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Integrated National Energy and Climate Plan for Slovenia

COURTESY TRANSLATION

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TABLE OF CONTENTS

COURTESY TRANSLATION

SECTION A: NATIONAL PLAN
1 OVERVIEW AND PROCESS FOR ESTABLISHING THE PLAN

1.1 Summary

This draft is based on long-term and middle-term strategic and action documents, laying down 2020 and 2030 objectives and measures that have already been adopted by Slovenia, and on indicated proposals for measures to achieve the 2030 targets that still have to be assessed and approved by Slovenia. Descriptions of the implementation of measures are summarised from reports that were approved by the Slovenian Government, and from report proposals that are being harmonised.

The draft will be upgraded in the final version of the national plan in line with the refreshed expert groundwork in cooperation with a contractor, which is then expected to be approved by the Slovenian Government following the public consultation. In the process of drawing up the final version of the national plan, Slovenia will also take part in regional consultations, and take the recommendations by the European Commission into consideration to the maximum extent possible. Before adoption of the National Energy and Climate Plan (NEPN), a comprehensive environmental impact assessment is expected to be carried out.

Bases for the Draft NECR include the following objectives and contributions of Slovenia, arising from the already adopted national strategic and action documents:

- reducing **GHG emissions** by 2030 in accordance with the Burden Sharing Regulation by 15 % in comparison to 2005;
- ensuring that there will be no net emissions produced from the **LULUCF** sectors by 2030, i.e. the emissions in LULUCF sectors will not exceed the sinks;
- **indicative sectoral targets** for reducing GHG in sectors that are not included in the Emissions Trading Scheme by 2030 (so called ESD sectors) are as follows:
    - transport: + 18 %,
    - general use: - 66 %,
    - agriculture: + 6 %,
    - waste management: - 57 %,
    - industry: - 32 %,
    - energy: - 16 %;
- in the area of **adjustment**, reducing the exposure, sensitivity and vulnerability to climate change impacts and increase the climate resilience and adaptive capacity of society;
- **reducing greenhouse-gas emissions in buildings** by at least 70 % by 2030 relative to 2005;
- achieving a **27 % share of renewable sources** in final energy consumption by 2030;
- achieving at least 2/3 of renewable **energy use in buildings** by 2030 (i.e. the share of RES in the final consumption of energy products without electricity and district heating included);
- increasing the efficient use of energy (and, consequently, reducing its use) as the first and key measure towards a low-carbon society;

COURTESY TRANSLATION

- **reducing energy end-use in buildings** by 30 % by 2030 relative to 2005;
- energy-saving renovation of almost 26 mio of m^2 of building areas or 1.3–1.7 mio of m^2 per year, of which more than a third according to the nearly zero-energy buildings standard;
- striving to **reduce the use of fossil energy sources and dependency thereon to the greatest extent possible** by gradually phasing out their use with great emphasis on increasing the efficient use of energy, and greater use of renewable and low-carbon sources.

1.2 Overview of current policy situation

On 7 December 2017, the Government adopted the Slovenian Development Strategy 2030 (SDS 2030), i.e. the country's umbrella development framework that puts quality of life for everyone in the foreground. The Strategy includes the sustainable development goals, agreed upon at the global level, while laying down new long-term development foundations of Slovenia by means of five strategic orientations and twelve interrelated development goals.

Slovenia will prepare the Long-term Strategy for at least the next 30 years that must include an analysis of at least different scenarios for the contribution of the Union to meeting its and Member States' commitments under the United Nations Framework Agreement on Climate Change and the Paris Agreement, inter alia the scenario for achievement of zero net greenhouse gas emissions in the Union by 2050 and, afterwards, negative emissions, as well as consequences of these scenarios for the remaining global and European carbon budget as the basis for discussion on cost-effectiveness, efficiency and fairness in reduction of greenhouse gas emissions. In Slovenia, the Long-Term Strategy and the Integrated National Energy and Climate Plan will be prepared harmoniously.

Energy concept of Slovenia (ECS) will be the basic development document in the energy field that will, on the basis of the projections of the country's economic, environmental and social development and the adopted international commitments, define the objectives of the reliable, sustainable and competitive energy supply for the next 20 years and, tentatively, for the next 40 years. ECS is to be adopted through a resolution by the Slovenian National Assembly on the Government's proposal. At its 170th regular session on 1 March 2018, the Government set the wording of the motion for the **Resolution on the Energy Concept of Slovenia (ReECS Motion)** and submitted it for adoption to the National Assembly, which was not able to put the ReECS Motion on the agenda and discuss it before the early elections. The Ministry of Infrastructure estimates that the revised ReECS Motion will be prepared and adopted by the Government by the end of 2019, and then submitted to the National Assembly that is expected to adopt ReECS in the first half of 2020.

The energy policy goals of Slovenia are to ensure a reliable, safe and competitive energy supply in a sustainable manner by ensuring transition to low-carbon society and achievement of the sustainable development goals and thereby, inter alia, the following: stimulating environment for economic development and creation of high added-value jobs, as well as acceptable energy services for people and the economy.

COURTESY TRANSLATION

Key challenges are gradual reduction of energy use and increase of its efficient use, increase of renewable energy production and thereby, phasing out the use of fossil resources for electricity generation, heating and transport, guidelines regarding the preparations for a decision on nuclear energy use, and technological development and commercial breakthrough of renewable energy sources, advanced technologies and services, including storage and efficient use of energy.

The main task of the future development of the energy industry in Slovenia is to continue providing balance among three general and inextricably linked pillars of energy policy, namely: climate sustainability, energy supply security and competitiveness.

By means of the Operational Programme for Reducing Greenhouse Gas Emissions by 2020 that constitutes the implementation plan of measures to achieve Slovenia's legally binding target of reducing GHG emissions by 2020 referred to in the Climate and Energy Package in accordance with Decision No 406/2009/EC, Slovenia set itself also **the long-term vision** to ***support the international vision of preventing dangerous consequences of climate change and keeping global temperature growth below 2 °C. It will actively contribute to make this vision a reality with the transition to an economy, the growth of which will not be based on the increased use of natural resources and energy, but will, by means of the efficiency and innovations, reduce the greenhouse gas emissions, improve competitiveness and promote growth and employment instead.***

In the area of adaptation to climate change, Slovenia adopted the Strategic framework for climate change adaptation in December 2016 that provides a framework and guidelines for adaptation to climate change in Slovenia. It determined **the vision** that, ***by 2050 Slovenia should become a society adapted and resilient to climate change impacts and characterised by a high quality of life and a high degree of safety of life, while taking full advantage of the changed climate on the basis of sustainable development.***

The vision aims to strengthen capacities for climate change adaptation, management of risks and for taking advantage of the opportunities presented thereby, while its **general objective** is to reduce Slovenia's exposure, sensitivity and vulnerability to climate change impacts and increase the climate resilience and adaptive capacity of society.

The objective of reducing GHG emissions affects **determination of the share of renewable energy sources** (RES) in final consumption. Currently, Slovenia's national objective is set at **27 % by 2030** and confirmed by the Slovenian Development Strategy 2030.

The measures of the **efficient use of energy** have positive effects on end consumers and the economy, as well as on the environment, while they also have extremely favourable macroeconomic effects, such as stimulating economic growth, creation of jobs and reduction of import dependency on fossil fuels. Promoting efficient use of energy will reduce the consumption of consumers and thereby, the energy costs, while it will also have a positive impact on human health; moreover, the efficient use of energy will increase the

COURTESY TRANSLATION

competitiveness of the economy. Increasing the efficient use of energy (and, consequently, reducing its use) **is the first and key measure of Slovenia towards a low-carbon society.**

Supply security is one of the three basic pillars of energy policy, and is inseparably related to climate sustainability and competitiveness of energy supply. For a reliable supply of energy, Slovenia will have to secure a sufficient supply of energy resources in a sustainable and economically viable manner, adequate capacity and dispersion of supply routes, sufficiently powerful and regularly maintained networks, adequate cross-border connections, as well as ensure efficient and secure operating cooperation between energy systems, dispersed electricity sources and power reservoirs. Considering Slovenia's size and EU energy policy, the interlacing of supply routes and sources in the region is very important for Slovenia. Taking climate change into consideration, preserving supply security will be particularly stressed in the electricity system.

According to the rating of the World Energy Council, Slovenia is the second country in the field of energy supply security in the world.

Slovenia will strive to reduce the use of fossil energy sources and dependency thereon to the greatest extent possible by gradually phasing out their use with great emphasis on increasing the efficient use of energy, and greater use of renewable and low-carbon sources. Considering decarbonisation projections, the share of RES in energy balances will increase.

Slovenia's electricity interconnection level was at **83.6 %** in 2017, thereby being already well above the 2020 target of 10 % and the 2030 target of 15 %.

Slovenia also has certain projects of common interest, including two electricity clusters with high-voltage power lines between itself, Croatia and Hungary and a high-voltage line between itself and Italy that will contribute to optimisation of electricity trade and energy supply and to an increase in electricity interconnectivity. Moreover, the Slovenian and Croatian electricity transmission network operators are implementing a project of common interest in the field of smart networks that is co-financed by Connecting Europe Facility.

For research and innovation, the Government adopted the goal in 2010 of a joint venture by the public and private sector into research and development in the amount of 3 % of GDP by 2020 (the target for public investments is 1 % of GDP). The Slovenian Development Strategy 2030, under which Slovenia has also undertaken to implement the 2030 Agenda for Sustainable Development, set two targets related to the dimension Research, innovation and competitiveness in Slovenia, i.e.

- competitive and socially responsible business and research sector where, inter alia, an orientation towards environmentally acceptable technology and eco-innovations is determined, which as an important factor of competitiveness of enterprises also contributes to a reduction of the environmental burden.
- Transition to low-carbon circular economy as a priority development orientation for the entire economy, where it will be necessary to eliminate the connection between

COURTESY TRANSLATION

economic growth and growth in the consumption of raw materials and non-renewable energy sources, and the associated increased environmental load.

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

Slovenian started preparing the Draft Integrated National Energy and Climate Plan (NECP) in October 2017, when an interministerial working group, led by the Ministry of Infrastructure (the Ministry) which is responsible for energy, was established, and to which the representatives of different ministries were appointed for the task of preparing the NECP proposal. In spring 2018, the interministerial working group carried out a review of the current situation, while the Ministry started preparing a tender, the aim of which was to find an external partner that would provide appropriate expert groundwork and offer necessary assistance, both technical and in terms of the content, in preparing the Draft NECP. In parallel, the interministerial working group prepared a review of the existing targets and objectives by individual dimensions, on the basis of which the Ministry of Infrastructure prepared the Draft NECP in cooperation with the group.

The bases for the Draft NECP provide an overview of targets, objectives and contributions, as well as policies and measures by 2020 and 2030, and sum up the current situation by individual dimensions of the Energy Union. It is based on already prepared expert groundwork and adopted long-term and middle-term strategic, action and reporting documents. All documents are publicly available and, for the most part, were drawn up and adopted on the basis of extensive public consultation in accordance with the Slovenian legislation. Because some of them focus on targets, objectives and policies by 2020, the Bases, in parts, only address certain elements of individual dimensions of the NECP.

Slovenia took part in the work of the Technical Group for Preparation of NECP under guidance of the European Commission. In the procedure of the Draft NECP preparation and iterative dialogue, Slovenia will strive for constructive cooperation with the European Commission and other EU Member States that will, as ambitiously as possible, contribute to the achievement of EU-level targets and objectives by 2030, while ensuring fair distribution of burdens and respect for the national limitations and particularities.

1.4 Regional cooperation in preparing the plan

The bases for the NECP will be, in line with the refreshed expert groundwork, updated and drawn up in the final Draft NECP in consultation with the public, which will serve as the basis for the regional consultations planned by Slovenia in 2019. Slovenia plans bilateral consultations with the neighbouring countries and, possibly, with certain other comparable EU Member States.

COURTESY TRANSLATION

2 NATIONAL OBJECTIVES AND TARGETS

2.1 Dimension Decarbonisation

The European Union (EU) has, in the framework of its nationally determined contribution (NDC) to the implementation of the obligations of the Paris Agreement, adopted the target of reducing greenhouse gas emissions (GHG) by 40 % by 2030 relative to 1990. This target is consistent with the target set by the EU by means of its climate and energy framework by 2030, which represents a 36 % reduction of GHG emissions relative to 2005 and is divided into two sub-targets:

- 43 % reduction of emissions in the framework of the EU Emission Trading System (EU ETS);
- 30 % reduction of emissions in the framework of so called non-ETS sectors, governed by the Burden Sharing Regulation.

2.1.1 GHG emissions and removals

Slovenia's binding national targets for greenhouse gas emissions and the annual binding national limits pursuant to Regulation (EU) 2018/842

Under the Burden Sharing Regulation, the national targets of reducing GHG emissions were set for each EU Member State in a range between 0 and 40 %. According to the Regulation, Slovenia is required to reduce its GHG emissions by 15 % by 2030. The form and manner of control and reporting in the framework of the Burden Sharing Regulation was harmonised for all Member States when the Regulation on the Governance of the Energy Union was adopted.

Slovenia's commitments pursuant to Regulation (EU) 2018/841

A part of the EU nationally determined contribution is the sector of Land Use, Land Use Change and Forestry (LULUCF), where the target is to ensure that the LULUCF sector does not produce net emissions, i.e. the emissions in the LULUCF sector will not exceed sinks. The adopted LULUCF Regulation also lays down the rules of calculation for specific LULUCF sub-sectors.

Other national objectives and targets

Slovenian Development Strategy 2030

On 7 December 2017, the Government adopted the Slovenian Development Strategy 2030 (SDS 2030)[1], i.e. the country's umbrella development framework that puts a high quality of life for all in the foreground. By means of five strategic orientations and twelve interrelated development goals, SDS 2030 lays down new long-term development foundations of Slovenia, and by including all United Nations (UN) Sustainable Development Goals, it places Slovenia among countries that have recognised the significance of global responsibility towards the environment and society.

[1] **Slovenian Development Strategy 2030**, available at: http://www.vlada.si/fileadmin/dokumenti/si/projekti/2017/srs2030/Strategija_razvoja_Slovenije_2030.pdf

COURTESY TRANSLATION

The primary objective of the Slovenian Development Strategy 2030 is to provide **a high quality of life for all.** This can be achieved through balanced economic, social and environmental development which takes account of the planet's limitations and creates conditions and opportunities for present and future generations. At the level of an individual, a high quality of life is manifested in good opportunities for employment, education and creativity, in a dignified, safe and active life, a healthy and clean environment and inclusion in democratic decision-making and participation in social co-management (SDS 2030, page 17).

The five strategic orientations for achieving the primary objective will be implemented through operations in various interconnected and interdependent areas, which are reflected in the Strategy's twelve development goals. Each goal is also linked to the sustainable development goals set out in the 2030 Agenda, and serves as the basis to form priorities and measures of the Government, the regional development drivers, local communities and other stakeholders (SDS 2030, page 21).

Under the eighth development goal, i.e. transition to a **low-carbon circular economy**, it will be necessary to eliminate the connection between economic growth and growth in the consumption of raw materials and non-renewable energy sources, and the associated increased environmental load (SDS 2030, pages 38–39).

Under the eighth objective of transition to a low-carbon circular economy, Slovenia set itself the following three performance indicators (SDS 2030, page 39):

1. Material Productivity, where it wishes to achieve the target value of 3.5 Purchasing Power Standard (PPS)/kg by 2030 (given the base value of 1.79 PPS/kg in 2015);
2. **Share of Renewable Energy in Gross Final Energy Consumption**, where it wishes to achieve the target value of 27 % by 2030 (given the base value of 22 % in 2015);
3. Emission Productivity, where it wishes to achieve the EU average by 2030 (given the base value of 2.9 PPS/kg of CO_2 equivalent that corresponds to 2015).

Under the ninth development goal, i.e. **sustainable natural resource management**, Slovenia defines the ensuring of sustainable management and planned use of natural resources as critical to the long-term preservation of the quantity and quality of our natural resources, which are one of the key pillars for ensuring a healthy living environment and food production, and carrying out economic activities with high value added and creating high-quality jobs (SDS 2030, page 40).

Effectiveness in terms of achieving the target will also be monitored via the value of the ecological footprint indicator, the major part of which is composed of the carbon footprint. The target value for 2030 is to reduce the ecological footprint by 20 % relative to 2013 (SDS 2030, page 41).

Motion for the Resolution on the Energy Concept of Slovenia

The Energy concept of Slovenia (ECS) will be the basic development document in the energy field that, pursuant to Article 23 of the Energy Act (EZ-1)[2] and on the basis of the projections

[2] **Energy Act (EZ-1)**, available at:https://www.uradni-list.si/glasilo-uradni-list-rs/vsebina/2014-01-0538/#Prvi%C2%A0del

COURTESY TRANSLATION

of the country's economic, environmental and social development and the adopted international commitments, defines the objectives of the reliable, sustainable and competitive energy supply for the next 20 years and, tentatively, for the next 40 years. ECS is to be adopted in a resolution by the Slovenian National Assembly on the Government's proposal. At its 170th regular session on 1 March 2018, the Government set the wording of the motion for the **Resolution on the Energy concept of Slovenia (ReECS Motion)** and submitted it to the National Assembly for adoption[3]. In the procedure of preparing the ReECS Motion, a comprehensive environmental impact assessment was also carried out.

The energy policy goal of Slovenia is to ensure reliable, safe and competitive energy supply in a sustainable manner by ensuring transition to low-carbon society and achievement of the sustainable development goals and thereby, inter alia, the following: stimulating environment for economic development and creation of high added-value jobs, as well as acceptable energy services for people and the economy (ReECS Motion, paragraph 8).

Key challenges are a gradual reduction of energy use and an increase of its efficient use, an increase of renewable energy production and thereby, phasing out the use of fossil resources for electricity generation, heating and transport, guidelines regarding the preparations for a decision on nuclear energy use, and technological development and commercial breakthrough of renewable energy sources, advanced technologies and services, including storage and efficient use of energy (ReECS Motion, paragraph 11).

The main task of the future development of the energy industry in Slovenia is to continue providing balance among three general and inextricably linked pillars of energy policy, namely: climate sustainability, energy supply security and competitiveness (ReECS Motion, paragraph 18).

Taking into consideration that, on 14 April 2018, the Slovenian President adopted the Decree on the dissolution of the National Assembly of the Republic of Slovenia and the announcement of early elections to the National Assembly of the Republic of Slovenia, that took place on Sunday, 3 June 2018, the National Assembly was not able to put the ReECS Motion on its agenda and discuss it before the early elections. The new Slovenian Government that was appointed on 13 September 2018 again referred the ReECS Motion to the public hearing procedure. The Ministry of Infrastructure estimates that the revised ReECS Motion will be prepared and adopted by the Government by the end of 2019, and then submitted to the National Assembly that is expected to adopt ReECS in the first half of 2020.

Indicative sectoral objectives defined in the Operational Programme for Reducing Greenhouse Gas Emissions by 2020 (OP TGP)[4]

Under the Climate and Energy Package that was adopted at the end of 2008, Slovenia adopted legally binding targets for reducing GHG emissions by 2020. According to Decision

COURTESY TRANSLATION

[3] Motion for the **Resolution on the Energy Concept of Slovenia (ReECS Motion)**, available athttp://www.energetika-portal.si/fileadmin/dokumenti/publikacije/eks/resolucija_eks/resol_eks_final.pdf

[4] **Operational Programme for Reducing Greenhouse Gas Emissions by 2020**, available at: http://www.energetika-portal.si/fileadmin/dokumenti/publikacije/op_tgp/op_tgp_2020.pdf

406/2009/EC, the obligations of reducing (limiting) greenhouse gas emissions refer only to emissions of sectors that are not included in the greenhouse gas emissions trading scheme in accordance with Directive 2009/29/EC. The obligation of reducing greenhouse gas emissions under Decision 406/2009/EC thus refers to the following (OP TGP, page 1):

- emissions from fuels used in households and service sector;
- emissions from fuels used in transport;
- emissions from fuels used (in small- and medium-sized companies, and industry and energy sectors);
- fugitive emissions from energy sector;
- process emissions from industrial processes;
- solvent and other product use;
- emissions from agriculture;
- emissions from waste management.

The Operational Programme for Reducing Greenhouse Gas Emissions by 2020 is an implementation plan of measures to achieve Slovenia's legally binding target of reducing GHG emissions by 2020 referred to in the Climate and Energy Package under Decision No 406/2009/EC. Accordingly, Slovenia also set itself the **long-term vision to** (OP TGP, page 1):

> ***'support the international vision of preventing dangerous consequences of climate change and keeping global temperature growth below 2 °C. It will actively contribute to make this vision a reality with the transition to the economy, the growth of which will not be based on the increased use of natural resources and energy, but will, by means of efficiency and innovations, reduce the greenhouse gas emissions, improve competitiveness and promote growth and employment instead'.***

By taking into consideration the legally binding targets in the 2013–2020 period, already adopted political decisions at the EU level on long-term targets, the costs of reducing greenhouse gas emissions in Slovenia by 2030 and other development, sectoral and environmental objectives and, in creating the vision, by taking the effects of technological solutions into consideration, Slovenia also set itself the indicative sectoral targets of reducing greenhouse gas emissions by 2030 (OP TGP, page 19).

In setting the targets for the development of alternative fuels in transport in Slovenia, consideration was given to the targets in line with the commitments that were adopted in Slovenia, as well as Slovenia's commitments deriving from Directive 2014/94/EU, OP TPG for 2020 and 2030, as well as the targets regarding the air pollutants. Thereby, CFP and the latest European Strategy for Low Emission Mobility were considered. The supplemented basis scenario (what can realistically be achieved in Slovenia) was selected, which was defined as the optimal scenario and enables the achievement of the indicative OP TGP targets and reduction of emissions of air pollutants, namely on the basis of current development in this area and possibilities of implementation by taking the realistic abilities of economic operators in the area concerned and the expected market development into consideration. The optimal scenario

COURTESY TRANSLATION

foresees the use of all alternative fuels for reduction of emissions pursuant to the indicative targets in OP TGP (Strategy for Development of the Market in Order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia, page 17.).

Table: Indicative sectoral targets for reducing GHG emissions in sectors that are not included in the Emissions Trading Scheme by 2020 and 2030, set by Slovenia in OP TGP 2020, relative to 2005

	Annual GHG emissions in 2005 kt CO_2 eq	**Indicative reduction targets relative to 2005**	
		In 2020	**In 2030**
Transport	4,431	+ 27 %	+ 18 %
General use	2,585	+ 53 %	+ 66 %
Agriculture	2,003	+5 %	+ 6 %
Waste management	692	+ 44 %	+ 57 %
Industry	1,511	+ 42 %	+ 32 %
Energy	365	+ 6 %	+ 16 %

Source: OP TGP 2020, pages 18–19.

Strategy for Development of the Market in order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia

As part of efforts for the achievement of environmental objectives for the GHG emissions, in the context of which Slovenia must ensure a reduction of GHG emissions in transport by 9 % relative to 2020, the Strategy for Development of the Market in Order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia was adopted in October 2017[5]. The Strategy defines the optimal scenario that enables achievement of the indicative OP TGP targets of reducing the air pollution emissions. The optimal scenario foresees the use of all alternative fuels for reducing emissions pursuant to the indicative OP TGP targets. **Indicative targets of reducing GHG** for transport relative to 2005 are presented in the below table.

Table: OP GHG

	Indicative GHG reduction targets relative to 2005	
	In 2020	In 2030
Transport	+27 %	+18 %

	Obligation of reducing pollutants compared to 2005				
	SO_2	NOx	NMVOC	NH_3	$PM_{2.5}$
For any year in the period from 2020 to 2029	63 %	39 %	23 %	1 %	25 %

[5] **Strategy for Development of the Market in order to Develop Appropriate Alternative Fuels Infrastructure in the Transport sector in the Republic of Slovenia,** available at: http://www.energetika-portal.si/fileadmin/dokumenti/publikacije/alternativna_goriva/strategija_alternativna_goriva_final.pdf

COURTESY TRANSL

For any year from 2030 onwards	92 %	65 %	53 %	15 %	60 %

Source: Strategy for Development of the Market in Order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia, page 17.

For passenger cars, the optimal scenario foresees the increase in share of passenger cars on alternative fuels to 20 % by 2030 (see the below table).

Table: Structure of passenger cars for the first time registered cars in Slovenia for 2015, 2020 and 2030 (P – petrol, D – diesel, LPG – liquefied petroleum gas, CNG – compressed natural gas, Hy1–hybrid, PHEV – plug-in hybrid electric vehicle, BEV –battery-electric vehicle, H2 – hydrogen)

		Optimal	
	2015	2020	2030
PC-P	34 %	33 %	18 %
PC-D	62 %	49 %	22 %
PC-LPG	1 %	10 %	1 %
PC-CNG	0 %	1 %	1 %
PC-Hyl	4 %	2 %	5 %
PC-PHEV	0 %	3 %	17 %
PC-BEV	0 %	3 %	33 %
PC-H2	0 %	0 %	2 %

Source: Strategy for Development of the Market in Order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia, page 21.

For light goods vehicles, the optimal scenario foresees their structure as given in the below table.

Table: Structure of light goods vehicles for the first time registered cars in Slovenia for 2015, 2020 and 2030 (P – petrol, D – diesel, LPG – liquefied petroleum gas, CNG – compressed natural gas, Hy –hybrid, PHEV – plug-in hybrid electric vehicle, BEV –battery-electric vehicle, H2 – hydrogen)

		Optimal	
	2015	2020	2030
LGV-P	2 %	2 %	1 %
LGV-D	97 %	94 %	56 %
LGV-LPG	0 %	0 %	0 %
LGV-CNG	0 %	0 %	1 %
CNG-BEV	0 %	3 %	40 %
CNG-H2	0 %	0 %	2 %

Source: Strategy for Development of the Market in Order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia, page 22.

COURTESY TRANSLATION

For transport by bus, the optimal scenario foresees the use of compressed natural gas (CNG) as the main alternative fuel and, consequently, the establishment of charging infrastructure for CNG in urban environments by 31 December 2020. As the key areas, the municipalities and area of Zasavje are identified.

Table: Structure for the first time registered buses in Slovenia for 2015, 2020 and 2030 (P – petrol, D – diesel, LPG – liquefied petroleum gas, CNG – compressed natural gas, Hy –hybrid, PHEV – plug-in hybrid electric vehicle, BEV –battery-electric vehicle, H2 – hydrogen)

		Optimal	
	2015	2020	**2030**
BUS-P	0 %	0 %	0 %
BUS-D	98 %	76 %	18 %
BUS-LPG	0 %	0 %	0 %
BUS-CNG	2 %	23 %	62 %
BUS-E	0 %	2 %	17 %
BUS-H2	0 %	1 %	4 %

Source: Strategy for Development of the Market in Order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia, page 24.

For heavy goods vehicles, the liquefied natural gas (LNG) is identified as the optimal energy product, i.e. so called bi-fuel versions, meaning that engines use diesel fuel and gas simultaneously. The bi-fuel versions enable the use of LPG, CNG and LNG. Namely, up to 30 % of diesel fuel is replaced with gas.

Table: Structure of heavy goods vehicles for the first time registered cars in Slovenia for 2015, 2020 and 2030 (P – petrol, D – diesel, LPG – liquefied petroleum gas, CNG – compressed natural gas, Hy –hybrid, PHEV – plug-in hybrid electric vehicle, BEV –battery-electric vehicle, H2 – hydrogen)

		Optimal	
	2015	2020	**2030**
HGV-P	0 %	0 %	0 %
HGV-D	100 %	94 %	44 %
HGV-LPG	0 %	0 %	0 %
HGV-LNG	0 %	3 %	21 %
HGV-BEV	0 %	0 %	2 %
HGV-PHEV	0 %	0 %	1 %
HGV-H2	0 %	0 %	6 %
HGV-D-NG/LPG	0 %	4 %	26 %

Source: Strategy for Development of the Market in Order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia, page 26.

