The SIEA is preparing a project entitled Technical Assistance and Aid for State and Public Administration to identify, in particular, building and public lighting renovation projects suitable for the use of GES in the public sector.

The GES model for the public sector is illustrated in a simplified way in the figure below.

Decision to upgrade building via EPC	<ul> <li>Identification of building upgrade requirements by administrator</li> <li>Analysis of possible upgrade variants</li> <li>Evaluation of potential to implement upgrade through EPC</li> <li>Decision to upgrade via EPC</li> <li>Depending on scope, possible to work with a specially selected consultant</li> </ul>	<u>Responsible</u> : Administrator
PP for professional consultant	<ul> <li>Time approx. 3 months</li> <li>Costs approx. 5 % of the estimated value of the upgrade project</li> <li>Consultant must be authorised by the Slovak Min of the Economy (energy auditor/or GES provider)</li> </ul>	<u>Responsible</u> : Administrator
Preparation of documents on PP for ESCO company	<ul> <li>Energy analysis of the building and measurement should be performed during the heating season</li> <li>Technical condition of the building and identification of needs and scope of upgrade, opinion of relevant authorities (conservationists, etc.)</li> <li>Determination of baseline consumption value and minimum savings value</li> <li>Estimated investment costs</li> <li>Draft contract (based on a standard contract)</li> </ul>	<u>Responsible</u> : consultant in cooperation with the administrator
PP for ESCO Company	<ul> <li>Form - either simpler (public tender, about 3 months) or more complex (negotiated procedure with publication, about 6 months)</li> <li>Terms of participation: authorization from Slovak Min. of the Economy, references, experience, capacities</li> <li>Evaluation criteria: either cost per unit savings, or 55 % savings and 45 % overall price, can also be the quality of implementation/appearance</li> </ul>	<u>Responsible</u> : Administrator and/or consultant
Implementation + Operation and Monitoring	<ul> <li>Project documentation for successful solution</li> <li>Construction permits</li> <li>Funding</li> <li>Implementation (independent building supervision)</li> <li>Monitoring and public awareness</li> </ul>	<u>Responsible</u> : ESCO

#### Figure 4b A simple schematic representation of the provision of guaranteed energy service.



Key:	
Dodavatelia energie	Energy suppliers
Dodanie energie	Energy supply
Účet za energie	Energy bill
<ul> <li>Prijatie opatreni v oblasti GES</li> </ul>	- Adoption of GES measures
<ul> <li>Záruka úspor energii (zniženie nákladov na</li> </ul>	- Guarantee of energy savings (reduction in energy
energie)	costs)
Subjekt verejne správy	Public administration body
Poskytovateľ GES	GES provider
Platba za GES	GES payment
Úver	Loan
Splácenie úveru	Loan repayment
Investori	Investors

iv. Other planned policies, measures and programmes to achieve the **indicative national energy efficiency contributions** for 2030 as well as other objectives referred to in point 2.2 (for example measures to promote the exemplary role of public buildings and energy-efficient public procurement, measures to promote energy audits and energy management systems<sup>27</sup>, consumer information and training measures<sup>28</sup>, and other measures to promote energy efficiency<sup>29</sup>)

Slovakia meets its energy efficiency objectives through cross-sectional measures that have an impact on several sectors of the national economy. There are several such measures, but the most important ones are:

- Monitoring the obligation to procure products and services with high energy efficiency is stipulated by Act No 343/2015, on Public Procurement and on a change and additions to certain laws, as amended.
- Continuation of "Energy Auditor" training courses

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- Promoting activities to share and exchange energy-efficiency experience with other Member States
- Raising the awareness of children and young people in the field of energy efficiency
- Support for information campaigns focusing on energy efficiency
- Enlargement of the energy efficiency monitoring system
- Energy Consulting providing information on energy efficiency and project funding options
- Analyses of potential energy savings in sectors of the national economy
- Analyses focused on the impact of energy efficiency on selected aspects, areas of the national economy
- Introduction of qualification schemes in the fields of energy efficiency and energy use
- Introduction of accreditation and certification systems

v. Where applicable, a description of policies and measures to promote the role of local renewable energy communities in contributing to the implementation of policies and measures in points i, ii, iii and iv

Will be completed, in line with current status, in the final version of the national energy and climate plan.

vi. Description of measures to develop measures to utilise energy efficiency potentials of gas and electricity infrastructure<sup>30</sup>

#### Description of measures to utilise energy efficiency potentials of gas and electricity infrastructure

An assessment of the energy efficiency of the electricity and gas infrastructure is introduced in the form of an obligation for the individual market participants who do business in accordance with the requirements of Act No 251/2012, on the energy sector in the field of electricity and gas, and who operate electricity or gas infrastructure.

#### **Electrical Power**

In the electricity sector, the energy efficiency potentials of the transmission system operator and the distribution system operators was assessed. The assessment was carried out by entities involved in the operation of the transmission system and distribution systems.

The main contributors to the increase of energy efficiency in the electricity sector include the transmission system operator, Slovenská elektrizačná prenosová sústava, a. s. (Slovak Electric Transmission System (SEPS)) and the distribution system operators.

The primary objective of SEPS is to ensure the security and reliability of electricity supplies within the defined territory and the fulfilment of international obligations arising from membership of ENTSOE. At the same time, however, it proposes and implements measures contributing to reduced system losses and thus decreasing energy intensity; building new lines and restoring older ones in order to ensure a decrease in transmission impedance and a gradual phase-out of the 220 kV system and its replacement by a 400 kV system. Specific projects are listed in the Ten-Year Plan for the Development of the Transmission System for 2015-2024, which sets out investment plans over the next 10 years for the needs of electricity transmission is assessed on the basis of annual balancing data for the transmission system.

In the Slovak Republic, electricity distribution is currently secured by three regional distribution systems (eastern, central and western Slovakia) and about 150 district (local) distribution systems. Evaluation of the energy efficiency of distribution systems is carried out in accordance with the requirements of Act No 321/2014, on Energy Efficiency and Slovak Ministry of the Economy Decree No 88/2015, establishing the scope for the evaluation, method of calculation and the value of the energy efficiency of the sources and distribution of energy, which replaced Decree No 428/2010.

Under current Slovak legislation, distribution system operators are responsible, in terms of increasing energy efficiency, for:

In accordance with Article 15(2) of Directive 2012/27/EU.

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- calculating the energy efficiency of the distribution system and sending this to the energy efficiency monitoring system,
- introducing smart metering systems in line with Decree 358/2013,
- installing HV/LV transformers in line with Commission Regulation No 548/2014, implementing Directive 2009/125/EC on ecodesign, with regard to small, medium and large power transformers,
- a plan for the development of the distribution system, which under the Energy Act must be sent each year to the Slovak Ministry of the Economy by distribution system operators with more than 100 thousand supply points,
- implementation of the Regulatory Office for Network Industries (URSO) methodological guideline No 05/12/2015 of 11 June 2015

Main measures by which distribution system operators contribute to increasing energy efficiency:

- replacement and modernisation of existing equipment, in particular the replacement of transformers
- installation and deployment of smart metering in systems
- reconstruction of electrical sub-stations
- optimisation of the operation and number of transformers depending on the projected electricity consumption in a given system
- introduction of control and diagnostic processes in the system
- reactive power compensation and implementation of automatic compensation control
- replacement of very high voltage cables, high voltage and low voltage cables
- distribution mapping and upgrading of distribution cabinets
- replacement of lights with LED lighting and installation of motion sensors for lighting
- installation of remote data collection devices
- improving the energy efficiency of the buildings in which these devices are located.

The level of investment in these types of measures in both regional and district (local) distribution systems amounts annually to approximately 90 million EUR, around which limit the figure oscillates in the planned years. This trend can be expected to be maintained over the next 10 years.

#### Gas industry

In the field of gas, the assessment was carried out by the transmission system operator, by the gas distribution network operators as well as by the gas storage operators. The necessary investments identified in the gas industry are about 30 mil. EUR for the entire ten-year period, to which the large investment projects of cross-border interconnections referred to in the Ten-Year Network Development Plan for Gas Transport (TYNDP) need to be added.

*The transmission system operator eustream, a.s.* performed most of the key measures in 2005-2015. This was mainly optimising the operation of the transmission network and optimising the compressor technology.

The major projects contributing to the reduction of energy demand, whose implementation is planned for the future, include the modernisation and reconstruction of gas transportation technology:

- modernisation of the compressor station control system
- redesign of RENet compressor stations
- further improvements to the accuracy and objectivity of measuring systems
- increased operational safety

• increased flexibility of the transport network associated with new cross-border interconnections that have been opened in the last three years, or are planned.

Distribution of gas is provided by approximately 50 distribution network operators. Evaluation of the energy intensity of gas distribution is elaborated in accordance with Slovak Ministry of the Economy Decree No 88/2015.

Among the most important planned measures are:

- introduction of a switch-off, switch-on regime for the heating of natural gas volume flow depending on the size of distribution
- replacement of boilers needed for gas heating
- optimisation of compressor performance, data and network pressure measurement and remote transmission.
- insulation of heat conduits and exchangers
- improved energy efficiency of the operation of heating in control stations
- control of gas conversion and preheat and gas heating control, control of route closure, gas pipeline tightness; additional insulation of pipelines
- introduction of intelligent metering systems in gas distribution and supply

As their key measures, gas storage operators have identified the optimisation of tank operations, the modernisation of the system for monitoring and controlling the productivity of equipment and technological units, and the possibility of using process heat in operations.

#### Energy efficiency criteria in network tariffs and regulation (EED Article 15)

Description of planned or adopted measures to ensure the removal of those incentives in transmission and distribution tariffs that are detrimental to the overall efficiency of the generation, transmission, distribution and supply of electricity.

Under Section 11 (1) access to the transmission system and electricity transmission (point d) and access to the distribution system and distribution of electricity (letter e) are also subject to price regulation. The method of calculating the maximum price is set out in the URSO Decree.<sup>31</sup>

Description of planned or adopted measures to incentivise operators to improve efficiency in infrastructure design and operation (Article 15(4) EED).

Under Section 9(1)(j) of Act No 250/2012 the Regulatory Office for Network Industries organises a bidding procedure for a contractor for technology to increase the energy efficiency of systems or to reduce electricity consumption and a contractor to prepare for the construction and construct of new power-generating facilities for which economic incentives are provided.

A description of the measures planned or adopted to ensure that tariffs allow suppliers to improve consumer participation in system efficiency, including demand response (Article 15(4) EED).

For individual tariff rates the URSO Regulation on Price Regulation in Electricity favours individual electricity end-users directly connected to the transmission system.

Regional cooperation in this area, if applicable. Financing measures, including EU support and the use of EU funds, in the area at national level Where possible, also include a description of policies and measures supporting the role of "local energy communities" in contributing to the implementation of

<sup>&</sup>lt;sup>31</sup> e.g. Decree of the Regulatory Office for Network Industries No 17/2017, providing for price regulation in the electricity sector and certain conditions for the implementation of regulated activities in the electricity sector.

### vii. Regional cooperation in this area, where applicable

Will be completed, in line with current status, in the final version of the national energy and climate plan.

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

Family homes and apartment blocks can from 2019 apply again for support in the form of a voucher for the installation of small installations for the use of renewable energy sources (RES), thanks to a national project of the Slovak Innovation and Energy Agency (SIEA) called Zelená domácnostiam II (Green for Households).

This national SIEA project is funded by the Operational Programme Quality of the Environment, managed by the Slovak Ministry of the Environment. The financial contribution for the installation of equipment to use renewable energy in households is provided from the funds of the European Regional Development Fund and the state budget of the Slovak Republic. In the pilot project,  $\in$  45 million will be available in the first phase up to the end of 2018. The total amount of support for the installation of small RES installations remains at the level of the original  $\in$  115 million from European and state sources. A voucher can only be requested during an open round. The dates of the upcoming rounds are published in the planned round schedule with indicative allocations.

The provision of aid is governed by the general conditions for the aid and the specific conditions for the particular round. A household chooses a suitable appliance from a list of devices that have met the technical conditions and a contractor who arranges the equipment supply together with installation. The list of contractors contains registered contractors who have signed a voucher repayment agreement with SIEA.

The following are supported devices within the programme:

- small power plants with an output of 10 kW or less
  - o photovoltaic panels
  - wind turbines (these devices cannot yet be supported)
- heat plants covering the energy needs of a family home or residential building
  - o solar panels
  - o biomass boilers
  - heat pumps

The aid is set to give households the incentive to buy high-quality systems with reasonable performance, longer life and higher energy conversion efficiency, and not to underestimate the need for installation expertise. The aid may not exceed 50 % of the eligible expenditure.

The vouchers cover part of the delivery and installation cost of the entire system. The voucher value will be determined automatically based on the type and output of the device. For individual device types, a rate is set per 1 kW of installed power as well as for the maximum amount of installation support.

Total eligible costs will only be apparent from the specific installation invoice. Since the maximum support is possible up to 50 % of the eligible expenditure, the value shown on the voucher need not be fully reimbursed. This is particularly true of less expensive installations. At that point, the contractor should also notify the household that the amount of support will be less than the amount stated on the voucher.

Data by http://zelenadomacnostiam.sk/sk/category/aktuality/

# 3.3. Dimension: energy security<sup>32</sup>

## *i.* Policies and measures **related to the elements** set out in point 2.3<sup>33</sup>

For the stability of securing primary energy sources, diversification of sources and transport routes, especially for natural gas and oil, is necessary. With regard to the announced transition to a low-carbon economy, it is important to note that coal, oil and gas consumption in the Slovak Republic is not copying the rate of economic growth, which implicitly indicates progress in energy efficiency and a continuing reduction in the energy intensity of the Slovak economy.

### *ii.* Regional cooperation in this area

Will be completed, in line with current status, in the final version of the national energy and climate plan.

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

Will be completed, in line with current status, in the final version of the national energy and climate plan.

# 3.4. Dimension: internal energy market<sup>34</sup>

## 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 mentioned in point 2.4.1, the targets for the interconnection of European electricity networks at the level of the Member States are also met in the context of the current and planned transmission capacities of the Slovak Republic in the event of a conservative approach to the envisaged load and development of RES by transposing the National Action Plan to 2030 However, the trend in these two parameters influencing the size of the import and export capacity of the Slovak TS depends on a number of factors reflecting the socio-economic development and the national economic orientation of the SR, which can to a certain extent be created by national policy and goals set at national level.

<sup>&</sup>lt;sup>32</sup> Policies and measures shall reflect the energy efficiency first principle.

<sup>&</sup>lt;sup>33</sup> 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]

<sup>&</sup>lt;sup>34</sup> Policies and measures shall reflect the energy efficiency first principle.

### *ii.* Regional cooperation in this area<sup>35</sup>

To support the preparation and implementation of cross-border investment projects in the field of electrical infrastructure, bilateral cooperation in particular is carried out at the level of the TS operators concerned. Wider regional cooperation to support cross-border transmission projects and other key electricity infrastructure projects is not currently needed. Discussions on future cross-border connections are taking place within the ENTSO-E 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 transmission infrastructure projects is secured through the payments of system users for electricity taken. The principles and rules are determined by the Slovak Regulatory Office for Network Industries. National support mechanisms (financial) to support the construction of transmission infrastructure are not in place. Selected key infrastructure projects (e.g. the set of buildings for the "400/110 kV Bystričany Transformer" project) are co-financed by the BIDSF support fund, managed by the European Bank for Reconstruction and Development, to reduce the impact of the early shutdown of the V1 nuclear power plant at Jaslovské Bohunice.

# 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 support the smooth implementation of PCI projects, Slovak legislation has adopted the relevant legislation (the Energy Act, Construction Act, etc.) as a "one-stop-shop" approach in the sense of Art. 8(3)(c) of Regulation of the European Parliament and of the Council (EU) No 347/2013. This enables the Slovak Ministry of the Economy to monitor the authorisation process of PCI projects in the Slovak Republic and to enter it effectively in order to accelerate the issue of relevant permits.

# *ii.* Regional cooperation in this area<sup>36</sup>

See previous sections, point 3.3.1 ii.

To support the preparation and implementation of cross-border investment projects in the field of electrical infrastructure, bilateral cooperation in particular is carried out at the level of the TS operators concerned. Wider regional cooperation to support cross-border transmission projects and other key electricity infrastructure projects is not currently needed. Discussions on future cross-border connections are taking place within the ENTSO-E System Development Committee.

<sup>&</sup>lt;sup>35</sup> Other than the PCI Regional Groups established under Regulation (EU) No 347/2013.

<sup>&</sup>lt;sup>36</sup> Other than the PCI Regional Groups established under Regulation (EU) No 347/2013.

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

See previous sections, point 3.3.1 iii.

The financing of any SEPS transmission infrastructure projects is secured through the payments of system users for electricity taken. The principles and rules are determined by the Slovak Regulatory Office for Network Industries. National support mechanisms (financial) to support the construction of transmission infrastructure are not in place. Selected key infrastructure projects (e.g. the set of buildings for the "400/110 kV Bystričany Transformer" project) are co-financed by the BIDSF support fund, managed by the European Bank for Reconstruction and Development, to reduce the impact of the early shutdown of the V1 nuclear power plant at Jaslovské Bohunice.

## 3.4.3. Market integration

### *i.* Policies and measures **related to the elements** set out in point 2.4.3

The objectives of the Slovak Republic in integrating the electricity market in all timeframes, increasing the flexibility of the energy system and related projects are based on and in line with the requirements of the aforementioned European legislation that is directly applied in the conditions of the Member States (i.e. the relevant market network regulations). Therefore, these objectives, as defined today, do not result from conceptually set goals at national level, nor from national policies and official government decisions in the area concerned.

ii. measures to increase the flexibility of the energy system with regard to renewable energy production such as smart grids, aggregation, demand response, storage, distributed generation, mechanisms for dispatching, redispatching and curtailment, real-time price signals, including the roll-out of intraday market coupling and cross-border balancing markets

See previous sections, point 2.4.3 iv. and v.

### Measures in the development of smart metering systems and smart grids

- to incentivise an electricity system operator to actively monitor the development of smart grid technologies in order to apply relevant technologies where this is cost-effective from the point of view of system security and securing energy supplies cost-effectively;
- to continuously review the scope of IMS deployment and increase the penetration of IMS in a cost-effective way, to maximise the full-scale benefits of deploying IMS and developing intelligent networks while taking into account technological progress;
- to ensure that IMS technical parameters meet the requirements of European energy efficiency legislation, in order to create the conditions for informing consumers so they can effectively manage their consumption;
- to ensure that IMS technical parameters support solutions for IS construction and development by ensuring interoperability of IMS components and adequate communication capabilities;

- to support local or broad testing of the IS and, in the time horizon to 2035, the development of intelligent cities, municipalities and regions, the development of system management in the direction of the construction of the IS at the level of the Slovak distribution systems and transmission system;
- to create the conditions for building local smart grids with almost equilibrated balance with minimum flows in or out;
- to make use of IMS and IS to support electromobility;
- to increase the number of households equipped with smart appliances and IMS with the possibility of remote supervision of the electricity consumption pattern of households;
- to develop the conditions for storing electricity 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

Will be completed, in line with current status, in the final version of the national energy and climate plan.

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

Act No 251/2012, on Energy, defines vulnerable and protected customers. A vulnerable household electricity consumer is a household electricity consumer whose life functions are dependent on electricity or is heavily disabled and uses electricity for heating and has reported and demonstrated this fact himself or through his electricity supplier to the operator of the distribution system to which his/her point of sale is connected, in the manner given in the market rules; a vulnerable household gas user who is heavily disabled and uses gas for heating and who has reported and demonstrated this fact himself or through his gas supplier to the operator of the distribution fact himself or through his manner given in the market rules.

A protected customer is a gas customer who is connected to a distribution network and who is

- a household gas consumer,
- a small enterprise,

- a gas customer who produces heat and hot utility water intended for households or persons and who is not able to switch to another fuel for heat generation,

- an operator of a medical facility,
- a social service facility,
- a facility for social and legal protection of children and social custody,
- a school,

Act No 250/2012, regulating network industries defines the following categories as vulnerable customers:

1. a household electricity consumer,

2. a household gas consumer,

3. a small enterprise,

# v. Description of measures to enable and develop demand response including those addressing tariffs to support dynamic pricing<sup>37</sup>

In the context of the modernisation of power stations, transmission and distribution networks, new possibilities for communication between energy companies and their customers are gradually being introduced through smart energy networks, smart home households, and smart meters.

This modernisation will also be reflected in time in the tariffs that will be an offer tool for energy suppliers. Their principal benefit is energy saving.

An indispensable requirement for the use of dynamic tariffs is that a household must have an intelligent electricity meter installed and a smart home controller that controls smart sockets, as well as heating, the hot water boiler, air conditioning and other smart home appliances.

The open questions are the forms of communication with the supplier operator, or in the form of an information SMS when the supplier sends information about cheaper electricity in a certain time interval, without the personal involvement of the customer, and direct communication of the supplier with an installed smart meter.

# 3.4.4. Energy Poverty

i.

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

Separate housing allowance should be a directed, direct, financial support by the state for apartment households, intended in particular to cover, or more exactly, reduce that portion of apartment household costs, for legal forms of housing, that have a direct impact on the retention of accommodation and which an apartment household typically cannot afford to pay for in part or in total because of the value of those costs or the low income of the household members. So this will not be a flat-rate benefit, the accommodation allowance will be paid only for apartment households that meet the statutory requirements.

# 3.5. Dimension: Research, innovation and competitiveness

# Policies and measures **related to the elements** set out in point 2.5

Basic climate change signs and greenhouse gas emission reduction requirements bring with them the need for a basic awareness in the population of energy sectors and of technologies that reduce negative environmental impacts. The greatest prerequisites for awareness raising and support for public information are in the areas of RES support, energy efficiency and energy savings. These are the cross-sectional areas of the energy industry that can help developments across the economy. Basic information on sustainability and its associated energy and RES savings should be part of the tuition as early as at elementary school, bringing into people's lives these ideas on sustainable lifestyles.

In accordance with Article 15(8) of Directive 2012/27/EU.

In this respect, it would be advisable to develop a National Strategy for raising awareness in the field of energy efficiency, targeting the public from children to specialists and manufacturers. The strategy should support the development of awareness and education for the lay and professional public on energy efficiency, support the implementation of information campaigns on energy efficiency and support the implementation of consultancy and training projects for state and local government employees in the field of energy efficiency, with the aim of monitoring and evaluating energy savings, as well as the design of measures for the efficient use of public funds in the field of energy efficiency. Education in basic funding and the available financial instruments will help to improve energy efficiency and RES development. The national strategy should assume smart metering systems that are the basis for information about consumption, or about generation from customers' own distributed sources.

# 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 (SET Plan)

Will be completed, in line with current status, in the final version of the national energy and climate plan.

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

These financing measures in this area at national level, including Union support and the use of Union funds were included in earlier chapters.

### Proposal for costs for the individual years of solution and the whole solution period (€ million)

The indicative budget for the whole ENERGETIKA SRDP is 84,093 mil. EUR for 2018-2023. The proposed budget below takes into account the sum of the three SRDP sub-programmes. The data are in millions of euros.

Year	2019 2020 2021		2022	2022 2023		
State 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 non- budget resources	5.953	7.253	7.450	6.515	1.580	28.751
Total eligible cost	23.893	28.291	29.049	25.431	6.180	112.844

If required, the budget will be increased by 35 %

Estimated financial provision for the implementation of the outlook plan. The indicative budget for

the ENERGETIKA SRDP is 84,093 mil. EUR for 2024-2028. The proposed budget below takes into account projected GDP growth and includes all three SRDP sub-programmes. The data are in millions of euros.

Year	2024	2025	2026	2027	2028	Total
State Budget	16.819	17.155	17.498	17.848	18.205	87.525

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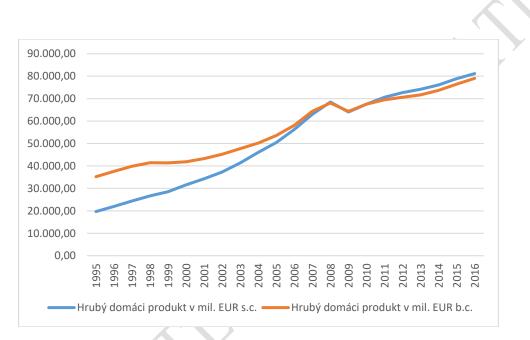
# SECTION B: ANALYTICAL BASIS<sup>38</sup>

# 4. CURRENT SITUATION AND PROJECTIONS WITH EXISTING POLICIES AND MEASURES<sup>3940</sup>

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

*i. Macroeconomic forecasts (GDP and population growth)* 

The Slovak Republic is one of the fastest growing countries in the EU and OECD (measured by GDP). Between 1995 and 2016 real GDP growth in Slovakia increased 2.24 times and the nominal increase was more than 4. The average annual growth rate of real GDP was therefore approximately 3.74 % (nominal 6.65 %).

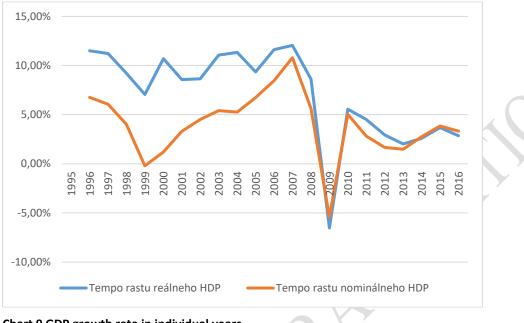


38 39 See Part 2 for a detailed list of parameters and variables to be reported in Section B of the Plan.

- 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 made by the date of submission of the national plan and there is a clear commitment to proceed with implementation. 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 legislation or national legislation is in force, one or more voluntary agreements have been established, financial resources have been allocated, human resources have been mobilized;
- <sup>40</sup> 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 to 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.

# Chart 8 GDP 1995 - 2016 at constant and current prices Key

Hrubý domácí product	GDP				
S.C.	constant prices				
b.c. current prices					
Source: Statistical Office of the Slovak Republic: 2018					



# Chart 9 GDP growth rate in individual years

кеу				
Tempo rastu reálného HDP	Growth rate for real GDP			
Tempo rastu nominálného HDP	Growth rate for nominal GDP			

#### Source: Statistical Office of the Slovak Republic; 2018

Gross domestic product per capita has risen 2.21 times between 1995 and 2016. Only in 1999 and 2009 was there a decrease in this indicator. In 2016, the per capita GDP was EUR 14.9 thousand at current prices and EUR 22.3 thousand (data available for 2015) at purchasing power parity (Eurostat). Thus, against the of the EU28 country average it reaches 51.38 % at current prices and 77.24 % at purchasing power parity. A positive trend is the gradual real convergence of Slovakia to the EU average.

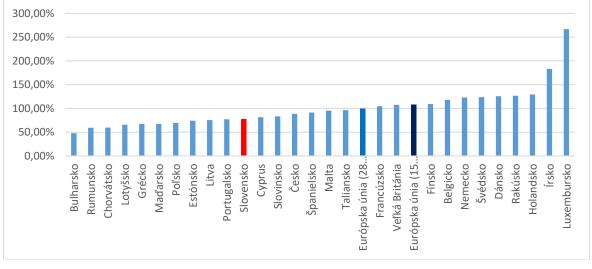


Chart 10 GDP at purchasing power parity as % of EU average (for 2016)

Source: Eurostat; 2017

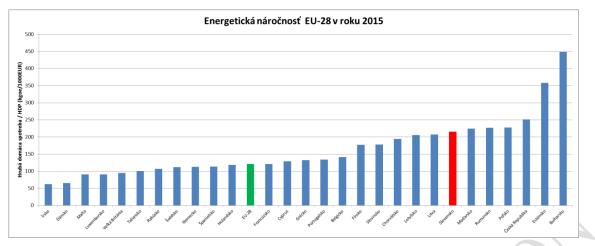
Key:

Key.	
Bulharsko	Bulgaria
Rumunsko	Romania
Chorvátsko	Croatia
Lotyšsko	Latvia
Grécko	Greece
Maďarsko	Hungary
Polsko	Poland
Estónsko	Estonia
Litva	Lithuania
Portugalsko	Portugal
Slovensko	Slovakia
Cyprus	Cyprus
Slovinsko	Slovenia
Česko	Czech Republic
Španelsko	Spain
Malta	Malta
Taliansko	Italy
Evropská únia (28)	EU-28
Francúzsko	France
Veľká (Británie)	United Kingdom
Evropská únia (15)	EU-15
Finsko	Finland
Belgicko	Belgium
Nemecko	Germany
Švédsko	Sweden
Dánsko	Denmark 🔨
Rakúsko	Austria
Holandsko	Netherlands
Irsko	Ireland
Luxemburg	Luxembourg

GDP growth was due to a gradual increase in all components of GDP, but was more pronounced due to an increase in final consumption and foreign trade results. Final government consumption grew faster than household consumption after 2010, influenced by the government's drive to revitalise the economy and implement investment projects (especially infrastructure).

Slovakia is an industrial country - industry accounts for almost a quarter of real GDP: 27.93 % in 2016, of which industrial production 24.12 % (in nominal terms 24.34 % and 20.45 % respectively). In nominal terms, the gross added value of industry represents more than a quarter of the total value added of Slovakia's economy (26.93 % in 2016). Sectoral GDP also indicates that the second most important sector is services<sup>41</sup>. This also applies to the creation of added value. From the point of view of GDP growth and added value growth, there is now a decline in the share of industry and an increase in the share of services.

<sup>&</sup>lt;sup>41</sup>) Wholesale and retail trade; repair of motor vehicles and motorcycles; transportation and storage; accommodation activities.



**Graph 11 Energy intensity of the Slovak economy compared to the EU-28** Source: Eurostat; 2017

Key:	
Energetická náročnosť EU-28 v roku 2015	Energy intensity EU-28, 2015
Hrubá domáca spotreba / HDP (kgoe/1000EUR):	Gross Domestic Consumption (kgoe/1000 EUR)
Irsko	Ireland
Dánsko	Denmark
Malta	Malta
Luxemburg	Luxembourg
Veľká (Británie)	United Kingdom
Taliansko	Italy
Rakúsko	Austria
Španelsko	Spain
Nemecko	Germany
Švédsko	Sweden
Holandsko	Netherlands
EU-28	EU-28
Francúzsko	France
Cyprus	Cyprus
Grécko	Greece
Portugalsko	Portugal
Belgicko	Belgium
Finsko	Finland
Slovinsko	Slovenia
Chorvátsko	Croatia
Lotyšsko	Latvia
Litva	Lithuania
Slovensko	Slovakia
Maďarsko	Hungary
Rumunsko	Romania
Polsko	Poland
Česko	Czech Republic
Estónsko	Estonia
Bulharsko	Bulgaria

As at 1 January 2017, the Slovak Republic had 5,435,343 inhabitants<sup>42</sup>, of whom 2,783,659 were women. The average age of the population is 40.36 years; the mean life expectancy at birth for men is 73.71 years and for women 80.41 years (all data for 2016). The trend in the age structure over the long run is not favourable, and Slovakia is ageing - there is an increasing number of people past their productive age.

<sup>42</sup>)

Source:http://www.infostat.sk/vdc/sk/index.php?option=com\_content&view=category&layout=blog&id= 13&Itemid=58

Demographic developments in the case of the Slovak Republic will, according to the SAS, mean an increase in the number of the population over the next few years. By 2025 to 2030, an increase from the current 5.43 million (2016) to 5.48-5.55 million is expected. A population decline over several decades will follow. By 2060, the population is expected to fall just above the 5 million mark. In the area of mitigation of the consequences of the demographic forecast, it is necessary for the Slovak Republic to conceptually and emphatically address the issue of support for young families and the birth rate, as well as creating the conditions for young people not to be motivated to emigrate.

The ageing of the population and its increasing economic burden will pose a challenge for the pension system. In the second half of the 20th century, when the on-going pension systems performed their missions without difficulty, about 1 person at a post-productive age accounted for about 10 people of working age. At present, this ratio is 1:4.8 and in 2060 it will be only 1:1.6. As early as 2030, there will be only 3 people of working age per person past productive age. On the other hand, however, one may observe pressure to increase the retirement age, or life expectancy, as well as the fact that a large group of people of a post-productive age continues to work. These facts will necessarily have to be reflected in the whole set-up of the social system, in particular in pensions and health care.

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

At present it can be said that the source of economic growth and development of the Slovak Republic, which is cost competitiveness based on low wages and other production costs, is gradually being exhausted and in essence will not form the basis of future economic policy.

Dynamic technological changes, new forms of entrepreneurship, an emphasis on sustainable growth, environmental solutions, innovation, science and research, as well as regional development, are the current challenges that the Slovak Republic will have to be able to face and develop in order to maintain and strengthen its competitiveness and secure its development in all areas affecting the living standards of the population.

Changes related, for example, to the introduction of the Industry 4.0 concept, represent pan-societal changes across a range of areas beginning with industry, security, technical standardisation, science and research, the labour market, the education system and ending with the legal framework.

The new nature of competitiveness for the Slovak economy is therefore determined by five key areas, namely: development of human capital, technological changes, ecological and energy efficiency of the economy, development of the business environment and regional development along with the area of agriculture.

An effective economic policy will require a stable political environment with clear responsibility for its implementation as well as an assessment of the costs necessary for its implementation.

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

#### Table 20: EU ETS carbon prices considered

	2015	2020	2025	2030	2035	2040
EU ETS carbon prices ( $\in$ /t of CO <sub>2</sub> )	7.5	15.0	22.5	33.5	74.0	117.0

Source: 2015-2030 EU Reference Scenario 2016, 2035-2040 Slovak Republic low-carbon study

	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	

 Table 21: Recommended international fossil fuel prices (values set in 2017 with updated deflators, exchange rates, US inflation and price index)

Source: EC

one barrel of oil is equivalent to 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 in terms of the reference data provided by the European Commission in May 2017. Any updates will be added to the final version of the national energy and climate plan based on current status.

# 4.2 Dimension: decarbonisation

## 4.2.1. GHG emissions and removals

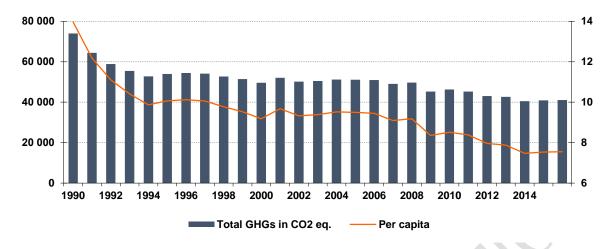
# *i.* Trends in current GHG emissions and removals in the EU ETS, effort sharing and LULUCF sectors and different energy sectors

Total GHG emissions were 41,037.12 Gg CO<sub>2</sub> (without LULUCF) in 2016. This represents a reduction of 44.5 % compared to the reference year 1990. Compared to 2015, emissions increased by 0.3 % Total GHG emissions in the Slovak Republic increased in 2016 compared to the previous year, probably due to increased fuel consumption in the energy sector, more intensive manufacturing in industry and consequently the quantities of processed waste. These changes were caused by Slovakia's improved economic performance. Total GHG emissions without LULUCF have fallen slightly in recent years compared to the base year. Significant changes in methodologies and emission factors have been introduced to ensure compliance with the EU ETS. Total greenhouse gas emissions in the Slovak Republic did not exceed the 1990 level of in any year being reviewed.

A significant emissions reduction in 2016 compared to 1990 was mainly due to a major but nevertheless temporary drop in economic activity accompanied by economic restructuring and the implementation of new and more efficient technologies. This has led to a reduction in the share of energy-intensive industry and an increase in the share of services in GDP. One exception is transport (especially road transport), where the intensity of activity increases annually.

In addition to basic macroeconomic indicators such as GDP, GDP per capita, foreign and domestic trade, inflation and employment, there are also data on the volume of investment in environmental protection and R&D activities, without specifying their direction. The economic crisis that began in 2008 brought about a significant weakening in external demand, which reduced the dynamic of Slovak growth, production, the labour market and total domestic demand. The debt crisis in the Eurozone, which began in 2012, also caused a decline in external demand.

Continued pressures are being developed to develop effective strategies and policies to achieve further emission reductions. While the carbon intensity indicator may change significantly due to increased economic growth, the GDP per capita indicator may show significant changes due to population growth. Unfortunately, this is not the case for the Slovak Republic. It will take longer to change the factor due to the implementation of new technologies, especially in combination with the high dynamic of the development of energy-intensive industry.



#### Figure 5: Total GHG emissions in Gg of CO2 eq. per capita. 1990 - 2016

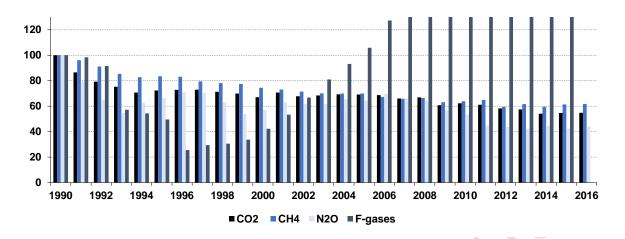
### Description and interpretation of emission trends by gas type

Total anthropogenic carbon dioxide (CO<sub>2</sub>) emissions without LULUCF fell by 45.2 % in 2016 compared to the baseline year (1990). In 2016, total CO<sub>2</sub> emissions were 33,996.77 Gg without LULUCF. Compared to 2015, this is a 1 % increase. The reason for the increase in CO<sub>2</sub> emissions in 2016 was mainly the increase in CO<sub>2</sub> emissions in industrial processes and waste as a result of increased economic output. In 2016, CO<sub>2</sub> emissions, including LULUCF, were comparable to the previous year and had dropped by 48.3 % compared to the baseline year.

Total anthropogenic emissions of methane without LULUCF decreased by 39.1 % compared to the baseline year (1990) and currently their value is 4,383.52 Gg CO <sub>2</sub> equiv. In absolute terms, CH<sub>4</sub> emissions were 175.34 Gg without LULUCF. Methane emissions from LULUCF represent 0.76 Gg of CH<sub>4</sub>, caused in particular by forest fires. This trend has been relatively stable over the last five years, with a slight decline in 2014 due to an increase in emissions from the energy sector. Methane emissions were the highest in 2002 and have been declining since then thanks to the implementation of new legislation on waste and the reduction of emissions from solid waste dumps in the Slovak Republic.

Total anthropogenic emissions of N2O without LULUCF decreased compared to the baseline year (1990) by 56.0 % and currently their value is 1,971.15 Gg CO 2 equiv. Emissions of N<sub>2</sub>O in absolute value reached 6.61 Gg without LULUCF. N<sub>2</sub>O emissions from LULUCF were 0.12 Gg. Emissions rose by 1 % compared with 2015 due to increased activity in the industrial processes sector. The trend is related mainly to the production of nitric acid. The overall decrease in these emissions is related to the decline in agricultural production due to the decreasing number of animals and use of fertilisers.

Total anthropogenic emissions of F-gases were 673.37 Gg HFC, 6.49 Gg PFC and 5.82 Gg SF<sub>6</sub> in CO<sub>2</sub> equiv. Since 1995, HFC emissions have increased as a result of increased consumption and substitution of PFCs and HFCs. Since that year, it has declined for the first time in the last inventory year (2016). This decrease applied to all F-gases and is a consequence of the implementation of F-Gas legislation at EU level. The PFC emission trend is decreasing and SF<sub>6</sub> emissions increased slightly due to an increase in industrial consumption.



### Figure 6: Trends in GHG emissions 1990 - 2016 by gas relative to 1990 levels (100 %)

### Description and interpretation of emission trends by source category

The main share of  $CO_2$  emissions comes from the energy sector (fuel burning, transport), which accounts for 75 % of the total carbon dioxide emissions in 2016, with 25 % of CO<sub>2</sub> emissions being produced by industrial processes and the use of products and with negligible quantities produced in agriculture, (0.23 %) and in waste (0.01 %). CO<sub>2</sub> emissions from incineration associated with energy are included in the energy sector. 31 % of CH<sub>4</sub> emissions are generated in the waste sector, 43 % of methane emissions are produced in the energy sector and 26 % in the agricultural sector. More than 74 % of N<sub>2</sub>O emissions are produced in the agricultural sector (nitrogen from soil), 10 % in the industrial processes sector (nitric acid production). 6 % in the sewage sector and 10 % in the energy sector. F-gases are largely produced in the industrial processes sector (Figure 7).

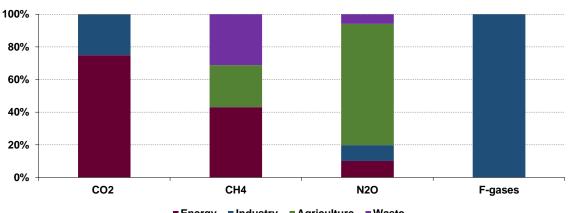


Figure 7: Emission trends by gas in sectors in 2016



Aggregated greenhouse gas emissions from the energy sector are based on data computed using the sectoral approach and are estimated to be 25,855.24 Gg  $CO_2$  equiv. including transport emissions (6,746.98 Gg  $CO_2$  equiv.), representing a decrease of 52 % compared to the baseline year and an increase of 1 % compared to 2015. The transport sector is stagnating and declined by 1 % compared to 2015 and declined by 2 % compared to the baseline year.

Total emissions from the industrial processes sector were 9,338.23 Gg CO<sub>2</sub> equiv. in 2016, representing a decrease of 5 % compared to the baseline year and an increase of 2 % compared to the previous year. This sector also includes emissions from the use of solvents and other products.

Emissions from the agricultural sector were estimated at 2,671.32 Gg  $CO_2$  equiv. This is a 56 % decrease compared to the baseline year and a 4 % increase compared to the previous year. The agricultural sector is the one with the most significant decline compared to the baseline year of 1990 due to the declining trend in cattle numbers and use of artificial fertilisers.

Emissions from the waste sector were estimated at 1,483.80 Gg  $CO_2$  equiv. In recent years, the time series are stable, so a decrease of 3 % was recorded compared to the previous year. Compared to the baseline year, the increase in waste emissions was more than 6 %, due to increased methane emissions from solid waste dumps.

Structural changes in the energy sector and the implementation of economic instruments have played an important role in achieving the current situation where the trend of greenhouse gas emissions does not duplicate the rapid GDP growth. In this context, the most important measure appears to be the adoption of the national air quality legislation, which was approved in 1991, and which started a positive trend in reducing emissions of basic air pollutants and indirectly also of greenhouse gas emissions. At the same time, consumption of primary energy sources as well as of total energy decreased.

According to statistical data from the Slovak Statistical Office - data from the Slovstat database, the energy sector including industrial processes (production and distribution of electricity, natural gas and water) reached 26 % of total Slovak GDP in 2016. Energy intensity, defined as the ratio of gross consumption to gross domestic product (GDP) for a given calendar year, is an important economic indicator in the national economy, measuring the economy's energy consumption and overall energy efficiency. Energy intensity in the Slovak Republic has been declining over the past 20 years, mainly due to a significant reduction in energy consumption. From 1995-2015, the Slovak Republic reduced its energy intensity by 57 % This is the second highest percentage reduction among all EU Member States. In addition, according to the European Commission's Joint Research Centre (JRC), the highest reduction in energy intensity over the 15-year period 2000-2014 was achieved in the Slovak Republic, which achieved a growth rate of 82.5 %<sup>43</sup>

This positive trend is the result of successful industrial restructuring, the introduction of energy-efficient industrial processes in industry, and effective energy-saving measures in the household sector through the replacement of domestic appliances with more efficient alternatives.

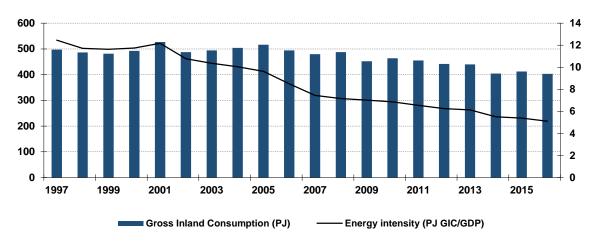


Figure 8: Trends in energy intensity (right-hand y-axis) from 1997 to 2016 (estimated on the basis of the revised NACE Rev.2 statistical classification)

An important source of emissions in the energy sector is transport with an 8 % share of Slovak GDP. The share of transport increases each year and the policies and measures adopted do not have a visible

<sup>&</sup>lt;sup>43</sup> Joint Research Centre: Energy Consumption and Energy Efficiency Trends in the EU-28 2000-2014 2016). p. 19. URL: <u>http://iet.jrc.ec.europa.eu/energyefficiency/node/9145</u>

positive impact on the trend in transport emissions in recent years. Emission balances in road transport are modelled using the COPERT 5.1 model. GHG emissions from other than road transport are balanced using the EMEP/EEA 2016 methodology by transport modes (air, water and rail). The rail and water transport share decreases year on year, while air traffic is increasing, mainly due to the increasing activity of low-cost carriers.

Fugitive methane emissions from mining (only 0.4 % of total GDP) and the distribution of fossil fuels are important, as the Slovak Republic is an important transit country for shipments of oil and natural gas from former Soviet Union countries to Europe. Raw materials are transported through high-pressure pipelines and the distribution network and pumped by pipeline compressors.

The industrial processes sector includes all greenhouse gas emissions generated by the technological processes of producing raw materials and products with a 25 % share of total GDP in the Slovak Republic. In the elaboration of the greenhouse gas emissions balance in the Slovak Republic, emphasis is placed on an analysis of individual technological processes and the difference between the emissions from combustion of fuels in heat and energy production and emissions from technological processes and production. The most important emission sources are specifically balanced, emission and oxidation factors, as well as other parameters going into the balance equations are reassessed and the results compared with verified emissions in the Union registry.

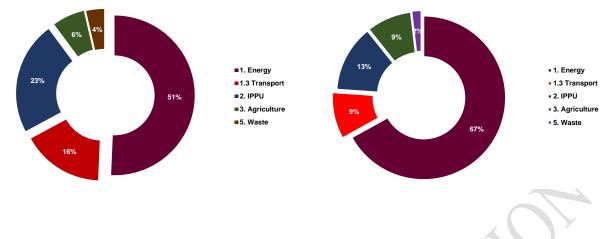
The baseline emission inventory is based on the balance of non-methane volatile organic compounds (NMVOCs) in line with the revised EMEP/EEA 2016 methodology. Emissions are re-calculated according to stoichiometric coefficients into CO<sub>2</sub> emissions.