COURTESY TRANSLATION

According to the foreseen number of vehicles operating on alternative fuels in Slovenia, and given the requirements of Directive 94/2014, it is also necessary to ensure the charging infrastructure, as shown in the below table.

COURTESY TRANSLATION

Table: The necessary number of public charging stations by types of alternatives fuels in 2015, 2020, 2025 and 2020

		The necessary charging infrastructure for optimal scenario		
	2016	2020	2025	2030
Charging stations for BEV	227	1,200	7,000	22,300
Charging stations for CNG	4	14 (12[1])	14 (12)	14 (12)
Charging stations for LNG	0	3	3	3
Charging stations for H2[2]	1	2	5–9	5–9

[1] – In case that, for the needs of urban areas, the charging stations in vicinity of or on TEN-T network would be used.

[2] – Depending on capacity of individual charging station.

Source: Strategy for Development of the Market in Order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia, page 30.

The Strategy mentions the possibility of charging ships with LNG in the Port of Koper, namely by 2025, simultaneously with establishment of system of charging ships at berths with electricity (Strategy for Development of the Market in Order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia, page 30). On the basis of already performed analyses, it is clear that the establishment of system of charging ships at berths with electricity potentially unlocks important benefits for the energy and environment, representing a growing challenge for the port infrastructure. However, it should be realised that charging of ships at berths with electricity requires a significant change of the existing electricity power network, which is a very expensive and relatively long-term process. It is also clear that, at the strategic level, EU must develop relevant regulations and provide incentive measures in order to encourage ports and ship owners to upgrade the existing systems and implement projects that will enable charging ships at berths with electricity (ELEMED Project, Study on technical possibilities for charging ships with electricity at times of berthing in the Port of Koper, page 80).

Strategic framework for climate change adaptation

Strategic framework for climate change adaptation (SOPPS)[6] provides a framework and guidelines for adaptation to climate change in Slovenia. It was adopted by Government in December 2016. The vision of SOPSS is as follows (SOPPS, 2016, page 4):

> ***"by 2050 Slovenia should become a society adapted and resilient to climate change impacts and characterised by a high quality of life and a high degree of safety of life, while taking full advantage of the changed climate on the basis of sustainable development.***

The purpose of vision of SOPPS is to strengthen capacities for climate change adaptation, management of risks and for taking advantage of the opportunities presented thereby.

The general objective is to reduce Slovenia's exposure, sensitivity and vulnerability to climate change impacts and increase the climate resilience and adaptive capacity of society

[6] Strategic framework for climate change adaptation, available at: http://www.mop.gov.si/fileadmin/mop.gov.si/pageuploads/podrocja/podnebne_spremembe/SOzP.pdf

COURTESY TRANSLATION

(SOPPS, 2016, page 4). Steps and guidelines to achieve the objectives set in SOPPS are based on inclusion, wider cooperation, research and transfer of knowledge, as well as education and training, awareness-rising and communication.

TARGETS, OBJECTIVES AND CONTRIBUTIONS OF SLOVENIA

- Slovenia's objective is to reduce **GHG emissions** by 2030 in accordance with the Burden Sharing Regulation for at least 15 % in comparison to 2005.

- Slovenia's objective is to ensure that there will be no net emissions produced from the **LULUCF** sectors by 2030, namely the emissions in the LULUCF sectors will not exceed the sinks.

- In the TGP 2020 Operational Programme, the indicative sector targets are set for so called ESD sectors by 2020 and 2030.

- General objective in the area of **adjustment** is to reduce Slovenia's exposure, sensitivity and vulnerability to climate change impacts and increase the climate resilience and adaptive capacity of society.

- Long-Term Strategy for Mobilising Investments in the Energy Renovation of Buildings is, as an intermediate objective by 2030, setting the **reduction of greenhouse-gas emissions in buildings** by at least 70 % by 2030 relative to 2005.

2.1.2 Renewable energy

Considering decarbonisation projections, which were drawn up for the ReECS Motion, the share of RES in energy balances will increase. In the future, the natural conditions of Slovenia will have to be much better exploited, taking the standards of physically placing energy facilities into consideration, and increase the suitability of such placing in order to be done faster and more efficient (ReECS Motion, paragraph 51).

The energy facilities will have to be physically placed in the way that this will not affect the recognisable characteristics of areas that are important in terms of nature protection and their biodiversity (Natura sites, Ramsar areas, IBA, UNESCO heritage areas, EPO, natural values and protected areas).

The objective of reducing GHG emissions affects determination of the share of renewable energy sources (RES) in final consumption. Currently, the Slovenia's national objective is set at **27 % by 2030** and confirmed by the Slovenian Development Strategy 2030.

COURTESY TRANSLATION

In the context of updating the National Renewable Energy Action Plan 2010–2020, the projection of the use of RES for the 2015–2030 period was prepared[7]. Objectives in terms of RES and scenarios for the achievement of these objectives are determined on the basis of projection of the gross final energy consumption by 2030 that presumes implementation of policy of efficient energy use as set out in the National Energy Efficiency Action Plan 2014–2020 AN URE 2020) and in the Long-Term Strategy for Mobilising Investments in the Energy Renovation of Buildings. Thus, it is planned that the measures of efficient use of energy by 2020 will be implemented in line with AN URE and, by 2030, to a comparable extent (see the below table) (Draft AN-OVE 2010–2020 (2017 update), page 27).

Table: Share of RES, gross final energy consumption and gross final consumption of energy from RES – projection for the 2015–2030 period

		2005	2010	2013	2014	2015	2020	2025	2030
	Share of RES [%]								
REF:	OVE-H and C:	18.9 %	28.1 %	33.4 %	32.4 %	34.1 %	34.5	31.7	30.5
REF:	RES-EN	28.7 %	32.2 %	33.1 %	33.9 %	32.7 %	38.6	43.5	47.4
REF:	OVE-P[20]	0.8 %	3.1 %	3.8 %	2.9 %	2.2 %	10.1	10.1	10.1
REF:	RES	16.0 %	20.4 %	22.4 %	21.5 %	22.0 %	25.0	26.3	27.0

RES-H and C: Heating and cooling sector

RES-EN Electricity sector

RES-T[20]: Transport sector, in which a share of RES is estimated in accordance with Directive 2009/28/EC; for electricity from RES in transport, the factor 2.5 was considered.

RES: Use of RES in total

Source: Draft AN-OVE 2010–2020 (2017 update,), page 27

In the long-term energy balances, which were prepared for ReEKS, the following were presented:

- gross national consumption of energy, meaning the total consumption in the country and constituting the amount of energy that is necessary to satisfy the national use (Report by the long-term energy balances developer, pages 53–59);
- production (including recovery of products) that is, jointly with the net import, necessary to satisfy the national consumption (Report by the long-term energy balances developer, pages 60–66);
- net import of energy for three main scenarios (Report by the long-term energy balances developer, pages 67–73);

Use of biofuels

Strategy for Development of the Market in order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia establishes that the introduction of zero-carbon vehicles on the Slovenian market lags behind the projections for a variety of reasons, thus this backlog will have to be addressed also by the use of low-carbon energy resources, where this is already enabled by the existing rolling stock. This includes the

[7] **Draft National Renewable Energy Action Plan 2010–2020** – 2017 update, available at: http://www.energetika-portal.si/fileadmin/dokumenti/publikacije/an_ove/posodobitev_2017/an_ove_2010–2020_posod-2017.pdf

COURTESY TRANSLATION

use of biofuels in different forms. In order to achieve the proposed objectives, the optimal scenario foresees the adding of seven per cent biodiesel to fossil diesel and, in the period from 2020 to 2030, the gradual increasing of the share of heavy goods vehicles that will be using pure biodiesel (B 100) from 0 to 10 % (Strategy for Development of the Market in order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia, page 28).

TARGETS, OBJECTIVES AND CONTRIBUTIONS OF SLOVENIA

- The Slovenia's objective is to achieving **27 % share of renewable sources** in final energy consumption by 2030.

- The Long-Term Strategy for Mobilising Investments in the Energy Renovation of Buildings is, as an intermediate objective by 2030, setting the achievement of at least 2/3 of renewable **energy use in buildings** (i.e. a share of RES in the final consumption of energy products without electricity and district heating included).

2.2 Dimension Energy efficiency

The measures of the efficient use of energy have positive effects on end consumers and economy, as well as on environment, while they also have extremely favourable macroeconomic effects, such as stimulating economic growth, creation of jobs and reduction of import dependency on fossil fuels. This involves a potential in the entire energy chain, i.e. from the production, transfer and distribution of energy to its overall use, which includes possible and necessary changes of living habits in many areas. Promoting efficient use of energy will reduce the consumption of consumers and thereby, the energy costs, while it will also have a positive impact on the human health; moreover, the efficient use of energy will increase the competitiveness of economy (ReECS Motion, paragraph 69).

Slovenia expects that by integration of systems, also locally at the level of buildings, the new possibilities for energy efficient solutions will raise that will ensure additional positive effects in the future (ReECS Motion, paragraph 70). Slovenia is expecting that increasing the efficient use of energy (and, consequently, reducing its use) **is the first and key measure of towards low-carbon society** (ReECS Motion, paragraph 71).

At its 161st session on 21 December 2017, the Government adopted the National Energy Efficiency Action Plan 2017–2020 (AN URE 2020), which brought new measures to promote energy efficiency in buildings, households, public sector and industry, as well as new measures to promote efficient heating and cooling[8]. When this Plan was adopted, Slovenia was on track to reach the national objective, but this trend does not indicate the long-term management of the primary energy use, in particular due to high 'volatility' of the overall use

[8] **National Energy Efficiency Action Plan 2017–2020 (AN-URE 2020)**, December 2017, available at: http://www.energetika-portal.si/fileadmin/dokumenti/publikacije/an_ure/an_ure_2017-2020_final.pdf

COURTESY TRANSLATION

of energy in transport that constituted 38 % of the total overall use of energy in 2015. This could also seriously jeopardise the objective of primary energy use by 2020.

AN URE 2020 covers the essential measures to improve energy efficiency, including the expected and achieved energy savings, with the aim to achieve the national objective of increasing energy efficiency by 2020, and the Slovenia's contribution to achievement of the common EU objective – increasing energy efficiency by 20 %. This target states that primary energy consumption in Slovenia will not exceed 7.125 Mtoe in 2020, meaning that it may not exceed the 2012 figure by more than 2 % (AN URE 2020, 2017, page 8). The effectiveness of the implementation of AN URE 2020 action plan is vital to achieving objectives of reducing greenhouse gas emissions (GHG) and achieving a 25 % target share of renewable energy sources (RES) in the balance of gross final energy consumption by 2020. Energy efficiency is amongst the most cost-effective measures for achieving these objectives, and it also significantly contributes to the objectives in the field of air quality (AN URE 2020, 2017, page 8).

On 29 October 2017, the Government adopted the **Long-Term Strategy for Mobilising Investments in the Energy Renovation of Buildings** (DSEPS), determining the important objectives of reducing energy use in buildings[9]. On 22 February 2018, the amendment to the Long-Term Strategy for Mobilising Investments in the Energy Renovation of Buildings was adopted, since it was proven during its implementation that certain areas, such as quality management, creation of the financial instruments and problems of moderately developed market of energy contracting, need a more detailed examination and follow up.

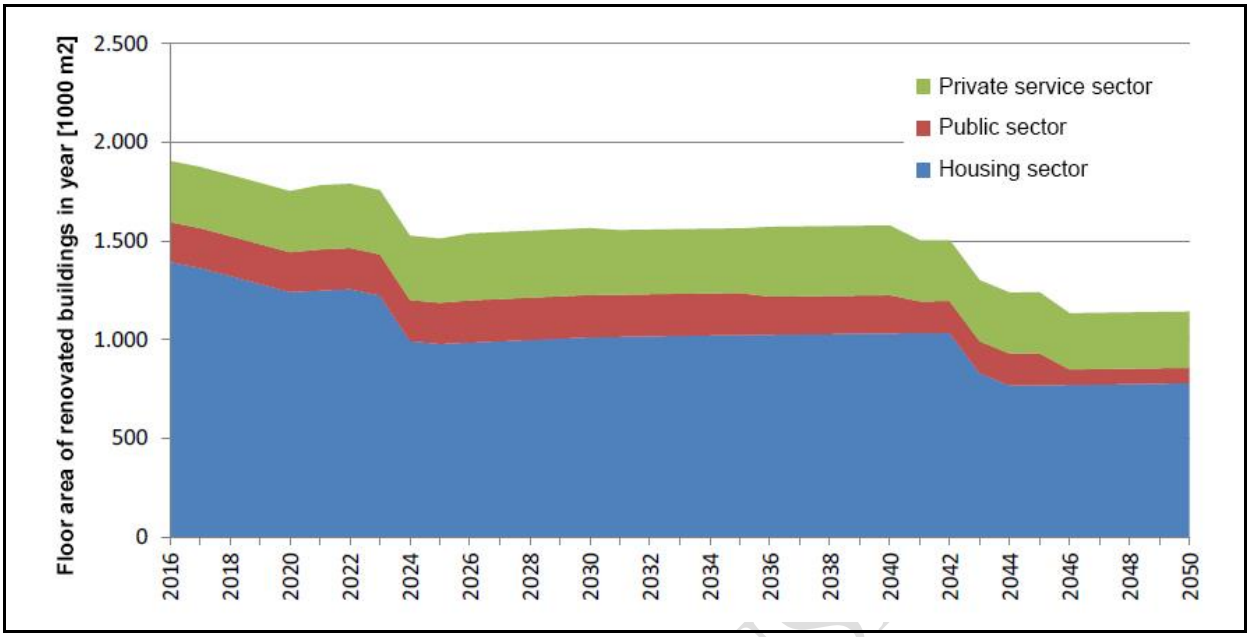
The vision, defined in DSEPS, is to achieve carbon-neutral energy use in buildings by 2050; Slovenia will achieve this by making considerable improvements in energy performance and by increasing the use of renewable energy sources in buildings. This will, in turn, significantly reduce emissions of other harmful substances into the atmosphere. A further objective is for Slovenia to become recognised for its activities in the field of sustainable construction (DSEPS, pages 9 and 57)

The below figure, contained in DSEPS, is the key one and shows the renovation of buildings by individual sectors.

COURTESY TRANSLATION

[9] **Long-Term Strategy for Mobilising Investments in the Energy Renovation of Buildings** October 2015, available at: http://www.energetika-portal.si/fileadmin/dokumenti/publikacije/dseps/dseps_final_okt2015.pdf

Figure: Floor area of renovated buildings in the residential and the public and private service sectors in the 2016–2050 period (the total floor area undergoing partial or complete energy renovation is shown; floor areas partly renovated can be renovated several times)



Source: DSEPS, page 89.

COURTESY TRANS

TARGETS, OBJECTIVES AND CONTRIBUTIONS OF SLOVENIA

- Increasing the efficient use of energy (and, consequently, reducing its use) is the first and key measure towards low-carbon society (ReECS Motion, paragraph 71).

- Scenario, which was prepared in order to develop the Long-term Energy Balances that served as the basis for different strategic documents, is based on the assumption that the primary energy consumption in Slovenia will not exceed 82,024 GWh in 2030.

- The intermediate objectives of the Long-Term Strategy for Mobilising Investments in the Energy Renovation of Buildings by 2030 are as follows:
  - reducing energy end-use in buildings by 30 % by 2030 relative to 2005;
  - energy-saving renovation of almost 26 mio of m^2 of building areas or 1.3–1.7 mio of m^2 per year, of which more than a third according to the nearly zero-energy buildings standard (AN sNES).

2.3 Dimension Energy security

According to the rating of the World Energy Council, Slovenia is second country in the field of energy supply security in the world (WEC, 2018)[10].

[10] **World Energy Council, Slovenia**, 2018, available at https://trilemma.worldenergy.org/#!/country-profile?country=Slovenia&year=2018

Energy supply security is one of the three basic pillars of energy policy, and is inseparably related to climate sustainability and competitiveness of energy supply (ReECS, paragraph 18). For reliable supply of energy, Slovenia will have to secure sufficient supply of energy resources in sustainable and economically viable manner, adequate capacity and dispersion of supply routes, sufficiently powerful and regularly maintained networks, adequate cross-border connections, as well as ensure efficient and secure operating cooperation between energy systems, dispersed electricity sources and power reservoirs. Considering the Slovenia's size and the EU energy policy, the interlacing of supply routes and sources in region is very important for Slovenia. Taking climate change into consideration, preserving the supply security will be in particularly stresses in electric power system (ReECS Motion, paragraph 25).

Slovenia will strive to reduce the use of fossil energy sources and dependency thereon to the greatest extent possible by gradually phasing out their use with great emphasis on increasing the efficient use of energy, and greater use of renewable and low-carbon sources (ReECS Motion, paragraph 49). Considering decarbonisation projections, the share of RES in energy balances will increase (ReECS Motion, paragraph 51).

Slovenia does not have any specific objectives **for energy storage**. According to Council Directive 2009/119/EC, it provides the amount of reserves of oil and its products that corresponds to at least nightly days average use in the past year (Commodity Reserves Act, Article 21a)[11].

Under the SincroGrid project (project of common EU interest), the Slovenian electricity transmission system operator will replace the 10 MW battery electricity storage facilities with the ones of 30 MWh capacity in order to relieve the local power flows in the 110 kV network and as the alternative source for secondary regulation (ELES, 2018)[12].

For security of natural gas supply, Slovenia specified protected customers as part of implementation of Regulation (EU) No 994/2010 that are, in addition to household consumers, connected to the distribution system, including the basic social services that are connected to the distribution or transmission network and serve as the providers of health-care (EZ-1, Article 168), including rehabilitation and care; childcare; education, including student halls of residence and university libraries; social services. In the procedure of implementation of Regulation 1308/2013/EU, the definition of protected customers will be changed accordingly to the EZ-1 amendment.

If in view of the extent and duration of a state of emergency or other circumstances for which reason the secure supply of natural gas is threatened or such supply in Slovenia is seriously disrupted for a considerable period of time, and by applying measures set out in the Emergency Plan suppliers cannot ensure the supply of natural gas to protected customers in sufficient

[11] **Commodity Reserves Act,** available at https://www.uradni-list.si/glasilo-uradni-list-rs/vsebina/2009-01-4179?sop=2009-01-4179

[12] **ELES. Sincro.Grid** project, available at https://www.eles.si/projekt-sincro-grid/uvedene-tehnologije

COURTESY TRANSLATION

quantities, system operators must take all steps to ensure through safe operation of the system the transfer and distribution for supply of natural gas to those customers (EZ-1, Article 169(1)).

EZ-1 stipulates (Article 166(5) that 'if, in the previous calendar year, one natural gas provider supplied natural gas to final customers in the Republic of Slovenia, the same provider will ensure that the supply of natural gas in the current calendar year is provided from at least two different sources of supply, on the condition that the largest supply source does not exceed 70 per cent of the volumes supplied by the same provider for final customers in the Republic of Slovenia.'

Slovenia will strive to reduce the use of imported natural gas by means of the energy efficiency measures. There are also possibilities of adding the home produced gas, which are not defined as targets. In the area of NE Slovenia, the supplies of natural gas were established, and the activities to start using them are underway. If the establishment of production and supply to the Slovenian gas transmission network would have been successful, would improve the picture of security of natural gas supply in Slovenia.

For the electricity supply, the Slovenia's electric power system must be capable of operating smoothly in the event of failure of one element at any time, or in other words: it must satisfy the N-1 criterion, which is a simple, robust, harmonised and established criterion in planning of transmission network. Based on the historical data on use and production for Slovenia, and on the measured balances of countries in Europe, the simulations were made for each hour in 2015, whereby all the Slovenian and cross-border overhead power lines and the majority of dual-system ones were considered in the analysis. In the event of failures, the majority of problems are expected on the Primorska and Dolenjska region networks, while the loads of the Pomurje region network are also high. Regarding the mentioned obvious transmission network problems, Eles as the electricity transmission system operator planned the network improvements that would ensure high-quality supply to customers with electricity, as well as better resilience to possible disturbances, which may occur in the Slovenian electric power system (Transmission System Development Plan 2017–2026, page 48).

System operator of distribution network (SODO) is obliged to plan the network so as to, as a rule, construct a medium voltage (MV) grid of loops according to the n-1 reliability criterion, which is satisfied in relation to the MV grids if, in the event of failure of one MV element, the use of the network is provided for all users outside the sector subjected to the failure after a short termination period **(up to 1 hour)**. SODO must try to establish the causes of the network failure, as well as the connection point, the latest in two hours following the user's failure notification. SODO must try to remedy the established failure immediately or in four hours at the latest. SODO must set or replace the measuring devices in seven days following the receipt of notification at the latest.

The objective of the energy supply security policy is of a qualitative nature, and is based on the principle of well-functioning energy markets and good cross-border interconnectivity, which contributes to the reduction in interruptions and failures of supply. Namely, Slovenia has no precise quantitative objectives in the majority of the required areas.

COURTESY TRANSLATION

2.4 Dimension Internal energy market

2.4.1 Electricity interconnectivity

Slovenia's electricity interconnection level5 was at 83.6 % in 2017 and thereby being already well above the 2020 target of 10 % and the 2030 target of 15 % (Slovenia: Energy Union factsheet, 2017, pages 5–6)[13]. Slovenia also has certain projects of common interest, including two electricity clusters with high-voltage power lines between itself, Croatia and Hungary and high-voltage line between itself and Italy, which will contribute to the optimisation of electricity trade and energy supply, as well as to increase in electricity interconnectivity. Moreover, the Slovenian and Croatian electricity transmission network operators are implementing the project of common interest in the field of smart networks that is co-financed by Connecting Europe Facility.

2.4.2 Energy transmission infrastructure

Electricity transmission infrastructure

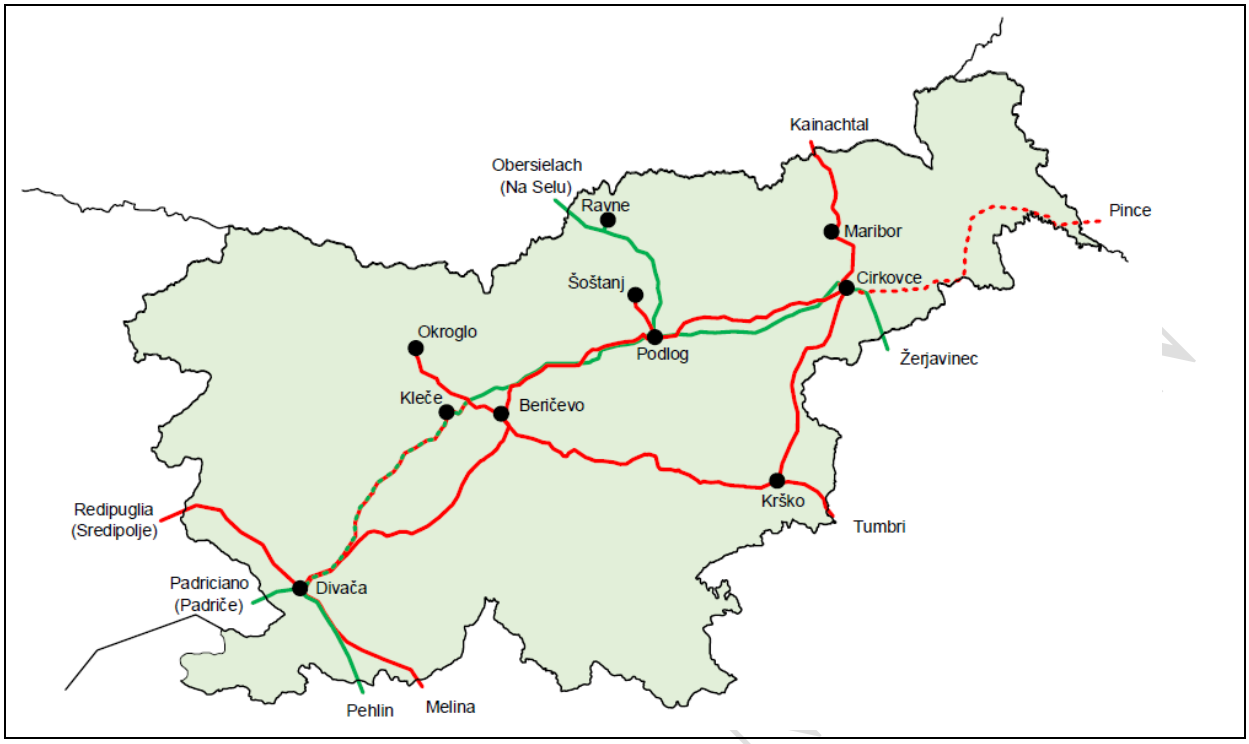
Slovenia has a small electric power system, in which every large production unit constitutes an important element of the system's reliability. In the long run, due to the phasing out of the the use of fossil resources and the end of existing nuclear power plant's life cycle, a large share of domestic electricity generation will have to be replaced. Selection of relevant technologies and energy products, construction of power plants and networks, their physical placing, and determination of the minimum possible share of the imported electricity will present a big challenge in the future (ReECS Motion, paragraph 50).

The Slovenian electricity transmission network will, in addition to the important improvements at the 220 kV and 400 kV voltage level that are presented in the below figure, require some additional investments, such as 2 x 400 kV Cirkovce–Pince overhead power lines and 2 x 220 kV Zagrad–Ravne overhead power lines. Moreover, an investment as part of the transition of 220 kV transmission network to 400 kV voltage level is possible in the future, as well as the new Slovenia–Italy HVDC (High Voltage Direct Current) connection. Both projects are in the phase of study, while their realisation depends on market conditions and achievement of a proper level of social welfare (Transmission System Development Plan 2017–2026, pages 16–18).

COURTESY TRANSLATION

[13] **State of the Energy Union – Slovenia**, available at: https://ec.europa.eu/commission/publications/state-energy-union-slovenia_en

Figure: The planned improvements of the Slovenian 220 kV and 400 kV transmission network by 2026



Source: Transmission System Development Plan 2017–2026, page 18.

Other planned additional investments in the Slovenian electricity transmission network (Transmission System Development Plan 2017–2026, pages 16–18):

400 kV and 220 kV transformer stations (TS) and power transformers (TR):

- Compensating devices in Divača, Beričevo and Cirkovce TS (under SINCRO.GRID project),
- 400 kV Cirkovce TS (in relation to 400 kV Cirkovce–Pince investment),
- Ravne TS 220/110 kV,
- other 400/110 kV TR in TS Divača,
- 400/110 kV TR in Podlog TS,
- 220/110 kV TR in Divača TS,
- 400/110 kV TR in Beričevo TS,
- 220/110 kV TR in Podlog TS.

110 kV connections:

- 2 x 110 kV Divača–Gorica (Renče) transmission line,
- 2 x 110 kV Dravograd–Velenje transmission line (tension hanging of the second system),
- 2 x 110 kV Brestanica–Hudo transmission line,
- 110 kV Koper–Izola–Lucija transmission line / kbV,
- 2 x 110 kV Divača–Pivka–Ilirska Bistrica transmission line,
- 2 x 110kV Divača–Koper transmission line.

COURTESY TRANSLATION

110 kV TS in TR:

- Electricity storage facilities in Okroglo and Pekre TS (under SINCRO.GRID project),
- 110 kV Hudo TS,
- 110/20 kV Slovenska Bistrica TS,
- 110/20(35) kV Pekre TS,
- 110/20 kV Tolmin TS,
- 110/20 kV Ravne TS,
- 110/20 kV Avče TS.