The agriculture sector with a 4 % share of total GDP is the main source of methane and N<sub>2</sub>O emissions in the greenhouse gas emissions balance in the Slovak Republic. The emissions balance is compiled 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 Slovak Ministry of Agriculture and Rural Development publishes annual statistics "Green Administration", agriculture and food industry section.

Areas of forest land in the Slovak Republic cover 40 % of the territory and logging is an historically important economic activity. Since 1990, capture from LULUCF have reached 8-10 % of total greenhouse gas emissions. This historically stable trend was disrupted in 2004 by the wind calamity in the High Tatra Mountains, which resulted in increased production of wood damaged by the calamity and by pests and consequently a decrease in total capture to half of previous volumes.

A comparison of the share of individual sectors in 2016 with the baseline year is shown in Fig. 9. Significant reductions in the share of the energy sector (excluding transport) and an increase in waste, industrial processes and the transport sector are visible. Emissions from international aviation and maritime transport are excluded from national summaries and are therefore not included here.

Emissions from international transport (bunkers) are the sum of emissions from international aviation and maritime operations outside the territory of the Slovak Republic. These emissions are reported but not included in the total national inventories. Greenhouse gas emissions from international aviation have shown a rising trend from 1992 to 2008. Between 2009 and 2014, these emissions decreased, partly reflecting the economic recession. Total GHG emissions from international transport amounted in 2016 to  $174.21 \text{ Gg CO}_2$  equiv. Emissions from international air transport had a 95 % share of this.



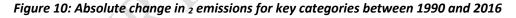
### Figure 9: Share of individual sectors of total GHG emissions in 2016 (left) and 1990 (right)

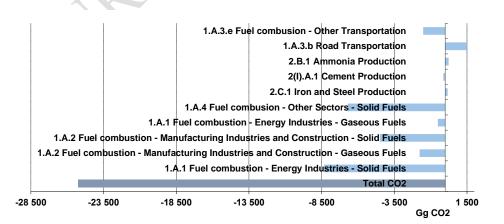
### Emission changes in key categories

Key categories are defined as emission sources or capture that have a significant impact on inventory as a whole, in terms of absolute emission levels, the trend or both.

CO<sub>2</sub> emissions from category 1.A.3.b - Road transport - diesel are the largest key category, responsible for 24 % of total CO<sub>2</sub> emissions without LULUCF in 2016. Between 1990 and 2016, emissions in road transport increased by 1.5 Mt CO<sub>2</sub>, an increase of 30 % due to the increase in fossil fuel consumption in this key category (Figure 10). Since 1990, the largest increase in CO<sub>2</sub> emissions has been identified as related to road transport. Figure 10 below shows that solid fuels from category 1.A.1 Fuel combustion is the second largest key category without LULUCF (17 %), although between 1990 and 2016 emissions in this category dropped by 35 % The main factors explaining this decrease in emissions are improvements in energy efficiency and the transition in (fossil) fuels from coal to gas. A transition was completed from solid and liquid fuels mainly to natural gas as well as an increase in the consumption of biomass and other fuels.

 $CO_2$  emissions from fuels in category 2.C.1 - Iron and steel production is the largest key source without LULUCF in the industrial process and product use (IPPU) sector and accounts for 16% of total  $CO_2$  emissions in 2016.  $CO_2$  emissions from category 1.A.2 in the energy sector are the third largest source in the Slovak Republic, accounting for 17% of total greenhouse gas emissions in 2016. Between 1990 and 2016, emissions from this category dropped by 50%

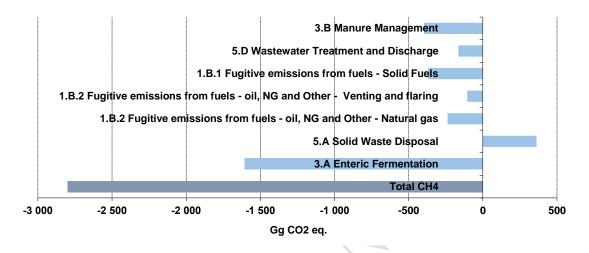




Methane emissions account for 9 % of total GHG emissions in 2016 and have fallen by 39 % since 1990 to 175.34 Gg CH<sub>4</sub> in 2016. The two largest key sources (5.A Solid Waste Disposal with 22 % and 3.A Enteric fermentation with 22 % of total CH<sub>4</sub> emissions in 2016) account for 50 % of CH<sub>4</sub> emissions in 2016.

Figure 8 shows that the main causes of the decline in CH<sub>4</sub> emissions, the reduction in the enteric fermentation category due mainly to the declining number of animals and reduced emissions in the categories of fugitive emissions from coal mining. Figure 8 also shows a significant drop in categories 3.A and 3.B and an increase in Category 5.A - Solid waste landfills (due to the change in IPCC methodology used for landfills, considering the time layer since 1960

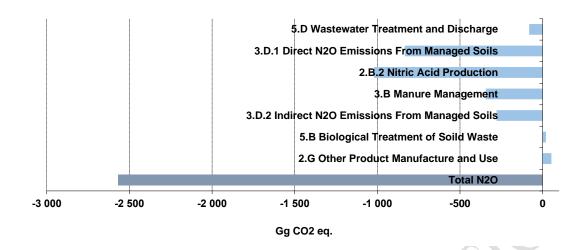
Figure 11: Absolute change in CH<sub>4</sub> emissions for key categories between 1990 and 2016



 $N_2O$  emissions account for 4.9 % of total GHG emissions and have fallen by 56 % to 6.61 Gg  $N_2O$  in 2016 (Figure 12). This trend was caused by a decline in the two largest key sources: 3.D.1 - Direct  $N_2O$  emissions from agricultural soils with a 52 % share and category 3.D.2 - Indirect  $N_2O$  emissions from agricultural land with a 16 % share of total  $N_2O$  emissions in 2016. The main reason for the large reductions in  $N_2O$  emissions was the application of reduction measures in nitric acid production processes and a slowdown in agricultural activities (Figure 12).  $N_2O$  emissions increased in category 5.B - Biological waste treatment. This increase was due to increased operations and output.

Emissions of fluorinated gases account for 1.7 % of total greenhouse gas emissions. In 2016, emissions were 679.86 Gg CO<sub>2</sub> equiv., which was 146 % higher than 1990 levels. The largest key source is category 2.F.1 - Cooling and Air Conditioning and accounts for 93 % of fluorinated gas emissions in 2016. HFC emissions from the use of halogenated hydrocarbons have grown significantly between 1990 and 2016. The main cause was the elimination of ozone-depleting substances such as chlorofluorocarbons under the Montreal Protocol and the replacement of these substances with HFCs (mainly in cooling, air conditioning, foam production and as aerosol propellants). On the other hand, PFC emissions have decreased significantly. The decline began in 1996 and was strongest in 1999 and 2000.

Figure 12: Absolute change in N<sub>2</sub>O emissions for key categories between 1990 and 2016



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

This chapter presents the results of greenhouse gas emission modelling by sector and gas, together with an impact assessment of policies and measures for all scenarios. The overall impact of policies and measures was defined as the difference between scenarios after defining the impact of a particular measure.

### 1. Energy sector including transport

The energy sector produces greenhouse gas emissions from the combustion and conversion of fossil fuels. Volatile methane emissions arise during the mining, transport and processing of fuels.

Modelling of emission projections was based on updated forecasts of value added (VA) growth, fuel prices and energy carrier prices, demand for energy in the sector, as well as predictions of population growth in the Slovak Republic from the Slovak Demographic Research Centre and from the Energy Efficiency Action Plan for the years 2014 - 2016 with an outlook to 2020.

Outputs from the modelling identified the potential for reductions based on measures to reduce greenhouse gas emissions. Updated data for macroeconomic and demographic data projections were used for the period 2015-2040 and the increase in value added (VA) growth and sectoral demand for energy was reflected in the final energy demand for several industries (see Table 22) according to the EU Reference Scenario for 2016.

The MESSAGE model was used for stationary sources while the TREMOVE model was used for the transport category.

Item	Units	2014	2015	2020	2025	2030	2035	2040
Final energy consumption: Total	ΤJ	364705	382904	397295	389636	384929	378169	368164
Final energy consumption: Industry	TJ	134830	138781	142804	139060	134950	127889	118995
Final energy consumption: Transport	LT	90765	90828	96788	99370	104337	108324	109846
Final energy consumption: households	τj	81723	83219	84436	85050	85278	85161	85045
Final energy consumption: Agriculture/Forestry	LΊ	5754	6297	6670	6483	6357	6158	5872
Final energy consumption: services	L	51633	63779	66598	59671	54008	50637	48406
Transport parameters								
Number of passenger-kilometres (pkm)	million pkm	37631	37979	45075	51338	57597	62133	62133
Freight transport tonnes-kilometres (tkm)	million tkm	22713	22938	26055	28985	32067	34289	34289
Final energy consumption: Transport	LΊ	86851	86911	92184	94099	98391	101904	101904

**Table 22:** Parameters used for energy consumption projection in relevant sectors of the economy

In the *WOM* scenario, all implemented measures are included in the emission level in the baseline year of the 2014 scenario. Emission levels in the following years are determined only by the final rate of energy growth.

### Parameters and policies and measures (PaM) used in the energy sector:

The modelling of emissions projections in the energy sector is based on the following input data and information:

- Updated Value Added (VA) growth forecasts, based on the annual growth rate used in the Reference Scenario for 2016 (PRIMES model);
- Updated forecasts of final energy consumption for industries, of heat production for apartment blocks and of other energy consumption in residential and other non/industrial sectors from the Reference Scenario for 2016 (PRIMES model);
- The impact of energy savings on family houses was modelled on the implementation of the Energy Efficiency Action Plan for 2014-2016 with an outlook to 2020, approved in July 2014;
- The impact of energy savings in the public sector was modelled on the implementation of the Energy Efficiency Action Plan for 2014-2016 with an outlook to 2020, approved in July 2014;
- The impact of energy savings in the residential sector, e.g. on family houses and apartment blocks was modelled on the implementation of the Energy Efficiency Action Plan for 2014-2016 with an outlook to 2020, approved in July 2014;

- The impact of energy from renewable sources in heat and electricity generation was also implemented in the WEM scenario, taking into account the National Action Plan for Renewable Energy (Government Resolution No 677/2010);
- Input data from this plan for 2014-2020 were implemented in the WEM scenario;
- 4. The Energy Efficiency Action Plan for 2017 2019 with an outlook to 2020 was used for the WAM scenario;
- Forecast of population growth from the Slovak Demographic Research Centre;
- Data on the fuel mix and emissions from individual ETS sources, as well as energy statistics, were used as input data in the MESSAGE model;
- Fuel prices from the Regulatory Office for Network Industries were used for the baseline years of 2014 and 2015. The trend was modelled using EU-recommended data. This source was also used for the determinative CO <sub>2</sub> prices for ETS.

The modelling outputs were influenced by the potential for reduction based on the measures and their synergies as well as implementation costs. Updated data for macroeconomic and demographic data projections were used for the period 2010-2040 and the increase in gross value added (VA) and final energy demand was reflected in the numbers for several industries.

### Parameters and PandM used in the energy sector - Transport:

For the WOM, WEM and WAM scenarios, existing measures in the transport subsector and other sectoral information from the Ministry of Transport, Construction and Regional Development of the Slovak Republic were taken into account. Transport sector forecasts were prepared using the TREMOV model, which is based on data from the COPERT model, which is used for emissions inventories in road transport. Data for the projected transport parameters were obtained from the Reference Scenario for 2016.

The transport emissions projections were prepared using the following assumptions:

- Promoting the use of biofuels: further increasing the proportion of biofuels in fuels. The proportion of biofuels in fuels should be in line with Act No 309/2009, on the promotion of renewable energy sources and high-efficiency cogeneration:
- Impact of EU legislation Regulation 2009/443/EC and Regulation 2011/510/EC, laying down emission standards for CO<sub>2</sub> for passenger cars and light commercial vehicles;
- Impact of the EU White Paper on the switch of long-distance freight transport from road freight to rail
- Promoting the use of rail by passengers: free tickets for students and senior citizens and other discounts;
- Civil aviation within the ETS;
- Urban hybrid transport Energy Efficiency Action Plan 2011-2013, Resolution of the Government of the Slovak Republic No 301/2011;

- Modal shift to public transport Energy Efficiency Action Plan 2011-2013, Resolution of the Government of the Slovak Republic No 301/2011;
- Modal transfer to public transport Transport policy of the Slovak Republic to 2015
- Improvement to transport behaviour and road infrastructure Transport Policy of the Slovak Republic until 2015;
- Introduction of Euro 6 emission standards Transport policy of the Slovak Republic to 2015
- Decree No 228/2014, laying down requirements for fuel quality and the maintenance of operating records for fuels;
- Government Regulation No 655/2007, on the technical requirements for the reduction of emissions from air-conditioning systems in motor vehicles;
- Electromobility development strategy Support for the sale of electric cars.

### Parameters and PandM used in the energy sector - fugitive emissions:

Fugitive CH<sub>4</sub> emissions from transport and the distribution of natural gas and oil in the SR were calculated from the following data:

- A. Data on natural gas and oil obtained from the following sources:
  - Slovak Statistical Office (for 2014 and 2015);
  - "Reference Scenario for 2016" (for 2015-2035);
- B. For the calculation of fugitive methane emissions, emission factors were used from the following sources:
  - 1. IPCC Guidelines 2006 for National Greenhouse Gas Inventories Chapter 4: Fugitive emissions;
  - 2. IPCC Guidelines on best practices and unpredictability management in national greenhouse gas inventories Fugitive emissions from oil and gas operations.

Table 23: Expect	ted production, transmission and distribution of oil and natural gas in the Slovak Republic
2015 - 2035	

Activity	Units	2014	2015	2020	2025	2030	2035
Oil output	t	12,000	12,000	0	0	0	0
Oil processing	t	5,220,000	5,954,527	5,272,940	5,123,536	5,018,020	5,011,865
Natural gas production	1000 m <sup>3</sup>	100,000	93,000	93,078	92,754	91,735	87,372
Long distance transmission of natural gas	1000 m <sup>3</sup>	46,500,000	55,800,000	68,454,601	67,601,291	66,659,537	69,201,164
Natural gas distribution	1000 m <sup>3</sup>	4,014,000	4,639,000	5,601,683	5,579,961	5,523,536	5,287,752

Fugitive emissions of methane from underground coal mining and activities following coal-mining in the Slovak Republic were calculated from the following data:

A. Data on coal mining in 2014 and 2015 from individual underground mines was obtained from official sources - from the following companies: HBP, a.s.; Baňa Dolina, a.s.; and Baňa Čáry, a.s.;

- B. Data on projected coal mining for 2015 2035 were obtained from the Slovak Ministry of the Economy "Energy Policy of the Slovak Republic for 2014".
- C. For the calculation of fugitive methane emissions and CO<sub>2</sub> emissions, the emission factors from the "IEA Global Methane and Coal Industry CIAB" and data specified by the a mining company HBP, a.s., were used

The data come from the Slovak Energy Policy adopted in 2014. In connection with the solution of mining and energy issues in Upper Nitra, in the coming weeks it is assumed that the Slovak Government will reassess the support for the production and supply of electricity and heat from domestic coal in the framework of the General Economic Interest (VHZ) and this support will be terminated by 2023. Any updates will be added to the final version of the national energy and climate plan based on current status.

### **1.1 Projected aggregated emissions of greenhouse gases**

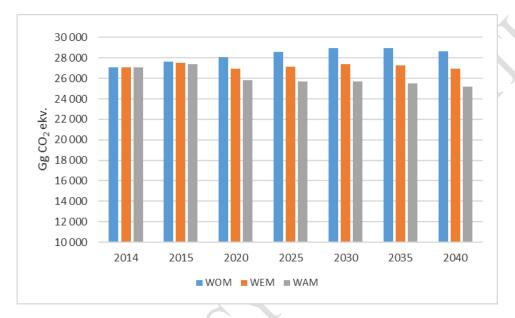
Table 24 shows aggregated projections of greenhouse gas emissions in the energy sector. Figure 13 shows a comparison of projected emissions in the energy sector in equiv.  $CO_2$  by 2020 for all scenarios, as well as their emission level index against the baseline year of UNFCCC (1990).

WOM	2014	2015	2020	2025	2030	2035	2040
1. Energy sector	27088	27627	28093	28563	28952	28957	28640
1.A Fuel combustion activities	25605	26027	26225	26719	27129	27162	26845
1.A.1 Energy sector	7135	7338	6689	6677	6562	6402	6185
1.A.2 Manufacturing sector and construction industry	7290	7251	7418	7407	7436	7417	7397
1.A.3 Transport	6493	6748	7299	7963	8587	8892	8883
1.A.4 Other sectors	4634	4639	4764	4615	4486	4394	4324
1.A.5 Others	53	52	55	56	59	58	55
1.B Fugitive emissions from fuels	1482	1600	1868	1844	1822	1795	1795
WEM	2014	2015	2020	2025	2030	2035	2040
1. Energy sector	27088	27546	26959	27168	27372	27248	26936
1.A Fuel combustion activities	25605	25946	25092	25324	25550	25454	25141
1.A.1 Energy sector	7135	7281	6178	6091	5914	5687	5462
1.A.2 Manufacturing sector and construction industry	7290	7251	7238	7228	7257	7237	7229
1.A.3 Transport	6493	6748	7009	7487	7988	8232	8223
1.A.4 Other sectors	4634	4613	4611	4462	4332	4241	4171
1.A.5 Others	53	52	55	56	59	58	55
1.B Fugitive emissions from fuels	1482	1600	1868	1844	1822	1795	1795
WAM	2014	2015	2020	2025	2030	2035	2040
1. Energy sector	27088	27364	25801	25699	25693	25494	25191

Table 24: Projected aggregated greenhouse gas emissions in the energy sector (CO2 equiv., Gg)

1.A Fuel combustion activities	25605	25764	23934	23855	23870	23700	23396
1.A.1 Energy sector	7135	7199	5603	5525	5405	5241	5026
1.A.2 Manufacturing sector and construction industry	7290	7224	7152	7142	7170	7151	7143
1.A.3 Transport	6493	6748	6845	7003	7237	7343	7334
1.A.4 Other sectors	4634	4542	4277	4129	3999	3907	3838
1.A.5 Others	53	52	55	56	59	58	55
1.B Fugitive emissions from fuels	1482	1600	1868	1844	1822	1795	1795

Figure 13: Projected total greenhouse gas emissions



## 2. Industrial processes and product use sector

The industrial processes and product use sector is generally not as sensitive to the implementation of various policies and measures as the energy sector due to the stoichiometric emissions production principle. One of the most important measures in this sector is the use of BAT technologies. Therefore, the baseline for both scenarios is the growth in added value according to the reference scenario, with the only limitation being the maximum technological capacity of production. The following measures have been included in all scenarios.

• In the **WOM** scenario, all implemented measures are included in the emission level in the baseline year of the 2014 scenario. Emission levels in subsequent years are determined only by the growth rate for added value.

Parameters and other key industry trends for **WEM** scenario development:

- Enhanced technology was installed in 2 ammonia plants in 2014 and the modelling results were used in the scenario.
- The upgrading of an ethylene production unit with 16 % lower emissions commissioned in 2016.
- Stable N<sub>2</sub>O emission factors from the production of nitric acid thanks to precise control of the technological process.

- Stable PFC emissions from aluminium production thanks to precise control of the process.
- The increase in HFC (hydrofluorocarbon) emissions will be less dynamic due to a significant increase in the use of refrigerants with new HFCs (with a lower GWP) after 2020 and sustained HCFC refrigerant replacement with "natural refrigerants".
- Stable SF<sub>6</sub> emission factors from electrical equipment as a result of using BAT for unit maintenance.
- Reduction of N<sub>2</sub>O content in aerosol canisters after 2020.

### Parameters and other key industry trends for **WAM** scenario development:

- Enhanced technology was installed in 2 ammonia plants in 2014 and the modelling results were used in the scenario.
- The use of carbonate-free raw materials for cement production will begin after 2020 (e.g. such as ground granular blast-furnace slag). 5 % fresh raw materials assumed, measured at the furnace inlet.
- There may be a decrease in the number of or the closure of dolomitic limestone quarries after 2020.
- In addition to the parameters described in the WEM scenario for fluorinated gases, foams containing HFCs will be banned, and high GWP refrigerants will also be limited. Increased use of fluorinated gases that are not covered by the IPCC (such as heavy oils (HFO)) will begin to a significant extent after 2025. The use of fluorinated gases with a lower GWP in aerosols and extinguishing agents will be mandatory.
- Servicing of electrical equipment will be possible only at the level of BAT and only in "lifetime sealed" systems.

### 2.1. Projected total greenhouse gas emissions

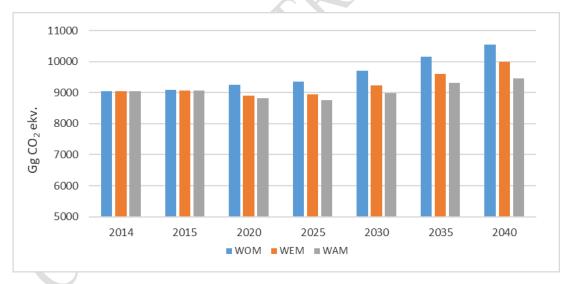
Table 25 and Figure 14 show aggregate data on the projection of greenhouse gas emissions in the industrial processes sector, including F-gases.

WOM	2014	2015	2020	2025	2030	2035	2040
2. Industrial processes and product use	9040	9080	9262	9355	9700	10157	10542
2.A Mineral products	2277	2269	2200	2330	2702	3305	4056
2.B Chemical industry	1365	1373	1449	1563	1693	1772	1846
2.C Metals production	4553	4533	4767	4734	4597	4362	3919
2.D Non-energy products	98	96	91	99	108	114	114
2.F Use of ODS products and substitutes	654	735	663	534	500	500	500
2.G Manufacture and use of other products	94	74	93	96	100	103	106
WEM	2014	2015	2020	2025	2030	2035	2040

**Table 25** products, including F-gases (CO<sub>2</sub> equiv., Gg)

2. Industrial processes and product use	9040	9073	8912	8945	9234	9611	9991
2.A Mineral products	2277	2269	2200	2330	2702	3305	4056
2.B Chemical industry	1365	1373	1358	1505	1660	1738	1812
2.C Metals production	4553	4526	4543	4500	4363	4127	3684
2.D Non-energy products	98	96	91	99	108	114	114
2.F Use of ODS products and substitutes	654	735	638	431	322	250	250
2.G Manufacture and use of other products	94	74	83	81	79	77	74
WAM	2014	2015	2020	2025	2030	2035	2040
2. Industrial processes and product use	9040	9073	8823	8751	8988	9313	9460
2.A Mineral products	2277	2269	2159	2213	2578	3180	3931
2.B Chemical industry	1365	1373	1347	1493	1647	1724	1669
2.C Metals production	4553	4526	4505	4459	4321	4085	3642
2.D Non-energy products	98	96	91	99	108	114	114
2.F Use of ODS products and substitutes	654	735	638	406	264	154	59
2.G Manufacture and use of other products	94	74	83	80	68	57	45

Figure 14: Projected aggregate greenhouse gas emissions under defined scenarios in industry and used products including F-gases (CO<sub>2</sub> equiv., Gg)



### 3. Agricultural sector

Potential for mitigation in agriculture is mainly related to manure management (storage and application to land) and animal feed policy. A Rural Development Programme has been developed for the period 2014-2020 into which these issues have been incorporated in relation to the measures (e.g. organic farming). From an older policy, Act No 220/2004, on the Protection and Use of Agricultural Land, as amended, partly addresses the issue of the use of lower-quality land in setting up plantations of rapidly growing trees. This is a land of lower quality and biomass production from it will increase the use of renewable energy, thereby reducing the need for fossil fuels. Current legislation and recommended

proven agricultural practices with the measures taken are particularly important for storing livestock manure and the application of animal waste to agricultural land. Although detailed landfill mapping is missing, it may be assumed that in the Slovak Republic in 2015 all liquid wastes were stored in covered areas for more than 120 days. This makes it possible to apply effective measures in the area of application of waste to agricultural land. This assumption will be applied in the construction of new landfills. This measure has the greatest impact on pig breeding. A portion of the liquid waste is then absorbed by straw and is stored in solid form. Therefore, beyond 2015, there is no further room for reducing emissions from manure storage. Effective control of the nitrogen cycle in agricultural production changes the loss of nitrogen emissions to valuable fertilizer. Waste storage is only possible on large farms for grazing animals (sheep, goats, horses, some categories of cattle). The most important climate change mitigation activities in the agriculture sector are part of the EU Common Agricultural Policy, support for agricultural markets and income support (1st pillar of the EU Common Agricultural Policy) and Rural Development Policy (2nd pillar of the EU Common Agricultural Policy).