The Slovenian operator of transmission network believes that investments in the neighbouring countries are important for permeability in the future, since the Slovenian electric power system has significantly higher net transfer capacity that is currently specified due to the limitations in the said countries (ELES, 2018):

- according to the N-1 criterion, ELES has 4,750 MW of cross-border trading capacities;
- there are 2,730 MW of cross-border capacities allocated;
- smaller allocated cross-border trading capacities are the consequence of an insufficient transmission capacities in the neighbouring countries;
- Slovenia's final electricity consumption does not exceed 2,500 MW;
    - in 2017 the highest hourly load of electricity transmission system amounted to 2131 MW, which is 153 MW more than in 2016 (Report on the Energy Sector in Slovenia for 2017, page 21);
- the reason for slightly less than half of all the transferred electricity in Slovenia lies in transit, meaning that more than half of the transmission network is used for international transits, which is the highest proportion of all in Europe relatively speaking;
- construction of new cross-border capacities is not justified in terms of national economy, with an exception of connection with Hungary that is almost realised.

Table: Cross-border transmission capacities for electricity in 2018

	AT->SI	SI-> AT	SI-> AT	AT->SI	HR->SI	SI->HR
Thermal capacity* [MW]	2860	2860	1488	1488	4716	4716
Maximum physical flow [MW]	1239	1112	1733	807	1901	1096
N-1 capacity [MW]	1250	1250	800	800	2700	2700
Allocated commercial capacities – 2017 realisation	727	937	547	649	1456	1459
Efficiency	58%	75%	68%	81%	54%	54%

Source: ELES, 2018.

TEST TRANSLATION

Natural gas transmission infrastructure

Due to the lack of own sources, the supply of natural gas to the Slovenian market depends entirely on its import. The supply of natural gas to Slovenia takes place from Russia and individual hubs of the European gas market. From Austria, natural gas physically flows via the Ceršak entry point and from Italy via the Šempeter entry point (Gas Transmission Network Development Plan for 2018–2027, page 8). The trading hubs from which natural gas is supplied to Slovenia are supplied with natural gas from the EU, Norway, the Russian Federation and North Africa as well as with liquefied natural gas (LNG) from other locations.

In Slovenia, the security of natural gas supply is ensured in accordance with Regulation (EU) No 2017/1938 (EZ-1, Article 166(1)). Activity of the system operator of the gas transmission network in Slovenia is performed by company Plinovodi d.o.o. The Energy Agency performs the task of the competent authority for the security of natural gas supply in accordance with Regulation (EU) 2017/1938.

Under Regulation (EU) 2017/1938 concerning measures to safeguard the security of gas supply and repealing Regulation (EU) No 994/2010 (Article 5), an exception in ensuring infrastructure standard applies for Slovenia. The exception applies for Slovenia provided it has (Article 5(9)):

a) at least two interconnectors with other Member States;
b) at least two different sources of gas supply; and
c) no gas storage facilities or an LNG facility on its territory.

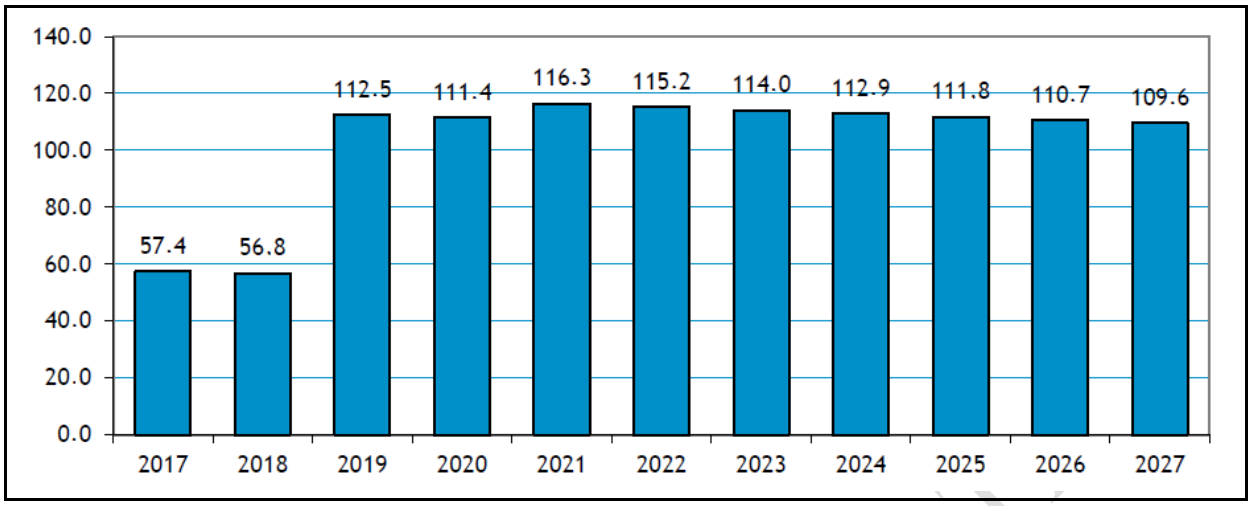
On the basis of analysis of the planned infrastructural projects (Gas Transmission Network Development Plan for 2018–2027, pages 12–13), the transmission system operator believes that the N–1 infrastructural standard will vary from 57.4 % to 56.8 %[14]. The transmission system operator believes that in the long term it can ensure the further development of the N–1 standard for the Slovenian transmission system up to the required 100 %. The below figure shows an evaluation of the development of the N-1 infrastructural criterion for the Slovenian transmission system. The transmission system operator will be able to meet the requirements of the N-1 infrastructural criterion in the long run by:

1. establishing entry capacities and therefore enabling physical flow from the direction of Croatia via the Rogatec cross-border interconnection point (planned in 2019);
2. an additional connection of the Slovenian transmission system to neighbouring systems that could be realised within the project of connection with Hungary (planned in 2021).

COURTESY TRANSLATION

[14] **Gas Transmission Network Development Plan for 2018–2027**, available at Razvojni načrt operaterja prenosnega plinovodnega omrežja za obdobje 2018-2027

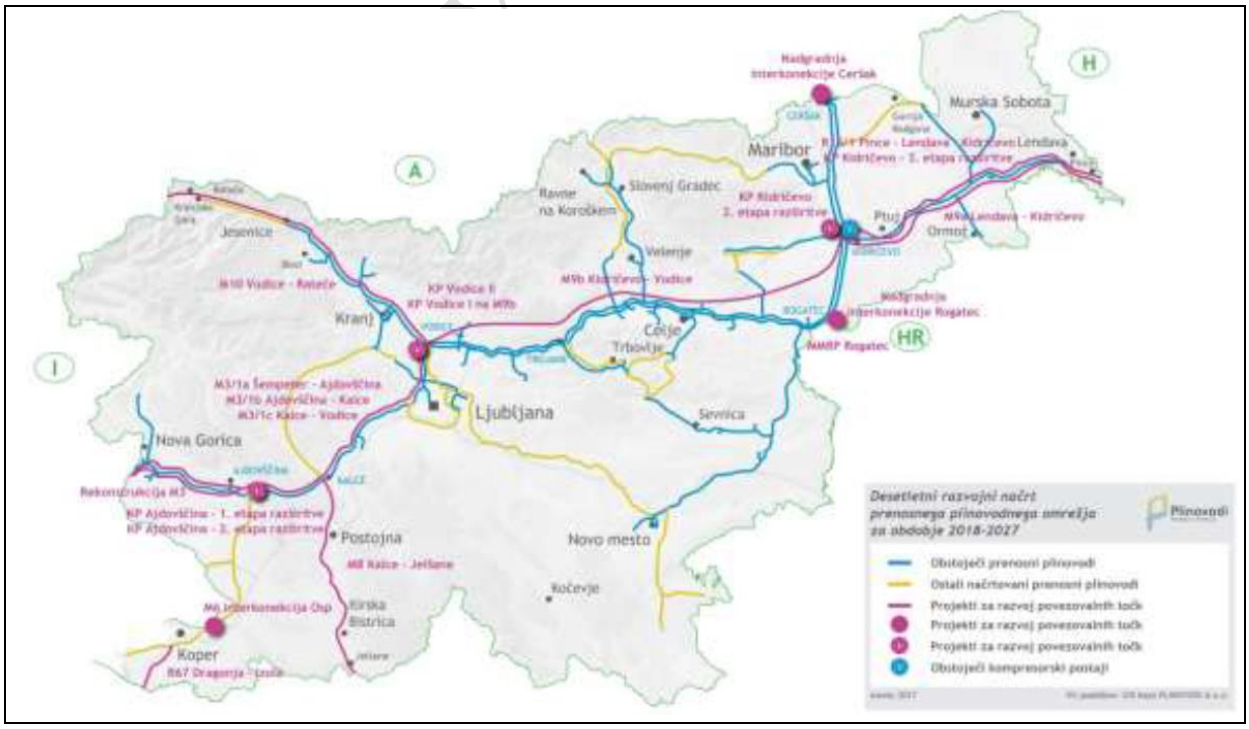
Figure: Assessment of the development of the N–1 infrastructure criterion for the Slovenian transmission system



Source: Gas Transmission Network Development Plan for 2018–2027, page 13.

In the 2018–2027 period, the transmission system operator is planning projects to increase the operational security, such as loops and adjustments to the pipeline system due to settlement and other circumstances (18 projects) and projects for development of the interconnection points with the neighbouring transmission systems (17 projects), including the projects of common interest Gas Transmission Network Development Plan for 2018–2027, pages 4, 34–38 and 40–45).

Figure: Projects for the development of interconnection points with the neighbouring transmission systems



Source: Gas Transmission Network Development Plan for 2018–2027, page 44.

V TRANSLATION

2.4.3 Market integration

Electricity market

In Slovenia, the electricity market operates in market conditions and without regulative restrictions. The prices of electricity are formed on the basis of free functioning of the market, i.e. the existing electricity offer and demand. Thus Slovenia does not have any national objectives that would aim at promotion of competitively determined gas prices.

For market integration and coupling, aimed at increasing the tradeable capacity of existing interconnectors, the objectives and deadlines are set in the Network Codes and Guidelines that can be implemented by the countries faster than specified therein. Slovenia is one of the leading countries in this area; it has already coupled daily and intraday markets with Italy and Austria, but not yet with Croatia.

The system operator of distribution network must ensure advanced metering systems to the customers that encourage their participation in the market for the natural gas supply (EZ-1, Article 174). In 2016 a study was drawn up by the distribution system operator, which provides an implementation plan for the advanced metering system as specified in the Decree on measures and procedures for the introduction and interoperability of advanced electric power metering systems (UL RS No 79/15). The study assumes the full introduction of the advanced metering systems for all customers by 2025 as shown in the following table.

Table: Estimated number of users included in AMS in the 2017–2025 period

Year	Total number of the users included in AMS*	Share of the included users in AMS* in %		
		1. Gen	2. gen	2. Gen
2017	471,399	27	24	51
2018	540,167	28	31	58
2019	612,813	28	38	66
2020	679,193	29	45	74
2021	747,107	29	52	81
2022	811,774	29	59	88
2023	866,553	27	67	94
2024	900,815	22	75	98
2025	923,850	19	81	100

**AMS – advanced metering system*
Source: SODO, 2016, page 29[15]

The other national objectives that would be related to other aspects of the internal energy market are not defined by Slovenia outside the European legislation in force (network codes).

[15] **Implementation Plan for the Advanced Metering System in the Slovenia's Electricity Distribution System**, 2016, available at *https://www.sodo.si/_files/3320/Nacrt_uvedbe_NMS_SODO_07072016.pdf*

COURTESY TRANSLATION

Natural gas market

In Slovenia, the natural gas market operates in market conditions and without regulative restrictions. The prices are formed on the basis of free functioning of the market, i.e. the existing electricity offer and demand. Thus Slovenia does not have any national objectives that would aim at promotion of competitively determined gas prices.

For the natural gas, Slovenia is too small for the creation of a liquid wholesale market; however, it is directly linked to the trading point in Austria and Italy. The planned pipeline with Hungary will also establish a possibility of a direct supply from the Hungarian trading point. In order to provide insight into the potential and opportunities with regard to integration of gas markets in the vicinity of Slovenia, as well as to place them, the Energy Agency carried out a study in 2018, in which it was established that there is no need for formal additional integration of markets by models recommended by the ACER's market target model for the Slovenian market. Instead, it was recommended for Slovenia that the regulator ensures the implementation of network codes, while the Slovenian traders may use the easily accessible Austrian node also in the future. In this regard, sufficient short-term cross-border capacities at competitive prices are of key importance. Moreover, the study encourages the regulator and operator of the transmission system to implement the projects that enable diversification of gas sources (Self-assessment and development options for the Slovenian gas wholesale market, 2018, page 54)[16].

2.4.4 Energy poverty

In Slovenia, there is no statutory definition of energy poverty. There is also no internationally agreed definition of energy poverty.

According to one of the definitions, a fuel poor household is 'one which needs to spend more than 10% of its income on all fuel use and to heat its home to an adequate standard of warmth' (Boardman, 1991). This definition was in use until 2013, when it was replaced by a new one, including the 'Low Income High Cost (LIHC)' indicator by John Hills. Under the LIHC definition, a household is considered to be fuel poor if they were to pay the fuel costs, they would be left with a residual income below the official poverty line (Podnebno ogledalo, 2018a, 7)[17].

The EU Official Journal defines energy poverty as the difficulty or inability to ensure adequate heating in the dwelling and to have access to other essential energy services at a reasonable price (EU Official Journal, 2011/C 44/09).

COURTESY TRANSLATION

[16] **Self-assessment and development options for the Slovenian gas wholesale market**, 2018, available in Slovenian at https://www.agen-rs.si/documents/10926/135879/Samoocena-in-razvojne-mo%C5%BEnosti-slovenskega-veleprodajnega-trga-z-zemeljskim-plinom---kon%C4%8Dni/9506c55a-3dbe-4648-91ed-20284d1af87a, available in English at https://www.agen-rs.si/documents/10926/135879/Self-assessment-and-development-options-for-the-Slovenian-gas-wholesale-market---final/39427e90-bdd4-4845-8b42-50f665cfbc8f

[17] **Podnebno ogledalo** (Climate Mirror); Volume 4: Energy Poverty, 2018, available at: https://www.podnebnapot2050.si/wp-content/uploads/2018/04/Podnebno_Ogledalo_2018_Zvezek4.pdf

According to the Statistical Office of the Republic of Slovenia, which monitors the phenomenon of fuel poverty in Slovenia, it '*appears when a household is not able to afford to keep its dwelling adequately warm (or cannot afford other energy services such as water heating, lighting, etc.) at reasonable cost. Fuel poverty is primarily caused by low income, prices of energy sources and their consumption, which depends on the behaviour of people in the household and energy efficiency of dwellings (SURS, 2016, 2-3)*[18].

And, according to the Slovenian environmental public fund (Eco Fund), the energy poverty 'occurs in households with low incomes, which are not able to afford to keep its dwelling adequately warm and other energy services at reasonable cost due to their social distress. Most often, the energy poverty affects the most vulnerable groups, such as the unemployed, pensioners and poorly paid employees (Eco Fund 2018)[19].

Statistical Office of the Republic of Slovenia establishes that the shares of household expenditure for electricity, gas and other fuels were, in relation to all means available to them, lower in 2015 than in 2012. In 2015 the Slovenian households spent approximately 6.7 % of the available means for electricity, gas and other fuels, which is for 0.7 percentage point less than in 2012 (to which the last available data refer) and the same as in 2000. The share of expenditure to this end was the lowest in the 2003–2005 period (6,3 %). The households with the lowest incomes spent almost 18 % of the available means to this end.

Slovenia does not have quantitative objectives for energy poverty, but is nevertheless active in this area (see point 3.4.4).

2.5 Dimension Research, innovation and competitiveness

In December 2017, Slovenia adopted the **Slovenian Development Strategy 2030**, under which Slovenia has also undertaken to implement the 2030 Agenda for Sustainable Development. Therein, the following two goals that relate to the Dimension Research, innovation and competitiveness in Slovenia are defined:

– '**competitive and socially responsible business and research sector**' where, inter alia, an orientation towards environmentally acceptable technology and eco-innovations is determined, which as an important factor of competitiveness of enterprises also contributes to reduction of environmental burden is specified as the sixth development goal of SDS 2030. For this goal, the following performance indicators that Slovenia wishes to achieve by 2030 (SDS 2030, pages 34–35) are specified:

- Labour Productivity (GDP per person employed, in purchasing power parity), in terms of which it wished to achieve the target value of 95, index EU = 100, by 2030.
- European Innovation Index, in terms of which it wished to achieve the ranking among EU leading innovators by 2030;

[18] **SURS, Fuel Poverty,** 2016, available at: http://www.stat.si/StatWeb/Common/PrikaziDokument.ashx?IdDatoteke=9200

[19] **Eco Fund, Fuel Poverty,** available at https://www.ekosklad.si/fizicne-osebe/energetska-revscina-zmanjsevanje-zero-ensvet

COURTESY TRANSLATION

- the Digital Economy and Society Index, in terms of which it wished to achieve tanking in top third of EU countries according to all five main components of the index by 2030.

– '**transition to a low-carbon circular economy'** as a priority development orientation for the entire economy where it will be necessary to eliminate the connection between economic growth and growth in the consumption of raw materials and non-renewable energy sources, and the associated increased environmental load (page 38). For this goal, the following performance indicators that Slovenia wishes to achieve by 2030 (SDS 2030, pages 38–39) are specified:

4. Material Productivity, where it wishes to achieve the target value of 3.5 Purchasing Power Standard (PPS)/kg by 2030 (given the base value 1.79 PPS/kg in 2015);
5. Share of Renewable Energy in Gross Final Energy Consumption, where it wishes to achieve the target value of 27 % by 2030 (given the base value 22 % in 2015);
6. Emission Productivity, where it wishes to achieve the EU average by 2030 (given the base value 2.9 PPS/kg CO_2 that corresponds to 2015).

For research and innovation, the Government has adopted the goal in 2010 of joint venture by public and private sector into research and development in the amount of 3 **% GDP** by 2020 (**the target for public investments is 1 % of GDP**), which was reaffirmed by the Research and Innovation Strategy of Slovenia 2011–2020, adopted by the National Assembly on 24 5 2011 (Resolution on Research and Innovation Strategy of Slovenia 2011–2020 (ReRIS11-20))[20]. This Strategy is even slightly more ambitious regarding hte goals (3.6 % of GDP). Under this goal, the means intended for achievement of objectives of the Energy Union are not specifically defined, but are included in many areas of research considering the multidisciplinary of the environment. Thus RISS defines in its vision:

> *'By 2020, a responsive research and innovation system, co-created by all stakeholders and open to the world, will be established. This system will be firmly entrenched in society, be in its service, will respond to the needs and ambitions of the citizens and* ***enable the resolution of major social challenges of the future, such as climate change, energy,*** *lack of resources, health and aging. As a result, the work of researchers, developers and innovators will gain greater acclaim influence in society. By adapting legislation, a legal framework for the operation of the system will be established in 2012.'*

Slovenia does not have legally prescribed national 2030 objectives for financing of public and, where available, private research and innovations relating to the Energy Union including a timeframe to meet the objectives. A certain amount of funds is available for research, development and innovations in the field of climate change that partially covers the Energy Union objectives in the framework of calls for proposals of the Slovenian Research Agency. Slovenia plans to allocate funds from the Climate Fund to this end in 2019.

[20] **Resolution on Research and Innovation Strategy of Slovenia 2011–2020 (ReRIS11-20)**, available at http://pisrs.si/Pis.web/pregledPredpisa?id=RESO68

COURTESY TRANSLATION

The national 2050 objectives related to the promotion of clean energy technologies and deployment of low carbon technologies have not (yet) been set out in the national documents.

For competitiveness, the Slovenian Industrial Policy (SID) that was adopted by the Government on 6 February 2013 sets out the 2020 objectives, where as the primary objective the restructuring of the existing industry into energy, material, environment and socially efficient industry of knowledge and innovation is specified to provide for new, more sustainable jobs of higher quality and better integration into international business flows. Therefore the increase in the value added per employee from 60 % to 80 % of the EU-27 average is specified as the indicator (Slovenian Industrial Policy 2013, page 10)[21].

On 20 September 2015, the Government adopted the **Slovenia's Smart Specialisation Strategy (S4)**[22] that constitutes the implementation plan for the transition to the highly productive economy by enhancing its innovation capacity, and by promoting the industries' transformation and diversification into new activities and growth of new and rapidly growing companies. S4 integrates, gives concrete expression and upgrades the already adopted strategic Slovenian documents (e.g. RISS and SIP), namely with a niche orientation (i.e. by means of the defined priorities), the associated approach to all development actors, the targeted, comprehensive and individual package of measures, and the globally integrated approach.

S4 defines three priority pillars and nine domains where Slovenia has the critical mass of knowledge, capacities and competences and where there is innovation potential for placing Slovenia within global markets (S4, 2017, pages 8–9):

I. Digital
1. Smart cities and communities
2. Smart buildings and homes, including wood chain

II. Circular
3. Networks for the transition to circular economy
4. Sustainable food
5. Sustainable tourism

III. (S)Industry 4.0
6. Factories of the Future
7. Health – medicine
8. Mobility
9. Materials as end-products

The S4 key objectives by 2023 are as follows (S4, 2017, page 7)**:**

1. raising the value added per employee which is to be measured at the level of the individual areas of application.

[21] **Slovenian Industrial Policy 2014–2020,** available at http://www.mgrt.gov.si/fileadmin/mgrt.gov.si/pageuploads/DPK/SIP/SIP_-_vladni_dokument.pdf

[22] **S4 – Slovenia's Smart Specialisation Strategy 2014–2020**, available at: http://www.svrk.gov.si/fileadmin/svrk.gov.si/pageuploads/Dokumenti_za_objavo_na_vstopni_strani/S4_strategija_V_Dec17.pdf

COURTESY TRANSLATION

2. improving Slovenia's competitiveness on global markets by increasing the share of knowledge-intensive and high-tech exports in total exports;
   a. increased share of high-tech intensive products in export from 22.3 % (in 2010) to EU-15 average of 26.5;
   b. increased share of export of knowledge-intensive services in total export from 21.4 % (in 2012) to 33% which will reduce Slovenia's below-EU-average rate by a half;
3. increased overall entrepreneurial activity from the current 11 % to at least the EU average of 12.8%.

The four remaining dimensions of the Energy Union are, in the broadest sense, addressed under all nine areas of the S4's application. However, in the narrow sense, promotion of clean energy technologies, deployment of low carbon technologies and provision of energy efficiency is addressed under the following areas of the S4's application:

- smart cities and communities, where one of the key objectives is to establish at least two pilot projects as a priority for energy, urban mobility and security;
- smart buildings and homes, including wood chain, where one of the key objectives is to develop integrated management systems for buildings, homes and the working environment of the future, and smart appliances for energy efficiency;
- networks for the transition to circular economy, where the key 2023 objective is to raise the material efficiency index of 1.07 (2011) to 1.50 and to establish five new value chains with closed material cycles by promoting and investing in technologies for processing of biomass and development of the new biological materials, technologies for the use of raw materials and re-use of waste, and technologies for energy production from alternative sources;
- sustainable food, where the key objective is to ensure long-term sustainable conditions for the development of the varieties and farming practices adapted to Slovenian territory and to climate change by promoting and investing in technologies for sustainable plant and livestock productions;
- sustainable tourism, where the one of the key 2023 objectives is to enhance energy efficiency in tourist facilities by 20 %, which will be reached, inter alia, through the targeted promotion and investment in technological solutions for sustainable use of resources in accommodation facilities;
- mobility, where the targeted promotion and investment in the niche components and systems for internal combustion engines, as well as in the e-mobility and energy storage systems is planned.

Focus areas and technologies, defined in the actual S4 document are regularly upgraded and complement in cooperation between the state and the Strategic Development and Innovation Partnerships (SRIP). One SRIP, i.e. long-term partnership between companies, knowledge institutions (e.g. research institutions and universities), municipalities, integration institutions, users, non-governmental organisations and other actors operates in each of nine areas of the S4's application. Close cooperation between the state (i.e. the State Secretary Working Group for Implementation of S4 – DSDS S4) and SRIPs constitutes the institutional basis for the new development model of stronger and complementary interaction between economy,

COURTESY TRANSLATION

knowledge institutions, other actors and the state, in particular as regards further specifying of objectives, priority focus areas, technologies and areas of common development or niches, as well as the necessary package of measures.

COURTESY TRANSLATION

3 POLICIES AND MEASURES

For the purpose of technical and scientific support and the preparation of the final proposal for an integrated NEPN, the Ministry of Infrastructure prepared an invitation to tender, on the basis of which it concluded a contract with the consortium of institutions under the direction of the Jožef Stefan Institute. On the basis of the REES-SLO model, the latter will update the necessary scientific bases and take part in the preparation of final version of NEPN; it will also take due account of the findings of the LIFE Climate Path 2050 project and be adequately consistent with the Long-term strategy. In the final version of NEPN, Slovenia will sketch out the precise proposal of policies and measures in respect of individual dimensions of energy union by 2030 (and looking ahead by 2040).

Below, we have provided a short cross-section for policies and measures designed in the context of the achievement of targets by 2020, which will be the basis for Slovenia to efficiently elaborate its policies and measures by 2030.

3.1 Dimension Decarbonisation

3.1.1 GHG emissions and removals

Operational programme for reducing greenhouse gas emissions until 2020

In 2014, Slovenia adopted Operational programme for reducing greenhouse gas emissions until 2020 (OP GHG 2020), which is an implementing plan of measures that should support Slovenia in reaching the objective of reducing greenhouse gas emissions on the basis of Decision 406/2008/EC. The measures for reducing greenhouse gas emissions laid down in OP GHG 2020 are oriented towards achieving greater development effects of public finance resources invested and improving the cost-efficiency of the implementation of measures. Therefore, OP GHG 2020 is focused on measures on areas or in sectors that represent the highest shares of greenhouse gas emissions, which are energy performance in buildings, emissions from transport, agriculture and greenhouse gases in waste management (OP GHG 2020, page 4).

OP GHG 2020 provided a stable framework for the implementation of activities, and was building on programmes already adopted and instruments and measures already established in the country, while enhancing and upgrading them by new and additional measures (OP GHG 2020, 2014, page 4). OP GHG 2020 is a complex programme of measures programmed by different sectors (OP GHG, 2014):

- green economic growth;
- buildings,
- transport;
- agriculture,
- other sectors (non-ETS industry, non-ETS energy, waste),
- education, training, information and awareness raising.

Almost half of the measures of OP GHG are implemented in cooperation with two or more institutions (Podnebno ogledalo, 2018b, page 22)[23].

[23] Podnebno ogledalo (Climate Mirror); Volume 0: Povzetek za odločanje (Summary for Decision-Making), 2018, available at: https://www.podnebnapot2050.si/wp-content/uploads/2018/04/Podnebno_Ogledalo_2018_Zvezek0.pdf

COURTESY TRANSLATION

Green economic growth

Measures laid down in OP GHG, allow the transition to a low carbon economy which fully separates economic growth and greenhouse gas emissions: improves resource-efficiency, reduces greenhouse gases, improves competitiveness through efficiency and innovation, and boosts growth and employment. The Slovenian economy is subject to a sizeable gap between BDP growth and greenhouse gas emissions, but not between economic growth and sharing of material resources, which is a key to meeting the greenhouse gas emission reduction targets and long-term competitiveness. Measures for the promotion of green economic growth are targeting the following areas: sustainable consumption and production, support for research and innovation, reduction of subsidies which are detrimental to the environment, and proper price setting. Subsidies that encourage inefficient use of fossil fuels and are inconsistent with the objectives of reducing greenhouse gas emissions will be gradually reduced. In order to preserve competitiveness of production entities and prevent fuel poverty – to mitigate the pressure on costs related to the use of fuels – the measure will be supplemented by incentives for increasing the efficiency in the use of fuels (OP GHG 2020, 2014, pages 5–6).