Previous emissions projections up to 2030 anticipated an additional significant reduction in the number of animals, which is not in line with the Slovak Republic's Concept for Agricultural Development.

An increase in the number of animals was planned in the latest internal document the Slovak Republic's Concept for Agricultural Development for 2013-2020 prepared by the Slovak Ministry of Agriculture and Rural Development (Table 26). Under the Concept, the Slovak Republic is seeking to ensure that self-sufficiency in important agricultural commodities reaches the 80 % level by 2020. This leads to support for primary production of animals in the Slovak Republic, which is also closely related to employment policy in the agricultural sector.

Input data on the number of livestock used for greenhouse gas projections in the agriculture sector are shown in Table 26.

	2014*	2015*	2016	2017	2018	2019	2020	2025	2030
Livestock	Projected livestock numbers (thousands)								
	Slovak Republic Concept for Agricultural Development for 2013-2020								
Bovine animals	465.5	457.6	470.3	471.9	473.0	473.8	474.4	437.6	427.2
Pigs	641.8	633.1	677.4	724.9	775.6	829.9	888.0	963.3	949.5
Poultry	12,494.1	12,836.2	13,415.2	13,817.6	14,093.9	14,729.5	14,994.5	13,235.1	13,235.1

Table 26: Projected livestock number	rs in the Slovak Republic by 2020 (thousands of a	inimals)

\* Real data

### Parameters and other key industry trends for agriculture sector development:

The **WOM** scenario (BAU) is identical to the scenario with measures. The scenario with additional measures includes strict implementation of the recommendations of the Common Agricultural Policy predominantly in the field of management of manure and agricultural land, which are implemented in Slovak Government Regulation No 342/2014, laying down rules for the granting of agricultural aid in connection with the separate direct payments schemes

- Scenario with existing measures (**WEM**):
  - The scenario includes new measures for handling and processing of manure in the category of enteric fermentation.
  - Effective use and appropriate timing of use of nitrogen fertilisers;
  - Reduction in the number of dairy cows;
  - Increasing self-sufficiency in important agricultural commodities to the 80 % level by 2020.
- Scenario with additional measures (**WAM**):
  - The scenario includes new measures for the handling and processing of manure, as well as the implementation of a new animal feed policy in the category of enteric fermentation and manure management;
  - More effective use and appropriate timing of use of nitrogen fertilisers;
  - Reducing the number of dairy cows, intensive feeding with active substances.

### 3.1. Projected total greenhouse gas emissions

Table 27 and Figure 15 show aggregated data on projections of greenhouse gas emissions in the agriculture sector.

WEM	2014	2015	2020	2025	2030	2035	2040
3. Agriculture	3051	3020	2977	2758	2673	2670	2676
3.A Enteric fermentation	1010	989	885	841	750	750	750
3.B Manure handling	336	331	338	320	301	300	303
3.D Agricultural land	1632	1626	1680	1524	1548	1546	1549
3.G Use of calcium fertilisers	16	16	16	16	16	16	16
3.H Use of urea	58	58	58	58	58	58	58
WAM	2014	2015	2020	2025	2030	2035	2040
3. Agriculture	3051	2979	2768	2561	2502	2502	2509
3.A Enteric fermentation	1010	989	741	698	626	629	629
3.B Manure handling	336	318	318	302	285	285	288
3.D Agricultural land	1632	1598	1635	1487	1517	1514	1518
3.G Use of calcium fertilisers	16	16	16	16	16	16	16
3.H Use of urea	58	58	58	58	58	58	58

### Table 27: Projected total greenhouse gas emissions in agriculture (CO2equiv., Gg)

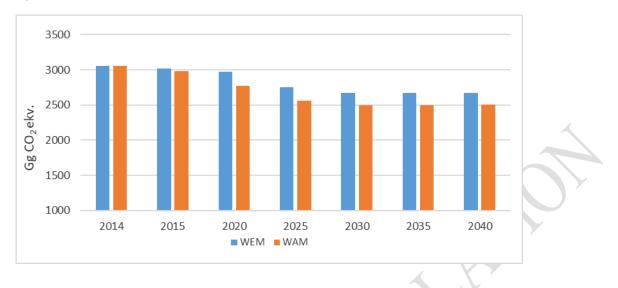


Figure 15: Projected total greenhouse gas emissions under defined scenarios in agriculture ( $CO_2$  equiv., Gg)

### 4. Land use, land use changes and forestry (LULUCF) sector

The LULUCF emission and capture projections were based on the sector strategy document Rural Development Programmes of the Slovak Republic for 2007 - 2013 and 2014 - 2020, taking into account the approved National Forestry Programme (NFP) of the Slovak Republic and the NFP Action Plans for 2009 - 2013 and 2015-2020. Projections for greenhouse gas emissions and capture assess all scenarios (without measures, with existing measures and with additional measures) and projection parameters (for managed forests). The baseline year for projection was 2015.

# Parameters and other key information for trends in land use, land use change and forestry (LULUCF):

The projections for LULUCF greenhouse gas emissions/capture were prepared in line with the following measures:

- afforestation of unforested areas,
- grassing over of arable land,
- enhancement of forest fire protection.

**Without measures (WOM)** - it corresponds to the state of forestry and land use without the measures implemented before 2015, as well as the measures planned for subsequent decades. Forest development is estimated according to effective forest management plans without the introduction of specific measures.

**With Existing Measures (WEM)** - represents the impact of the measures under consideration and implemented before 2015. From 2004-2006 only minimal specific mitigation measures were implemented in forestry and land use. During this period, afforestation of agricultural land was supported by the Rural Development Programme (RDP) and the Sectoral Operational Programme Agriculture and Rural Development (according to the provisions in paragraph 4.7.1).<sup>13</sup> The conversion of agricultural land into

forest land (afforestation) has been approved under these programmes for 15 projects covering a total of 100 hectares. Between 2007 and 2015, afforestation of unforested areas and grassing over of arable land continued under the Regional Development Programmes for 2007-2013 and 2014-2020. The following measures were considered mitigation in the scenario:

- afforestation of 800 ha of unproductive land with rapidly growing tree species and the first afforestation of 600 ha of agricultural land by 2015;
- grassing over of 50,000 ha of arable land by 2015;
- the impact of Regulation No. 2152/2003/EC on forest monitoring in relation to forest fires estimates the reduction in forest fire risk to 90 % as compared to 2000-2003.

*With Additional Measures (WAM)* - corresponds to measures planned after 2015. The Rural Development Programme (2014-2020) was approved as a continuation of the previous document, without any newly introduced specific measures. The WAM scenario took into account the afforestation of 23,000 ha of agricultural land by 2020-2030.

The methodology used for the calculations was based on the mathematical relationships defined in the IPCC Guidelines on Best Practices in the Land Use, Land Use Change and Forestry Sector, 2003 (IPCC 2003 GPG LULUCF), the basic instrument for greenhouse gas emission and capture. Emission factor and conversion/expansion factor values used in the projections are the same as those used in emission inventories for LULUCF in 2017.

### 4.1. Projected total greenhouse gas emissions and capture

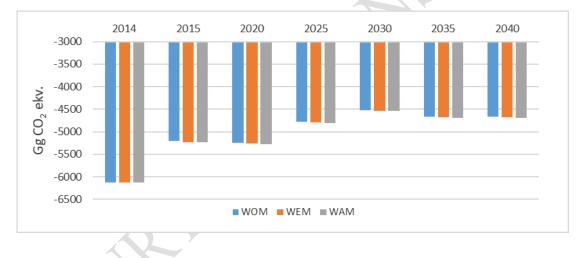
Table 28 and Figure 16 show aggregated data on projections of greenhouse gas emissions and capture in LULUCF.

WOM	2014	2015	2020	2025	2030	2035	2040
4. Land use, land use changes and forestry (LULUCF) sector	-6122	-5204	-5253	-4780	-4518	-4670	-4670
4.A Forest land	-4605	-3848	-3853	-3415	-3144	-3298	-3298
4.B Arable land	-795	-728	-760	-713	-713	-713	-713
4.C Grass lands	-184	-191	-215	-215	-215	-215	-215
4.E Habitation	84	92	114	114	114	114	114
4.F Other land	108	192	136	136	136	136	136
4.G Harvested wood products.	-731	-721	-675	-687	-695	-693	-693
WEM	2014	2015	2020	2025	2030	2035	2040
4. Land use, land use changes and forestry (LULUCF) sector	-6122	-5230	-5265	-4793	-4530	-4682	-4682
4.A Forest land	-4605	-3873	-3865	-3428	-3157	-3311	-3311
4.B Arable land	-795	-728	-760	-713	-713	-713	-713

Table 28: Projected total greenho	use gas ei	missions in L	.ULUCF (CO2 equiv.,	Gg)
		Y		

4.C Grass lands	-184	-191	-215	-215	-215	-215	-215
4.E Habitation	84	92	114	114	114	114	114
4.F. Other land	108	192	136	136	136	136	136
4.G Harvested wood products.	-731	-721	-675	-687	-695	-693	-693
WAM	2014	2015	2020	2025	2030	2035	2040
4. Land use, land use	(122	5330	5076	400.4	45.40	4600	4600
changes and forestry (LULUCF) sector	-6122	-5230	-5276	-4804	-4542	-4693	-4693
4.A Forest land	-4605	-3873	-3876	-3439	-3168	-3322	-3322
4.B Arable land	-795	-728	-760	-713	-713	-713	-713
4.C Grass lands	-184	-191	-215	-215	-215	-215	-215
4.E Habitation	84	92	114	114	114	114	114
4.F Other land	108	192	136	136	136	136	136
4.G Harvested wood products.	-731	-721	-675	-687	-695	-693	-693

Figure 16: Projected total greenhouse gas emissions under defined scenarios in LULUCF (CO2 equiv., Gg)



### 5. Waste

Policies and strategies in the waste sector affecting emissions forecasting in the Slovak Republic are prepared and implemented by the Ministry of the Environment, the Ministry of the Economy and the Office for Regulation of Network Industries.

#### Solid waste

The Ministry of the Environment regulates waste management through Act No 79/2015, on waste, as amended, emphasising the sorting of packaging and recyclable materials. Also, the funding scheme for separate collection is changing from the State Recycling Fund to the Producer Responsibility Organisation . The impact of this change is not yet known. Waste disposal is possible only at authorised managed waste landfills (Section 97). The Waste Act prohibits not only the disposal of biodegradable garden waste but also the disposal of sorted biodegradable kitchen and restaurant waste (Section 13), while the Waste Act

also establishes an obligation for municipalities to ensure the introduction and implementation of a sorted collection for biodegradable kitchen waste from households, edible oils and fats, and so-called. biodegradable green waste (Section 81). The Waste Act as well as Slovak Ministry of the Environment Decree No 371/2015, implementing certain provisions of the Waste Act, have been in force from 1 January 2016; similarly the collection standards for biodegradable municipal waste laid down in this Decree, the entry into force of which had been shifted to 1 January 2017, are currently in force.

The Waste Management Plan of the Slovak Republic defines the approach to waste management for 2016 - 2020. It sets out the following targets for separate collection (or diversion from waste disposal):

Fraction (tonnes)	Target 2020	Actual 2015	Base datum 2013
Glass	90,000	53,518	48,890
Plastics	110,000	34,658	29,010
Paper	120,000	65,158	64,022
Catering waste		4,755	2,838
Yard waste;		133,582	98,168
Biodegradable waste (see Note)	717,185	212,263	169,523

Note: The target for biodegradable waste (paper + kitchen + garden + other biodegradable waste fractions) was estimated as the difference between the modelled amount of biodegradable waste generated (1,047,585 t) and the quantity that can be disposed of in accordance with the Landfill Directive targets (35 % of which equals 330,400 t).

Landfill gas must be collected and burned if a landfill generates it in quantities sufficient to be burned and the landfill operator is required to monitor its occurrence, quantity and composition. (Ministry of the Environment Regulation No 372/2015, Section 5).

The Ministry of the Economy regulates the use of landfill gas and biogas from waste water treatment through Act No 309/2009, on the Promotion of Renewable Energy Sources, as amended.

In 2015 the Ministry of the Environment started to support the removal of illegal landfills. For the first round,  $\in$  10 million was provided by the Environmental Fund in 2015 and  $\notin$  9 million was allocated to 211 municipalities. The Ministry of the Environment continued this activity in 2016 when it provided EUR 7 million to 165 municipalities.

### Effluent water treatment

The Ministry of the Environment regulates the management of waste water by Act No 364/2004, on water, as last amended by Act No 303/2016. The maximum concentrations in waste water parameters permitted for discharge are defined in the Government Regulation of the Slovak Republic No 269/2010, laying down the requirements for achieving good water quality.

The strategy implementing this legislation is formulated in the Public Sewerage Development Plan for 2010-2015. This plan has been updated to include the period up to 2021, but it lacks information to quantify emissions trends in the waste water sector.

#### Access to projections

The waste sector is only a scenario with existing measures. The input data for a scenario with existing measures are only partially available, measures to promote renewable energy sources are inconsistent with the steps taken by distribution companies and the targets defined in the Waste Management Plan do not seem to be feasible. There are no further current measures in the waste sector in the Slovak Republic.

#### WEM scenario

Emissions projections in the waste sector are based on solid municipal waster emissions and municipal waste water emissions. These emissions represent 65 % of the total waste sector emissions expressed in  $CO_2$  equivalents. It is assumed that the remaining 35 % of emissions will remain constant over the projection period.

#### Solid Municipal Waste Disposal Projections

Emissions from solid waste disposal depend on population, waste generation per inhabitant and the proportion of waste put to landfill. Information on the future population growth in the Slovak Republic was obtained from the Population Ageing Report 2015 (AR2015) and from the INFOSTAT Demographic Research Centre (DRC). The AR2015 envisages a decrease in the population of the Slovak Republic by 4 % by 2035, with the DRC projecting an increase of 2 %

Since per capita waste generation is strongly correlated with the real wages index, the Institute for Financial Policy (IFP) assumption on real wage growth up to 2020 has been used. The IFP assumes that in the long-term (2020) the real wage index will grow by 2.9 % per year. The proportion of disposal of solid municipal waste in the Slovak Republic is high, reaching 65-70 %. The recorded long-term trend of the proportion of disposal of solid municipal waste shows a decrease of 10 % over the decade. This trend is expected to continue in the future, and the proportion of disposal of solid municipal waste will be reduced to 50 % in 2035.

#### Projected waste water

Emissions from municipal waste water depend on population, protein consumption and waste water distribution by treatment type. Waste water emissions projections are based on the same demographic projections as for the disposal of solid municipal waste.

Although data indicate a falling trend in protein consumption, the FAO predicts an increase of 20 % by 2035. This assumption was included as a target for the nitrogen balance by 2035.

A key issue in the distribution of waste water by treatment type is the proportion of digesters as they are the main source of waste water emissions. At first, the proportion of the population using centralised WWTPs and domestic WWTPs was estimated, the use of digestion tanks is then assumed for the remaining population. Given the mountainous nature of the Slovak Republic, it is assumed that the share of the population connected to the centralised WWTPs will increase from 65 % to 70 % and the share of the population connected to the domestic WWTPs from 2 % to 5 % This will result in a reduction in the share of digesters from 30 % to 22 % It is also assumed that the proportion of waste water treated in

modern WWTPs will grow from 60 % to 70 % This will lead to increased direct emissions from sewage treatment.

#### Constant emission sources

Sources of the waste sector that are expected to remain constant include industrial waste disposal, biotreatment, incineration and industrial waste water. Information is lacking about their development over the next 20 years. The probability of an increase or decrease in these emissions cannot be quantified.

There are no plans to build new waste incinerators, so it is assumed that existing incinerators will continue to operate without any change. Industrial waste generation may increase if industrial production increases but can be reduced if modern low-waste technologies are introduced.

#### **Outcomes**

The WEM scenario suggests that total emissions from the waste sector will decrease by 4.4 % if demographics develop in line with the AR2015 or will drop by 1.5 % if demographics develop in line with the DRC forecast. The main driving force behind this reduction would be a reduction in the use of digesters.

Disposal of solid municipal waste will remain unchanged as the main source of waste sector emissions. Increased solid municipal waste generation will be offset by increased sorting. The use of landfill gas also plays an important role in emissions from solid municipal waste disposal.

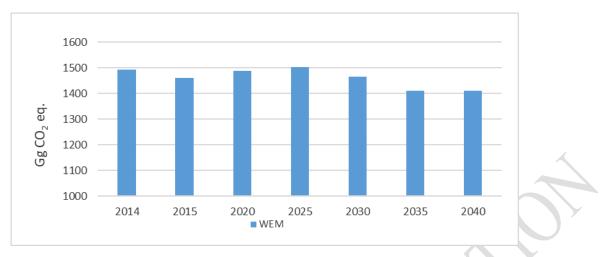
### 5.1. Projected total greenhouse gas emissions

Table 29 and Figure 17 show aggregated data on projections of greenhouse gas emissions in the waste management sector.

WEM	2014	2015	2020	2025	2030	2035	2040
5. Wastes	1492.58	1461.26	1487.72	1502.98	1465.09	1411.17	1411.17
5.A. Solid waste disposal	962.20	958.32	992.42	1021.80	1000.01	963.81	963.81
5.B. Biological treatment of solid waste	149.73	132.80	132.80	132.80	132.80	132.80	132.80
5.C. Incineration and open burning of waste	13.20	12.86	12.86	12.86	12.86	12.86	12.86
5.D. Waste water treatment and discharge	367.45	357.29	349.64	335.52	319.42	301.70	301.70

Table 29: Projected total gre	eenhouse gas emissions in waste	management (CO2 equiv., Gg)

# Figure 17: Projected total greenhouse gas emissions under defined scenarios in waste management $(CO_2 equiv., Gg)$



### 6. Projected total greenhouse gas emissions in sectors under review

GHG emissions from international transport are not included in the national balance. Projections of greenhouse gas emissions from international aviation and international maritime activities were prepared for a scenario with measures. It is clear from the data in Table 30 that the projected GHG emissions from these categories are negligible compared to other sources.

Table 30: Aggregated data on projections of greenhouse gas emissions from international transport in the case of a scenario with existing measures (equiv. (CO<sub>2</sub> equiv., Gg)

WEM	2014	2015	2020	2025	2030	2035	2040
M.International bunkers	133.84	134.38	137.11	138.15	139.66	139.66	139.66
M.IB. Aviation	119.43	119.97	122.71	123.74	125.26	125.26	125.26
M.IB. Maritime	14.40	14.40	14.40	14.40	14.40	14.40	14.40

Projections of greenhouse gas emissions, converted to  $CO_2$  equivalents according to current GWP values, have been developed for all defined IPCC sectors and years and relevant scenarios. Table 31 lists the results of model data in summary.

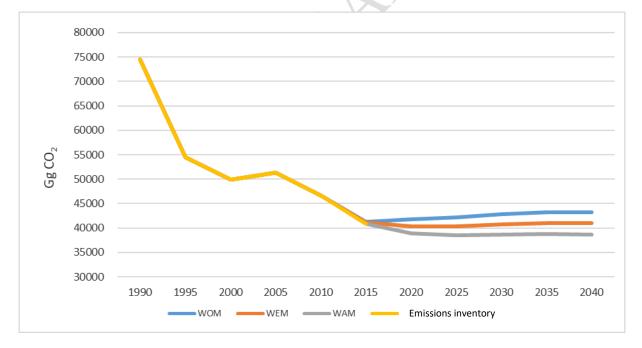
**Table 31:** Projected total greenhouse gas emissions in sectors under review (CO<sub>2</sub> equiv., Gg)

WOM	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040
Total excluding LULUCF	74460	54412	49863	51396	46560	41188	41819	42179	42790	43194	43269
Total including LULUCF	65469	45127	40144	45791	40547	35984	36567	37399	38272	38524	38600
1. Energy	56668	39568	36540	36759	32741	27627	28093	28563	28952	28957	28640
2. Industrial processes	9813	9383	8594	10258	9610	9080	9262	9355	9700	10157	10542
3. Agriculture	6587	4122	3379	3022	2813	3020	2977	2758	2673	2670	2676
4. LULUCF	-8991	-9284	-9719	-5605	-6013	-5204	-5253	-4780	-4518	-4670	-4670
5. Wastes	1393	1339	1351	1357	1395	1461	1488	1503	1465	1411	1411
WEM	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040
Total excluding LULUCF	74460	54412	49863	51396	46560	41099	40336	40374	40744	40940	41014

Total including LULUCF	65469	45127	40144	45791	40547	35870	35070	35582	36214	36258	36332
1. Energy	56668	39568	36540	36759	32741	27546	26959	27168	27372	27248	26936
2. Industrial processes	9813	9383	8594	10258	9610	9073	8912	8945	9234	9611	9991
3. Agriculture	6587	4122	3379	3022	2813	3020	2977	2758	2673	2670	2676
4. LULUCF	-8991	-9284	-9719	-5605	-6013	-5230	-5265	-4793	-4530	-4682	-4682
5. Wastes	1393	1339	1351	1357	1395	1461	1488	1503	1465	1411	1411
WAM	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040
Total excluding LULUCF	74460	54412	49863	51396	46560	40877	38880	38514	38647	38721	38570
Total including LULUCF	65469	45127	40144	45791	40547	35647	33603	33710	34106	34028	33877
1. Energy	56668	39568	36540	36759	32741	27364	25801	25699	25693	25494	25191
2. Industrial processes	9813	9383	8594	10258	9610	9073	8823	8751	8988	9313	9460
3. Agriculture	6587	4122	3379	3022	2813	2979	2768	2561	2502	2502	2509
4. LULUCF	-8991	-9284	-9719	-5605	-6013	-5230	-5276	-4804	-4542	-4693	-4693
5. Wastes	1393	1339	1351	1357	1395	1461	1488	1503	1465	1411	1411

Aggregated data on projections of greenhouse gas emissions according to the three model scenarios between 1990 and 2040 are summarised in Figure 15. Their development shows that the Kyoto Protocol's emission reduction target can also be achieved by a scenario without measures during the first binding period with an outlook to 2030.