Energy-saving building renovation

Energy-saving building renovation is an opportunity for fast economic growth and re-booting the economy as well as considerable reducing greenhouse gas emissions. In order to improve the effectiveness of existing measures and increase investment in the field, energy-saving building renovation in the public sector should be promoted by improving financial leverage (ratio between subsidies and promoted investments) from 1.2 in 2012 to minimum 1.3 in 2020 by strengthening the implementation of energy contracting. Measures are envisaged to ensure greater accessibility of reimbursable grants and sources of reimbursable earmarked funds of international financial institutions. This will enable a wider range of energy-saving building renovation in all sectors. Since investments are to be repaid by reducing the costs of fuel, the effects on competitiveness and economic growth will be considerable and long-term (OP GHG 2020, 2014, page 6).

Transport

A key sector in achieving the state objectives by 2020 is transport. The measures adopted so far have been upgraded by amendments to the concession system, price policy and system of subsidizing in the public passenger transport and amendments to the system of reimbursement of transport allowances and reimbursement of travel expenses. Phase out of subsidies for the use of fuel/reimbursement of excise duties in relation to the enforcement of new measures will also be essential: a scheme of voluntary commitments and financial incentives for increasing the efficiency in the use of energy. Measures in this area will be directed towards controlling greenhouse gas emissions; enhancement of activities and coherent implementation of measures are therefore of key importance, and in particular the following (OP GHG 2020, 2014, page 6):

– promotion and competitiveness of public passenger transport;
– promotion of sustainable freight transport;
– increase in energy efficiency of motorised road vehicles; and
– promotion of non-motorised transport modes.

COURTESY TRANSLATION

Agriculture

The long-term goal of Slovenian agriculture from the point of view of sound management of climate changes is controlling greenhouse gas emissions, while at the same time raising self-handling of healthy and quality food, and the preservation of agricultural land in use.

The targets are consistent with orientations and objectives of the **Resolution on strategic guidelines for agricultural and food industry development by 2020 – Ensuring Food for Tomorrow (**UL RS No 25/2011 of 4 April 2011**)** and five strategic adaptation pillars, defined in the Strategy of adaptation of Slovenian agriculture and forestry to climate change (adopted by the Government in 2008).

Measures to achieve the objectives set are already being implemented within the framework of the **Rural Development Programme 2014–2020, with special emphasis on agri-environmental payments,** and in the framework of other programmes, projects or regular works and tasks implemented by public services in the field of agriculture.

After 2020, measures for achieving the objective of reducing greenhouse gas emissions will be oriented also towards reducing emissions per unit of food production which is, considering natural conditions for farming and the structure of greenhouse gas emissions. especially important in the production of cow's milk and meat of bovine and ruminant. The key issues are efficient transfer and exchange of knowledge which are particularly demanding due to fragmentation and small size of agricultural holdings.

Measures

An overview that includes measures from OP GHG 2020 and other measures to reduce greenhouse gas emissions given in the latest strategic programming documents and measures implemented pursuant to the legislation in force, is provided below.

Table: List of measures from OP GHG 2020

Instrument/measure from OP GHG 2020	Sector
Financial incentives for enhancing research and innovation infrastructure and networking into centres of knowledge	Green economic growth
Financial incentives (several instruments) for investments of businesses in innovation and research: for eco-innovation and development of new green products, services, business models and other measures	
Entrepreneurship incentives: technological modernisation of enterprises, business start-ups, including capital investments and investments in development to improve the material and energy efficiency of enterprises	
Revision and amendment of product legislation which is based on the Ecodesign Directive, Energy Labelling Directive and Ecolabel Regulation.	Cross cutting measures
Gradual cutting subsidies for fossil fuels	Green economic growth Transport
Extension and upgrade of the Green Public Procurement system, including the introduction of public procurement and innovation	Green economic growth Transport
Demonstration projects	Green economic growth Industry

COURTESY TRANSLATION

Energy efficiency in the framework of sustainable spatial planning	Cross cutting measures
Support scheme for the production of electricity from high-efficiency RES and CHP	Cross cutting measures
Support scheme for heat generation from RES	Buildings
Revision of environmental taxes in the field of waste disposal	Waste
Promotion of efficiency of vehicles in the framework of vehicle tax	Transport
Promotion of EE and RES in buildings	/
Changes and amendments of regulations on energy performance of the building stock	Buildings
Reimbursement schemes for energy efficiency in households: Eco Fund loans and incentives to other providers of green loans for the housing sector.	Buildings Cross cutting measures
Creation and enforcement process of instruments for the promotion of Competitiveness of public passenger transport	Transport
Schemes of subsidies for new freight vehicles in connection with voluntary obligations for freight	Transport
Grants for sustainable mobility in the 2014−2020 period	Transport
Grants for the rail transport infrastructure in the 2014-2020 period	Transport
Promoting a sustainable choice of transport in the context of the calculation of travel costs	Transport
Marking of vehicles	Transport
Subsidies for the purchase of new vehicles	Transport
Mandatory share of RES for the propulsion of vehicles	Transport
Promoting ecnomic driving	Transport
Investment grants for investment in capital assets to improve the overall performance of the agricultural holding and for infrastructure related to the development and adaptation of agriculture	Agriculture
Incentives for the implementation of above-standard farming practices which contribute to the reduction of nitrous oxide emissions	Agriculture
Implementation of above-standard farming practices which contribute to the reduction of methane emissions	Agriculture
Training and advice programmes, demonstration projects	Agriculture
Research and innovation in agriculture	Agriculture
Local action groups	Agriculture
Implementation of the Common basic breeding program for cattle and ruminants	Agriculture
Public advisory service	Agriculture
Grants for EE and RES specifically dedicated to medium-sized companies	Other ESD sectors
Ensuring energy savings to final customers as a result of the obligations Energy suppliers	Cross cutting measures Other ESD sectors

COURTESY TRANSLATION

Changes and amendments of regulations that govern the emissions of F-gases	Other ESD sectors
Investments grants for EE and RES in the industry	Other ESD sectors
Incentives for introducing energy management systems	Other ESD sectors
Eco Fund's loans with a favourable interest rate for EE and RES measures	Cross cutting measures Other ESD sectors
Grants for the building of missing infrastructures	Other ESD sectors
Pilot projects for awareness-raising	Other ESD sectors
Grants for investments in the systems for collection and appropriate cleaning level of waste water treatment in bigger agglomerations and investments into cost-effective and environmentally sound small wastewater treatment systems.	/
Upgrading and implementing inventories of forest reserves	/
Development of a methodology to monitor sinks	/
Further inclusion of measures into the sectoral policy	/
Reporting to the UNFCCC and European Commission	/
Subsidies for the training to boost staff potential for the transition to a low-carbon society	
Planning and development of training for the transition to a low-carbon society	
Education and Training	
Information and awareness raising among target audiences	
Integration of EE issues in a broader process of developing education and training for a sustainable development in Slovenia at all levels of education	
Coordinated implementation of OP-TGP-2020	
Increasing capacities for the implementation of OP-TGP-2020 measures under the competent institutions	
Carrying out processes for the designing and speeding up the implementation of measures in the following areas: taxes and charges, promotion of innovation, energy renovation of cultural heritage buildings, introduction of energy contracting and energy renovation of multi-apartment buildings	
Carrying out processes for the designing and speeding up the implementation of measures in the field of sustainable transport	
Reporting to the Government on the implementation of OP TGP 2020	
Projected greenhouse gas emissions and reporting to the European Commission	
Reporting to the UNFCCC	
Upgrading the methodology for the establishment of projections in transport	
Developing models for the preparation of projections by 2050 and evaluation of the effects on green economic growth	

COURTESY TRANSLATION

Enhanced analysis of cost-benefits and of the effects of implementing measures for reducing greenhouse gas emissions	
Harmonising methodology for assessing the effect of measures on the reduction of greenhouse gas emissions	

Source: Second report on implementation of OP TGP 2020, 2017, page 16-19

Slovenian Development Strategy 2030

Under the eighth development goal, i.e. transition to a **low carbon circular economy,** Slovenia is planning to achieve the goals by (SDS 2030, page 38–39):

a) decoupling economic growth from the growth of the use of resources and GHG emissions, which could only be done by way of training and connecting various shareholders for the transition into circular economy;
b) promoting innovation, the use of creation and information and communication technologies for development of new business models and products for the efficient use of raw materials, energy, and by adapting to climate changes;
c) replacing fossil fuels through the promotion of EE and the use of RES in all areas of energy consumption, while aligning interests in cross-sectional areas: water – food – energy –ecosystems;
d) ensuring that infrastructure and energy consumption in transport support the transition to a low carbon circular economy and enable sustainable mobility, also by introducing new concepts of mobility and increasing the share of public passenger transport;
e) using spatial planning to form hubs of a low carbon circular economy and development solutions at regional and local level.

A desire to **disconnect the link between the growth of GDP and the growth in traffic** has already been stated in the White paper on European transport policy for 2010: time to decide - Brussels, 12.9.2001, COM(2001) 370 final). However, this goal has been withdrawn already during the mid-term review of this document in 2006 (Mid-term review of the European Commission's 2001 Transport White Paper, Brussels, 22.6.2006, COM(2006) 314 final) and replaced by the co-modal principle, which means efficient use of all transport modes on their own or in combination. This would result in an optimal and sustainable utilisation of all resources in the transport area. Based on experience it has been proven that transport increases by each per cent of GDP growth, could be also by 2 %. This has been considered also in the national transport model (read more in the Transport development strategy of the Republic of Slovenia of 29 7 2015, Government Decision No: 37000-3/2015/8, page 76).

Under the eighth development goal, i.e. **sustainable natural resource management**, Slovenia is planning to achieve the goals by (SDS 2030, page 40):

a) introducing ecosystem mode of natural resource management and by overcoming the sector way of thinking, also by timely aligning national and cross-border interests in cross-sectional areas water – food – energy – ecosystems, which will be changing and adapting in the future also as the result of climate changes;

COURTESY TRANSLATION

b) effective management of surface and underground waters, coastal and marine resources and achieving their good condition;
c) ensuring sustainable development of forests as ecosystems, considering its ecological, economic and social functions;
d) preventing overburdening of all components of the environment;
e) preserving high level of biodiversity and quality of natural values, and fostering ecosystem services;
f) sustainable soil management and preserving ecosystem soil services, preventing further degradation and restoring degraded soils;
g) permanent protection and preservation of quality agricultural land and promoting agricultural practice to increase self-supply with the local sustainable and in particular ecological food production which has positive effects on human health;
h) ensuring quality living environment and providing for a responsible and effective management of space, priority using of functionally degraded areas, on the basis of harmonised priority and balanced tasks, also in the light of more consistent regional development;
i) providing management system at all levels for an effective adaptation to climate changes and maximising the opportunities

Energy concept of Slovenia

In order to achieve orientations and objectives provided for by the ReECS Motion, Slovenia will pursue the key measures by:

- increasing energy efficiency and consequently reducing energy consumption;
- raising awareness of consumers and providers in relation to sustainable energy supply and management;
- supporting the development of knowledge and new technologies in the field of sustainable energy supply and management;
- moving beyond the fossil fuel-based economy and gradually switching to renewable and low-carbon sources;
- introducing advanced energy systems and services.

Land Use, Land Use Change and Forestry (LULUCF)

Based on the resolution adopted (UL RS No 111/07), the national forest programme is the basic strategic document in the field of forests and forestry, which defined forests as a sustainable source for ensuring maintenance of health of Slovenians and, subject to sustainable forest management and use of wood, environment protection and biological diversity, forests provide for economic development and jobs. The resolution lays down the targets, directions and indicators for the realisation of vision and main objectives set by the national forest programme and subordinated operational programmes. The five-year operational programme for the implementation of the national forest programme 2017–2021, adopted in 2017, constitutes the link between the basic strategic document and documents which form the basis for planning, implementation and monitoring of forestry policy measures. The area is governed by the Forestry Act (UL RS Nos 30/93, 56/99 – ZON, 67/02, 110/02 – ZGO-1, 115/06 – ORZG40,

COURTESY TRANSLATION

110/07, 106/10, 63/13, 101/13 – ZDavNepr, 17/14, 24/15, 9/16 – ZGGLRS and 77/16) and the related statutory instruments for the area of forests and forestry.
Article 1.a of the Forestry Act also lays down obligations towards the European union, which were associated by the EU Regulation 2018/841 or Regulation on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry (Land Use Land Use Change and Forestry; LULUCF)[24]. LULUCF Regulation includes agricultural land, wetlands and forests.

Slovenia, as other Member States, will make its contribution in relation to the LULUCF sector, with the objective that during the period from 2021 to 2025 or from 2026 to 2030, this sector does not produce any net emissions or that emissions do not exceed the sinks. Each Member State will provide the calculation of emissions and sinks, or a reference value for a specific sub-sector, in its own national plan, elaborated according to the accounting rules laid down in Regulation 2018/841. The forward-looking reference level will be calculated by considering the area of land use, land use and management intensity from the reference period between 2000 and 2010, present situation and modelling of the situation from the first part of the period from 2012 to 205. The model will enable comparison between the expected management intensity, linked to the reference period, and that actually implemented during the period 2012 to 2015. Values exceeding the reference values will be accounted for as an emission, while lower intensity will be accounted for as a sink.

3.1.2 Renewable energy

Promoting renewable energy sources and prioritising efficient use and renewable energy sources are components of the Energy Act (EZ-1) defined as energy policy goals.

In the area of developing renewable energy sources, Slovenia must achieve ambitious targets that will contribute to increasing the reliability of energy supply, reducing impacts on the environment, economic growth and the development of jobs and employment (Draft AN OVE 2010–2020 (2017 update), page 15)[25].

On the basis of directive on the promotion of the use of energy from renewable sources (RES), Slovenia has been imposed by an obligation to attain 25 % of renewable sources in the overall energy consumption by 2020. According to this, the Government adopted the National Renewable Energy Action Plan 2010–2020 (AN OVE-2010). In 2017 a proposal to update the AN OVE was prepared and included also the projections of production and use of renewable energy sources by 2030, and an indicative national target in the field of RES by 2030 (minimum 27 %). With a view to attain the target by 2030, two scenarios were elaborated: wind (better use of wind energy) and solar (better use of solar energy); solar scenario has

[24] Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU.
[25] **Draft AN-OVE 2010–2020 (2017 update)**, available at http://www.energetika-portal.si/fileadmin/dokumenti/publikacije/an_ove/posodobitev_2017/an_ove_2010–2020_posod-2017.pdf

COURTESY TRANSLATION

proved better from the economic and environmental point of view and was thus chosen to be the scenario of the updated AN OVE (draft AN OVE 2010–2020 (2017 update), page 9).
Among the technologies for electricity production from RES, **large hydro power plants** (HPP) have energy and macroeconomic advantages; therefore, both scenarios were elaborated in such a way as to enable maximum possible and realistic use of water potential, namely that from the full unrealised technical potential for energy production in HPP, which amounts today to 51 %, additional 13.6 percentage points of potential are planned to be used, meaning that 62 % of the technical potential will be used by 2030. However, the projection does not take into account exploitation of the entire technical potential on the planned water bodies but about one quarter less, mainly as the result of environmental restrictions relating to the implementation of projects. The programme or projections in principle take into account that potentials for RES outside the protected areas should be prioritised for exploitation. However, in order to achieve the targets set in relation to RES at the minimum level, also RES in the protected areas should be exploited; thus, projects are planned also in the NATURA 2000 area (draft AN OVE 2010–2020 (update 2017), page 9).

> **'In the absence of any implementing arrangements with no significant effect on Natura 2000 for the planned large HPP, located in the Natura 2000 area, by 2030, and consequently no building of HPP realised, the AN OVE target will not be reached neither in the year 2020 nor in 2030'** (Draft AN OVE 2010–2020 (update 2017), page 9).

Besides nature conservation factor, the realisation of projects in the field of large HPP depends significantly also on the activity of the Government as regards determination of concession obligations, placing procedures as realisation of water infrastructure associated with such projects, and also investment capacities of concessionaires. Where there is a substantial likelihood that the Mokrice HPP project is not completed by 2020, AN OVE will have to be complemented by activities to speed up the execution of other AN OVE projects that were foreseen for the implementation in the period 2020-2030; priority will be given to measures in the district heating and industry sectors, as well as other cost efficient measures (Draft AN OVE 2010–2020 (update 2017), page 9).

In implementing the measures, account is taken of the **environmental objectives in the area of water, biodiversity, environment and cultural heritage** that need to be observed in planning eligible use of space through national and municipal spatial acts. AN OVE focuses as a priority on projects for exploitation of RES outside protected areas. However, in order to achieve the targets set in relation to RES at the minimum level, also RES in the protected areas should be exploited; thus, projects are planned also in the NATURA 2000 area (draft AN OVE 2010–2020 (update 2017), page 15).

Long-term perspective on the role of energy from renewable sources is provided in the ReECS Motion. Considering decarbonisation projections, which were drawn up in the framework of the preparation of the ReECS Motion, the **share of RES** in energy balances will increase. In the future, the natural conditions of Slovenia will have to be much better exploited, taking the

COURTESY TRANSLATION

standards of physically placing energy facilities into consideration, and increase the suitability of such placing in order to be done faster and more efficient. This will require special consideration of RES in concentrated system units and dispersed production at combined customers and local communities. RES will be as a priority placed in areas less important from the environmental and nature-protection point of view (ReEKS Motion, paragraph 51).

At the same time, the **development of intelligent networks** will enable active role of consumers and increased utilization of RES at the local level. Since energy produced from RES is volatile within a given time-frame and is not responsive to the needs of consumers, the mass utilization of such energy in the coming period will require infrastructure that is sufficiently efficient and advanced managed, and high capacity converters for energy surpluses produced to be converted into other useful forms of energy or energy products, the storage of which in high quantities will be cheaper. Transition to a low-carbon society will be supported also by inclusion of innovative, even cleaner energy sources as soon as the solutions are considered technologically mature (ReEKS Motion, paragraph 52).

During the transition period, **solar energy** will partly take over the burden resulting from the phasing out of fossil fuels. Slovenia will continue to increase intensively the utilization of solar energy, in particular for the production of electricity, and also the passive use of solar energy by means of buildings that will be modified and adapted to solar energy. Solar energy is expected to play an important role in self-handling of buildings, neighbourhoods or wider communities with electricity in connection with energy storage and heat from heat pumps. **Greater use of solar energy will require greater linking of systems, introduction of new methods of energy storage and creation of an environment for the exploitation of production and business opportunities** (ReEKS Motion, 2018, paragraph 53).

Slovenia lacks large flat areas with stable and sufficient wind speed where highly effective larger fields of wind turbines could be constructed; however, there are still unexploited areas with sufficient wind outside protected areas where economic exploitation of wind energy could take place. Considering the decarbonisation targets set, the utilization of available unexploited wind potential should begin as soon as possible (ReEKS Motion, 2018, paragraphs 54 and 55).

Wood biomass from Slovenian woods is an important factor of mitigating climate changes, sustainable development, reliability in the supply of thermal energy, positive economic effects, synergistic interactions along the wood-processing chain and reducing reliance on imports. Economic aspect is also relevant here, since the utilization of poor quality wood for energetic purposes considerably improves the economics of wood-processing chains. Waste wood biomass is considerably important for the production of heat and electricity in remote systems, utilising the latest technology which contributes to the reduction of air pollution. Utilization of wood biomass for energy purposes will only be possible in the controlled and environmentally friendly manner, so as to avoid excessive emissions of dust particles and volatile substances;this will represent educational, legislative and technical implementing challenge (ReEKS Motion, 2018, paragraphs 56–58).

COURTESY TRANSLATION

During the transition to a low-carbon society, **aerothermal, geothermal and hydrothermal energy** will represent an important source of heat. Slovenia will promote the exploitation of all three forms, in particular for heating in the environmentally friendly manner and mainly by means of heat pumps (ReEKS Motion, 2018, paragraph 59).

Water energy allows extremely fast and economically beneficial response to the changes in demand for electricity; therefore, it will maintain the leading role in the provision of the quality and reliable operation of electricity system. Its utilization has some other positive effects, such as flood protection when there is too much water, regulation of water flow for the purpose of cultivation of agricultural lands and, finally, the provision of drinking water, if it is appropriately placed and the mitigation measures are implemented. Slovenia still has some potential for the utilization of water energy. Renovation and upgrading of the existing hydro power plants are prioritised, and new hydro power plants are built which have minimum impact on the decline in biodiversity and deterioration of the status of waters. Transition to a low-carbon society will require the inclusion of water resources suitable for energy use. Since the best locations have already been used, every subsequent building of new water objects for electricity production will be more challenging and thus more expensive (ReEKS Motion, 2018, paragraphs 60–62).

Measures in the area of RES

Several measures for the promotion of renewable energy sources were or are still carried out under the adopted programming documents, besides AN OVE-2010, in particular in the framework of operational programmes for the implementation of cohesion policy, for the reduction of greenhouse gas emission and others. In order to achieve the targets of renewable energy sources, Slovenia will provide for a suitable supportive environment for the following proposed measures (Draft AN OVE 2010–2020 (update 2017), page 16; proposals on the measures are still under assessment before the action plan is provided to the Government for approval), which will be the foundation of its policies in the area of RES by 2030:

- energy-saving renovation of existing buildings, in particular in the public sector, and the construction of nearly zero-energy buildings which are technologically the most advanced objects;
- replacing fuel oil for heating by wood biomass and other renewable energy sources;
- district heating systems on renewable energy sources and highly efficient cogeneration;
- replacing electricity for the preparation of domestic hot water by solar energy and other renewable energy sources;
- RES electricity production;
- increasing the share of rail and public transport;
- introduction of biofuels and other renewable energy sources in the transport and agriculture, and introduction of electric vehicles;
- development of distribution networks for the inclusion of dispersed production of electricity, including the development of active/intelligent networks;
- development of industrial production of technologies of efficient use of energy and renewable energy sources.

COURTESY TRANSLATION

Table: Overview of the existing policies and measures

ELECTRICITY	1. *Support scheme for electricity generated from RES and high-efficiency cogeneration of heat and electricity* 2. *Guarantees of origin* 3. *Promoting self-handling of electricity from RES* 4. *Investment subsidies to promote generation of electricity from RES*
HEATING AND COOLING	5. *Rules on efficient use of energy in buildings* 6. *Financial incentives for energy renovation and sustainable construction of buildings in the public sector* 7. *Project office for the energy renovation of public buildings* 8. *Innovative systems for local energy supply* 9. *Demonstration projects* 10. *Promoting the utilization of RES in households* 11. *Training, informing and awareness raising on renewable energy sources* 12. *Energy advice for residents (EnSvet)* 13. *Effective district heating systems – obligatory share of RES in district heating systems* 14. *Promoting RES in local energy concepts* 15. *Excise duties on heating fuels, with a view to ensuring competitive prices of biomass and biofuels in comparison to the price of fossil fuels*
EE AND RES MEASURES IN AGRICULTURE	16. *RURAL DEVELOPMENT PROGRAMME 2014–2020 (RDP)* a. *Support for investments in agricultural holdings* b. *Support for investments in processing/marketing and/or development of agricultural products* c. *Support for investments in creation and development of non-agricultural activities* d. *Support for investments in forestry technologies and in processing, mobilising and marketing of forest products*
TRANSPORT	17. *Decree on the promotion of the use of biofuels and other renewable fuels for the propulsion of motor vehicles It was replaced by Decree on renewable energy sources in transport (UL RS No 64/16), which falls under the competence of the ministry of energy)* 18. *Decree on sustainability criteria for biofuels and life-cycle greenhouse gas emissions from fuels in transport* 19. *Obligatory share of renewable energy sources in motor fuels* 20. *Exemption from excise duty for biofuels*
CROSS CUTTING MEASURES	21. *Green taxation for air pollution by CO_2 emissions* 22. *Motor vehicles tax act* 23. *Decree on green public procurement*
OVERWIEV OF ADDITIONAL POLICIES AND MEASURES	
HEATING AND COOLING	*UTILIZATION OF GEOTHERMAL ENERGY* 24. *Ensuring effective utilization of heat when using geothermal water from geothermal aquifers and use of shallow geothermal energy* *DISTRICT HEATING* 25. *Support scheme for heat generation from RES for heating and cooling* *BUILDINGS:*

COURTESY TRANSLATION

	26. Introducing nearly zero-energy buildings *27. Financial mechanisms for energy services with RES* *URBAN PLANNING AND MUNICIPALITIES:* *28. Urban guidelines for the planning of systems that exploit RES in built environment* *29. Energy-efficient spatial planning* *PUBLIC SECTOR:* *30. Promoting RES under green public procurement* *31. Energy management system in the public sector*
ELECTRICITY	*GENERATION FROM RES:* *32. Signing and implementing concession contract for the construction of HPP above 10 MW* *33. Construction of planned HPP* *34. Proactive role of the state in the identification of environmentally compatible locations for the exploitation of HPP potential* *35. Accelerated elaboration of spatial plans for energy infrastructure of national importance which exploits RES* *36. Protection from noise from the operation of wind turbines* *NETWORKS:* *37. Planning the development of distribution and transmission networks* *38. Technical measures and procedures for connecting small units to the network* *39. Tariffs for connection to the network* *40. Checking the seriousness of investment projects* *41. Promoting RES in local energy concepts* *42. Accelerated introduction of active networks*
TRANSPORT	*43. Tax relief on vehicles powered by the energy from renewable sources when paying annual fee on the use of motor vehicles*
HORIZONTAL ACTIONS	*44. Spatial Information System* *45. Single approval for RES facilities* *QUALITY OF BIOFUELS:* *46. Quality of fuels from woody biomass* *EDUCATION AND TRAINING:* *47. Education of persons managing administrative procedures for renewable energy projects* *48. Systematic integration of teaching subjects relating to EE and RES into primary and secondary school educational programmes and universities, as well as of lifelong learning programmes and vocational training* *RES STATISTICS:* *49. Data collection in relation to installations for RES exploitation within the real estate registry* *50. Upgrade of data collection related to the use of RES in wide use* *51. Upgrade of data collection related to indirect supply of woody biomass for energy generation* *52. Harmonisation of the system for collecting data that must be collected under (EPAct), with the need to demonstrate progress in achieving the target share of RES* *53. Upgrade of data collection related to the use of RES in transport*

Source: Draft AN-OVE 2010–2020 (2017 update,), pages 58–73 MF, 2018

COURTESY TRANSLATION

3.1.3 Other elements of the dimension

Strategic framework of adapting to climate changes which provides a framework and orientations for adapting to climate changes in Slovenia, lays down the steps and orientations needed to reach the objectives that are based on inclusion, wider cooperation, research and knowledge transfer, education and training, awareness raising and communication (SOPPS, 2016, page 6), i.e.:

- **inclusion** will be based:
  - effective coordination of contents and processes of the development and spatial planning, including consideration of the capability to manage risks of accidents;
  - increased use of instruments of environmental impact assessment;
- **wider cooperation** will be based on the following:
  - ensuring proper inter-service collaboration;
  - proactive inclusion in European and international activities:
  - linking with the local and regional level as well as the private sector;
  - finding common ground with other policies and actors;
- research and knowledge transfer will be based on:
  - ensuring climate services (elaboration of long-term climate scenarios and regular updating, upgrading and adapting climate basis);
  - upgrading and linking of databases and processes to support decision-making;
  - establishment of regular cooperation of researchers and decision makers;
- **education and training, awareness raising and communication** will be based on:
  - analysis of the situation and developing systemic integrated monitoring and evaluation for updating, and quality, systematic and more effective implementation of guidelines, curriculum, programmes and other curricular documents already adopted, in particular by connecting and upgrading the existing quality practices, projects, initiatives and other potentials, and by implementing recommendations;
  - identifying, exchanging, disseminating and further developing good practices;
  - preparing and executing communication campaigns and activities with the media.