Figure 18: Projected total greenhouse gas emissions under defined scenarios in sectors under review



#### 4.2.2. Renewable energy

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

	Year 2015	Year 2016
RES-H&C 44 ( %)	10.8	9.9
RES-Electricity generation <sup>45</sup> (%)	22.7	22.5
RES-T <sup>46</sup> ( %)	8.5	7.5
Overall RES share <sup>47</sup> (%)	12.9	12.0
Of which from cooperation mechanism <sup>48</sup> ( %)	0	0
Surplus for cooperation mechanism <sup>49</sup> ( %)	0	0

*ii.* Indicative projections of development with existing policies for the year 2030 (with an outlook to the year 2040)

Will be completed, in line with current status, in the final version of the national energy and climate plan.

<sup>&</sup>lt;sup>44</sup> Share of renewable energy in heating and cooling: gross final consumption of energy from renewable sources for heating and cooling (as defined in Articles 5(1)(b) and 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.

<sup>&</sup>lt;sup>45</sup> Share of renewable energy in electricity: gross final consumption of electricity from renewable sources (as defined in Articles 5(1)(a) and 5(3) of Directive 2009/28/EC) divided by total gross final consumption of electricity. The procedure is the same as that applied in Table 3 of the NREAP.

 $<sup>^{46}</sup>$  Share of energy from renewable sources in transport: final energy from renewable sources consumed in transport (cf. Article 5(1)(c) and 5(5)of Directive 2009/28/EC) divided by the consumption in transport of 1. petrol; 2.diesel; 3. biofuels used in road and rail transport and 4. electricity in land transport (as reflected in row 3 of Table 1). The procedure is the same as that applied in Table 3 of the NREAP.

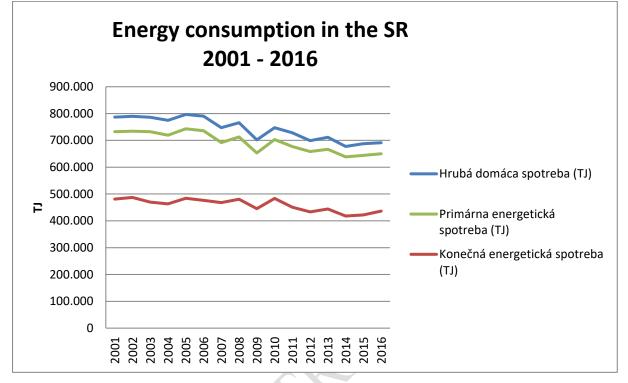
<sup>&</sup>lt;sup>47</sup> Share of renewable energy in gross final energy consumption. The procedure is the same as that applied in Table 3 of the NREAP.

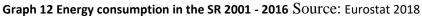
<sup>&</sup>lt;sup>48</sup> In percentage points of overall RES share.

<sup>&</sup>lt;sup>49</sup> In percentage points 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)

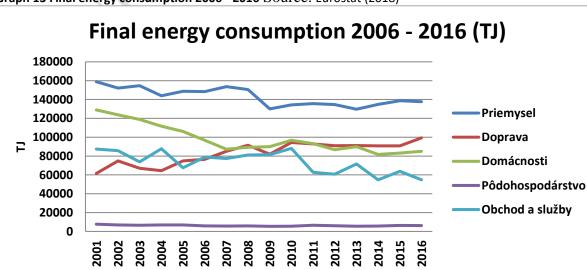




Key:
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ine ji	
Hrubá domáca spotreba (TJ)	Gross domestic consumption (TJ)
Primárna energetická spotreba (TJ)	Primary energy consumption (TJ)
Konečná energetická spotreba (TJ)	Final energy consumption (TJ)

Primary energy consumption reached 639,696 TJ in 2016, 113 TJ (0.02 %) less than in 2015. Final energy consumption in 2016 amounted to 382 938 TJ, which was 34 TJ (0.01 %) less compared to 2015.



Graph 13 Final energy consumption 2006 - 2016 Source: Eurostat (2018)

Key:

KCy.	
Priemysl	Industry
Doprava	Transport
Domácnosti	Households
Pôdohospodarstvo	Agriculture
Obchod a služby	Commerce and services

#### Energy consumption trends by sector

#### Industry

The industrial sector is the largest consumer of energy. Energy consumption in industry declined until 2009. After 2009 energy consumption in industry levelled out, with a moderate increase in 2015. Final energy consumption in industry was 138 PJ in 2016, accounting for 36 % of final energy consumption in Slovakia. Year-on-year energy consumption in industry fell by 0.8 %.

#### Transport

Consumption in the transport sector was 99 PJ in 2016. The largest year-on-year rise in energy consumption was in 2016, increasing by 9.3 %. Between 2006 and 2016 it rose by up to 30 %, making it the largest increase in consumption during that period.

The chief factors fuelling long-term energy consumption growth in transport in the reporting period include: the ever-growing numbers of registered motor vehicles and the accompanying rise in the numbers of people travelling by car, along with an expansion in road haulage as the carriage of goods switches from less energy-intensive modes of transport to road transport.

#### Households

Year-on-year household energy consumption increased slightly (by 2.1 %). This was mainly due to lower average outdoor temperatures, meaning higher consumption for household heating.

### Agriculture

Energy consumption in the agriculture sector does not exhibit such pronounced fluctuations as in other sectors. In 2016 the sector recorded a year-on-year fall of 1.1 %.

### **Commercial and public services**

Energy consumption in the trade and services sector fell significantly in 2016, by up to 14 % compared to the previous year. This variation can be explained by the break-up and merger of undertakings, changes in their sectoral classification and the resulting changes in terms of where their consumption is classified in the energy balance, and by the calculation method used by the SO SR for this item.

# *ii.* Current potential for the application of high-efficiency cogeneration and efficient district heating and cooling<sup>50</sup>

In 2017, the total installed capacity for high-efficiency cogeneration was 1,241.85 MW, while the electricity generated was 2,545.28 MWh, representing 9 % of total electricity generation in Slovakia. According to cogeneration technologies, the generation of electricity in steam vapour condensing or

In accordance with Article 14(1) of Directive 2012/27/EU.

backpressure turbines is currently predominant. The share of these installations in total installed power is 58.0 %, and 83.0 % of the total heat produced by high efficiency cogeneration.

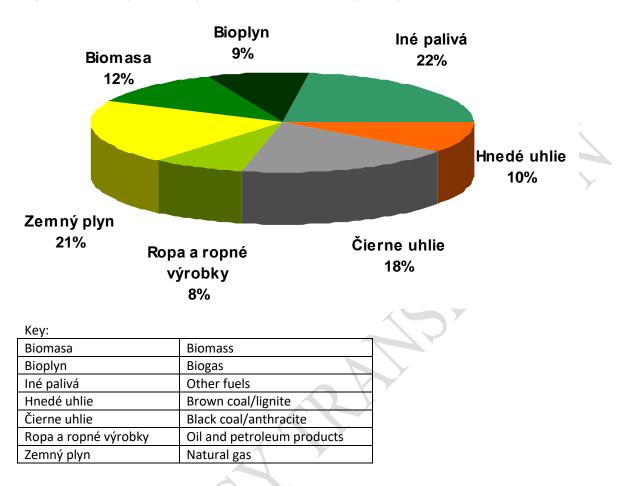


Figure 19: Share of individual fuels in combined heat and power plants

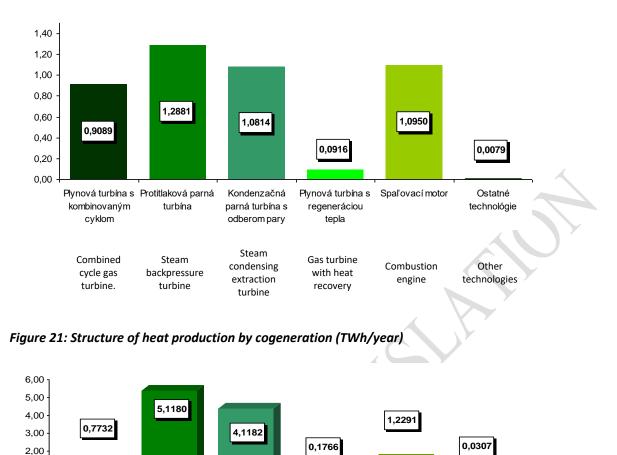
In recent years, plants using combined heat and power technology have been rebuilding boilers to burn biomass with coal and building new boilers to burn biomass, and this trend will continue, although to a lesser extent than hitherto.

For large sources with steam and gas turbines, only a slight increase in installed capacity is expected, which is achieved by the essential reconstructions of existing technology with combined heat and power technology. In this segment of electricity output through cogeneration, especially in the heat plants with condensing steam turbines, recently, in addition to the reconstruction and modernisation of these facilities, these technologies are being replaced by gas piston engines for natural gas with an electric motor power of up to 10 MW. The greatest potential for additional high-efficiency cogeneration is assumed for existing district heating systems, which supply heat to end users.

Year		Act	ual		Prediction					
	20	2011		2014		20	20	25		
CHP technology	Capacity Installed	Electricity generated								
	(MWe)	(GWh)	(MWe)	(GWh)	(MWe)	(GWh)	(MWe)	(GWh)		
Combined cycle gas turbine.	394.9	874.0	394.9	908.9	394.9	947.8	394.9	967.6		
Steam backpressure turbine	583.0	1370.6	577.0	1,288.1	582.8	1340.4	594.4	1,367.2		
Steam condensing extraction turbine	1622.9	1299.9	1631.1	1,081.4	1647.4	1153.2	1663.9	1,164.7		
Gas turbine with heat recovery	25.4	124.8	25.4	91.6	30.5	115.8	36.6	139.0		
Combustion engine	47.1	231.5	187.1	1,095.0	261.9	1571.3	340.4	2,042.7		
Other technologies	0.0	0.0	1.2	7.9	5.9	38.7	8.8	58.1		
Total	2,673.3	3,900.8	2,816.7	4,472.8	2,923.3	5,167.2	3,039.1	5,739.2		

# Table 32 Estimated economic potential of heat production by cogeneration

Year		Act	ual		Prediction					
	202	11	20	14	20	20	2025			
CHP technology	Capacity Installed	Heat supplied	Capacity Installed	Heat supplied	Capacity Installed	Heat supplied	Capacity Installed	Heat supplied		
	(MW)	(GWh)	(MW)	(GWh)	(MW)	(GWh)	(MW)	(GWh)		
Combined cycle gas turbine.	332.0	748.2	332.0	773.2	346.2	806.4	353.4	823.2		
Steam backpressure turbine	1854.0	5359.2	1818.2	5118.0	1891.9	5325.8	1929.8	5,432.3		
Steam condensing extraction turbine	4873.0	4760.1	4902.0	4118.2	5227.6	4391.8	5279.8	4,435.7		
Gas turbine with heat recovery	83.4	262.9	83.4	176.6	105.4	223.2	126.5	267.9		
Combustion engine	52.9	264.2	206.9	1229.1	296.9	1763.8	386.0	2,292.9		
Other technologies	0.0	0.0	4.8	30.7	23.7	151.3	35.5	227.0		
Total	7,195.3	11,394.6	7,347.3	11,445.9	7,891.7	12,662.2	8,111.1	13,478.9		



Plynová turbína Spaľovací motor

Combustion

engine

s regeneráciou

tepla

Gas turbine

with heat

recovery

Ostatné

technológie

Other

technologies

Figure 20: Structure of electricity production by cogeneration (TWh/year)

1,00 0,00

Plynová turbína

s kombinovaným

cyklom

Combined

cycle gas

turbine.

Protitlaková

parná turbína

Steam

backpressure

turbine

Kondenzačná

parná turbína s

odberom pary

Steam

condensing

extraction

turbine

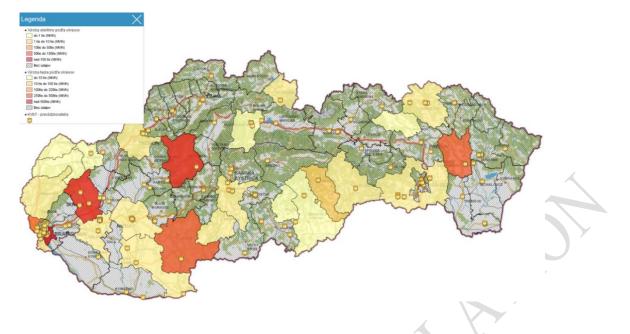


Figure 22: Co-generators and the amount of electricity and heat produced by district

Heat supply from district heating systems is provided to approximately 16,000 apartment blocks, with a total of 650,620 apartments (more than 1.8 million inhabitants). Over the last 15 years, heat consumption in apartment blocks connected to the district heating systems has decreased by 26 % to 1,800 GWh. This reduction followed the introduction of energy-efficiency measures (hydraulic regulation of heating systems and hot water distribution, insulation of circulating pipelines for hot water distribution, installation of thermoregulating valves, thermal insulation of building façades and replacement of windows) and depending on the number of degree-days, reflecting the climate conditions in different years.

Slovakia's Innovation and Energy Agency, which operates the energy efficiency monitoring system, has created and operates a Thermal Map of the Slovak Republic. The Thermal Map serves in particular to identify those areas where heat can be efficiently and efficiently delivered through high-efficiency combined heat and power, through renewable sources, and through the use of heat from industrial processes for heating and cooling. The Thermal Map should help to provide potential investors with information on locations where it is advisable to think in the future about the introduction of district heating systems and hence the potential for the use of cogeneration.

More detailed information on the Thermal Map is available at www.siea.sk/tepelna-mapa/.

# Table 33 Current heat supply in district towns of the SR and the potential for cogeneration for selected cities

		llost supplied			CHP potential	
District		Heat supplied		Total number (combustion	Power	
District	Heating	Hot water heating	Total	motors)	Heat	Electrical
		(GWh)		(-)	(kW)	(kW)
Banska Bystrica	184.95	79.94	264.89	27	7,617	6,591
Banska Stiavnica	9.82	5.21	15.03	6	560	447
Brezno	15.99	6.58	22.57	9	702	561
Detva	31.90	14.09	45.99	2	1,537	1,331
Krupina	12.61	6.32	18.93	2	677	541
Lucenec	45.10	18.08	63.18	14	1,829	1,463
Poltar	6.38	2.74	9.13	1	234	187
Revuca	35.75	11.90	47.64	7	907	725
Rimavska Sobota	47.95	16.32	64.27	4	452	361
Velky Krtis	36.24	13.36	49.61	3	524	420
Zvolen	104.20	52.66	156.86	10	795	636
Zarnovica	11.60	6.76	18.36	4	621	497
Žiar nad Hronom	88.02	40.31	128.33	1	80	64
Bratislava I.	175.56	32.07	207.63	24	2,717	2,173
Bratislava II.	449.70	143.21	592.92	14	1,392	1,113
Bratislava III.	869.88	77.11	946.99	17	2,119	1,695
Bratislava IV.	492.74	101.97	594.71	12	2,089	1,672
Bratislava V.	652.96	120.22	773.19	22	13,982	11,335
Malacky	72.13	17.46	89.59	9	1,943	1,555
Pezinok	17.08	1.01	18.09	4	675	540
Senec	18.63	0.01	18.64	3	712	570
Gelnica	9.70	4.00	13.70	3	448	359
Košice - surrounding						
area	16.58	6.58	23.16	3	185	148
Košice I.	168.52	66.52	235.04	4	208	167
Košice II.	148.84	74.17	223.01	1	0	0
Košice III.	44.57	28.24	72.81	0	0	0
Košice IV.	78.17	31.75	109.92	1	16	13
Michalovce district	60.69	30.75	91.44	19	3,659	2,929
Roznava	52.23	18.66	70.88	17	1,231	986
Sobrance	2.97	2.13	5.10	3	239	192

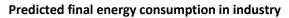
Spisska Nova Ves	79.84	31.85	111.69	27	3,592	2,874
Trebisov	42.69	18.55	61.24	13	1,932	1,547
Komarno	72.61	32.86	105.47	16	765	612
Levice	91.57	40.47	132.05	20	2,414	1,932
Nitra	195.16	54.34	249.50	27	4,735	3,792
Nové Zámky	166.99	45.03	212.02	7	1,886	1,509
Šaľa	45.66	0.02	45.68	4	1,365	1,091
Topoľčany	106.93	18.06	124.99	1	1,949	1,754
Zlate Moravce	32.30	5.55	37.84	3	766	613
Bardejov	55.68	20.84	76.53	11	2,233	1,787
Humenne	109.20	47.67	156.87	0	0	0
Kezmarok	20.49	11.33	31.82	10	1,279	1,022
Levoca	14.41	6.05	20.46	6	400	320
Medzilaborce	10.10	4.82	14.92	2	489	391
Propad	104.01	49.72	153.73	35	4,649	3,720
Prešov	139.13	52.30	191.42	32	7,902	6,840
Sabinov	14.48	7.24	21.72	6	827	662
Snina	31.19	13.43	44.62	1	185	148

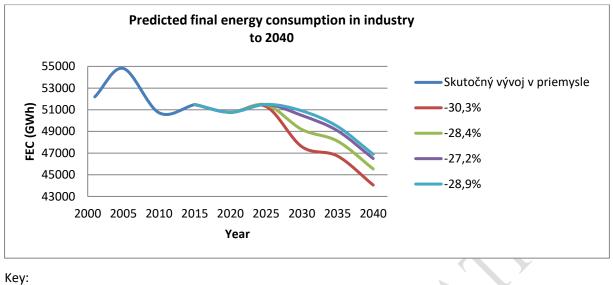
iii. Projections considering existing energy efficiency policies, measures and programmes as described in point 1.2.(ii) for primary and final energy consumption for each sector at least until 2040 (including for the year 2030)<sup>51</sup>

Forecasts in individual sectors of the national economy were based on outputs from a model developed by the World Bank, with 4 variants being created for each sector. The variants reflect the PEC decline forecasts for 2030 compared to the reference year 2007. The PEC prognosis values in 2030 for the following variants are as follows: -27.2 %. -28.9 %. -28.4 %. -30.3 %.

51

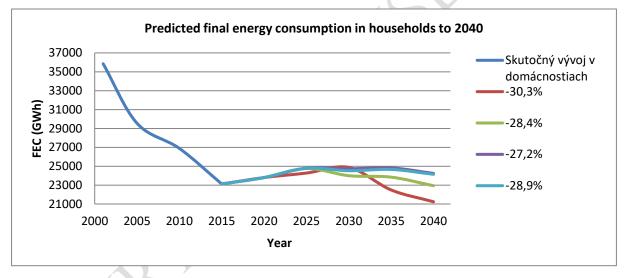
This reference business as usual projection shall be the basis for the 2030 final and primary energy consumption target which is described in 2.3 and for conversion factors.





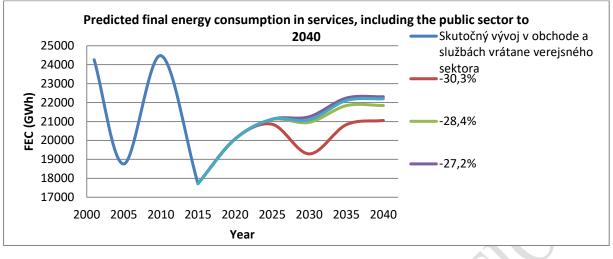
Skutočný vývoj v priemysle Actual trend in industry





# Key:

Skutočný vývoj v domácnostiach Actual trend in households

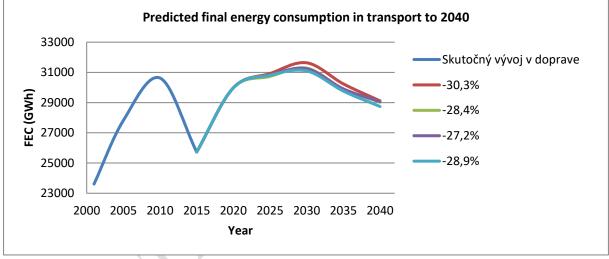


#### Predicted final energy consumption in services, including the public sector

Key:

Skutočný vývoj v obchode a službách vrátane verejného sektora Actual trend in commerce and services including public sector





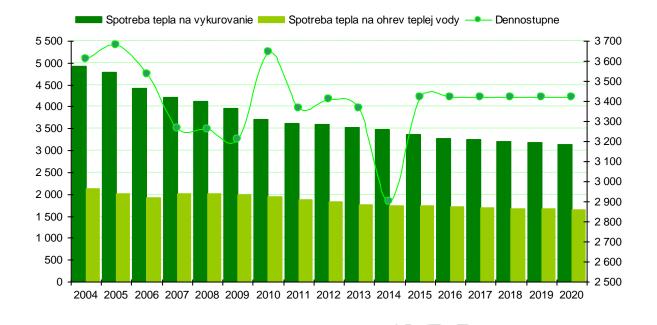
Key:

Skutočný vývoj v doprave Actual trend in transport

### Predicted heat consumption

Heat supply from district heating systems is provided to approximately 16,000 apartment blocks, with a total of 650,620 apartments (more than 1.8 million inhabitants). Over the last 15 years, heat consumption in apartment blocks connected to the district heating systems has decreased by 26 % to 1,800 GWh. This reduction followed the introduction of energy-efficiency measures (hydraulic regulation of heating systems and hot water distribution, insulation of circulating pipelines for hot water distribution, installation of thermoregulating valves, thermal insulation of building façades and replacement of windows) and depending on the number of degree-days, reflecting the climate conditions in different years.

# Figure 23: Actual and predicted trend in heat consumption in GWh in apartment buildings with heat supplied from district heating



Key:

Spotreba tepla na vykurovanie Heat used for heating Spotreba tepla na ohrev teplej vody Heat used for heating hot water Dennostupne Day-degrees

It is assumed that the decline in heat consumption will continue, but not so markedly as in the last 15 years. Estimates and forecasts for 2020 provide for a decrease in heat consumption of 8.5 %, that is, 450 GWh.

The forecast for heat consumption for the next few years was determined by analysing the potential for the energy efficiency of thermal plants, from which to a large extent the supply of heat from district heating systems and is covered and the anticipated development of heat consumption for heating, especially in apartment buildings supplied by heat from these systems. In addition to reducing heat consumption in apartment buildings, it is expected that there will be significantly reduced heat consumption in public buildings supplied by heat from district heating systems. Consideration was also given to the assumed heat consumption in development areas (industry, housing construction). The potential increase in heat consumption will largely be covered by the expected reduction in the supply to existing heat consumers. According to the above, the anticipated heat consumption was modelled up to 2025.

#### Table 34 Real and projected heat consumption in Slovakia from district systems

		2010	2012	2014	2015	2017	2019	2021	2023	2025
Public and industrial heating plants, heating systems - district heating systems	(GWh)	24,002	22,089	19,063	20,864	20,790	20,453	20,669	21,162	21,666
Individual heat supply - local boilers (households, services)	(GWh)	19,370	18,783	15,790	18,279	17,647	17,484	17,617	17,911	18,214
TOTAL	(GWh)	43,372	40,872	34,853	39,143	38,437	37,937	38,286	39,073	39,881

#### Table 35 Real and projected energy mix with heat from district systems

Primary fuels and ene	ergy	2010	2012	2014	2015	2017	2019	2021	2023	2025
natural gas	(GWh)	12,551	11,001	8,361	9,875	9,686	9,285	9,497	9,983	10,479
Coal	(GWh)	5,519	3,177	3,015	3,230	3,221	3,157	3,095	3,033	2,973
wood and wood waste	(GWh)	1,293	2,643	3,068	3,059	3,183	3,311	3,378	3,446	3,515
nuclear	(GWh)	1,526	1,373	844	996	1,037	1,078	1,089	1,111	1,133
other fuel*	(GWh)	3,112	3,895	3,775	3,704	3,663	3,622	3,611	3,589	3,567
TOTAL	(GWh)	24,002	22,089	19,063	20,864	20,790	20,453	20,669	21,162	21,666

\* oil and petroleum products, waste incineration, effluent, metallurgical gases, usable heat from chemical production

### **Financial instruments**

Investment programmes for energy efficiency and renewable energy use:

### **Operational Programme 'Quality of the Environment' Priority Axis 4**

Within the priority axis, 940 mil. has been earmarked for 2014-2020. The Priority Axis is aimed at transitioning to a low-carbon economy by using renewable energy sources and improving energy efficiency (increasing heat and power from renewable energy sources, systematically reducing greenhouse gas emissions, developing efficient district heating systems)

### National "Zelená domácnostiam" project

This project focuses on the use of the so-called small renewable sources in family and apartment homes to increase the share of renewable energy use in households. By November 2018, 17,434 vouchers, worth more than € 38.8 million, were reimbursed as part of the Operational Programme Quality of the Environment. If all currently valid vouchers are used, by the end of 2018 more than 18,600 installations for the use renewable energy should be supported from the project.

The SIEA is preparing a continuation of the "Zelená domácnostiam" project so that vouchers can be issued from 2019. The plan for the new project, with a total budget of € 48 million, has already been approved. As part of the project, an additional 25,000 installations could be supported in 2023 in households outside

the Bratislava autonomous region. It is planned to extend the original SIEA voucher system plans with an applications stack to allow households to demand vouchers on an ongoing basis.

# State environmental protection aid scheme for the reduction of GHG and pollutants in the energy sector

The indicative value of expenditure planned under this scheme over the period 2017 - 2020 is 100 million euros. The scheme is intended to provide State aid to increase environmental standards by going beyond the applicable Union standards, in the form of a subsidy from the state budget, to support projects in the field of achievable and measurable greenhouse gas and pollutant emissions savings, reducing the use of primary energy sources, replacing fossil fuels with renewable energy sources, constructing, renovating and modernising heat distribution from district heating, construction or upgrading energy infrastructure, and introducing best available techniques to reduce greenhouse gas and pollutant emissions

# Table 36: Overview of the most important policy measures to achieve the objective of Art. 7 of Directive 2012/27/EU

Source of financing	Measures
Own resources of the obligated entities	- Mandatory energy audits for large businesses
Own resources of the obligated entities	<ul> <li>Mandatory hydraulic regulation of the heat and hot water distribution system including the provision of hot water distribution with appropriate thermal insulation in buildings with a total floor area greater than 1000 m<sup>2</sup> (Act No 321/2014, on energy efficiency)</li> </ul>
Own resources of the obligated entities	<ul> <li>The obligation to monitor, evaluate and provide consumption data to the operator of the energy efficiency monitoring system for central government authorities, municipalities, higher territorial units, organisations in their jurisdiction and building owners/administrators with a total floor area of more than 1000 m<sup>2</sup> (Act No 476/2008, and Act No 321/2014, on energy efficiency)</li> </ul>
Operational Programme 'Competitiveness & Economic Growth' SF 2007-2013	<ul> <li>Innovation and technology transfer in industrial plants.</li> <li>Increasing the energy efficiency of industrial production,</li> </ul>
Operational Programme 'Health' SF 2007-2013	<ul> <li>Improving the thermal characteristics of public buildings — hospitals and health facilities</li> </ul>
Operational Programme Transport SF 2007-2013	<ul> <li>Renewal and upgrading of the vehicle park,</li> <li>Building and upgrading transport infrastructure</li> </ul>
Regional Operational Programme SF 2007-2013	<ul> <li>Improving the thermal characteristics of public buildings — schools and educational establishments, social services facilities, cultural establishments, etc.</li> </ul>
Operational Programme 'Research & Development' SF 2007-2013	<ul> <li>Improving the thermal characteristics of public buildings — schools and educational establishments</li> </ul>
State Housing Development Fund - Insulating residential housing	- Improving the thermal and technical characteristics of residential housing
Operational Programme 'Quality of the Environment' ESIF 2014-2020	<ul> <li>Ensuring energy audits in SMEs and implementing measures from energy audits,</li> <li>Improving the energy efficiency of public buildings</li> <li>Development, approval and implementation of plans for sustainable energy and reduction of greenhouse gas emissions</li> <li>Introduction of energy management systems, including energy audits and environmental management</li> <li>Support for energy services development at regional and local level</li> <li>Construction, renovation and upgrading of heat distribution pipes</li> <li>Construction, renovation and upgrading of installations for the production of electricity and heat through high-efficiency cogeneration with a maximum thermal input of 20 MW</li> </ul>

Source of financing	Measures					
	<ul> <li>Raising the awareness of children and young people in the field of energy efficiency</li> <li>Information campaign focusing on energy efficiency</li> </ul>					
	<ul> <li>Monitoring and Information System – interconnection with most energy efficiency support mechanisms</li> </ul>					
Operational Programme	- Renewal and upgrading of vehicle park for public passenger transport,					
'Integrated Infrastructure' ESIF	<ul> <li>Building and upgrading transport infrastructure</li> </ul>					
2014-2020	<ul> <li>Promoting the development and use of public passenger transport, including support for the creation of integrated transport systems</li> </ul>					
Integrated Regional	- Support for the development of non-motorised transport, especially cycling					
Operational Programme SF 2014-2020	<ul> <li>State Housing Development Fund - Insulating residential housing using EU funds (see above),</li> </ul>					
Green programme Slovseff III.	<ul> <li>Improving the thermal characteristics of residential housing.</li> <li>Improving energy efficiency in industry</li> </ul>					
Subsidy under MoE	<ul> <li>Implementation of energy efficiency measures from energy audits in SMEs in Bratislava region</li> </ul>					
	- Increasing the energy efficiency of heat distribution in Bratislava region,					
Environmental Fund	- Improving the thermal and technical characteristics of public buildings					
Subsidy for insulation of family homes	- Improving the thermal and technical characteristics of residential housing.					
Voluntary agreement	<ul> <li>Implementing energy efficiency measures for entities, particularly in industry and the energy sector, in order to reach agreed energy savings or provide information.</li> </ul>					

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

Cost-optimal levels of minimum energy performance requirements for buildings have been established according to the EC comparative methodology given 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 framework for a comparative methodology for the calculation of cost-optimal levels of minimum energy performance requirements for buildings and building elements and guidelines accompanying Commission Regulation (EU) No 244/2012. By calculations and comparisons, it was to be demonstrated whether the current minimum energy performance requirements for buildings and building elements. Comparison of the calculated cost-optimal levels with current minimum energy performance requirements for buildings The results of the comparison for the SR have revealed the justification for the tightening of requirements after 2015.

By selecting according to specified features (building category, construction period, size, availability of project data) using the database of residential and non-residential buildings based on statistical analysis methods, 11 reference buildings were proposed. In addition to the set obligation to propose 2 reference buildings from the existing pool and 1 reference new buildings to represent the categories of apartment buildings, family houses and administrative buildings, 1 reference building representing school buildings and 1 reference building representing a sports building were proposed.

As part of the packages of measures, measures were applied complying with the applicable requirements set for low-energy construction, for ultra-low energy construction and for buildings with nearly zero energy requirement according to STN 73 0540-2: 2012. All packages, including the package with the optimal building design properties being considered, were used to determine primary energy, life cycle costs, including net present value.

For each reference building, between 5 and 12 packages/variants of measures were used. One special package is the reference case characterised by the original state for existing buildings and a package characterised by current requirements for new buildings. Variant solutions have been proposed for individual thermal protection levels of buildings (e.g. 12 variants for thermal protection of the outer cladding with various thicknesses of thermal insulation varying from 40 mm to 240 mm in additional thermal protection in an additive thermal insulating contact system). The value of the heat transfer coefficient took into account the original quality of the cladding, the roof covering and the internal dividing structures between the heated and unheated spaces. For the variations in the change in the thermal properties of the opening structures, a selection was made of products characterised by the heat transfer coefficient of the frame and the glazing  $(U_f, U_g, U_w \text{ in } W/(m^2.K))$ , solar energy transmittance g (-) and a linear loss coefficient for the glazing spacing frame. Variants were also considered for heat generation (7 variants, e.g. natural gas district heating, wood chips, combined heat and power generation, condensing gas boiler, wood pellet boiler, air - water heat pump, ground - air heat pump), as well as variants for hot water production and cold production. For lighting, an analysis was independently conducted of the cost optimality of the measures when compared with the energy requirement. The option chosen was applied in all packages of proposed measures when determining the net value.

The results of the calculations show that global costs are different for the macroeconomic and financial aspects, but this does not change the optimum position. The national reference value that was considered for the SR to compare the calculated cost-optimal levels with the current minimum energy performance requirements is the financial (microeconomic) level, i.e. including VAT and without considering  $CO_2$  costs.

Under Art. 4(1) of Directive No. 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 shall be reviewed at regular intervals which shall not be longer than five years.

The results of the calculation of the cost-optimal levels of minimum energy performance requirements for buildings in 2013 were compared with the established requirements (as recommended) from 1 January 2016 for the ultra-low energy level of construction. By an amendment to standard STN 73 0540-2: 2012/Z1: 2016 standardised requirements were introduced for ultra-low energy construction with effect from 1 August 2016, which correspond to the results of the calculation of cost-optimal levels of minimum energy performance requirements for buildings.

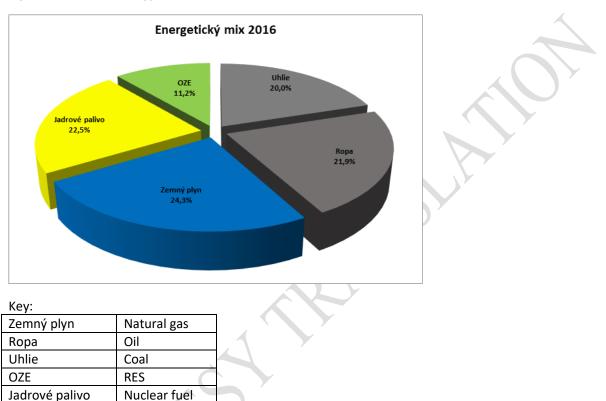
When calculating cost-optimal levels of minimum energy performance requirements in 2018, the procedures used and results of the cost-optimal minimum level of 2013 calculations, introduced in the applicable legislation, have been respected. This means that the basic level of assessment are the current requirements for the ultra-low energy level of construction.

The calculation of the minimum requirements for the energy performance of buildings and at the same time the subject of the second phase of the assessment was the calculation of the cost-optimal level of minimum energy performance requirements for buildings with nearly zero energy needs. For the second phase of assessing the cost optimalities of the minimum building energy efficiency requirements, reference was made to the reference building categories: apartment buildings, family houses and administrative buildings.

Due to the introduced clarifications and adjustments to the entry conditions of calculations (e.g. taking into account the influence of thermal bridges, poor heat use, change of primary energy factors) and taking into account the supply of new construction products and changes in the parameters of construction products, a new assessment of reference buildings in the ultra-low energy level of construction had to be carried out.

# 4.4. Dimension: energy security

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



### Figure 24: Current energy mix

Main domestic sources of energy are renewables and brown coal. After 2023, when support for the production of electricity from coal is discontinued, we expect a significant decline in brown coal mining.

# Hydroelectric plants

Total output from hydroelectric power plants is more than 2500 GW. Their annual output is between 4,000 - 5,500 GWh per year, representing 14-19 % of total consumption, or more exactly, of electricity generation.

The most important of these is the Gabčíkovo hydro-electric plant (720 MW) with an average annual output of about 2200 GWh and the Čierny Váh pumped storage plant (735 MW), which provides support services for the power grid. They are expected to operate until 2035.

The SR is almost 90 % dependent on the import of primary energy sources: nuclear fuel 100 %, natural gas 98 %, oil 99 % and coal 68 %

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

In the past, certificates of compliance of an investment plan with energy policy have been issued for potential upcoming new source projects:

The <u>Sered' Hydroelectric</u> project is aimed at utilising the untapped energy potential of the Váh River in the Sered' - Hlohovec section to generate about 180 GWh per year of electricity. This hydro plant with a lock system is part of the Vážska route project and its completion will create a navigable route from Komárno to Hlohovec. The main obstacle to implementation of the work is the long-term return on investment at current electricity prices.

The <u>new nuclear source</u> (NNS) will, due to its impact on the whole system and on the energy security of the SR, be the most significant Slovak energy project in the long run. In its 2012 programme statement the Slovak Government stated that it will accelerate the preparations for its construction. At the Jaslovské Bohunice site a nuclear power plant with a total installed capacity of up to 2400 MW can be implemented with 1x1200 MW, 2x1200 MW or 1x1700 MW variants, while complying with the conditions and recommendations set out in the Feasibility Study and underlying studies for the NNS project.

The <u>Ipel' Pumped Hydropower</u> Project, with a proposed installed capacity of 600 MW, represents significant potential for providing a wide range of support services. This is a weekly cycle pumped hydro source that is able to move weekend "surplus" energy from nuclear power plants to peak load on weekdays. It is also an optimum balancing factor for the output of wind and photovoltaic power plants. Implementation of the project will depend on the growth of the international electricity market and interest from a strategic investor.

It is also possible to assess the feasibility of using hydroenergy potential within the comprehensive use of the Danube above Bratislava.

The Enviral Leopoldov bioethanol enhancement project, with installed capacity of 15 MW of CHP from RES.

Even with the construction of relatively small local, widely distributed power sources with relatively limited installed power, an installed power increase of several tens of MW can be expected in the coming years. This generation is highly efficient especially through the use of the latest technologies, esp. CHP, and because of its proximity to the customer does not place increased demands on transmission capacity.

# 4.5. Dimension: internal energy market;

# 4.5.1. Electricity interconnectivity

i.

Current interconnection level and main interconnectors<sup>52</sup>

The current level of interconnection of the transmission system including the main interconnection lines is shown in the following figure. Their current transmission capability is documented in the following table and graph.

<sup>52</sup> 

With reference to overviews of existing transmission infrastructure by Transmission System Operators (TSOs).

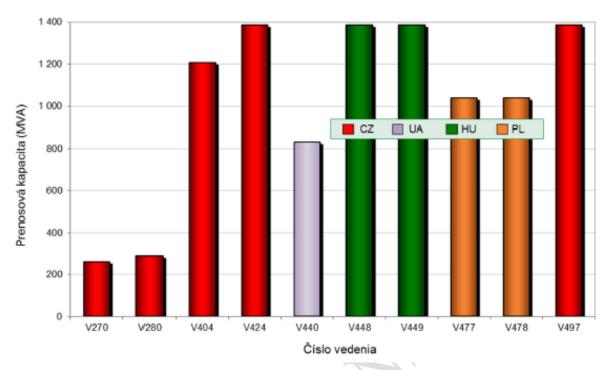
Vedenie	Elektrická stanica		Elektrická	stanica SK	Napätie	I <sub>max</sub>	Limitovaná prenosová	
vedenie	krajina	názov	spoločnosť	názov	spoločnosť	kV	A	kapacita MVA
V270	cz	Liskovec	ČEPS	Pov. Bystrica	SEPS	220	683	260
V280	cz	Sokolnice	ČEPS	Senica	SEPS	220	755	288
V404	cz	Nošovice	ČEPS	Varín	SEPS	400	1 740	1 206
V424	cz	Sokolnice	ČEPS	Križovany	SEPS	400	2 000	1 386
V440	UA	Mukačevo	WPS	V. Kapušany	SEPS	400	2 000	1 386
V448	HU	Győr	MAVIR	Gabčíkovo	SEPS	400	2 000	1 386
V449	HU	Göd	MAVIR	Levice	SEPS	400	2 000	1 386
V477	PL	Krosno - Iskrzynia	PSE	Lemešany	SEPS	400	1 500	1 039
V478	PL	Krosno - Iskrzynia	PSE	Lemešany	SEPS	400	1 500	1 039
V497	cz	Sokolnice	ČEPS	Stupava	SEPS	400	2 000	1 386

1

# Prenosové kapacity cezhraničných vedení

Key:	
Vedenie	Line No.
Elektrická stanica	Sub-station
krajina	Country
názov	Name
spoločnosť	Company
Napätie kV	Voltage kV
I <sub>max</sub> A	I <sub>max</sub> A
Limitovaná prenosová kapacita MVA	Limited transmission capacity MVA
ORT	

#### Graph 14 Transmission capacities of cross-border lines



Prenosové kapacity cezhraničných vedení

Note: Permissible current loads of the V440 V. Kapušany - Mukachevo (UA) and V449 Levice - Göd (HU) are seasonally adjusted. At present, the V440 line current load rating is 1609 A (summer 1200 A) and V449 is 2000 A (summer 1800 A).

Key:	
Číslo vedenie	Line No.
Prenosová kapacita MVA	Transmission capacity MVA

# *ii.* Projections of interconnector expansion requirements (including up to 2030)<sup>53</sup>

According to SEPS, the total installed capacity of generation facilities will be 8,720 MW ( the boundary scenarios 7240 and 9560 MW) in 2030, of which RES (including installed hydro power plants) accounts for 3,790 to 4,630 MW. The maximum load will increase proportionally with 1.2 % year-on-year consumption growth up to 5,250 MW. The total thermal capacity of the Slovak border crossings is now 10,200 MVA (9,306 MW); by 2030 this should reach 14,000 MVA (12,203 MW).

The trend in the overall level of Slovak interconnection by 2030 and its dispersion with respect to trends in the source mix, i.e. the ratio of the assumed net import transmission capacity to the total expected installed electricity generation capacity in the SR is shown in Fig. 25.

With reference to national network development plans and regional investment plans of TSOs.

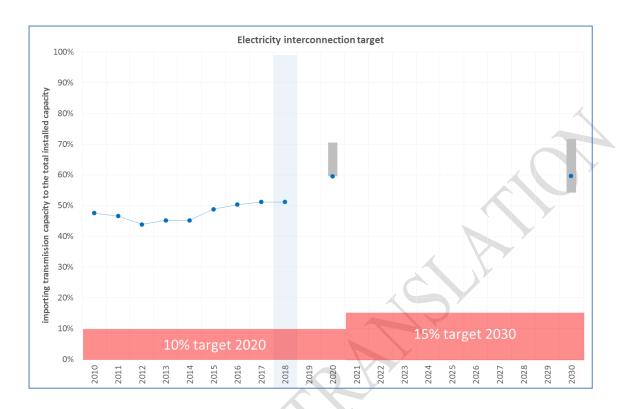
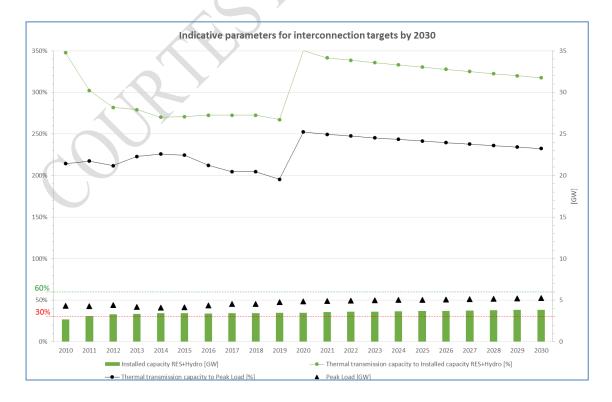


Figure 25: Estimated trend in indicative interconnectivity parameters

The expected trend in the indicative parameters for interconnection, due to achieve a minimum of 30 % of import of the expected maximum load and 30 % of export of installed RES output including hydroelectric power plants is shown in the following figure.



It is clear from this that the 15 % target by 2030 will be met as well as the indicative parameters. The price difference between business zones will depend on the electricity market in 2030.

The net transmission capacity of the Slovak Republic will depend on the development of the electricity market and it is complicated to predict its development at present. The expected development of Slovak transmission capacity according to the expected scenario of potential development of the SR grid, expressed as the nominal capacity (thermal capacity) of the cross-border lines to the total installed capacity and indicatively related to the maximum load of the system and installed RES capacity is shown in the following figure.

Within the framework of the Ten-Year Plan for Transmission System Development for 2018 to 2027 (https://www.sepsas.sk/Dokumenty/ProgRozvoj/2018/07/DPR\_PS\_2018\_2027.pdf., the text below comes from this document), analysis was performed of the values for the maximum transmission capacities on the individual cross-border profiles of the Slovak transmission system (TS SR) for the development time horizons 2022 and 2027 for the import and export power flow directions, considering the restrictions only in the TS SR i.e. the validity of the basic N-1 safety criterion is verified only on elements of the TS SR. These total transmission capacities (TTC) of Slovak profiles depend, in particular, on the configuration of the system, the location of the power generating plants, their deployed capacity and the permitted line loads. On the other hand, the necessary safety provisions for unexpected events and for the large differences between business and real power flows, so-called circular flows, are also taken into account in the hourly values of tradable (net) transmission capacity (NTC) for the next year. Taking these states into consideration, which can only be estimated very poorly for the coming years, the NTC values for the years 2022 and 2027 would be lower compared to the TTC values.



Graph 15 Development of TTC values on Slovak cross-border profiles for 2022 and 2027 in the import and export directions

In the time horizon 2022, the SK-HU cross-border profile foresees an increase in the maximum transmission capacities compared to the present day, in the export direction of approximately 100 %, and in the import direction of approximately 50 % This increase is due to the commissioning of new 400 kV cross-border lines on the SK-HU profile in 2020 (see Figure 17). This topological change in the TS SR has a negligible effect on the TTC values of other SR profiles.