Strategy for Development of the Market in order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia

In accordance with the Strategy for Development of the Market in order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector, within the context of promoting electro mobility, low vehicle tax rates (0.5 %) measures have already been put in place in the Republic of Slovenia in respect of motor vehicles producing CO_2 emissions of up to 110 g/km CO_2, which includes electrically-powered vehicles. Electrically-powered vehicles are also exempted from the annual fee on the use of motor vehicles. Co-financing the purchase of energy efficient vehicles is carried out within the framework of the Slovenian environment fund where grants are provided in the amount of EUR 7 500 for electrically-powered M1 vehicles and EUR 4 500 for N1 or L7e vehicles and M1or N1 plug-in hybrids with emissions under 50 g/km. The grant for L6e electrically-powered vehicles amounts to EUR 3 000. Ecofund provides the crediting of environmental investments, which includes

COURTESY TRANSLATION

also the purchase of passenger cars, motorcycles and electric or hybrid bicycles with CO_2 emission of maximum 110 g/km. The amount of credit is limited to EUR 40 000 (Strategy for Development of the Market in Order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia, 2017, page 31).

Filling infrastructure for high power filling stations will be expanding in the areas of the TEN-T network where the coverage is not optimal and in line with the number of electrically-powered vehicles. Installation of public filling infrastructure will be promoted in municipal centres and bigger towns in Slovenia, as well as filling infrastructure for multi-apartment buildings and for private use. Installation of a systemic centre for the management of smart grids and smart communities will promote the use of filling units with intelligent measurement systems, as well as the purchase of autonomous battery systems. Slovenia will ensure that the number of filling units is such as to represent optimal ratio between the number of electrically-powered vehicles and the number of filling units, which is seven vehicles per a public filling unit. A simplified payment system for the filling of such vehicles will be introduced, and customers who will not conclude contracts with suppliers, will be enabled 'ad hoc' filling under favourable conditions that will guarantee non-discriminatory treatment. Filling infrastructure will fulfil the conditions laid down in points 1.1 and 1.2. of Annex II to Directive 94/2014 EU (Strategy for Development of the Market in Order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia, 2017, page 32).

Slovenia has already provided **financial incentives** for the purchase of electrically-powered vehicles, which cover 50 % of the difference between the price of such vehicle and the price of the same or comparable vehicle with engines using petrol or diesel fuel. Subsidies for the purchase of electrically-powered vehicles will be maintained until large-scale production of such vehicles starts and the prices of such vehicles with comparable characteristics as regards range, use are aligned with the prices of vehicles with different propulsion systems. It is envisaged that the procedures for allocating subsidies are simplified and the subsidization of testing vehicles is arranged. Subsidies will be reduced with gradually falling prices of electrically-powered vehicles. Electrically-powered vehicles are exempted from the annual fee on the use of motor vehicles (Annual Fee on the Use of Motor Vehicles Act, UL RS No 57/08). The exemption is foreseen for the period of promoting the purchase and use of electrically-powered vehicles. When the number of registered electrically-powered vehicles reaches 10 % of the total number of registered vehicles by categories, the annual fee will be introduced and comparable with the annual fee for vehicles with the lowest share of greenhouse gases and pollutants. The annual fee on the use of motor vehicles will be adjusted to environmental parameters of the vehicle and proportional to emissions of greenhouse gas and pollutants. Corporate taxpayers and natural persons pursuing an activity can also reduce the tax base in the amount of 40 % of the amount invested in electric or hybrid passenger cars and buses, but it should not exceed the tax base (Strategy for Development of the Market in Order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia, 2017, page 32).

COURTESY TRANSLATION

Legislative amendments and removing administrative obstacles foresee as follows (Strategy for Development of the Market in Order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia, 2017, page 33):

- regulation in the transport sector which promotes positive discrimination for electrically-powered vehicles as regards parking, use of particular trafficked areas, special marks or registration plates;
- integration into the systems of advanced networks and advanced communities;
- online or user-friendly applications for subsidising the purchase of electrically-powered vehicles, where vendors are to prepare all documentation and evidence;
- enabling the selling of electrically-powered testing vehicles as new vehicles which could be subject to subsidies;
- promoting dynamic rate fixing;
- parking arrangements at spots reserved for electrically-powered vehicles;
- providing for the installation of filling infrastructure for multifamily properties.

In the area of provision of public transport, incentives will be provided for the exchange of public transport vehicles EURO IV or less with alternative fuel vehicles, particularly in locations with lower air quality. As regards **promotional activities** to promote electrical mobility, in city centres restrictions will be imposed on passenger cars traffic which imposes heavy burden of greenhouse gas emissions and pollutants on the environment; by 2030, the annul sales of alternative fuel vehicles or vehicles in the groups below 50 g CO_2/km should be achieved. Sharing of vehicles and shared ownership will be encouraged, which could contribute to the significant reduction of the number of vehicles in city centres. Concerning the transition to low carbon vehicles in road traffic, a communication strategy with information about the impact of transport on climate change, characteristics of alternative fuel vehicles and possibilities for their use, will be prepared. Updated online information on the filling infrastructure for alternative fuels, their use and accessibility and on all forms of sustainable mobility, will be provided as well. Promotional activities and the promotion of use of electric vehicles will take place in cooperation with non-governmental organisations (Strategy for Development of the Market in Order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia, 2017, page 33.).

In order to achieve a breakthrough in the use of electric mobility, much remains to be done also at the local, municipality level. Therefore, the strategy recommends measures that municipalities should implement at the local level, for example providing for the installation of public filling stations also in multifamily agglomerations; providing for the elaboration of decrees regulating the parking of electrically-powered vehicles in front of the public filling infrastructure or laying down the procedures for the installation of filling units and reservations of parking lots; encouraging alternative fuel urban and taxi transport; driving along yellow lanes and exemption from the parking fees for electrically-powered vehicles (Strategy for Development of the Market in Order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia, 2017, pages 34–35).

In order to attain the objectives in the field of ensuring electricity supply for ships from the operational quay, measures are envisaged for the construction of a new transmission line and

COURTESY TRANSLATION

connection to the transmission network of 110 kV to satisfy the needs of the Port of Koper, and consideration of the amount of the tax on electric power for the delivery of products to vessels from the operational quay (Strategy for Development of the Market in Order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia, 2017, page 35). The Slovenian system operator of transmission network has already included these upgrades in the actual development plan (ELES, Development plan for the transmission system of the Republic of Slovenia as from 2017 until 2026).

In the context of measures for the **promotion of hydrogen usage** and fuel cell vehicles, Slovenia will encourage research work related to industry, in order to maintain the position among producers and suppliers for the automotive industry. Installation of four or eight hydrogen filling stations is envisaged. Financial incentives that are envisaged for electrically-powered vehicles are to be provided also for hydrogen powered vehicles. Slovenia will promote the use of hydrogen also through other measures (at the level of urban municipalities, promotional activities, demonstration projects, legislative adaptation). Slovenia will carry out various measures with a view to promote also the use of liquefied petroleum gas (LPG) (Strategy for Development of the Market in Order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia, 2017, page 36).

To promote the use of CNG, publicly accessible supply units will be established by 31 December 2020 in urban municipalities in Slovenia. It is envisaged that the establishment of the supply points for CNG will be subsidized. An appropriate number of publicly accessible supply units for CNG is thus established, since establishment of a network of filling stations is essential for achieving a breakthrough in the use of CNG. By 31 December 2025, an appropriate network of publicly accessible supply units for CNG will be established in the existing central TEN-T network. By carrying out various measures, Slovenia will encourage also the processing and purchase of vehicles using CNG, including also incentives for the enforcement of CNG for vehicle propulsion as an important energy product for attaining environmental goals (Strategy for Development of the Market in Order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia, 2017, page 39).

In the area of **promoting the use of LNG**, according to the requirements laid down in the road transport legislation, the filling infrastructure will be established not later than in the second half of the year 2019; Slovenia will also provide financial incentives for 100 vehicles using LNG (Strategy for Development of the Market in Order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia, 2017, page 41).

3.2 Dimension Energy efficiency

In December 2017, Slovenia adopted the Action Plan for Energy Efficiency 2017–2020 (AN URE 2020), which is the second action plan that Slovenia has prepared under Directive 2012/27/EU on energy efficiency or the fourth action plan since 2008. The action plan covers the essential measures to improve energy efficiency, including the expected and achieved energy savings, with the aim to achieve the national objective of increasing energy efficiency

COURTESY TRANSLATION

by 2020, and the Slovenia's contribution to achievement of the common EU objective – increasing energy efficiency by 20 % (Action Plan for Energy Efficiency 2017–2020, 2017, page 8).

The effectiveness of the implementation of AN URE 2020 action plan is vital to achieving objectives of reducing GHG and achieving a 25 % target share of RES in the balance of gross final energy consumption by 2020. Energy efficiency is amongst the most cost-effective measures for achieving these objectives. It also significantly contributes to the objectives in the field of air quality (Action Plan for Energy Efficiency 2017–2020, 2017, page 8).

According to AN URE 2020 action plan, Slovenia implements horizontal and cross-cutting measures to improve energy efficiency, and measures in the public sector, in buildings, industry, transport, in heating and cooling, as well as transformation, transmission and distribution of energy. Update of the action plan resulted in several new measures, mainly in the field of establishment of financial instruments for a comprehensive energy renovation of buildings and for guaranteeing quality of planning and implementing measures associated with such renovations, considering the fact that the existing building stock represents the sector with the biggest potential for achieving energy savings. Moreover, AN URE 2020 action plan introduces several new measures in the field of promoting efficiency of heating and cooling, since in achieving goals in this field, besides renovation of existing buildings, more effort is needed to improve energy efficiency of technologies and the use of renewable energy sources, particularly in district heating and cooling. These measures are the starting point for the necessary accelerated development of sustainable heating and cooling which are among the priorities of the Energy Union (Action Plan for Energy Efficiency 2017–2020, 2017, page 8).

In the table below, measures included in the AN URE 2020 action plan are organised according to the sector or sectors where they are implemented.

Table: The measures contained in AN URE 2020

HORIZONTAL ACTIONS
1. Energy contracting
2. The system of compulsory obtaining of energy saving and alternative measure
3. Training and licensing of independent experts
4. The promotion of training
5. Information and awareness raising among target audiences
6. Inclusion of EE contents into the wider process of developing early childhood education
7. Environmental tax on air pollution from CO_2 emissions
CROSS CUTTING MEASURES
1. Changes and amendments of regulations on energy performance of the building stock
2. Quality assurance scheme for energy audits
3. Heating and cooling strategy, heat map
4. The support scheme for electricity, generated from RES and CHP
5. Encouraging the optimisation of energy systems performance (RE-CO)
6. Carrying out energy overviews in big enterprises

COURTESY TRANSLATION

7. Energy labelling and minimum standards for products and facilities
8. Comprehensive monitoring of energy renovation of buildings
ENERGY EFFICIENCY MEASURES IN PUBLIC SECTOR
1. Energy management in the public sector
2. Quality management
3. Financial incentives for comprehensive energy renovation and sustainable construction of buildings in the public sector
4. Financial incentives for efficient energy use in the public sector
5. Renovation of cultural heritage buildings and other special groups of buildings
6. Project office
7. Green Public Procurement
8. Production of sustainable criteria for buildings
9. Use of information supported design in public tenders
ENERGY EFFICIENCY MEASURES IN HOUSEHOLD BUILDINGS
1. Financial incentives for energy efficiency, and use of RES in residential buildings
2. Energy advisory network for residents – ENSVET
3. Aid scheme for energy efficiency in households for vulnerable population groups
4. Instruments for financing renovation in co-owned buildings
5. Establishment of a guarantee scheme
6. The legal basis for decision making in multi-apartment buildings
7. Distribution of incentives among owners and tenants in multi-apartment buildings
8. Division and billing of heating costs in multi-apartment and other buildings according to actual consumption
9. The programme of measures for efficient energy consumption in households to reduce energy poverty
ENERGY EFFICIENCY MEASURES IN INDUSTRY
1. Financial incentives in the form of grants
2. Financial incentives in the form of reimbursable grants
3. Financial incentives to raise efficiency and RES use in industry
4. Financial incentives for demonstration projects
ENERGY EFFICIENCY MEASURES IN TRANSPORT
1. Promoting sustainable transport in general: *a. Integrated transport strategy (ITS) of municipalities* *b. Mobility management measures* *c. Incentives for using modern technologies for efficient mobility management* *d. Promoting sustainable transport choices in the context of statement of mission expenses* *e. Promoting sustainable mobility measures/targeted public information and awareness raising* *f. Examining the options for progressive reduction of environmentally harmful incentives* *g. Sustainable mobility in the context of spatial planning* h. *Coordination of the development of sustainable mobility*

COURTESY TRANSLATION

2. Promoting public transport: *a. Transport subsidies in public transport* *b. Concessions for the performance of public service for passenger transport services* *c. A system of integrated public transport (IJPP)* *d. Other measures of mobility management to improve public transport services* e. *Incentives for the creation of infrastructures for public transport and the promotion of multimodality*
3. Promoting sustainable freight transport: *a. Other measures to promote co-modality* b. *Improving the efficiency of road freight transport*
4. Promoting improvements in vehicle efficiency, efficient driving and vehicle occupancy, and fuel consumption with low CO_2 emissions *a. Financial incentives for low-emission vehicles* *b. Promoting the efficiency of vehicles and the use of fuels with low emissions within the motor vehicle tax and other duties* *c. Information on the fuel consumption of vehicles and tyre labelling* *d. Promoting energy-efficient driving* *e. Financial incentives for infrastructure for alternative fuels and electromobility* *f. Subsidy schemes for new lorries and voluntary commitments to freight* g. *Green public procurement*
5. Promoting non-motorised forms of transport *a. Promoting construction of cycling infrastructure* b. *Promoting construction of infrastructure for pedestrians*
6. Providing funds for the 2014-2020 period for the development of railway transport
HEATING AND COOLING EFFICIENCY MEASURES
1. Co-financing of district heating for RES
2. Eco Fund's Financial Incentives for Sustainable Development
ENERGY EFFICIENCY MEASURES IN TRANSFORMATION, TRANSMISSION AND DISTRIBUTION SECTORS
1. Investment incentive grants

Source: National Energy Efficiency Action Plan 2017-2020, page 9-10

Slovenia is carrying out a series of measures to promote, regulate and coordinate the energy renovation of buildings field that provide the points of departure for the measures to be taken in future. The key measures are as follows (DSEPS, 2017, page 59):

– incentives in the form of grants to reduce energy use in the housing sector, which have been allocated since 1991 and saw a significant increase between 2008 and 2014;
– grants to reduce energy use in the public sector have been allocated since 2010;
– regulations on the energy performance of buildings: the regulations brought into force comply with the criteria applying to nearly zero-energy building requirements.

COURTESY TRANSLATION

Activities have already been planned in relation to the following measures, although they are not yet fully under way (DSEPS, 2017, page 59):

– enhancing the effects and effectiveness of incentives:
    - o promoting the energy services market,
    - o ensuring a stable support environment,
    - o quality management;
– promoting measures for special target groups:
    - o vulnerable households,
    - o buildings in the business sector, particularly SMEs,
    - o cultural heritage buildings;
– coordinating policies and measures, and coordination with development policy in particular:
    - o implementation of demonstration projects,
    - o incentives aimed at earlier phases of the development of technologies.

3.3 Dimension Energy security

In order to achieve the long-term objectives set, Slovenia will have to considerably restrict the use of fossil fuels. This represents a major challenge for the production and distribution of electricity, heating mode and in particular for transport. In the long term, electricity generation will be the most affected by international commitments of a state in the energy and climate area, which follow the direction of reducing GHG emissions, increasing the share of RES and achieving energy savings. In projections, the speed of transition will be significantly affected also by the EU emission coupons market. Energy in Slovenia will have to adjust to such transition on time. With a view to reducing dependency on the use of fossil fuels and their phase out, ReEKS motion emphasises the increase of effective energy consumption and greater use of renewable and low-carbon sources (ReEKS Motion, paragraph 49).

Slovenia has a small electric power system, in which every large production unit constitutes an important element of the system's reliability. In the long run, due to the phasing out of the the use of fossil resources and the end of existing nuclear power plant's life cycle, a large share of domestic electricity generation will have to be replaced. Selection of relevant technologies and energy products, construction of power plants and networks, their physical placing, and determination of the minimum possible share of the imported electricity will present a big challenge in the future (ReECS Motion, paragraph 50).

Electric power supply

The quality of electricity supply, in particular the most important aspects – constant supply and time necessary for rectifying the defects – are provided for by the following three acts:

1. Rules on the system operation of electricity distribution network (UL RS No 41/11 in 17/14 – EZ-1), which lay down in Article 95 the requirements for network planning.:

the electricity distribution system operator (SODO) plans the development of the network as follows:

COURTESY TRANSLATION

- the 110 kV network satisfies the n–1 reliability criterion. The n-1 reliability criterion is fulfilled if during a blackout of one 110 kV element, distribution of electricity is not disturbed;
- the rated transformer loads of 110 kV/SN in normal operational status does not exceed 60 % of rated power in case of two transformers and 80 % of rated power in case of three transformers in TSS;
- medium voltage network usually builds in the form of loops according to the n-1 reliability criterion. The n-1 reliability criterion in medium voltage networks is fulfilled if during a blackout of one medium voltage element after a short interruption (**up to1 hour**) the use of the network may be ensured to all consumers outside the defected sector. SODO plans the medium voltage cable network so that the loading in normal condition does not exceed 75 %, and also the medium voltage overhead network so that the loading in normal condition does not exceed 80 %. During back-up charges, loading of medium voltage lines should not exceed thermal limit;
- admissible voltage deviation in the medium voltage network in normal condition does not exceed 7.5 %;
- admissible voltage deviation in the medium voltage network during back-up charge does not exceed the voltage deviation reached in normal condition by more than 5 %;
- admissible voltage deviation in the low voltage network does not exceed the ceiling set in the General conditions for connection to the distribution electric system (SPDOEE);
- it meets the criteria for quality of the electricity supply, set out in SPDOEE.

2. Decree on the manner of performing the public utility service activity of system operator of electricity distribution network and public utility service supply of electricity to tariff customers (UL RS No 117/04, 23/07 in 17/14 – EZ-1) provides for that system operator of transmission grid within the systemic services »is responsible for the regulation of voltage and must ensure such quality of electricity voltage on the transmission grid that would enable SODO to ensure the quality of electricity voltage on the medium voltage level in accordance with this decree. Assessment of the quality of electricity voltage in the distribution network is subject to the Slovenian standard SIST EN 50160' (Article 28). SODO must try to establish the causes of the network failure, as well as the connection point, the latest in two hours following the user's failure notification. SODO must try to remedy the established failure immediately or in four hours at the latest. SODO must set or replace the measuring devices in seven days following the receipt of notification at the latest. (Article 30).

3. Grid code for electricity transmission grid of the Republic of Slovenia (UL RS No 29/16) provides for the admissible total number and the duration of all unannounced disruptions in supply or feed at one accepting-transferring unit resulting from own reasons, expressed in minutes in one year, as presented in the table below.

COURTESY TRANSLATION

Table: Admissible duration and the number of short-term and long-term disruptions in the year for the high-voltage network

Network	*Total number of short-term disruptions, lasting less than three minutes (disruptions/year)*	*Total duration of long-term disruptions longer than three minutes (in minutes/year)*
high-voltage	*1*	*150*

Source: Grid code for electricity transmission grid of the Republic of Slovenia, Annex 12: Duration of unannounced disruptions in supply or feed of electricity

Natural gas supply

As it has already been stated in point 2.4.2., under Regulation (EU) 2017/1938 concerning measures to safeguard the security of gas supply and repealing Regulation (EU) No 994/2010 (Article 5), an exception in ensuring infrastructure standard applies for Slovenia. Based on the analysis of the planned infrastructural projects, the transmission system operator believes that in the long term it can ensure the further development of the N–1 standard for the Slovenian transmission system up to the required 100 %. The transmission system operator will be able to control in the long term the requirements of the N-1 infrastructure criterion (Development plan of transmission gas network operator 2018–2027, pages 12–13):

1. establishing entry capacities and therefore enabling physical flow from the direction of Croatia via the Rogatec cross-border interconnection point (planned in 2019);
2. an additional connection of the Slovenian transmission system to neighbouring systems that could be realised within the project of connection with Hungary (planned in 2021).

On the basis of risk a assessment in relation to the reliable natural gas supply the Preventive measures action plan was elaborated in accordance with regulation (EU) 2017/1938, which includes necessary measures to reduce risks. These measures are foreseen also in the ten-year development plan of transmission system operator. Implementation of regulation (EU) 2017/1938 involves also solidarity mechanism of aid between EU Member States when there is a need for support in the supply of protected consumers with natural gas.

It was established on the basis of a special study on self-assessment that formal integration of markets in the context of variant from the *ACER Gas Target* model is not necessary, since Slovenia is sufficiently connected with Italian and Austrian trading centre. Additionally, a connection with Hungary is planned which will allow Slovenia access to the new trading hub and natural gas storage facilities in Hungary.

Supply of oil products

Supply of oil products is a market activity in Slovenia. According to Council Directive 2009/119/EC, it provides the amount of reserves of oil and its products that corresponds to at least 90-day average use in the past year (Commodity Reserves Act, Article 21.a). Obligatory reserves of petroleum and its derivatives are provided for the following groups of products (ibid):

– petrol, aviation spirit, aviation fuel on petrol basis;
– diesel fuel , extra light fuel oil, fuel kerosene, aviation fuel on kerosene basis;
– fuel oil.

COURTESY TRANSLATION

3.4 Dimension Internal energy market

3.4.1 Electricity infrastructure

As described in the second chapter, the level of cross-border interconnection in Slovenia (**83.6 % in 2017**) is already well above the specified goal at the EU level for the year 2020 (10 %) and 2030 (15 %).

Major investment of the transmission system operator, the company ELES, in the coming period, will be construction of DV 2 x 400 kV Cirkovce – Pince, which will provide for the creation and increase of cross-border transmission capacity with the neighbouring Hungary; it is also expected that the investment will contribute to increased possibility of import of electricity from the neighbouring countries. The project will icrease security of off-take supply in Slovenia in the event of blackouts of bigger production facilities or other unforeseen events, and provide for greater reliability of operation of the Slovenian transmission system and in the surrounding region. Together with the an interconnector, TSS 400/110 kV Cirkovce will also be constructed, which is, together with the existing 110 kV lines of transmission network, a favourite location to increase secure and reliable operation of the transmission network in this part of Slovenia (Development plan of transmission system of the Republic of Slovenia from 2017 until 2026, page 105).

In relation to this project, Slovenia intensively cooperates with Hungary at the bilateral level. Slovenian transmission network operator intensively cooperates with Hungarian and Croatian transmission network operators.

DV 2 x 400 kV Cirkovce – Pince holds the status of an EU project of special interest and was thus successfully drawing funds from the Connecting Europe Facility.

3.4.2 Energy transmission infrastructure

In this area, Slovenia has no special objectives (yet).

With a view to implementing projects of common interest, special interministerial working group was established under the Ministry of infrastructure, in which besides the Ministry of the Environment and Spatial Planning, also other ministries and representatives of investors, namely operators of electricity transmission system, the company ELES, and natural gas, namely Družba Plinovodi, d.o.o., participate. Operation of the interministerial working group contributes significantly to faster and more efficient resolving of outstanding issues among all stakeholders.

As for individual projects of common interest, Slovenia cooperates bilaterally with relevant neighbouring countries. From 2015, Slovenia operates also within the framework of the Central and South-Eastern European Gas Connectivity (CESEC).
Both transmission system operators, ELES and Plinovodi d.o.o., also intensively and successfully cooperate at the bilateral level with transmission system operators from the neighbouring countries as well as multilaterally within regional associations (ENTSO-E; ENTSO-G).

COURTESY TRANSLATION

3.4.3 Market integration

In Slovenia, electricity market is well developed and competitive. Slovenia has a market operator, the company Borzen, which is separated from the transmission system operator, the company ELES.

The basic activity of the company Borzen is performance of public utility service, electricity market operator activity, which consists of two major parts (Borzen, 2018):

- Borzen as a market operator provides services to ensure and enable coordinated operation of the Slovenian electricity system. It carries out the tasks of balance scheme management, registration of bilateral contracts, elaboration of indicative timetable, balance settlement and financial settlement of business operations related to these tasks;
- Asa support centre, Borzen carries out operative support schemes for electricity generation from renewable sources and highly performing co-production of heat and electricity. In this way, it supports the environmental protection policy and raises public awareness. Under its own trade mark TRAJNOSTNA ENERGIJA Borzen carries out the activity of information, awareness raising and training in relation to renewable energy sources and efficient use of energy, and thus supports the environmental protection policies through public awareness-raising.

A well-developed power exchange, company BSP SouthPool, operates in Slovenia. The share of energy sold at BSP SouthPool, exceeds 50 % of electricity consumption in Slovenia. This power exchange is also nominated electricity market operator. Despite the small market, BSP is liquid and gives a good price signal as a result of market coupling and significant share of electricity transmitted across Slovenian borders.

Slovenia has day ahead coupled with all neighbouring countries with which it has cross-border connections (cross-border connection with Hungary is under construction). Slovenia is connected with:

- Italy from 1 January 2011,
- Austria from 21 July 2016,
- and Croatia from 20 June 2018.

The Slovenian day ahead is coupled by Multiregional Coupling – MRC which connects the majority of the EU day ahead.

Intraday market in Slovenia is connected with Italy from 21 June 2016. The projects of intraday coupling with Austria and Croatia are ongoing. In the beginning of 2019, a forward market will start operating at the BSP SouthPool Connection of balancing energy markets in Slovenia is subject to commitments in market codes, i.e.:

- *Capacity Allocation & Congestion Management (CACM);*
- *Forward Capacity Allocation (FCA);*
- *Electricity Balancing (EB).*

COURTESY TRANSLATION

On the other side, several pilot projects are ongoing in Slovenia aiming to test advanced systems in the of final consumers supply. Slovenia will be subject to commitments resulting from the adoption of new directive on electricity market in the following fields:

- active customers;
- consumption reaction;
- self-handling;
- energy communities;
- dispersed energy generation and storage;
- independent aggregators;
- dynamic tariffs, and other.

This will result in a system created by consumers that will enable more flexible inclusion of final consumers on the energy market.

3.4.4 Energy poverty

Energy poverty in Slovenia is not a part of energy policy; however, several projects were carried out in the past, which are briefly described below, aiming at reducing energy poverty. Slovenia has not (yet) established any special objectives regarding energy poverty.

The first instrument for energy poverty reduction, named Efficient Use o Energy Scheme for Households with Low Income, was included already in the National Energy Efficiency Action Plan 2008-2016. Other projects were also carried out in Slovenia in the field of energy poverty (two were funded within the framework of the European Commission programme Intelligent Energy – Europa (IEE): Achieve project; REACH project) (Podnebno ogledalo, 2018b, page 19).

Funds available for the reduction of energy poverty within the framework of cohesion funds, amounted to EUR 5 million. In autumn 2016, the project ZERO was established once again under the ENSVET network (reducing energy poverty – support for fuel-poor residents. Funds for the purchase of a free package of devices are provided from the Climate Change Fund at the Ministry of the Environment and Spatial Planning, while funds for visits of a counselor are provide from the funds collected under Decree on energy savings requirements, as for the operation and other activities of the ENSVET network. The project ZERO is aiming at providing a certain number of support hours at the target group of residents, namely about 300 visits at homes per year (Podnebno ogledalo, 2018b, page 20).