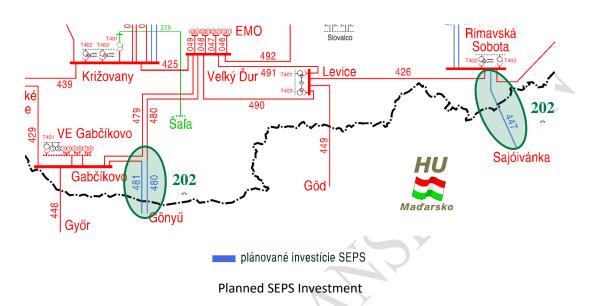


Figure 26: Schematic view of the planned investment project for the construction of new cross-border lines on the SK-HU profile

With a time horizon of 2022, SEPS intends to shut down the 220 kV cross-border line Senica - Sokolnice on the SK-CZ profile as part of the planned phase-out of the 220 kV part of the TS in the Central and Western Slovak regions. In the next step in this process, with a time horizon of 2027, SEPS is considering the shutdown of the 220 kV cross-border line V270 Považská Bystrica - Lískovec. Due to these topological changes, the total transmission capacity in the import and export directions on this profile may be reduced by approximately 10 % of the current TTC value in both directions, as confirmed by the results of the SEPS and ČEPS (TSO in the Czech Republic) joint study calculations. In order to eliminate any reduction of the total transmission capacity on the CZ-SK profile, the reconstruction of the V404 Varín-Nošovice (Czech Republic) cross-border line is scheduled by SEPS for 2024 to 2025. On the ČEPS side, the reconstruction of this cross-border line should be completed by 2018. The implementation of the above-mentioned planned investments on both sides will compensate not only for the shutdown of the 220 kV cross-border line but also provide the option to further increase the TTC value on the CZ-SK profile. The goal of SEPS and ČEPS for the future is, based on the recommendations of the joint study, to synchronise the planned investment measures on both sides both in a material and chronological manner so as to reduce the reduced-TTC period on the CZ-SK profile resulting from the total shutdown of 220 kV cross-border lines.

These described changes in the 220 kV Slovak TS have a negligible impact on the TTC values of other cross-border profiles, and there is also no significant change in the maximum transmission capacities for the 2027 time horizon on these cross-border SK profiles in both the export and import directions.

All the above mentioned considerations and assumptions about the development of the TTCs of the individual cross-border SRS profiles in the 2022 and 2027 time horizons are based on the analyses and assumptions of the TS operator (SEPS) and ENTSO E. The TTC values of the development horizons analysed for 2022 and 2027 should be understood as informative and non-binding annual values that apply exclusively to the analysed development variants for the Slovak TS. The NTC values for the next period are, or will be, specified by the SEPS electricity dispatching.

# 4.5.2. Energy transmission infrastructure

*i.* Key characteristics of the existing transmission infrastructure for electricity and gas<sup>54</sup>

# Characteristics of the Slovak Transmission System

(information based on https://www.sepsas.sk/Dokumenty/ProgRozvoj/2018/07/DPR PS 2018 2027.pdf)

The SR transmission system is above all a set of electrically interconnected 400 kV, 220 kV technology devices, 110 kV in selected equipment, via which transmission is achieved of electricity from its generators to individual customers for the Slovak transmission system (TS SR) as well as cross-border transmission of electricity. These are, in particular,

- national and cross-border 400 kV, 220 kV lines and selected 110 kV lines,
- 400/220 kV, 220/110 kV and 400/110 kV transformers,
- 400 kV, 220 kV substations and selected 110 kV substations,
- compensating devices.

The TS SR also includes the relevant support, so-called secondary installations without which transmission and control of the Slovak electricity grid would not be possible. These are management information systems (MIS), commercial metering, protection and automation systems, telecommunication transmission devices, and so on. Users of the TS SR are also directly connected to the TS SR by means of their electrical equipment; these users are:

- three regional distribution system (DS) operators,
- five electricity customers,
- four electricity generators.

In addition, the TS SR is synchronously connected to adjacent transmission systems to the following extent:

- two single 220 kV interconnections and three single 400 kV connections to the Czech Republic ("CZ"),
- one double 400 kV link to Poland ("PL"),
- one single 400 kV link to Ukraine ("UA"),
- two single 400 kV connections to Hungary (HU).

Through these interconnections, the Slovak electricity grid is synchronously connected with TSs in Europe, the operators of which are together with SEPS part of ENTSO-E.

# **Electrical lines**

(information based on https://www.sepsas.sk/Dokumenty/ProgRozvoj/2018/07/DPR\_PS\_2018\_2027.pdf)

The individual stations in the TS SR are connected by means of forty-six 400 kV transmission lines with a total length of 2,138 km, seventeen 220 kV transmission lines with a total length of 826 km and seven 110 kV transmission lines with a total length of 80 km. Of the total number of 400 kV and 220 kV transmission lines, the TS SR has eight 400 kV and two 220 kV cross-border lines, together with a total length of about 444 km in the SR, connecting the TS SR with the neighbouring CZ, HU, PL and UA transmission systems.

<sup>&</sup>lt;sup>54</sup> With reference to overviews of existing transmission infrastructure by TSOs.

Further information - for example, on the number of masts, is published at the TSO SEPS web site (https://www.sepsas.sk/TechnickeÚdaje.asp?kod=16).

### Transformers

(information based on https://www.sepsas.sk/Dokumenty/ProgRozvoj/2018/07/DPR\_PS\_2018\_2027.pdf)

Power transformers, which with the power lines make up the core of the transmission system, are installed at almost all substations, with the exception of the Veľký Ďur, Veľké Kapušany, Gabčíkovo and Košice switchgear stations, and are owned by SEPS.

The following graphs show the operating time, the residual reliable operation time of and the lifetime of the transformers. The design life is marked with a yellow mark. The residual reliable operation time for SEPS transformers is verified by regular diagnostic inspections.

For transformers which remain in operation after their design lifetime is reached, diagnostic measurements are then repeated at shorter intervals. These measurements have shown the possibility of safe transformer operation even after reaching the design lifetime. Despite this, SEPS is preparing the replacement of these transformers over a number of years. More detailed information on upcoming transformer replacements is described in chapter 4.4 National Investment Projects.

More technical data is available at SEPS (https://www.sepsas.sk/TechnickeUdaje.asp?kod=16).

# Characteristics of the transmission network

The transmission network is characterised in law as: 'A network of compressor stations and a network of high-pressure gas pipelines interconnected and serving to transport gas within the defined territory, except for the extraction network and storage and high-pressure pipelines serving primarily to transport gas to a part of the defined area'.

One company is active in the area of gas transmission in Slovakia – eustream, a.s. – the operator of the national transmission network. Based on the decision of the Government of the Slovak Republic of 28 November 2012, the form of separation was determined according to the requirements of European legislation using the independent transport network operator model (the so-called ITO model).

In 2017 natural gas transport totalled CZK 64.2 billion m<sup>3</sup>. As a result of the amount transported, eustream, a.s. continues to be one of the most important gas transporters within the EU, based on the volume of gas transported.

The transmission network is made up of parallel DN 1200 and DN 1400 pipes in four to five lines, the total length of the pipelines in the transport network is almost 2,270 km. The transmission network includes 4 booster stations (BS) – BS Veľké Kapušany, BS Jablonov nad Turňou, BS Veľké Zlievce and BS Ivanka pri Nitre – which ensure the pressure differential required for continuous gas flow with a total output of 600 MW. They are located about 110 km from one another. The total transmission deliverability is more than 90 bil. m<sup>3</sup> annually. From the transmission network, natural gas within the defined area passes through the national interconnection stations into the distribution system and is transported to final customers.

The connection between Slovakia and the neighbouring countries at the transport networks level currently exists with Austria [Baumgarten crossing point], the Czech Republic [Lanžhot crossing point],

Hungary [Velka Zlievce crossing point] and Ukraine [Velké Kapušany crossing point and Budinka crossing point].

Border crossing point	Output fixed capacity	Input fixed capacity		
	(GWh/day)	(GWh/day)		
Veľké Kapušany [SK/UA]	0	2,028.0		
Budince [SK/UA]	280.8	176.8		
Baumgarten [AT/SK]	1,570.4	247.5		
Lanžhot [CZ/SK]	400.4	696.8		
Veľké Zlievce [SK/HU]	126.9	0		

# *ii.* Projections of network expansion requirements at least until 2040 (including up to 2030)<sup>55</sup>

By 2040, the SEPS TS operator is considering the reinforcing the SK-CZ profile by 1x400kV line from Ladce (SK) - Otrokovice (CZ). According to the information in point 2.4.2 ii, this is to minimise the impact of the planned shutdown of the 220kV TS on the SK-CZ profile, or more exactly, on the TS SR and TS CZ. It is a realistic assumption that preparation of this project will begin after 2025 so that the line will be commissioned around 2032, with SEPS as well as ČEPS trying to shorten this term as much as possible. For this purpose SEPS and ČEPS have signed a Memorandum of Cooperation, where both companies have declared their willingness to coordinate cooperation on their operational and developmental plans on the SK-CZ profile. For the 2030 - 2040 timescale, SEPS is not considering building further cross-border connections. A 2x400kV SK - PL line and a fifth line between SK and HU are at the consideration and potential planning stage. However, these lines are currently at the level of consideration and there are no discussions on this subject between SEPS and the neighbouring TS concerned.

# Implementation of investment plans by the transmission system operator

Following the decision on the gradual phase-out of the 220 kV system, TS SR development is focused mainly on the development of the 400 kV system from the point of view of the transmission infrastructure (TS/DS lines and transforming). The controlled phase-out of the 220 kV TS is long-term, technologically and organisationally, a time- and cost-intensive task requiring repairs of PS 220 kV equipment to the extent necessary, via maintenance work or partial reconstruction to ensure the operation of some 220 kV systems until around the year 2025 when they will be at the limit of their technical and reasonable life, or beyond.

A significant impact on the development of the 400 kV TS comes in particular from the development of new generating capacities and the change in their structure both in the Slovak Republic and in neighbouring countries. Both factors have a direct or indirect impact on the loading of the Slovak energy grid, which implies a need to strengthen TS SR infrastructure. In addition, the strategic goal of the SR in electricity generation is directed by the SR's Energy Policy towards an export balance for the Slovak Republic (EMO 3,4, decentralised production and RES, and also a new nuclear source around 2035), which has, or will have, an effect on the load on cross-border profiles through export flows. The

<sup>55</sup> 

With reference to national network development plans and regional investment plans of TSOs.

enhancement, and associated strengthening of, the 400 kV TS, in addition to the aforementioned gradual phase-out of the 220 kV TS, are also conditional on no less important impacts, either in the form of existing investment plans, as well as potential new 400 kV TS users or indirectly impacting impulses from lower voltage level individual distribution systems (particularly in terms of decentralised production), as well as through external influences such as transit flows, typically from north to south. The TS operator has to respond flexibly to these impacts, which, in view of the TS operator's development plans, leads to necessary planning and implementation of both national and cross-border investment projects.

The following information on the TS operator's investment plans is based on the Ten-Year Plan for the Development of the Transmission System for 2018-2027, which is published at the SEPS website www.sepsas.sk and also on the current status of the individual investment projects . Information on selected SEPS projects is also available in the ENTSO-E Ten Year Network Development Plan, the current version of which is available at http://tyndp.entsoe.eu/.

# TS operator national investment plans

The main investment plans of the TS operator identified in previous years include ongoing sub-station redevelopment to permit their remote-controlled and unattended operation. During the implementation of this, the requirements for sufficiently long faultless operation of the equipment ,with minimum requirements for the implementation of inspection and maintenance activities, are taken into account.

There are currently significant changes related to the transition from 220 kV to 400 kV at the Bystričany sub-station and the work on the Senica sub-station is under way (more detailed information is given below). In this context, a remote control mode will be implemented at these sub-stations. For other sub-stations owned by SEPS at 220 kV voltage with 220/110 kV transforming (except for the 220 kV station at Senica, which is already remotely controlled), these sub-stations are no longer being considered for implementation of remote control, having regard to the aforementioned gradual phase-out of the 220 kV TS. Due to the technical condition of the 220 kV switchgear in the Sučany sub-station, its reconstruction is in preparation, in order to maintain a reliable supply to the OFZ, a.s. and SSD, a.s. customers.

Unless there are unforeseeable difficulties in implementing the SEPS investment plan, after 2030 all sub-stations owned by SEPS should be operated under remote control. In this context, it is worth mentioning that a decision is currently being made on the Považská Bystrica sub-station. Its future will be decided with the SSD a.s. DSO after evaluating the 400/110 kV transformation feasibility study for the Považská Bystrica and Ladce sites, which will determine which is the more suitable site to replace the existing 220/110 kV Považská Bystrica transformer, with a 2026 time horizon.

An important investment in the process of gradual replacement of the 220 kV system in the TS SR is the aforementioned transition of the Bystričany sub-station from 220/110 kV transforming to 400/110 kV transforming. This transition is part of the "400/110 kV Bystričany Transformer" construction. This construction is co-financed by the BIDSF support fund, managed by the European Bank for Reconstruction and Development, to reduce the impact of the early shutdown of the EBO V1 nuclear power plant at Jaslovské Bohunice. The following are part of this construction:

- 400 kV switchgear Bystričany,
- 2x400 kV power lines Horná Ždaňa Oslany site,
- 400 kV switchgear Horná Ždaňa expansion,
- 2x400 kV power line Bystričany Križovany,

- 400 kV switchgear Križovany expansion,
- 400/110 kV transforming Bystričany T401 and T402 transformers.

For the new line the corridor of the original 220 kV power line V274 Križovany - Bystričany will be used. One branch of the 2x400 kV line Bystričany - Križovany will be temporarily operated as a 220 kV line Bystričany - Križovany, a second branch of this line will be operated as 400 kV line Bystričany - Križovany and will be interrupted at the Oslany site and diverted to the 400 kV station at Horná Ždaňa. This is a transitional stage before the definitive termination of 220/110 kV transformer operations in Bystričany, given the time limitation on the use of BIDSF funds for this construction.

In the western part of TS SR, SEPS plans two major investment projects. The first is the construction"400/110 kV transformer Senica" with the following scope:

- 400 kV substation Senica replacement R 220 kV to R 400 kV,
- 400/110 kV transformer Senica,
- integrating the V424 line into 400KV station Senica.

The need for a new 400/110 kV transform resulted from a study drawn up jointly with the distribution company ZSD, a.s., which also requested an increase in the transformer capacity at the Senica sub-station.

The conversion to the 400 kV level in this station will be assured by the construction of a new 400 kV substation with five arrays, by integrating the existing 400 kV line V424 (Križovany - Sokolnice) into a new 400 kV substation and building a new 400/110 kV, 350 MVA transformer. At the same time, the construction of the 400 kV station Senica will mean the disposal of the existing 220 kV station Senica. The construction for the new substation and the new transformer is in the procurement preparation phase and for connecting line is in the project and engineering works phase.

The second in line is the investment project "Switching the 400 kV Subunitska Biskupice substation to a new-type substation". Within the framework of the investment project, two actions are under way. The first is the transition of the 400 kV part of Podunajské Biskupice station from remote control mode to unmanned operation mode with remote control. This part of the investment project associated with the transition to remote control also includes the transition of the existing 400 kV station Podunajské Biskupice to a new type of substation with tubular busbars and a field width of 18 m.

Under this new investment project (IPR) in April 2018, existing transformer (400/110 kV, 250 MVA) T404 was replaced by a new 400/110 kV, 350 MVA transformer. The replacement of transformer T404 was triggered by the requirement of the ZSD, a.s. distribution company to increase transformer capacity at the supply point at Podunajská Biskupice.

It was decided to resolve high-voltage operating problems in the northern branch of TS SR from station Varín, via station Sučany, station Medzibrod, station Liptovská Mara (also 400 kV substation Čierny Váh) to station Spišská Nová Ves by strengthening the compensation capacity in the related stations. Compensation is being built as a priority (2x45 MVAr) into the tertiary winding of T401 and T402 transformers Liptovská Mara. Implementation should be complete in 2021. Another important project is "Replacement of transformer T401, installation of compensating dampers in station Varín". Within this IPR, the existing T401 transformer will be replaced with a new one rated at 350 MVA. Compensation dampers rated at 2x45 MVAr will also be connected to its tertiary winding. Implementation should be complete in 2023. Furthermore, this station will be transferred to remote control with an expected completion date of 2028. In this part of the TS, there is a planned replacement of the T401 and T402 transformers station Liptovská Mara and the transfer of the station to remote control by 2032.

An important task from the point of view of the reliability of the electricity supply to OFZ, a.s., which is a direct customer for electricity from the TS, is the implementation of a 400/110 kV, 350 MVA transformer,

transfer of the station to remote control, a new 110 kV sub-station and reconstruction of the 400 kV substation in station Sučany. This extensive investment project will enable SEPS to phase out the 220 kV line V273 (including associated facilities in station Lemešany) while maintaining the quality and reliability of electricity supplies for OFZ, a.s. This project will also include increasing the compensation facilities in station Sučany from a total compensation capacity of 150 MVAr (at the time of the project launch<sup>56</sup>) to 180 MVAr.

In the eastern part of the TS SR implementation of investment project "Replacement of Transformers T401, T402 and Remote Control in station Spišská Nová Ves" is under way, under which the station is being transferred to remote control and existing transformers T401 and T402 are being exchanged for new ones with a nominal output of 250 MVA.

In TS/DS transforming, the addition/replacement of existing transformers is anticipated, where it is assumed their technical condition at the end of their service life does not allow their further safe and reliable operation. These are the following projects:

- exchange of T401 in the Stupava station,
- exchange of T402 in the Podunajské Biskupice station,
- exchange of T401 and T403 in the Upper Ždaňa station<sup>57</sup>.
- exchange of T403 in the Rimavská Sobota station,

# Cross-border investment plans of the TS operator

The priority cross-border projects currently under preparation by SEPS are projects for the construction of transmission lines to Hungary, which also have the status of projects of common interest (PCI). These are the 2x400 kV line Gabčíkovo (SK) - Gönyű (HU) - Veľký Ďur (SK) on the route from the town of Veľký Meder to the national border with Hungary and the 2x400 kV line Rimavská Sobota (SK) - Sajóivánka (HU) along one branch.

In connection with the construction of the above cross-border line, a construction contract between the transmission system operators of SR and Hungary, between SEPS and MAVIR ("the Contract") was signed on 1 March 2017. In June 2018, SEPS and MAVIR signed an addendum to the Contract, which defines the basic technical parameters of the new lines being prepared and an updated timetable for their implementation. SEPS has received a financial contribution from the European Union Instrument "Connecting Europe" for project and engineering work. The planned date for commissioning these new lines is the end of 2020.

On the Czech profile, the renewal of the cross-border line V404 Varín (SK) - Nošovice (CZ) is planned for 2024 - 2025. This project is in the engineering and project activities preparation phase. The aforementioned phase-out of the transmission system working on 220 kV will in future also affect the existing cross - border lines 220 kV (V270 and V280) on the Slovak - Czech profile. However, the possible decrease in transmission capacity on the SK - CZ profile due to the gradual phase-out of 220 kV cross - border lines will be partially offset by increasing the transmission capacity of the V404 line as part of its renewal.

<sup>&</sup>lt;sup>56</sup> In 2019, the compensation capacity in the Sukany station will increase from 120 MVAr to 150 MVAr as part of a separate investment.

<sup>&</sup>lt;sup>57</sup> The final decision and specific timetable for the exchange will depend on the final agreement with Slovalco, a.s. on the further operation of its facilities in the TS and on the total amount of the offtake from the TS.

No negotiations with the Austrian TS operator are currently under way, since even in the long term, the TSs of Slovakia and Austria are not considering an interconnection.

In 2017, communication with the TS operator in Ukraine, NPC "Ukrenergo", was restored. In June 2017, a Memorandum of Understanding was signed on the plan of both operators to strengthen the existing cross-border line from Veľké Kapušany (SK) - Mukachevo (UA). The cooperation between SEPS and NPC "Ukrenergo" should then be specified in the form of a cooperation agreement within the meaning of this Memorandum. Currently, a joint SEPS and NPC "Ukrenergo" study is being prepared, the conclusions of which will determine the extent of the need to strengthen the existing SK - UA cross - border line and the scope of the contract referred to. At present it can be stated that, in the course of May 2018, due to modifications of NPC "Ukrenergo" in the 400 kV Mukachevo substation (increase of the nominal transfer of the instrument transformer current, due to exchange of some obsolete devices in the substation), an increase took place in the permitted current load of the Velké Kapušany (SK) - Mukachevo (UA) line from the current 1200 A (limit is the PTP in the Mukachevo station ) to 1609 A (limit is the conductor itself) in the summer season and 2000 A (limit is main busbar and instrumentation in the Mukachevo station) in the winter. This fact was officially confirmed by representatives of NPC "Ukrenergo" by letter dated 21 May 2018. The impact of the increase in the maximum permitted current load capacity of the cross-border SK-UA line on tradeable transmission capacities on the SK-UA profile is currently being analysed by both TSOs.

# Implementation of investment plans by the distribution system operator

# Stredoslovenská distribučná, a.s. (SSE – D)

The permanent objectives are to strengthen the critical points of the system, to renovate the system in terms of its physical condition, to comply with quality standards, to reduce electricity distribution losses and to connect new supply points. The investment activity reflects the actual development and quality needs of the distribution system, previous developments, as well as the legislative requirements on a distribution system operator. Quality of distribution and trouble-free operation of the distribution system is very important for customers. Planned activities and investments in the distribution system are aimed at achieving the expected quality of service, and SSE-D is making every effort to meet customer expectations. The investment process is divided into three basic chapters - new connections, quality and increase in the transmission capacity of lines and other investments related to distribution activity.

### **NEW CONNECTIONS**

Under this investment chapter, development actions for the construction of the distribution system have been addressed because of the need to connect larger supply points to high voltage, such as industrial parks, multifunctional buildings and commercial premises, as well as the connection of new supply points to low voltage, such as standard supply points (family houses, apartment developments, smaller business premises, and civic amenities). Under this chapter in 2017, 214 constructions were completed for low- and high-voltage and 8,49 mil. euros invested.

### QUALITY AND INCREASE IN TRANSMISSION CAPACITY

From the point of view of investment construction in the quality and increase in transmission capacity, in 2017 178 structures were built for low- & high voltage level and 21 structures for very high voltage at a total annual investment cost of 23.74 mil. euros. The purpose of these investments was to ensure the reliability and continuity of electricity distribution. The continuing priorities of this construction were compliance with qualitative parameters, elimination of the unfavourable physical condition caused by

external influences and the age of the equipment, reduction of the fault rate, modernisation of the facilities, deployment of elements with remote monitoring and control functions and improvement in the possibilities for electricity distribution. These contribute to reducing the SAIDIP parameters, i.e. the planned downtime in client-minutes, and SAIFIP, i.e., the planned downtime frequency in client-downtime events.

#### MAIN ACTIVITIES AND INVESTMENTS FOR DISTRIBUTION SECTOR DEVELOPMENT

In order to ensure the development and stability of the distribution system, significant projects for the very high voltage distribution system were implemented in the year 2017 and prepared for the upcoming period. In particular, these were the construction of the new 110/22 kV substation Novaky, which will ensure safe and reliable supply of customers with regard to the needs of Slovenské elektrárne, a.s. in the plants of Elektrárne Nováky (power supply and supply of own requirements) and Fortischem, a.s., Nováky (supply from the transmission system), preparation for the application of European Commission regulations on Requirements for Generators (RfG) from the point of view of access and connection to the distribution system, preparation of connection conditions for nodal areas Liptovská Mara - Sučany and Liptovská Mara - Spišská Nová Ves to ensure higher operational reliability of electricity distribution and more.