As part of its activities, Eco Fund provides two more measures for the reduction of energy poverty, which lower energy costs and improve the quality of life: grants for socially disadvantaged persons to enable them to exchange old combustion installations using solid fuel, in the amount of up to 100 % of the recognised investment, and grants for socially disadvantaged persons – unit owners for new joint investments of improved energy performance of older multi-apartment buildings, in the amount of up to 100 % recognised investments, considering their

COURTESY TRANSLATION

corresponding share of funding (Podnebno ogledalo 2018b, page 21). Moreover, Eco Fund organises visits of energy advisor for socially disadvantaged persons, with a free package of devices and counselling about reduced energy consumption (Eco Fund, 2018).

3.5 Dimension Research, innovation and competitiveness

Provision of a reliable and competitive energy supply is vital for the Slovenian economy; energy policy and its objectives must be consistent with the entire sustainable development policy of Slovenia and should support the achievement of its targets (ReEKS Motion, paragraph 1).

Preparation for and transition to a low-carbon society results in the establishment of needs and markets for sustainable energy technologies and services. The area of sustainable acquisition and use of energy will become a priority area for integrating research and development of new products, production processes and solutions, with the economy. The objective of integration into a wider research and innovation space must be acquisition of applicable solutions for the market. Technological development and successful breakthrough on the market will require higher levels of knowledge and skills as well as encouraging and stimulating creativeness and innovation, ensuring bigger investments in research and development, and introduction of green, environment-friendly technologies on the market. With a view to achieving long-term objectives, further development in the field of efficient use of energy, renewable energy sources, energy storage, active consumers and advanced networks must be speed-up, in particular as regards electricity distribution (ReEKS Motion, paragraph 40).

Final energy prices do usually not include properly indirect or outer costs of fuel consumption; therefore, the use of low-carbon technologies which are not competitive in this view, should also be promoted, in order to contribute to the realisation of objectives and have positive effects on domestic economy. The extent of incentives will be established in an open, transparent, competitive, non-discriminatory and cost-effective manner, so that incentives will contribute to attaining long-term objectives in the field of energy also by supporting new technologies, which will contribute to the realisation of objectives set and have positive effect on the economy until their maturity phase, in such a manner as to cause minimum disturbances in the market.

Other financial instruments will also be created in the direction of encouraging the attainment of long-term objectives in the field of energy. Considering the transition to a low-carbon society it is essential that external costs of energy sources consumption are included in the final energy price according to the 'polluter pays' principle (ReEKS Motion, paragraph 45).

Slovenia's development strategy up to 2030, on the basis of which Slovenia bounded itself also to the implementation of 2030 Agenda for Sustainable Development up to 2030, sets two objectives that have already been mentioned in point 2.5, namely:

– the sixth objective of SRS 2030 is '**competitive and socially responsible business and research sector**' where, inter alia, an orientation towards environmentally acceptable technology and eco-innovations is determined, which as an important factor of

COURTESY TRANSLATION

competitiveness of enterprises also contributes to the reduction of environmental burden which Slovenia intends to attain by (SRS 2030, pages 34-35):

a) promoting the development of sciences and research in priority areas, and transfer of research results for high-competitive economy, higher quality of life and effective tackling societal challenges;
b) promoting internationalisation of companies by means of direct foreign investments and integration into global value-chains, and including research organisations into international environment;
c) providing a supporting and predictable environment, systems of standardisation, accreditation and metrology, and promoting the development of high-tech companies;
d) creating an environment for creation of digital trends, support for new research and technological ideas, economy of sharing and by developing globally competitive systemic solutions in the area of smart networks and platforms;
e) promoting creativity and thus strengthening cooperation of science and art;
f) promoting social and environmental responsibility of companies and research organisations;
g) long-term effective corporate governance of state-owned enterprises and promoting withdrawal of the state from the ownership of companies that do not involve a strategic investment.

– '**transition to a low-carbon circular economy'** as a priority development orientation for the entire economy where it will be necessary to eliminate the connection between economic growth and growth in the consumption of raw materials and non-renewable energy sources, and the associated increased burdening of the environment that Slovenia intends to reach (SRS 2030, pages 38–39):

a) decoupling economic growth from the growth of the use of sources and GHG emissions, which could only be done by way of training and connecting various shareholders for the transition into circular economy;
b) promoting innovation, the use of creation and information and communication technologies for development of new business models and products for the efficient use of raw materials, energy, and by adapting to climate changes;
c) replacing fossil fuels by promoting EE and the use of RES in all areas of energy consumption, while aligning interests in cross-sectional areas: water – food – energy – ecosystems;
d) ensuring that infrastructure and energy consumption in transport support the transition to a low carbon circular economy and enable sustainable mobility, also by introducing new concepts of mobility and increasing the share of public passenger transport;
e) using spatial planning to form hubs of a low carbon circular economy and development solutions at regional and local level.

In the past, Slovenia has already adopted three key sectoral strategies that are overlapping to a certain extent with the fifth dimension of energy unit (research, development and competiveness), and are focused in particular on the period up to 2020, namely:

COURTESY TRANSLATION

- Resolution on Research and Innovation Strategy of Slovenia 2011–2020 (ReRIS11-20))[26],
- Slovenian Industrial Policy 2014–2020 (SIP),[27]
- Digital Slovenia 2020: Development strategy for the information society until 2020[28].

As referred to in Section 2.5, the Government adopted the Slovenia's Smart Specialisation Strategy (S4) on 20 September 2015, which is the area implementation document of already adopted strategic documents that, in one way or another, refer to innovations (e.g. RISS, SIP and Digital Slovenia), whereby their guidelines are integrated, given concrete expression and upgraded by means of the following:

1. niche orientation (i.e. by means of the defined priority areas);
2. integrated approach to all development actors;
3. targeted, comprehensive and individual package of measures,
4. globally integrated approach.

S4 defines three priority pillars and nine domains where Slovenia has the critical mass of knowledge, capacities and competences and where there is innovation potential for placing Slovenia within global markets (S4, 2017, pages 8–9):

I. Digital

1. Smart cities and communities with IT platforms and conversion, distribution and management of energy.
2. Smart buildings and homes, including wood chain with smart housing units, management systems for buildings, smart appliances and advanced materials and products.

II. Circular

3. Networks for the transition to circular economy with biomass transformation, development of new biological materials, technologies for the use of secondary raw materials and energy production from alternative sources.
4. Sustainable food with sustainable production and processing of food products into functional foods, and technologies for sustainable livestock and plants production.
5. Sustainable tourism with IT-based marketing and networking, investments to inhence the quality of services, technological solutions for sustainable use of resources in accommodation facilities and green Slovenian tourism scheme.

III. (S)Industry 4.0

6. Factories of the Future with optimisation and automation of production and production processes, including the enabling technologies.
7. Health – medicine with biopharmaceuticals, diagnostics and therapeutics in translational medicine, cancer treatment, resistant bacteria, and natural medicines and cosmetics.

COURTESY TRANSLATION

[26] **Resolution on Research and Innovation Strategy of Slovenia 2011-2020 (ReRIS11-20)**, available at http://pisrs.si/Pis.web/pregledPredpisa?id=RESO68

[27] **Slovenian Industrial Policy 2014–2020 (SIP),** available at: http://www.mgrt.gov.si/fileadmin/mgrt.gov.si/pageuploads/DPK/SIP/SIP_-_vladni_dokument.pdf

[28] **Digital Slovenia 2020:** Development strategy for the information society until 2020, available at: http://www.mju.gov.si/fileadmin/mju.gov.si/pageuploads/DID/Informacijska_druzba/DSI_2020.pdf

8. Mobility with niche components and systems for internal combustion engines, e-mobility and energy storage systems, systems and components for security and comfort, and materials for the automotive industry.
9. Development of materials as the metallurgy products, and multi-component smart materials and coatings.

Focus areas and technologies, defined in the actual S4 document, and the areas of common development or niches, are regularly upgraded and complement in cooperation between the state and the Strategic Development and Innovation Partnerships (SRIP). One SRIP, i.e. long-term partnership between companies, knowledge institutions (e.g. research institutions and universities), municipalities, integration institutions, users, non-governmental organisations and other actors operates in each of nine areas of the S4's application in compliance with the quadruple helix principle. SRIPs operate on the basis of action plans (business and development strategies) that, in addition to the activities of common development or niches, define the method of joint acting in terms of the human resources development, and in the area of internationalisation, promoting entrepreneurship and other joint activities. The State Secretary Working Group for Implementation of S4 (DSDS S4), composed of State Secretaries of 13 ministries, who have a key role in implementation of S4, is responsible under the authority of the Government to approve action plans at SRIP's proposal and thus, it decides on further focus and concretisation of focus area priorities, technologies, and areas of common development or niches.

S4 addresses in a comprehensive manner a broad range of development policies related to innovation, in particular the policy of promoting research and innovation, industrial policy, entrepreneurship promotion as well as some parts of the education system, rural development policy, international relations, improved regulatory environment (procedures related to the issuing of permits), etc. The state support to the three priority pillars and nine domains of S4 is financial, while the non-financial part of the state's support services, which is implemented in close collaboration between the state and SRIPs, is also important.

S4 also defines the targeted, comprehensive and individual package of measures for the following (S4, 2017, pages 29–39):

- research, development and innovation (basic science, research, development and innovation in value chains and networks, supporting investments, complementarity with Horizon 2020 and international initiatives, better utilisation and development of research infrastructure, and specific measures);
- human resources, research potential of researchers and international mobility, strengthening development competences and innovation potentials, employee knowledge and competences, and young and creative Slovenia);
- entrepreneurship and innovation, (newly established enterprises and knowledge transfer, growth and development of SMEs, and internationalisation and FDI);
- Slovenia of development (innovative and green public procurement, tax relief, economic diplomacy and promotion, issuing permits and eliminating regulatory barriers, and efficient justice administration).

COURTESY TRANSLATION

Under S3, the measures or public tenders are implemented in the following areas:

1. clustering, i.e. operation of SRIPs on each of nine areas of the S4's application;
2. incentives for research and development projects at the Technological Readiness Levels 3-6 and 6-9, where the target is to co-finance before development and research and development projects of consortia that refer to development of the new or improved products, processes or services with high value added and market potential in the areas of application, focus areas and the S4 technologies;
3. supplementing the SME instrument to support positively evaluated projects that are awarded the so called stamp of excellence in case they are not eligible for co-financing at the EU level;
4. pilot/demonstration projects in the application and focus areas and areas of S4 technologies;
5. research infrastructures related to the areas of S4's application;
6. strengthening competences and innovation potentials (e.g. in the framework of competence centres for career development and of early-stage researchers);
7. promotion of economic transformation through measures that promote transformation by companies in terms of procedural improvements, electronic commerce and business models;
8. innovative support environment and promotion of support innovations;
9. co-financing of market and development internationalisation of SRIPs and companies that operate in the areas of S4's application.

The added value of the these measures is as follows:

- to try out new technologies and services in real environment in order for the Slovenian companies to obtain references;
- to involve the Slovenian technologically innovative companies that are export oriented;
- to set up technologies and services that can be used in other environments, as well as the market ones on global markets;
- to develop and use products of the Slovenian companies that will be marketable on global markets, and to use system changes in applications that are not yet on the market;
- to invest in research and development, which contributes to results in a form of new products, procedural improvements and creation of new work places with high value added, as well as to well-being both in Slovenia and the European Union;
- new strategic partnerships.

In the future multi-annual financial perspective for the 2021–2027 period, S4 constitutes the enabling condition without which at least the cohesion funds related to the smart Europe objective will no longer be accessible, while it also covers the complementary areas of the other goals of cohesion policy in terms of content. In 2019 a thorough review of S4's implementation will be carried out; in 2020 the upgrade of this document will follow, as well as adoption of the updated S4 valid until 2030.

COURTESY TRANSLATION

SET-Plan

Pursuant to Article 129 of the Environmental Protection Act,[29]the funds obtained by auctioning emission coupons are to be used for the financing of research and development and demonstration projects for the reduction of emissions and adaptation to climate change, including participation in the initiatives of the European Strategic Energy Technology Plan and European technology platforms (SET-Plan).

This provision enables beneficiaries to co-finance own participation in implementation of the European projects for energy, transport and climate change (i.e. of all projects that contribute to the emission reductions), as well as in the actual preparation of these Climate Change Fund projects. The aforementioned will serve as the system support to the EU funds applicants applying for support to projects for the reduction of emissions and adaptation to climate change (the LIFE Programme, Innovation Fund and HORIZON 2020) and financing of activities that are related to the SET-Plan (participation in the initiatives of the European Strategic Energy Technology Plan and European technology platforms, participation of the Slovenian experts in the working groups for implementation of the SET-Plan implementation plans.

In the area of research and development, Slovenia will follow the guidelines of the SET-Plan implementation plans, which ensure implementation of the requirements of the new EU's Clean Energy for All Europeans energy package.

Research, development and competitiveness as the dimension of the Energy Union relate, in the broadest sense, to areas of the S4's application and measures in these areas that will contribute in different manner to the promotion of research, development and competitiveness of Slovenia in the remaining dimensions of the Energy Union.

COURTESY TRANSLATION

[29] UL RS Nos 39/06 – official consolidated version, 49/06 – ZMetD, 66/06 – Constitution Court Decision, 33/07 – ZPNačrt, 57/08 – ZFO-1A, 70/08, 108/09, 108/09 – ZPNačrt-A, 48/12, 57/12, 92/13, 56/15, 102/15, 30/16, 61/17 – GZ and 21/18 – ZNOrg

SECTION B: ANALYTICAL BASIS

4 CURRENT SITUATION AND PROJECTIONS WITH EXISTING POLICIES AND MEASURES

In the past, different models were used to draw up the strategic plans in Slovenia. The Ministry responsible for energy has updated the national long-term energy balances by 2030 on the basis of REES-SLO model in order to form national position on 2030 climate and energy targets and set national objective of increasing energy efficiency by 2020 (Long-term Energy Balances of the Republic of Slovenia by 2030)[30].

In order to prepare the motion for the Energy Concept of Slovenia, the Ministry of Infrastructure has procured the drawing up of the energy balances by 2035 and, tentatively, by 2055. Following a call for tender, the PRIMES model was selected for Slovenia, which was fully updated on the basis of the data for 2015 that were provided by the Slovenia's Statistical Office and Eurostat and were used to quantify the three main scenarios and their nine versions. An assessment of the effect of energy scenarios on macroeconomic aggregates, industrial production and employment had to be drawn up in order to support the energy design. The GEME3 model, which was updated and applied to quantify the effects of main scenarios, was used to this end (Report by the long-term energy balances developer 2017, page 1)[31].

The LIFE Climate Path 2050 project is implemented in Slovenia in cooperation with the Ministry of the Environment, the general objective of which is to support the decision-making that will enable Slovenia to set its own target of reducing GHG emissions by 2050 and contribute to the international objective of maintaining the global temperature growth. On the basis of the REES-SLO model, the project has several operative targets, such as the drawing up of the projected greenhouse gas emissions by 2050+ and the assessment of the impacts for the Long-term low emission strategy to be prepared by Slovenia until 2020 (LIFE Climate Path 2050).[32]

For the purpose of technical and scientific support and the preparation of the final proposal for an integrated NEPN, the Ministry of Infrastructure prepared an invitation to tender, on the basis of which it concluded a contract with the consortium of institutions under the direction of the Jožef Stefan Institute. On the basis of the REES-SLO model, the latter will update the necessary scientific bases and prepare the proposal of the final version of NEPN; it will also take due account of the findings of the LIFE Climate Path 2050 project and be adequately consistent with the Long-term Strategy of Slovenia.

The main tool to be used in this analysis that will focus on calculation of energy balances, emissions and costs of the energy use and supply in Slovenia is a reference energy-ecological model REES-SLO, prepared in the MESAP environment in a form of linear lattice model of processes and connections, which enables consistent modelling of energy use based on the

[30] **Long-term Energy Balances of the Republic of Slovenia by 2030,** 2014, available at http://www.energetika-portal.si/fileadmin/dokumenti/publikacije/nep/deb__2030.pdf

[31] Report by the long-term energy balances developer, 2017, available at http://www.energetika-portal.si/fileadmin/dokumenti/publikacije/eks/razprava_jun_2017/eks_priloga2.pdf

[32] **LIFE Climate Path 2050**, available at https://www.podnebnapot2050.si/o-projektu/

COURTESY TRANSLATION

needs for energy services and calculations of emissions, costs and other effects. The energy system reference model is basically a set of programmes and tools to mathematically describe an individual subsystem in correlation with all parameters that affect such a subsystem; these systems are then interconnected in an appropriate whole, i.e. the real energy system. The modern energy system models, such as the REES-SLO model, use an integrated approach, meaning that they combine the characteristics of the specific and general models, and thus enable assessment of the sectoral, energy, ecnomic and environmental effects.

The REES-SLO model is calibrated on statistical data (Standard Classification of Activities – 2008) and linked with the indicator system of statistical indicators, as well as those that were developed for monitoring of the energy policies in Slovenia. It enables comparison according to the methodologies of the Statistical Office of the Republic of Slovenia (SURS), the Statistical Office of the European Communities / Organisation for Economic Co-operation and Development (EUROSTAT/OECD) and UNFCCC. The following is calculated under the REES-SLO model:

- balances of the energy use (of the final and primary energy, namely by sub-sectors, energy products and technologies);
- emissions of the harmful substances from energy conversions (by sectors, energy products and technologies, as well as by the levels of conversions and the total one);
- costs related to the energy use (des-aggregated by sectors or conversion levels, while costs are also divided into investment costs, costs for the EE promotion programmes, and costs of energy or fuels; the model also distinguishes between taxes and other costs).

The REES-SLO logical process-technological model enables simulation and evaluation of anticipated instruments and their influences, as the set of instruments are connected within strategies. The calculation model with a transparent model presentation prevents double counting and an unconnected consideration of effects, and provides a framework for consistent and equal access to the identification of instruments, measures and outputs in different sectors and subsectors. The set of models that is used for an integrated approach requires, depending on the details of the treatment, a more detailed simulation or optimisation models of individual segments of the energy system, meaning that the models interconnect at the input/output data levels or take the same assumptions into consideration and jointly affect the calculations.

4.1 Projected evolution of main exogenous factors influencing energy system and GHG emission developments

Slovenia managed to achieve a relatively high level of economic growth in the period before the economic crisis. The average GDP growth rate was 3.4 % between 2000 and 2003 and 4.9 % between 2004 and 2008. GDP growth slowed with the onset of the economic crisis in 2008 and fell steeply in 2009 (-7.8 %). Fast deterioration in the national and international environment was best reflected in the reduction in the exports and investments, which had been the critical factor in economic growth in previous years. After modest GDP growth in 2010 and stagnation in 2011, Slovenia in 2012 again found itself in a period of negative

COURTESY TRANSLATION

growth rates, which lasted well in 2013. Positive values of GDP growth were again recorded in 2014 and 2015, which was mainly due to increased exports (AN URE 2020, page 13).

With high rates of economic growth in the period before the crisis, Slovenia gradually approached the EU average development level, measured by GDP per capita in purchasing power, and in 2008 lagged behind the European average by just 10 %. Since the beginning of the economic crisis in 2008, Slovenia recorded the sharpest decline in GDP per capita in purchasing power standards in the group of EU Member States. Its gap with the EU average has therefore increased and in 2015 amounted to 17 %, which is the same as in 2003 (AN URE 2020, page 13).

Economic growth will total 4.4 % in 2018 and remain relatively high in the following two (3.7 % and 3.4 % respectively). The contributions of domestic and foreign consumption to the continuation of strong economic growth in 2018–2020 will be even more balanced than in 2017. The robust growth of domestic consumption will, in addition to the still rapidly rising investment, be due to the significant contribution of higher growth in *private consumption* boosted by relatively strong growth in disposable income (wage bill in particular). The vigorous growth of *construction investment* related to the low level of this investment in previous years and the increased absorption of EU funds will continue. *Investment in machinery and equipment* will see somewhat more moderate growth than last year, yet still high. Amid rising demand, it will continue to be driven by high capacity utilisation and strong business performance. We also expect further growth in *government consumption*, which will ease off gradually after accelerating this year. The strong growth of exports and, to a somewhat lesser extent, of imports will gradually slacken over the forecast period (except in 2020) and the still positive contribution of net exports to GDP growth will diminish. This, together with rising labour shortages, will lead to a moderation of economic growth, which will nevertheless remain relatively high over the forecast period in the absence of external shocks (IMAD, 2018).

Table: Gross value added by activity and gross domestic product (real growth rates in %)

	2017	2018	2019	2020
		forecast	forecast	forecast
A Agriculture, forestry and fishing	-5.0	5.0	1.0	0.5
BCDE Mining and quarrying, manufacturing, electricity and water supply, waste management	7.7	5.9	4.7	4.7
of which: C Manufacturing	8.4	6.5	5.0	5.0
F Construction	8.5	10.5	8.0	6.0
GHI Trade, transportation and storage, accommodation and food service activities	6.6	4.5	4.0	3.6
J Information and communication	5.9	4.5	5.0	5.5
K Financial and insurance activities	-1.8	1.5	4.0	3.0
L Real estate activities	1.2	1.0	1.5	1.5
MN Professional, scientific, technical, administrative and support services	8.7	6.0	5.0	4.0
OPQ Public administration, education, human health and social work	1.6	2.1	1.6	1.3
RST Other service activities	1.9	2.0	3.0	4.0
TOTAL VALUE ADDED	5.2	4.5	3.9	3.6
GROSS DOMESTIC PRODUCT	**4.9**	**4.4**	**3.7**	**3.4**
Source of data: SURS, forecasts by IMAD.				

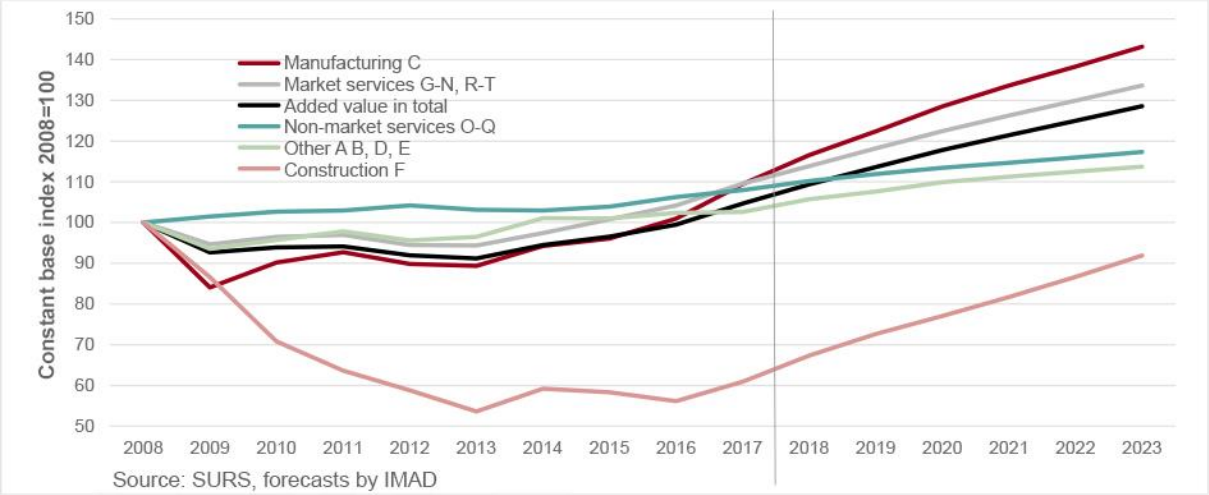
Source: IMAD 2018.[33]

[33] IMAD, 2018, Autumn Forecast of Economic Trends 2018 , available at http://www.umar.gov.si/fileadmin/user_upload/napovedi/jesen/2018/JesenskaNapoved2018-22okt.pdf

COURTESY TRANSLATION

The contributions of sectors to value added growth will be fairly **balanced**, similar to 2017. The moderation of growth over the forecast period (2018–2020) will reflect the gradual easing of economic growth abroad and the rising limitations on the supply side in the domestic environment, related mainly to ever greater shortages of skilled labour. In manufacturing, the main engine of growth will remain export-oriented activities, where positive trends are expected to continue in most industries. After strengthening last year, value added in construction will increase even more this year, consistent with growth in private and public investment in non-residential buildings and civil-engineering works, and further growth of the property market and hence residential construction. In the next two years the growth of construction activity will gradually slow down, but remain relatively strong with faster growth in the residential segment and a gradual increase in the absorption of EU funds. Under the influence of stronger growth in domestic demand, we expect relatively high value added growth in trade and other market services this year and in 2019 (particularly in transportation, accommodation and food service activities and ICT services), and stronger growth in services related to leisure. In segments related to transportation, tourism and some business services, value added growth will continue to be also driven by foreign demand. Value added growth in public services will be moderate amid slackening growth in employment (IMAD, 2018).

Figure: Real growth of value added by sector



Source: IMAD, 2018.

4.2 Dimension Decarbonisation

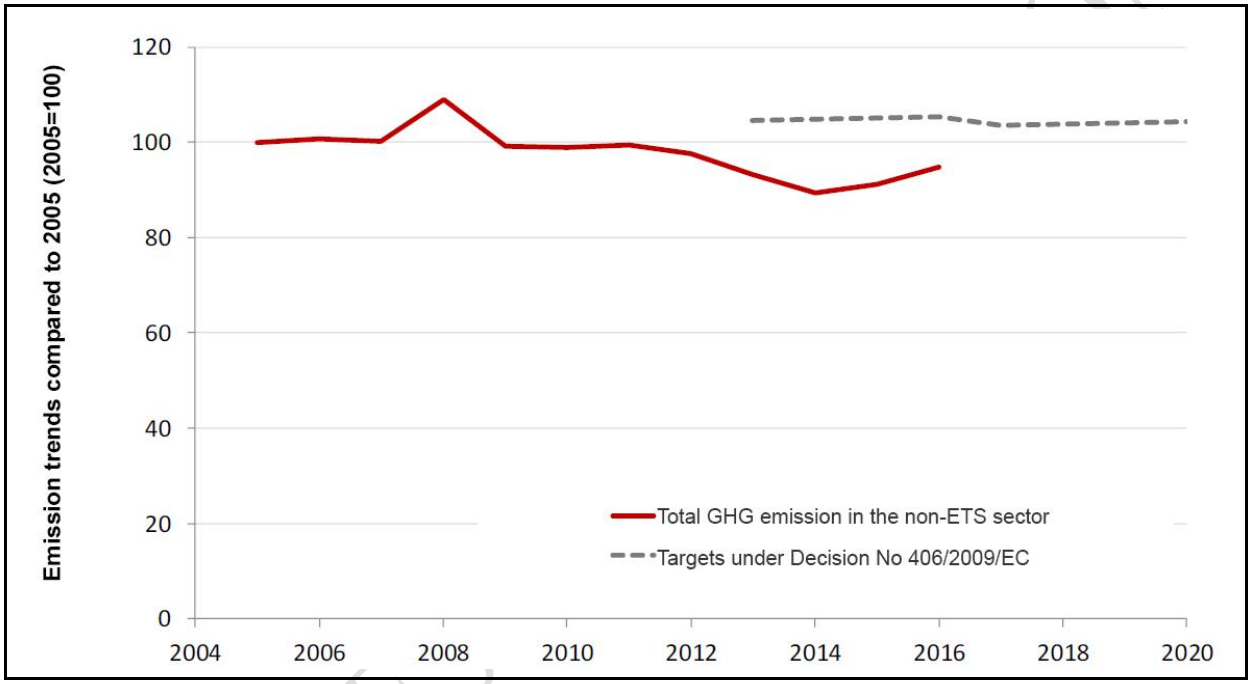
4.2.1 GHG emissions and removals

By adopting Decision 406/2009/EC, Slovenia took over the responsibility not to increase its GHG emission from the ESD sectors by 2020 for more than 4 % in comparison to emissions in 2005. In addition to the final objective, the decision lays down also the methodology for determining annual allocation of emissions (target values) for the starting year of the 2013–2020 period and for the intervening years (proposal for the Third annual report on the implementation of OP TGP 2020).