### Východoslovenská distribučná, a.s. (VSD)

VSD operates an extensive distribution system, which accounts for nearly 22,000 km of power lines at very high voltage, high voltage and low voltage. At very high voltage, the distribution system is powered by four higher-level transmission system power stations with a voltage level of 400 kV and 220 kV. At very high and high voltage, the company operates 57 electrical transformer and switching stations. Reliable and secure distribution of electricity to all company customers, independent of the voltage level of the connection, is ensured by VSD by the set-up of all internal processes such as planning for the renewal and development of the distribution system, setting up and overseeing compliance with technical standards in respect of distribution reliability quality, and increasing the overall efficiency of electricity distribution. Level of reliability of electricity distribution. In 2017 as well, VSD succeeded in maintaining the distribution network reliability index at a favourable level of 99.96 % ASAI (Average Service Availability Index), also taking into account weather and distribution interruptions caused by third parties. A programme of systematic renewal and modernisation of networks in eastern Slovakia also made a significant contribution to this result, with the help of which our company can ensure a high-quality electricity distribution for new investors and the growing economy. Investments in renovation and modernisation of the distribution system. It is in the long-term interests of VSD to have reliable and safe operation of the distribution system. It directs its decisions in proposing investment plans in line with this basic objective. In 2017, VSD invested 44.1 million EUR into its system (2016: 43.7 million EUR), with the largest amount of funds invested as usual in system renewal to further improve customer service.

Investments in automation and innovative technologies are an essential and natural effort on the part of VSD to increase the quality of services provided, not only in the area of electricity distribution but also in areas such as the provision of metered electricity values through the eVSD customer portal, but also for more comfortable communication with the customer. In 2017, VSD invested in innovative technologies in the field of communication and transmission of measured and monitored data from the customer to VSD information systems, focusing on communication technologies related to the operation of smart metering, especially in the areas of: 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

A problem of the current EU electricity market having an impact on the electricity market in the Slovak Republic and neighbouring markets is that the market is fundamentally distorted by various subsidies and grants in particular in the development of renewable energy sources. The increase in the volume of renewable sources (mostly photovoltaic and wind power) has been achieved through the introduction of support schemes in the form of direct operating subsidies, essentially throughout the EU, including the SR. Wholesale electricity prices are also negatively influenced by the existence of capacity mechanisms that are already in place or are being introduced in some countries. This causes low market prices, even if they have recently begun to grow, as a result of which the EU's energy system as a whole suffers from the shutting down of conventional and flexible resource capacities and insufficient investment in new capacities.

To address the challenges of the current EU electricity market, the European Commission has presented a proposal for EU Electricity Market Reform (a new electricity market design) under the new energy package "Clean energy for all Europeans". The third liberalisation package was not designed for the current and a future source base with a high proportion of decentralised and variable renewable resources. This package is a reflection of the Energy Union concept in concrete legislative proposals and should form the basis for implementing the EU's climate and energy targets by 2030 in the electricity sector. It represents a vision of the organisation of the market in the 2030 horizon.

The aim of the EC is to achieve better electricity market preparedness for a change the energy system (energy transformation). The aim is to provide the right investment signals as well as the market and energy market flexibility required for the market integration of new production sources, especially volatile renewable sources. At the heart of the energy transformation are end-users, who will get more rights and the option to choose their electricity suppliers as well as to produce electricity and supply it to the network.

From the SR perspective, it is particularly important that the future model of the EU electricity market does not jeopardise the security of electricity supply and does not lead to increased end-user electricity prices.

There have been no significant changes in gas supply for Slovak gas customers. Due to the size of the gas market in the Slovak Republic and the relatively stable natural gas prices that increased slightly during the year 2018, this trend should remain unchanged and neither a significant increase in the number of customers nor the entry of new suppliers into the energy market in Slovakia is expected.

The price of electricity, or of gas, across the EU depends on a range of different supply and demand conditions, including the geopolitical situation, the national energy mix, diversification of imports, network costs, environmental protection costs, adverse weather conditions or excise rates and taxation, as well as government measures reducing energy prices.

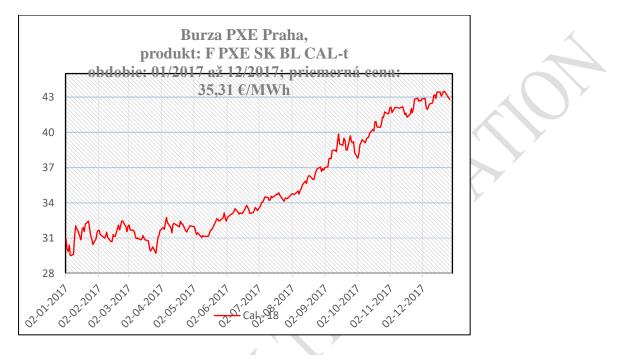
The Slovak Ministry of the Economy has prepared measures to increase the competitiveness of enterprises in the form of compensation for the tariffs for the operation of the system for energy-intensive enterprises that meet the conditions specified in the amendment to the Act on the Promotion of Renewable Energy Sources.

Also, the reform of the system to support the production of electricity from renewable energy sources and cogeneration of electricity and heat will ensure the cost-effectiveness of the support system, while minimising the impact on end-user energy prices.

#### **Electricity market**

In the wholesale electricity market, the Authority's competences are only in the creation of legislative conditions and in compliance monitoring.

Graph 16 Electricity price trends in 2017



The decisive participants in the electricity market in the Slovak Republic are:

- Slovenské elektrárne, a.s. - the major producer of electricity, which in 2017 provided 69.38 % of electricity generation in the Slovak Republic from its own sources. Electricity generation in the amount of 19,444 GWh provided 62.61 % of electricity consumption within the Slovak Republic. The installed capacity of Slovenské elektrárne, a.s. for electricity generation was 4 081 MW,

- encouraging generators of electricity from renewable energy sources and high-efficiency cogeneration. For 2017, the amount of electricity generated from renewable energy sources at a surcharge was estimated to be 2,780 GWh and the amount of electricity produced by high-efficiency cogeneration of electricity and heat at a surcharge was 2,316 GWh,

- Slovenská elektrizačná prenosová sústava, a.s. ("SEPS") as the sole holder of a permit for electricity transmission , the transmission system operator, also fulfilling the tasks of energy dispatching (provided an equalised balance on the defined territory of the Slovak Republic),

- OKTE, a.s., organiser of the short-term electricity market as an institution for evaluating and organising the short-term electricity market and ensuring the clearing, evaluation and settlement of variances in the Slovak Republic,

- Západoslovenská distribučná, a.s., Stredoslovenská energetika - Distribúcia, a.s. and Východoslovenská distribučná, a.s. are the exclusive operators of the regional distribution systems in the relevant parts of the defined territory, to which more than 100,000 supply points were connected. In addition to these

three distribution companies, 157 holders of permits to distribute electricity were also active in the electricity market. These were operators of local distribution systems in production and non-production facilities, to which less than 100,000 supply points were connected,

- other entities permitted to operate in the electricity sector, of which there were 439.

## **Retail market**

The adoption of Act No 250/2012, on regulation in network industries, introduced price regulation of the supply of electricity to vulnerable customers, which are household customers and small businesses.

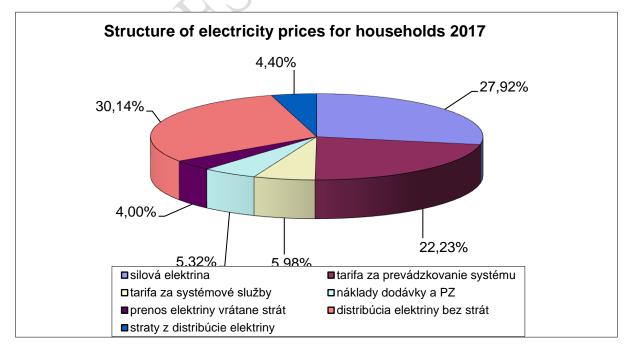
Price regulation in electricity supply covers:

- electricity supply to households
- electricity supply to small firms
- electricity supply by the supplier of last resort.

## **Electricity supply to households**

Maximum electricity prices for households have two components and consist of a monthly payment per single supply point and of the price for electricity supplied in the low or high band. Electricity supply for households is divided into eight tariffs.

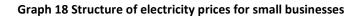
## Graph 17 Structure of electricity prices for households

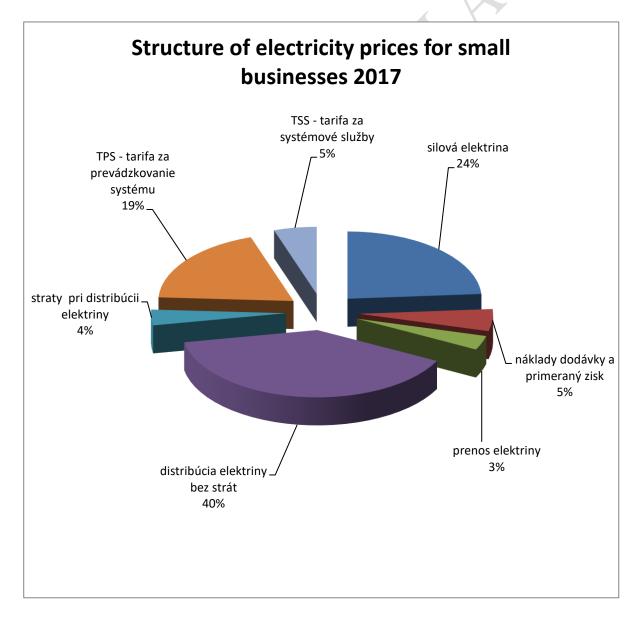


Key:	
silová elektrina	power
tarifa za systémové služby	system services charge
prenos elektriny vrátane strát	electricity transmission including losses
straty z distribúcie elektriny	electricity distribution losses
tarifa za prevádzkovanie system	system operating charge
náklady dodávky a PZ	cost of supply and reasonable profit
distribúcia elektriny bez strat	electricity distribution without loss

## Electricity supply to small firms

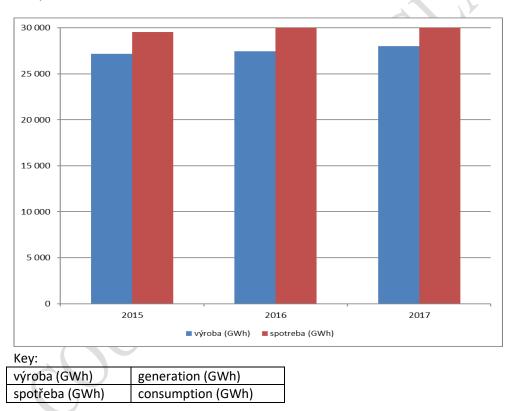
A small enterprise is considered to be an end-user of electricity with an annual electricity consumption for all its supply points of no more than 30,000 kWh in the year prior to the submission of the draft price. The supply of electricity to small businesses has been divided into 11 tariffs.





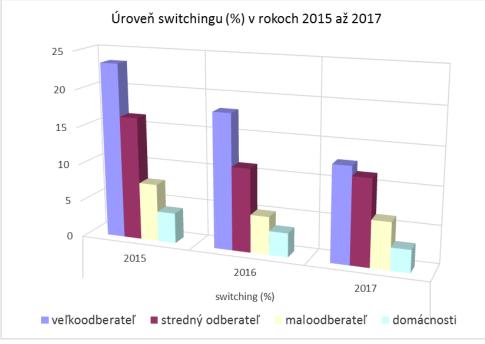
Key:	
silová elektrina	power
TSS - tarifa za systémové služby	system services charge
prenos elektriny	electricity transmission
straty pri distribúcii elektriny	electricity distribution losses
TPS - tarifa za prevádzkovanie system	system operating charge
náklady dodávky a primeraný zisk	costs of supply and reasonable profit
distribúcia elektriny bez strat	electricity distribution without loss

Graph 19 Total generation and consumption of electricity by sources from the transmission system operator SEPS, a.s.



## Switching electricity supplier

In order to assess the level of liberalisation of the electricity and gas markets, a percentage coefficient is used, so-called switching, which expresses the ratio of the number of supply points with a change of electricity or gas supplier to the total number of supply points that year.

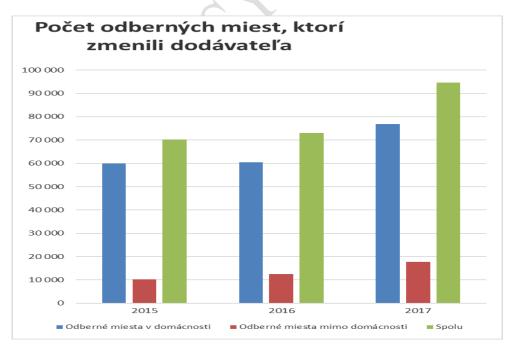


## Graph 20 Ratio of the number of supply points with a change of electricity or gas supplier to the total number of supply points

### Key:

- /	
Úroveň switching (%) 2015-2017	Incidence of switching (%) 2015-2017
veľkoodberateľ	Major customer
stredný odberateľ	Medium customer
maloodberateľ	Small customer
domácnosti	Households

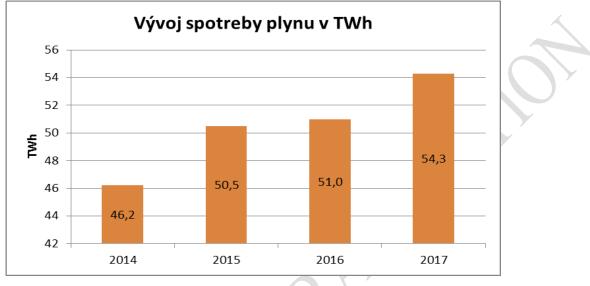
## Graph 21



Кеу:	
Počet odberných miest, ktori zmenili dodávateľa	Number of supply points with change of supplier
Odberé miesta v domácnosti	Household supply points
Odberé miesta mimo domácnosti	Non-household supply points
Spolu	Total

## Gas market

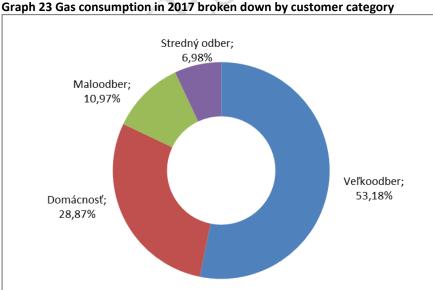
### Graph 22 Gas consumption 2014 - 2017



Key:

Vývoj spotreby plynu v TWh

Gas consumption (TWh)



Graph 23 Gas consumption in 2017 broken down by customer category

кеу:	
veľkoodber	Major customer
stredný odber	Medium customer
maloodber	Small customer
domácnosti	Households

The highest share of gas consumption in the SR, up to 53.18 %, are traditionally industrial customers included in tariff groups for which annual gas consumption at the supply point reached more than 4,000,000 kWh. The share of households in total gas consumption in the SR is 28.87 %

## Gas market participants

1/ -----

- the transport network operator (eustream, a.s.),
- the distribution network operator on a defined territory of the Slovak Republic (SPP distribucia, a.s.),
- 40 operators of local distribution networks,
- two storage operators,
- 28 gas suppliers,
- gas customers.

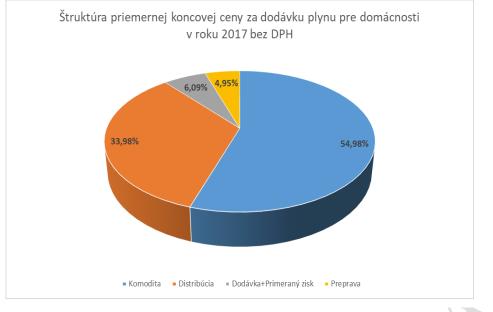
## Wholesale market

The wholesale gas market is characterised by:

- the purchase of gas on the basis of long-term contracts,
- the purchase of gas on commodity exchanges,
- the purchase of gas from another trader gas supplier
- trading at the virtual point of trade of the transport system operator
- trading, respectively. by a change in ownership of stored gas in underground storage facilities.

## Retail market

Maximum gas supply prices for vulnerable customers were comprised of two components, a maximum fixed monthly rate and a maximum gas tariff for gas supplied. Consumer tariffs were divided into six tariff groups 1 to 6 according to the amount of gas consumed annually. A vulnerable gas consumer according to the Regulatory Act is a household gas customer or a gas subscriber in the small business category. A small business within the meaning of the Regulatory Act is a natural gas customer with an annual gas consumption at all supply points of up to 100,000 kWh in the previous year and is part of the vulnerable consumers group.



#### Graph 24 Structure of average end-price for gas supply to households 2017

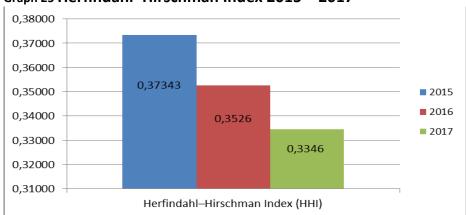
#### Table 38: Structure of supply points and switching

			-			
Kategórie odberných miest odberateľov	počet odberateľov plynu so zmenou dodávateľa plynu		switching (%)			
initiation of a bolatorov	2015	2016	2017	2015	2016	2017
veľkoodberateľ	174	130	93	23,39	18,06	12,72
stredný odberateľ	480	318	322	16,44	11,14	11,44
maloodberateľ	5 877	3 967	4 743	7,72	5,08	6,21
domácnosti	58 081	45 827	43 670	4,07	3,21	2,98
spolu	64 612	50 242	48 828	4,29	3,33	3,16

#### Key:

Kategorie odbernych miest odberateľov	Supply point customer category
Počet odberných miest, ktori zmenili	Number of supply points with change of
dodávateľa	supplier
switching (%)	switching (%)
veľkoodberateľ	Major customer
stredný odberateľ	Medium customer
maloodberateľ	Small customer
domácnosti	Households
spolu	Total

The concentration level on the gas market can also be measured by the HHI index (Herfindahl-Hirschman Index). The market is concentrated if the HHI is more than 0.1 and is highly concentrated at a value exceeding 0.2. The following graph shows the HHI trend between 2015 and 2017. There is a gradual decrease in the HHI value in the gas market, but it can be said that in 2017 this value was also above the high concentration threshold.



## Graph 25 Herfindahl-Hirschman Index 2015 - 2017

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

Will be completed, in line with current status, in the final version of the national energy and climate plan.

## 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**)

Will be completed, in line with current status, in the final version of the national energy and climate plan.

*ii.* Current level of public and, where available, private research and innovation spending on low-carbon-technologies, current number of patents, and current number of researchers

Only data from the RDD IEA questionnaire are available; this looks at structured research and development funding for energy, which also provides information on R&D funding for low-carbon technologies for 2015-2017. Any updates will be added to the final version of the national energy and climate plan based on current status.

## iii.

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

Transparency of energy prices is guaranteed in the EU through the obligation of EU Member States to send EUROSTAT information on prices for different categories of consumers in industry as well as data on market shares, sales conditions and pricing systems. Provision of prices for household consumers is voluntary.

Gas and electricity tariffs vary by supplier. They can result from agreed contracts, especially for large industrial consumers. In the case of smaller consumers, they are usually determined by the amount of gas consumed using other characteristics, most of which include some form of fixed charge. Therefore, there

is no single price for natural gas or electricity. The information that is published in EUROSTAT statistics on natural gas prices is surveyed together for three different types of households, and information on electricity prices is surveyed for five different types according to individual annual consumption bands. In the case of industrial consumers, price information is surveyed for six different types of users in the case of gas prices, and for industrial consumers, information on electricity prices is collected for seven different types of users.

The legal basis for the statistical surveying of gas prices charged to consumers in industry is <u>European Commission Decision (2007/394/EC)</u> of 7 June 2007 amending <u>Council Directive (90/377/EEC)</u> with regard to the methodology to be applied for the collection of gas and electricity prices charged to industrial end-users. Directive 2008/92/EC of the <u>European Parliament</u> and of the Council of 22 October 2008 concerning a Community procedure to improve the transparency of gas and electricity prices charged to industrial end-users

The natural gas price, or the electricity price for end-users within the meaning of Regulation (EU) 2016/1952 of the European Parliament and of the Council of 26 October 2016 on European statistics on natural gas and electricity prices and repealing Directive 2008/92/EC is the sum of three main components: "Energy and supply", "network" (transport and distribution) and a component including taxes, levies and fees. The following items are included in the individual components:

## 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 appropriate, storage costs and costs associated with the sale of natural gas to final customers.

**Network charges** include the following costs: gas transmission and distribution tariffs, transmission and distribution losses, network charges, after-sales service costs, system operating costs, and rental costs and consumption measurement.

Taxes, fees and charges are the sum of all taxes, fees and levies.

## Electricity

**Energy and supply** include the following costs: electricity generation, storage, balancing energy, delivered energy costs, customer service, post-warranty service and other delivery costs.

**Network charges** include the following costs: electricity transmission and distribution tariffs, transmission and distribution losses, network charges, post-warranty costs, system operating costs, and costs of renting a meter and measuring consumption.

Taxes, fees and charges are the sum of all taxes, fees and levies.

## iv. Description of energy subsidies, including for fossil fuels

Will be completed, in line with current status, in the final version of the national energy and climate plan.

## 5. IMPACT ASSESSMENT OF PLANNED POLICIES AND MEASURES<sup>58</sup>

5.1. Impacts of planned policies and measures described in section 3 on energy system and GHG emissions and removals, including comparison to forecasts based on 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.

Will be completed, in line with current status, in the final version of the national energy and climate plan.

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

Will be completed, in line with current status, in the final version of the national energy and climate plan.

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

Will be completed, in line with current status, in the final version of the national energy and climate plan.

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 with forecasts based on existing policies and measures

Will be completed, in line with current status, in the final version of the national energy and climate plan.

<sup>&</sup>lt;sup>58</sup> 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.

## 5.3. Overview of investment needs

*i.* Existing investment flows and forward investment assumptions with regard to the planned policies and measures

Will be completed, in line with current status, in the final version of the national energy and climate plan.

## ii. Sector or market risk factors or barriers in the national or regional context

Will be completed, in line with current status, in the final version of the national energy and climate plan.

## *iii.* Analysis of additional public finance support or resources to fill identified gaps identified under point *iii*)

Will be completed, in line with current status, in the final version of the national energy and climate plan.

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

Will be completed, in line with current status, in the final version of the national energy and climate plan.

## *ii.* Impacts on energy prices, utilities and energy market integration

Will be completed, in line with current status, in the final version of the national energy and climate plan.

## iii. Where relevant, impacts on regional cooperation

Will be completed, in line with current status, in the final version of the national energy and climate plan.

## Part 2

# List of parameters and variables to be reported in Section B of the National Plan<sup>59 60 61 62</sup>

The following parameters, variables, energy balances and indicators, *if used*, are to be reported in Section B 'Analytical Basis' of the National Plans:

### 1. General parameters and variables

The data is presented in the Excel table: 20181112 Annex I part 2 NECP ac

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<sup>60</sup> As far as possible, reported data and forecasts shall build on and be consistent with Eurostat data and methodology used for reporting European statistics in the relevant sectoral law, as European statistics are the primary source of statistical data used for reporting and monitoring, in accordance with Regulation (EC) No 223/2009 on European statistics.

<sup>61</sup> Note: all projections are to be performed on the basis of constant prices (2016 prices used as base year)

<sup>62</sup> 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.

For the plan covering the period from 2021 to 2030: For each parameter/variable in the list, trends over the years 2005-2040 (2005-2050 where appropriate) including for the year 2030 in five year intervals shall be reported both in section 4 and 5. Parameter based on exogenous assumptions vs. modelling output shall be indicated.

Excel spreadsheet with the data and variables used to create development assumptions

X 20181112 Annex I separate file 20181112 Annex I part 2 NECP ac.xlsx