CONSULTATION

So far, Slovenia has been reaching annual objectives. **Emissions from the ESD sectors in 2016 amounted to** 11 236.89 kt CO_2 ekv., which is **9 % less than the limiting value**. These emissions represented 63 % of total GHG emissions the remaining 37 % are emissions from sources included in the system of trading in emission allowances (ETS system). Comparing to year 2015, **emissions from ETS** increased by 6 %, while comparing to year2013, they were reduced by 14 %. **Sinks from the LULUCF sectors** in 2016 represented 28 % of all emissions. Their quantity in the last period has remained almost at the same level (proposal for the Third annual report on the implementation of OP TGP 2020).

Figure: The ESD emission trends in the 2005−2016 period and the emission trends in target trajectories in the 2013−2020 period, in comparison to the 2005 emissions

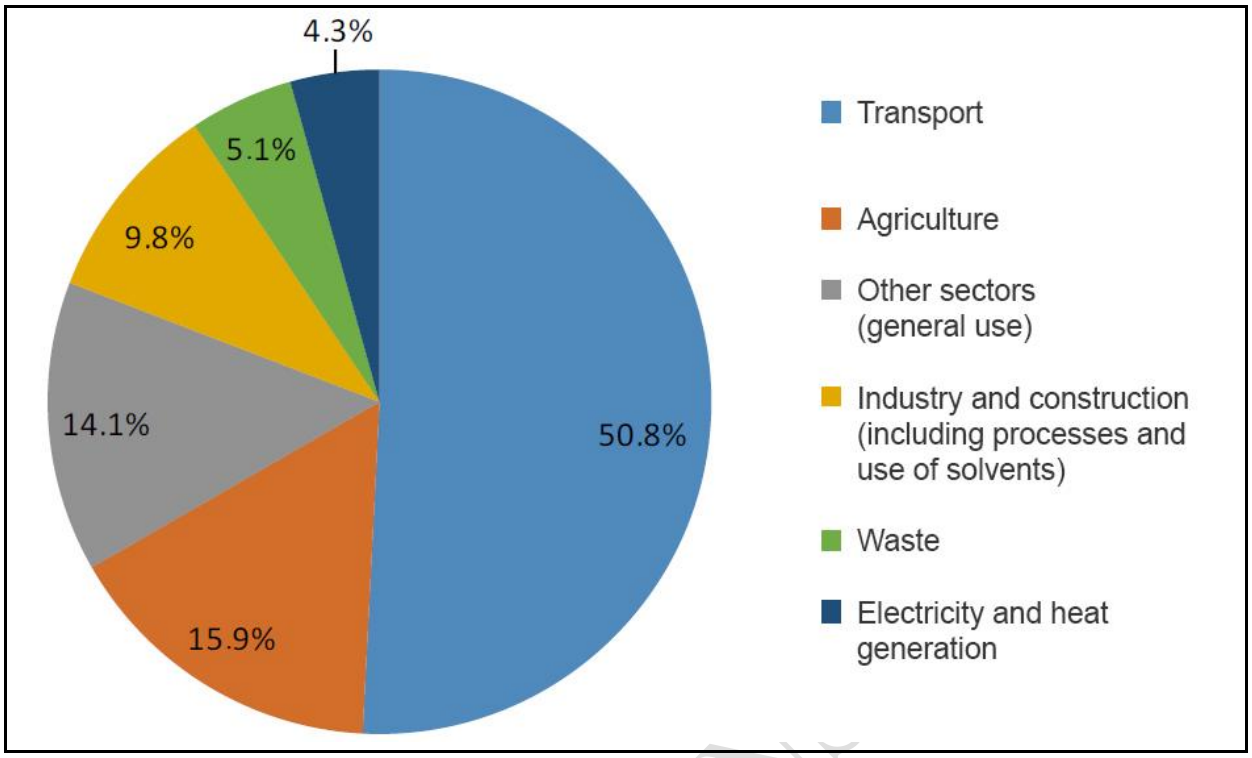


Source: proposal for the Third annual report on the implementation of OP TGP 2020; Podnebno ogledalo, 2018b, page 8.

GHG emissions from the ESD sectors in 2016 decreased by 5 % in comparison to year 2005 , and increased by 5 % when compared to year 2015. Growing trend was noticed again in 2015, after a three-year decline. Transport represents about 51 % of all emissions from the ESD sectors. Except for transport, no other ESD sector represents more than 16 % share in the emission balance, and for this reason annual sectoral variations in the total balance established until now are not reflected in such extent than in the case of transport. In comparison to year 2015, besides transport, greater annual change in emissions was noticed also for the sectors buildings (other areas – wide use) and non-ETS energy sector (generation of electricity and heat). In the last year, emissions in other sectors (agriculture, waste) were subjected to significant changes (proposal for the Third annual report on the implementation of OP TGP 2020).

COURTESY

Figure: Structure of GHG emissions by the non-ETS sectors in 2016



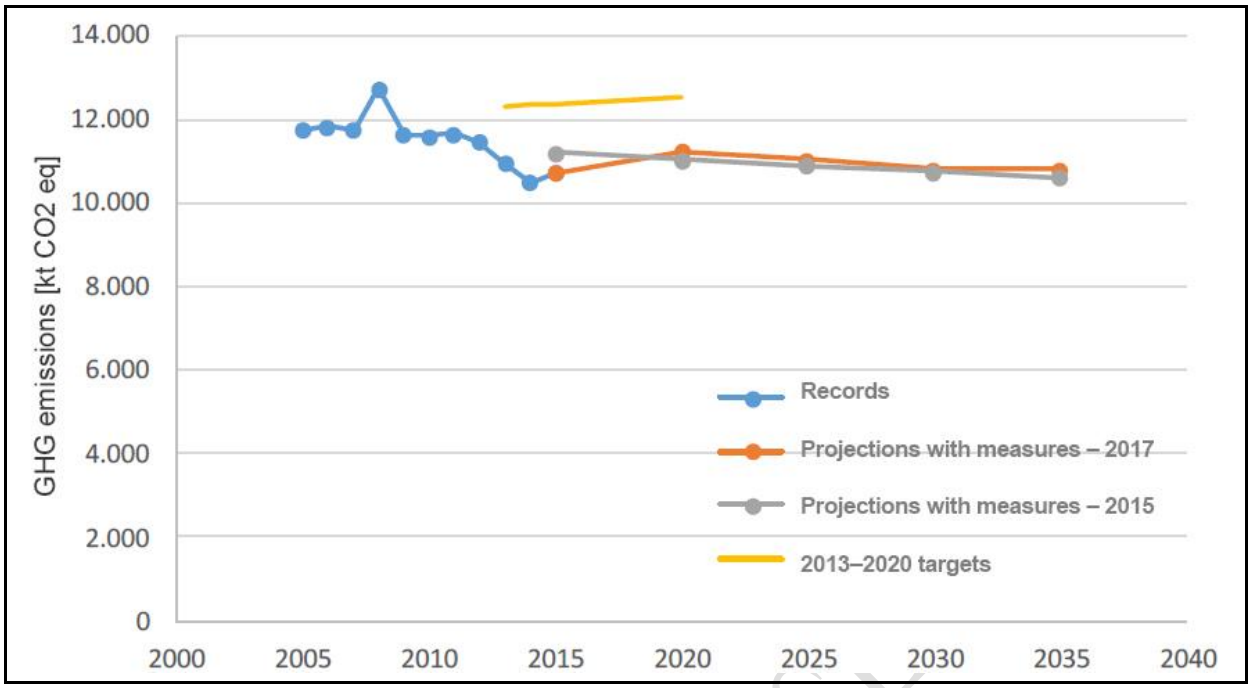
Source: Podnebno ogledalo, 2018b, page 9.

Emission productivity associated with the environmental performance of economy shows that GDP growth in 2016 was based on an increase of emissions, which is contrary to the objective set. The subsidies also increased in 2016, which is contrary to achieving the GHG emission reduction targets. They amounted to EUR 123.6 million. For the promotion of measures to reduce GHG emissions in the public sector, households and transport, EUR 24.6 million in non-refundable funds was provided, which is 52 % less than the year before (Podnebno ogledalo, 2018b, page 5).

In 2017, projections of GHG emissions were updated; however, they were not significantly different from that in 2015, showing that the binding national targets under Decision 406/2009/ECS will be reached or even exceeded during the entire 2013−2020 period. Transport represents the major uncertainty regarding future emissions. Analysis of the sensitiveness of projections on the impact of transit transport has been made as well as comparison of scenarios of implementation of measures of transport and environment policy in the transport sector. Range between the highest and the lowest projection of GHG emissions in transport for year 2020 amounts to 25 %. Considering the projection of emissions from transport which represents the upper limit in the sensitive analysis, and emissions for other sectors from the projection with the existing measures, the resulting scenario is the most pessimistic one. However, also in this the most pessimistic scenario, total GHG emissions from non-ETS sectors in the period up to 2020, do not exceed target emissions (Second report on the implementation of OP TGP, page 7).

COURTESY TRANS

Figure: Non-ESD emission trends and the latest projection of GHG emissions, updated in 2017



Source: Second report on implementation of OP TGP, page 168

Monitoring of the implementation of OP TGP 2020 measures in Slovenia is oriented towards sectors with the highest contribution to emissions in non-ETS sectors.

Transport

Reduction of GHG emissions by 9 % until year 2020 regarding year 2008 with the enforcement of sustainable transport or retain emissions so that increase with regard to year 2005 will not exceed 27 % is the target.

After the adoption of OP TGP 2020, the following programme and action documents were also adopted, which impact the implementation of measures for the reduction of GHG emissions in transport (Second report on the implementation of OP TGP, page 11):

- Strategy of transport development in the Republic of Slovenia (SRP), 2015, the Government;
- Action plan for effective use of energy for the 2014−2020 period (AN URE), 2015, the Government;
- Resolution on the national programme of the development of transport in the Republic of Slovenia for the period up to year 2030, (ReNPRP 2030), 2016, the National Assembly;
- Operational programme for the implementation of European cohesion policy for the 2014−2020 period (OP EKP), 2015, the Government;
- Expenditure programme for the funds of the climate change fund in years 2017 and 2018, the Government.

The major factor for changing the trend of GHG emissions from the ESD sectors remain emissions from the transport sector, since they represent 51 % of all emissions, and their possible annual variability is estimated at 18 %. In 2016, emissions from this sector for

COURTESY TRANSL

example increased by 7 % (proposal for the Third report on the implementation of OP TGP 2020).
Transport is the only sector where emission increased in the 2005−2016 period, namely by 28.7 %. GHG emissions are the most influenced by two factors: Activity in the transport sector (transport work) and export of fuel in tanks of vehicles (transit transport) (Podnebno ogledalo, 2018, page 14).

The following elements of the policies in the area of transport are in the most critical situation (Second report on the implementation of OP TGP, pages 11.12; Podnebno ogledalo, 2018b, page 14; Ministry of Finance, 2018):

- the share of RES in transport is moving away from the 2020 target (Directive 2009/28/EC), thus strict implementation of Decree on renewable energy sources in transport (UL RS No 64/16) or EZ-1 and AN OVE must be ensured.
- Subsidies which oppose to the objectives of reducing GHG emissions have increased in the transport sector and are moving away from the OP TGP 2020 objective. Within the framework of green budgetary reform an in-depth analysis of incentives was performed, which do not contribute to the reduction of environment burdening. It was found out that the mission should be performed reasonably and gradually, while considering their impact on the competitiveness of the economy and on general government revenue, since solutions that seem simple do not bring desirable outcomes.
- The number of passenger kilometres in public passenger transport increased in 2015 and 2016, which is an important progress, however still significantly lagging behind the objective.
- Average emissions of vehicles in Slovenia are higher than the objective set. Initiatives for the utilization of alternative fuels and effective vehicles in transport should be upgraded, particularly within the annual fee for the use of motor vehicles in road traffic.
- The share of railway transport in the freight transport decreased in 2015. Transfer of the transport to railways will depend significantly on investments into upgrading and updating of the network.

Biofuels

Evaluation of the possibilities to reach indicative OP TGP targets in Slovenia by 2020 and 2030 showed that these could not be reached without using biofuels. Biofuels defined in 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 (Official Journal EU L 140, page 16) as alternative fuel in transport and may, if generated sustainably, contribute to the reduction of entire CO_2 emissions. At the same time, they represent a clean source of energy for all forms of transport.

Slovenia holds a specific position, since it does not dispose of production or processing capacities neither in the area of generation of fossil fuels nor biofuels. Therefore, it depends on import in both areas and thus on the actual market prices. Since the production price of

COURTESY TRANSLATION

biofuels is higher than the price of conventional fossil fuels, which holds good for all kinds of biofuels, and in particular for biofuels generated from sustainably obtained raw material or for biofuels of advanced generation, reaching the objectives of reducing emissions by the use of biofuels and increasing their use, is subject to an appropriate deregulation of the prices of fuels, inclusion of real costs in the model of the prices of fuels on the market or appropriate subsidization of the price. In the absence of these measures, reaching the objectives set is not possible or feasible (Strategy for Development of the Market in Order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia, page 12).

Public filling stations which were intended to be supplied by clean or majority proportion of biofuel, such as B100 (100 % biodiesel) or E85 is not present in Slovenia at the moment. Smaller quantities of clean biodiesel are on the market only through retail sale networks, bur up till now, the majority of biofuels were placed on the market in the form of mixtures with fossil fuels, mixed in quantities still allowed by the valid standards for diesel or motor gasoline. Also gas biofuels could be mixed with the gas fuel of fossil origin and supply this to final consumers through the existing infrastructure (Strategy for Development of the Market in Order to Develop Appropriate Alternative Fuels Infrastructure in the Transport Sector in the Republic of Slovenia, page 16).

Green economic growth

The objective is to support the transition to the economy, the growth of which is not based on the increased use of natural sources and energy but which through effectiveness and innovation reduces greenhouse gas emission, improves the competitiveness and promotes greater security of energy supply.

After the adoption of OP TGP 2020, the Government adopted the following programme and action documents, which impact the implementation of measures for the reduction of GHG emissions in the area of green economic growth (Second report on the implementation of OP TGP, page 8).

- Operational programme for the implementation of European cohesion policy for the 2014−2020 period (OP EKP), 2015;
- ¤Framework programme for the transition to green economy (OPZG) with the Action plan of implementation of OPZG (ANi OPZG) and Activityy plan of ministries and government services (NAMVS) for 2015 and 2016.

Emission productivity associated with the environmental performance of economy shows that GDP growth in year 2016 was based on an increase of emissions, which is contrary to the OP TGP objective set (Podnebno ogledalo, 2018b, page 10).

The extent of public sources that oppose to reaching the objectives of GHG emission reduction has increases over the last years. Latest available data is for 2016. They show that, in this year, EUR 123.6 million were earmarked for this purpose, which represents an increase of almost 6 %. E major factor of the last annual change is 14 % more sources earmarked for

COURTESY TRANSLATION

reimbursement of excise duties for diesel fuels, due to higher quantity of fuel sold within the commercial diesel scheme. In comparison to the previous years, in 2016 no incentives were allocated from the funds of European and infrastructural funds, since the last incentives from the previous financial perspective were paid in 2015. First applications for from the new financial perspective were published only in 2016 funding (Third annual report on the implementation of OP TGP 2020, page 16).

Implicit tax rate in Slovenia for measuring burdening of the final energy with taxes, has somewhat decreased in the last year. It is still above the EU average and does not change much during the years (Podnebno ogledalo, 2018b, page 10).

According to the eco-innovation index, Slovenia was again placed above the EU-28 average in 2016. The value in the year of monitoring from 2015 until 2016 varies with regard to the European average (Podnebno ogledalo, 2018b, page 10). Considering the said index, Slovenia has somewhat improved, but the resource efficiency outcomes remain the same, under the EU-28 average (55 %).

The Slovenia's Development Strategy (SRS 2030) was adopted, which places the **transition to a low-carbon circular economy** among development goals of the country, which is essential for the long-term reduction of GHG emissions, since measures of circular economy and efficient use of sources have even higher development/environmental potential than the applicable OP TGP measures. According to SRS 2030, objectives include also improvement of emission productivity (ratio between GDP and greenhouse gas emission), which is important since this indicator follows at the same time the objective of improvement of the competitiveness of the society and decrease of GHG emissions (Podnebno ogledalo, 2018b, page 10)[34].

Agriculture

The objective is to keep the GHG emissions at the maximum level of +5 % by 2020 compared to 2005, while simultaneously increasing the Slovenia’s food self-sufficiency.

Following of OP TGP 2020, the Government adopted the following programme and action document, which affect the implementation of measures for the reduction of GHG emissions in agriculture (Second report on the implementation of OP TGP, page 12).

- Rural Development Programme 2014–2020 (RDP), 2015.

The most important greenhouse gases in agriculture are methane and dinitrous monoxide. The first contributes somewhat less than 70 % and the second about 30 % of the greenhouse effect of the sector (Second report on the implementation of OP TGP, page 12).

[34] More information on this is available also in the Development Report, which follows also the emission productivity (UMAR, 2018), available via http://www.umar.gov.si/fileadmin/user_upload/razvoj_slovenije/2018/POR_2018.pdf

COURTESY TRANSLATION

Solutions for the reduction of dinitrous monoxide coincided within then solutions for the protection of water against nitrate pollution and solutions the decreasing ammonium emissions. In the area of water pollution prevention we have a long-standing tradition and rather well developed system of public counselling service. Water protection is among the priorities of agricultural-environmental-climate payments (KOPOP) of the Rural Development Programme 2014–2020 (RDP 2015–2020) and the results are shown also in the area of dinitrous monoxide emissions. Measures Investment in physical assets and Organic Farming (both under RDP 2015–2020) contribute to more effective circulation of nitrogen. The said is indicated in attaining the objectives in the area of nitrogen consumption from mineral fertilizers and gross balance surplus of nitrogen (Second report on the implementation of OP TGP, pages 12–13).

Although methane contributes the majority of greenhouse effect in agricultural sector, Slovenia dedicates essentially less attention to decreasing methane emissions than for decreasing dinitrous monoxide emissions. The weak point is lack of ambition in the area of reducing methane emissions from gastrointestinal tract of livestock which contribute about 50 % of all GHG emissions in agriculture (Second report on the implementation of OP TGP, pages 13).

The sector agriculture is the second the biggest source of GHG emissions among ESD. In year 2016 it represented 16 % share. The trend of emissions somewhat varies; after the decrease in the 2005–2013 period, the quantities were raising in the following years, so as to reach the 2005 level in 2016. The main contribution to GHG emissions from this sector still goes to methane emissions (about 70 %), which is followed by emissions of dinitrous monoxide (about 30 %). The main source is livestock farming (more than 70 %) (proposal for the Third annual report on the implementation of OP TGP 2020). Evolution of emissions of the sector agriculture is for the time being in line with the objective set (Podnebno ogledalo, 2018b, page 16).

Other non-ETS sectors: industry, waste and energy industry

Objectives are reduction of GHG emissions by 2020 relative to 2005:

– from industry outside the EU-ETS scheme by 42 % with measures for the transition to the competitive low-carbon production;
– from waste management by 44 % and gradual enforcement of circular economy.

After the adoption of OP TGP 2020, the Government of the Republic of Slovenia adopted the following programme and action documents, which impact the implementation of measures for the reduction of GHG emissions in transport (Second report on the implementation of OP TGP, page 13).

- Operational programme for the implementation of European cohesion policy for the 2014−2020 period (OP EKP), 2015;
- Expenditure programme for the funds of the climate change fund in 2017 and 2018;.
- National Energy Efficiency Action Plan 2014–2020, (AN URE), 2015;

COURTESY TRANSLATION

- Waste Management Programme and Waste Prevention Programme of the Republic of Slovenia (PPO and PrZO), 2016.

Industry (non-ETS). In 2016, emissions from combustion of fuels in industry and construction, and process emissions represented in total 10 % of emissions from the ESD sectors. In comparison to 2015, emissions stagnated; from 2005 to 2016, they decreased by almost 29 % (proposal for the Third annual report on the implementation of OP TGP 2020).

In the last year, emissions stagnated, but are still moving away from the indicative sectoral objective OP TGP-2020. The value of financial incentives for EE and RES has been constantly decreasing after 2012; in 2016, no grants were given. Indicator of the share of RES in the use of fuels in non-ETS industry substantially worsened in 2016, but is still above the annual objective; however, the trend in the last two years has not been favourable to achieve the objective in 2020 (Podnebno ogledalo, 2018b, page 16).

Waste. In 2016, GHG emission from waste management represented 5 % emissions from ESD sectors. In comparison to the previous year, they decreased by one per cent. The majority of GHG emissions from the waste sector are represented by methane emissions (proposal for the Third annual report on the implementation of OP TGP 2020).
In the future, emissions will be reduced rapidly due to significantly lower quantity of biodegradable waste disposed; thus, the 2020 target is attainable. The quantity of biodegradable waste disposed decreased significantly in 2016 and was 94 % lower than in the preceding year. Thus, the quantity was lower also from the 2020 objective. Reduction was the result of two measures, separate waste collection and construction of the systems for mechanical biological treatment of mixed municipal waste before disposal. Emissions i the sector are also contributed by waste water management, which in 2016 contributed 31 % to total emissions of the sector waste (Podnebno ogledalo, 2018b, page 16).

Energy industries (neETS). According to Decision 406/2009/EC, emissions include emissions from combustion of fuels in energy industries outside the ETS scheme. The majority represent emissions in remote heating systems and fugitive emissions (68 %). The share of energy industries in total non-ETS emissions in 2016 was 4.3 %. In 2005−2016 period, emissions fall almost by 18%. In the last two years, emissions have increased, by 6.7 % in year 2016. Increase in emissions is the result of increased emissions in the remote heating and increase of fugitive emissions. Emissions in this sector currently meet the indicative sectoral objective and are considerably below the trajectory set (Podnebno ogledalo, 2018b, page 16).

Building capabilities necessary for the implementation of measures and coordination
The OP TGP 2020 objectives for this area are (Second report on the implementation of OP TGP, pages 14):
– education and training for the transition to low-carbon society;
– strengthening of human resources for opening new green working places;

COURTESY TRANSLATION

– information about the benefits of mitigating climate changes and practical aspects of the implementation of measures.

After the adoption of OP TGP 2020, the Government of the Republic of Slovenia adopted the following programme and action documents, which affect the implementation of measures for the reduction of GHG emissions in transport (Second report on the implementation of OP TGP, page 14).

- Operational programme for the implementation of European cohesion policy for the 2014−2020 period (OP EKP), 2015;
- Expenditure programme for the funds of the climate change fund in years 2017 and 2018.
- ¤Framework programme for the transition to green economy (OPZG) with the Action plan of implementation of OPZG (ANi OPZG) and Activityy plan of ministries and government services (NAMVS) for years 2015 and 2016.

In Slovenia, different operators (government and non-government sector, economy, expert institutions, media etc.) carry out the activities of education, training, information and awareness rising in the area of mitigating climate changes. Activities are financed from different sources, namely from the state budget, funds from the climate change fund, funds from EU funds and programmes and other international and national sources (Second report on the implementation of OP TGP, page 14). However, in Slovenia we still do not have a systematic planning of training for the transition into low-carbon society, since one of the key OP TGP measures – Detailed training plan for moving to a competitive low-carbon economy, has not started to be implement yet, in spite of the fact that considerable funds are available for this purpose (Podnebno ogledalo, 2018b, page 1).
Within the framework of the preparation of the National Environmental Action Programme (NPVO), coordination for the integration of contents of sustainable development into the education system was strengthened. Implementation of measures and their effects in the area of education, training information and awareness rising, is not yet the subject of a sufficiently systematic monitoring (Podnebno ogledalo, 2018b, page 21).

The assessment of staffing capacity at the ministries for the implementation of measures indicates that most of staffing capacity is intended for administrative tasks for allocating financial incentives and less for other development and implementing tasks (Second report on the implementation of OP TGP, page 14).

Other cross cutting measures

Other cross cutting measures also contribute to the reduction of GHG emissions (Podnebno ogledalo, 2018b, page 20):

- the measure necessary to be implemented with a view to achieving final energy savings at the final consumers (defined in detail AN URE),
- renewed support scheme for promoting generation of electricity from RES in the co-generation of heat and electricity (SPTE) of high efficiency (enforced in 2017),
- establishing the support scheme for the generation of heat from RES (not implemented (yet)),

COURTESY TRANSLATION

- integrating measures of transition to low-carbon society into spatial policy is carried out under the preparation of the Spatial Development Strategy of Slovenia, which will enable the preparation a wider set of measures of spatial policy for transition to low-carbon society and their implementation in practice (in transport, these are mainly measures to reduce the needs for transport work and for the promotion of sustainable transport. In the field of buildings, this is particularly integrated planning of buildings and settlements (new or during renovation), including the planning of systems that exploit RES in the built environment,

Organisation of implementation

OP TGP does not set objectives for this area, but within the framework of the Second report on the implementation of OP TGP it was highlighted that implementation of measures could be more effective, if (Podnebno ogledalo, 2018b, page 20):

- for implementing OP TGP, sufficient human capacities are planned, in particular at the Ministry of the Environment and Spatial Planning;
- enhancing the training for the implementation of measures;
- the process of cooperation of stakeholders in early phases of the creation of measures and when addressing issues related to the implementation of measures, is established;

The results of social science analysis, oriented also to staff capacities of individual institutions included in the implementation of OP TGP showed that the systemic staff malnutrition at the Ministry of the Environment and Spatial Planning is outstanding. OP TGP 2020 is a complex programme of measures in eight sectors, whereby almost half of them is carried out in cooperation between two or more institutions. In 2017 the coordination of implementation of measures in the field of sustainable mobility and energy contracting in the public sector strengthened; there are still clear gaps in coordination in the area of green economic growth, (that are also evident in subsidises that contradict the objectives of reducing greenhouse gas emissions, and in uneven promotion of measures that cause extreme demand peaks) and in promotion of measures in SMEs and industry in general (Podnebno ogledalo, 2018b, page 20).

4.2.2 Renewable energy

In the area of developing renewable energy sources, Slovenia must achieve ambitious targets that will contribute to increasing the reliability of energy supply, reducing impacts on the environment, economic growth and the development of jobs and employment. (AN OVE 2020 – 2017 update, page 15).

In 2005 the share of RES in final overall energy consumption in Slovenia was 16.2 %. Slovenia must achieve at least a 25 % share in the balance of final energy by 2020. The most important renewable source of energy in the country is wood biomass, followed by hydroenergy, while in recent years development has been most dynamic in exploiting solar energy and biogas. The potentials of these energy sources, plus the potentials of wind and

COURTESY TRANSLATION

geothermal energy, will contribute to increased consumption of renewable energy sources (AN OVE 2020 – 2017 update, page 15).

According to the SURS's data, the share of RES in gross overall energy use in Slovenia was 22.0 % in 2015, whereby the plan according to AN OVE-2010 was exceeded by 0.8 percentage point. In the 2005−2015 decade, the share of RES increased by 6.0 percentage points, and in the 2016−2020 five-year period the share of RES will have to be increased for another 3.0 percentage points. The reason for exceeding the target in particular lies in 5.9 % smaller gross overall energy use relative to the AN OVE-2010 projection for 2015, despite the fact that the production of energy from RES is by 2.4 % smaller that the planned one. The heating and cooling sector mostly contributed to exceedance of the target, while the targets in the electricity and transport sectors are off track (Draft National Renewable Energy Action Plan 2010–2020 – 2017 update, page 22).

With 33.4 % share of RES in gross overall energy use for heating and cooling, the 2020 target has been fully implemented as early as in 2013, and even exceed by 2.5 percentage points. In the 2005–2015 period, the share of RES in this sector increased by 15.1 percentage points and achieved the value of 34.1 %. The key reason lies in a smaller use of energy; since 2005, the use of energy for these purposes has reduced by 22.0 %, while the exploitation of RES increased by 40 %. A large part of increase between 2008 in 2009 is a result of the improved capture of statistical data on exploitation of wood biomass in households, which includes their use of other RES, while in the last period, it is in particular the result of the reduced use of energy for heating (Draft National Renewable Energy Action Plan 2010–2020 – 2017 update, page 22).

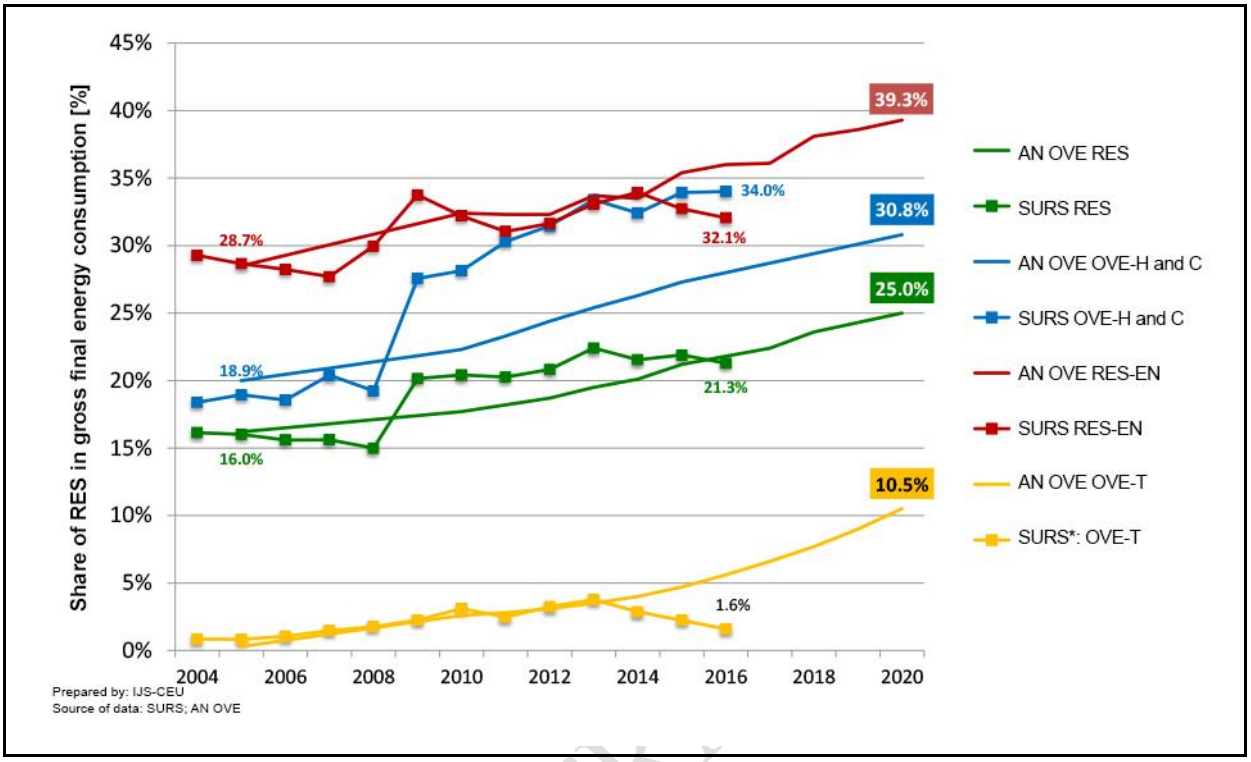
The increase in share of electricity generation from RES was slightly lagging behind the plans in 2015, since the share of RES in gross final electricity consumption was 32.7 %, which is 2.7 percentage points less than it was planned for that year, and for additional 6.6 percentage points less than the 2020 target. In the last year, the share reduced for 1.2 percentage points. In the 2005–2015 period, the share of electricity from RES increased for 4.1 percentage points, because the electricity generation from RES increased by 14.0 %, while the gross final electricity consumption remained practically the same, namely it reduced by 0.2 %. The increased exploitation of RES is, in particular, the result of the increased electricity generation in solar power plants, which was much higher than planned; regarding all other technologies, the production growth was smaller than planned (Draft National Renewable Energy Action Plan 2010–2020 – 2017 update, page 22).

Since 2005 the share of RES in transport has been increasing, namely by 3.5 % in 2013, but has significantly decreased in 2015 to 2.2 %. In 2015 the methodology of monitoring the RES share in transport changed. Again, this sector has been lagging behind the 2020 target for as much as 7.8 percentage points, as well as the planned share for 2015 (Draft National Renewable Energy Action Plan 2010–202 – 2017 update, page 22).

More information is available in the figure and tables below.

COURTESY TRANSLATION

Figure: Achievement of the target shares of RES in the period until 2015 considering the national objective and indicative sector targets of AN OVE-2010. For the transport sector, the projection from AN OVE-2010 in force is prepared according to the old methodology, while the statistical data according to the new one



Source: Draft National Renewable Energy Action Plan 2010–2020 – 2017 update, page 23.

COURTESY TR

Table: Share of RES in gross overall energy use in 2005 and target share in 2020

A. Renewable energy share in gross final energy consumption for 2005	[%]	16.2
B. Renewable energy target in gross final energy consumption for 2020	[%]	25.0
C. Expected total adjusted gross final energy consumption for 2020	[ktoe]	5,118
D. Expected amount of renewable energy that corresponds to the 2020 target	[ktoe]	1,278

Source: Draft National Renewable Energy Action Plan 2010–2020 – 2017 update, page 53.

Table: Share of RES, use of gross final energy and use of gross final energy from RES – projection for the 2015–2030 period. The projection is the same for both variants: REF-SE and REF-VE[35]

		2005	2010	2013	2014	2015	2020	2025	2030
	Share of RES [%]								
REF:	OVE-H and C:	18.9 %	28,1 %	33.4 %	32.4 %	34.1 %	34.5	31.7	30.5
REF:	RES-EN	28.7 %	32.2 %	33.1 %	33.9 %	32.7 %	38.6	43.5	47.4
REF:	OVE-P20	0.8 %	3.1 %	3.8 %	2.9 %	2.2 %	10.1	10.1	10.1
REF:	RES	16.0 %	20.4 %	22.4 %	21.5 %	22.0 %	25.0	26.3	27.0
	Gross final consumption of energy [Mtoe]								
REF:	H and C	2.37	2.26	1.94	1.75	1.84	1.84	1.84	1.86
REF:	EN	1.27	1.22	1.25	13	1.27	1.26	1.31	1.36
REF:	p21	1.44	1.77	1.80	1.78	1.76	2.02	2.13	2.20
REF:	In total	5.08	5.25	4.99	4.78	4.88	5.12	5.28	5.42
	Gross final consumption of energy from RES [Mtoe]								
REF:	OVE-H and C:	0.45	0.64	0.65	0.57	0.63	0.63	0.58	0.57
REF:	RES-EN	0.36	0.39	0.41	0.42	0.42	0.49	0.57	0.64
REF:	OVE-T	0.00	0.05	0.06	0.04	0.03	0.16	0.23	0.25
REF:	RES	0.81	1.07	1.12	1.03	1.07	1.28	1.39	1.46

Source: Draft National Renewable Energy Action Plan 2010–2020 – 2017 update, page 27.

COURTESY TRANSLATION

[35] Source: Statistical data for the years between 2005 and 2014, SURS, SI STAT data portal, 2 February 2016.

Table: Movements of the gross final energy consumption in Slovenia for heating and cooling, electricity and transport in the 2010–2015 period, and the expected gross final energy consumption in the 2016−2020 period taking into account the effects of EE measures in the reference scenario.

[ktoe]	2005	2010	2011	2012	2013	2014	2015
	Base year	SURS data					
1. Heating and cooling(1)	2,370	2.259	2.096	1.961	1.938	1.750	1.841
2. Electricity(2)	1,272	1.215	1.250	1.248	1.248	1.240	1.270
3. Transport pursuant to Article 3(4)a(3)	**1,443**	1.771	1.874	1.891	1.797	1.783	1.759
4. Gross final energy consumption(4)	**5,079**	5.248	5.224	5.104	4.991	4.785	4. 882

[ktoe]	2016		2017		2018		2019		2020	
		REF		REF		REF		REF		REF
1. Heating and cooling(1)		1,840		1,839		1,838		1,837		1,836
2. Electricity(2)		1,269		1,268		1,267		1,266		1,264
3. Transport pursuant to Article 3(4)a(3)		1,811		1,863		1,915		1,966		2,018
4. Gross final energy consumption(4)		**4,920**		**4,970**		**5,019**		**5,069**		**5,118**

(1) Final consumption of all energy products except electricity for purposes that do not include transport, plus heat for own consumption in power stations and heat stations and heat losses in networks (points 2 ‘Own use by plant’ and 11 ‘Transmission and distribution losses’ in Regulation (EC) No 1099/08 (pages 23–24)).

(2) Gross final electricity consumption is gross national production of electricity, including own generation, plus imports minus exports.

(3) Final energy consumption in transport,

(4) as defined in Article 3(4)(a) of Directive 2009/28/EC. This includes final energy consumption plus network losses and own use of heat and electricity in power and heat stations (note: does not include electricity consumption for pumped storage hydroelectric stations or conversion in electric heaters or heat pumps in heat stations for district heating).

Source: Draft National Renewable Energy Action Plan 2010–2020 – 2017 update, page 47.

COURTESY TRANSLATION

The last available data of the Statistical Office of the Republic of Slovenia on use of renewable energy sources are shown in the below table.

Table: Use of renewable energy sources (total share and by sectors)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
RES heating and cooling (%)	18.39	18.95	18.55	20.40	19.24	27.56	26.14	30.29	31.46	33.40	32.42	33.93	34.01	-
RES electricity (%)	29.27	28.65	28.23	27.70	29.96	33.76	32.20	31.04	31.63	33.09	33.94	32.73	32.06	-
RES transport (%)	0.85	0.83	1.06	1.47	1.77	2.25	3.12	2.48	3.25	3.77	2.88	2.24	1.60	-
RES overall share (%)	16.15	16.02	15.60	15.61	15.00	20.15	20.42	20.26	20.82	22.41	21.54	21.89	21.29	-

Source: prepared based on the data of the Statistical Office of the Republic of Slovenia, 27 November 2018

Environmental and other limitations that affect deployment of renewable energy in Slovenia

As already mentioned in section 3.1.2, the large hydroelectric power plants in Slovenia have both energy and macroeconomic advantages, therefore the further hydropower potential is planned to be used, meaning that 62 % of the technical potential could be used by 2030 in Slovenia. This technical potential cannot be fully used on the planned water bodies due to the environmental restrictions relating to the implementation of projects, and is thus reduced by slightly over one quarter. However, in order to achieve the targets set in relation to RES at the minimum level, also RES in the protected areas should be exploited; thus, projects are planned also in the NATURA 2000 area (Draft AN OVE 2010–2020 (update 2017), page 9).

'In the absence of any implementing arrangements with no significant effect on Natura 2000 for the planned large HPP, located in the Natura 2000 area, by 2030, and consequently no building of HPP realised, the AN OVE target will not be reached neither in 2020 nor in 2030' (Draft AN OVE 2010–2020 (update 2017), page 9).

In implementing the measures, account is taken of the **environmental objectives in the area of water, biodiversity, environment and cultural heritage** that need to be observed in planning eligible use of space through national and municipal spatial acts.

Besides nature conservation factors, the realisation of projects in the field of large HPP depends significantly also on the activity of the Government as regards determination of concession obligations, placing procedures as realisation of water infrastructure associated with such projects, and also investment capacities of concessionaires in this period. Becuse there is a substantial likelihood that the HPP Mokrice project is not completed by 2020, AN OVE will have to be complemented by activities to speed up the execution of other AN OVE projects that were foreseen for the implementation in the period 2020–2030; priority will be given to measures in the " district heating and industry sectors, as well as other cost efficient measures (Draft AN OVE 2010–2020 (update 2017), page 9).

In the framework of the comprehensive environmental impact assessment procedure in order to update AN OVE 2017, an appeal procedure against the plans of Slovenia for the long-term

COURTESY TRANSLATION

energy exploitation of the Mura River is underway. If the non-governmental environmental organisation will succeed in the appeal procedures, the Mura River will no longer be the source that Slovenia could use to achieve the RES targets by 2030. The energy exploitation of the Mura River is currently insignificant (<1 %), while the potential of watercourses used by the small hydro power plant accounts for a 25.5 % share (Draft AN OVE 2010–2020 (update 2017), page 9). The below tables show the HPP potential in Slovenia, and the potential energy use of the Mura River, as specified in the Draft AN OVE 2010–2020 (update 2017), pages 30 and 35).

Table: The HPP potential in Slovenia, taken from the study of University of Ljubljana, Faculty of Civil and Geodetic Engineering, and updated in relation to construction of new and modernisation of the existing HPP that were implemented in the period until 2014

	Gross potential	Technically exploitable potential	Annual production	Share of exploitation of technical potential
	[GWh/year]	**[GWh/year]**	**[GWh/year]**	**[%]**
	GWh/year	GWh/year	GWh/year	%
Sava River	4,134	2,794	790	28 %
Drava River	4,301	2,919	2,887	99 %
Soča River	2,417	1,442	491	34 %
Mura River	928	690	5	0.7 %
Kolpa River	310	209	0	0 %
Other watercourse	7,350	1,114	284	25 %
Slovenia – in total	19,440	9,168	4,457	49 %

Source: Draft AN OVE 2010–2020 (2017 update,), page 30.

Table: Potential areas for the construction of HPP above 10 MW by 2030

Potential energy use of the Mura River					
Power plants at the border section with Austria to the motorway bridge at Vučja vas on the inner Mura River	Based on the results of the environmental assessment and cross-border assessment with Austria, Hungary and Croatia, which have already requested for the notification, the total power of power plants amounts from II do 53 MW.	Power plants at the border section with Austria to the motorway bridge at Vučja vas on the inner Mura River. A concession[31] was awarded for the energy use of the Mura River, namely for 8 power plants in the area from Vrh to Veržej.	**Environmental** Assessment referred to in OP shows that the impact of HPP constructed on the Mura River could be assessed as an essential due to the significant impacts on the protected and endangered species, and areas with environmental protection status. It is very likely that in the further procedures of decision-making, the public interest of climate protection / use of RES might prevail over the public interest of nature protection. Since the outcome of this procedure is uncertain, it is possible that the energy potential in this area might be used in a limited scope or even that the project will not be implemented. Even in case of a positive outcome, it is possible that the procedure will not be implemented by 2030 for reasons of its duration.	up to 23 MW*	2020–2022 period

Source: Draft AN OVE 2010–2020 (2017 update,), page 35.

Stakeholders that contest the environmental assessment for the further use of hydropower on the Mura River under AN OVE 2017 insist that the exclusion zones be mandatory declared, under which Natura 2000 areas definitely fall according to their opinion and which cover 37 % of area in Slovenia that also includes a large part with hidropower and wind potential, thereby strongly undermining the achievement of the targets set for the RES deployment in Slovenia in a manner that is currently planned.

COMMISSION TRANSLATION

Under support scheme for electricity generation from RES and high-efficiency CHP, the problems regarding implementation were identified, namely difficulties in placement of wind power stations and national spatial plan adoption and, consequently, difficulties in acquiring of construction licences for wind power stations. Since the approval of the scheme in 2016, the Energy Agency has published and concluded three public calls, namely in 2016, 2017 and 2018, in the framework of which 19 projects of new hydro power stations were selected, 24 projects of renovated hydro power plants, 44 projects of solar power plants, 61 projects of wind power stations, 3 landfill biogas power plants, 1 biogas power plant and 11 wood biomass power plants were selected. Of the selected projects, only 6 new or renovated hydro power plants, 1 landfill biogas power plant and 1 wood biomass power plan were realised by mid-2018 (Ministry of Infrastructure, 2018).

Analyses of the last two public calls under the support scheme show that the number of applications is high, but lower for the selected projects, whereby the realisation is critical since so far only 8 were realised. It is estimated that realisation of all approved projects is questionable mainly due to the difficulties in physical placement and adoption of national spatial plans and, consequently, difficulties in acquiring of construction licences. The same problems were detected as part of the realisation of large hydro power plants.

In Slovenia, the placement procedures for large hydro power plants are demanding and are not given a priority, meaning that they do not have the priority status at the national level. Construction of HPP on the mid Sava River, which represents the other large technical potential for the use of hydropower has not yet begun, despite the necessity and priority of its construction being specified in different documents (e.g. coalition contract). The reason lies in the indeterminate procedure of drawing up the national spatial plan (NSP) for the lower three HPP (Renke, Trbovlje and Suhadol HPPs), which has formally started but has not made any progress in the past two years.

In Slovenia, further promotion of RES is strongly conditioned by a relevant environmental and spatial legislation, which can be only partially be influenced by the state, since this area is strongly regulated by the EU legislation and international conventions. Thus Slovenia estimates that the question of collision of environmental and energy targets, as well as the demanding placement, will have to be addressed at the EU level though common measures. The further realisation of the RES projects, in particular from the area of hydropower and wind, will be extremely hard to carry out, since the procedures arising from the environmental assessments and placements are very long and lead to negative results for the investors.

Currently, biomass has a great potential as the the renewable energy source, but there are restrictions to its introduction due to the EU requirements in terms of air quality in certain areas. It has to be pointed out that placement of the RES investments in the NAUTRA 2000 areas is more expensive and complex due to the additional measures of the environmental requirements, while it also constitutes a greater risk for the implementation of projects. The aforementioned will also have a major influence on achievement of the set RES targets in the future.

COURTESY TRANSLATION

The set AN OVE objective, i.e. the 27 % share of RES in 2030, will not be achieved by implementation of projects outside the Nature 2000 areas and projects that have no significant impact on the environment. In order to achieve this objective, the project of construction of HPPs would also have to be implemented, but their impact on nature is likely to be assessed as significant. If in the environmental report prepared as part of the NSP's drawing up, the impact of these HPPs will be assessed as significant, the procedure of public interest of climate protection / use of RES overriding the public interest of nature protection will have to be implemented in the further drawing up of NSP, which has not yet been done in Slovenia and, thus, the duration of procedures and the final result cannot be predicted (Ministry of Infrastructure, 2018).

4.3 Dimension Energy efficiency

Slovenia pursues the indicative national target of improving energy efficiency by 20 % by 2020. This target means that the primary energy use will not exceed 7.125 Mtoe (82.86 TWh) in 2020. The following indicative targets were also set by Slovenia under AN URE 2020:

- at the level of **final energy consumption**, the overall final consumption in 2020 will not exceed 59.52 TWh;
- at the level of **final energy consumption in industry**, the overall final consumption in 2020 will not exceed 15.21 TWh;
- at the level of **final energy consumption in transport**, the overall final consumption in 2020 will not exceed 25.59 TWh;
- at the level of **final energy consumption** in households, the overall final consumption in 2020 will not exceed 12.10 TWh;
- at the level of **final energy consumption in services**, the overall final consumption in 2020 will not exceed 6.62 TWh.

In Slovenia, the activities in the area of energy efficiency (EE) arise from the National Energy Efficiency Action Plan (AN URE 2020) as the umbrella document. AN URE 2020 was prepared in line with the prescribed template, and meets all requirements under Directive 2012/27/EU on energy efficiency.

The evaluation of the achievement of the indicative national target of improving energy efficiency by 20 % by 2020 was favourable in 2018; with primary energy use of 8.2 TWh in 2016, Slovenia remained within the indicative target for that year, but the primary energy use increased by 5 % compared to the previous year (Evaluation of the AN URE 2020 implementation for 2016, page 10). The below figure shows the primary energy trends at the national level. The trend is favourable, but it does not yet indicate the long-term management of the primary energy use.

*Figure: **Primary energy** consumption trends in the 2000–2015 period, under Directive 2012/27/EU on energy efficiency, compared to indicative target for 2020*

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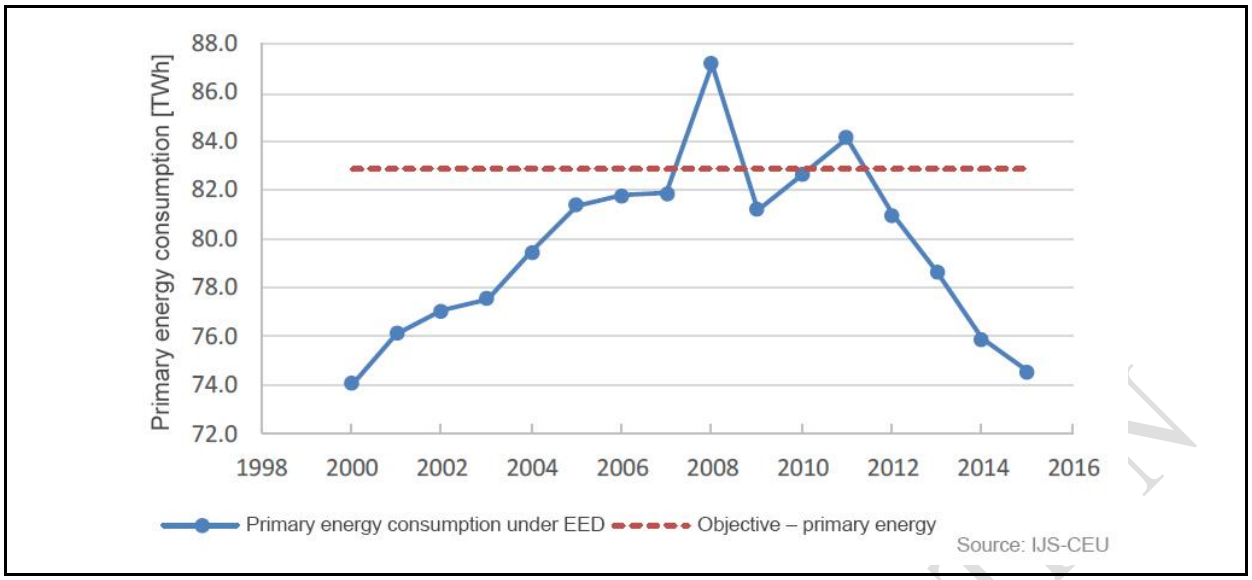
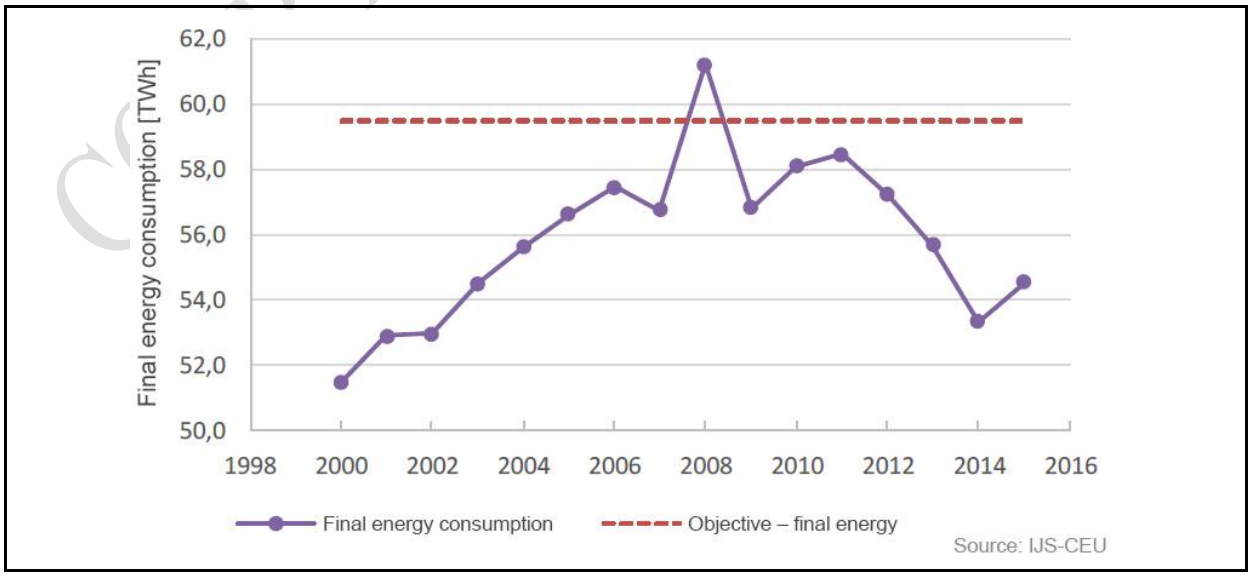


Source: National Energy Efficiency Action Plan 2017–2020, page 12

A short-term, but major growth in the final energy consumption in any of the sectors, e.g. in transport, where the final energy consumption, that represented 38 % of the overall final energy consumption in 2015, is very variable, could seriously threaten the achievement of the objective of the primary energy consumption. Assessments of the basis of monthly data on the petrol and diesel consumption show that the energy consumption in transport in 2016 has, compared to 2015, grown by 6.4 %, which would mean approximately 2 % growth in energy supply (primary energy consumption). Final energy consumption represents approximately 70 % the energy supply. Final energy consumption in 2015 was lower than the 2020 indicative target, namely for 8 %. Final energy consumption has been decreasing since 2010 (National Energy Efficiency Action Plan 2017–2020, page 11).

The below figure shows the primary energy trends at the national level. This figure also testifies of favourable trend in achievement of targets.

*Figure: **Final energy** consumption trends in the 2000–2015 period, compared to the indicative target for 2020*



Source: National Energy Efficiency Action Plan 2017–2020, page 12

In terms of energy efficiency, it is worth drawing attention to the Action Plan for Nearly Zero-Energy Buildings by 2020 (AN sNES)[36].

Action Plan for Nearly Zero-Energy Buildings by 2020

Article 330 of the Energy Act (EZ-1) sets out the requirement for all new buildings to be nearly zero-energy. The term 'nearly zero-energy building', transposed from the Directive 2010/31/EU on the energy performance of buildings, means a building with very high energy efficiency or requiring a very low quantity of energy in order to function, where the energy required is produced to a large degree from renewable energy sources at the actual location or nearby. Provision of Article 330 of the Act states that the obligation of the nearly zero-energy building will apply from 31 December 2020. Moreover, it is stated that Article 330 will apply from 31 December 2018f or new buildings owned by the Republic of Slovenia or by local self-governing communities and occupied by public sector entities (AN SNES, 2015, page 6). In line with the above, the Government adopted the Action Plan for Nearly Zero-Energy Buildings by 2020 at its session in April 2015 (AN-sNES).

This action plan provides a projection of the dynamics for construction of the nearly zero-energy building namely for new single-family and multi-family houses. In accordance with recast of Directive 2010/31/EU on the energy performance of buildings, the Member States must ensure that all new buildings will be nearly zero-energy building by 31 December 2020. On the basis thereof, the 100 % share of new buildings that will satisfy the requirement of the nearly zero-energy building as of 1 January 2021 was identified. This share will be reached gradually; it was relatively small in the building stock at beginning in 2015, and is based on experience in constriction of passive and low-energy buildings with a high share of RES. It is assumed that the share of nearly zero-energy building will rapidly increase as late as when approaching the deadline set by the Directive for the enforcement of the requirement. The key instruments are as follows: incentives in the form of grants and returnable funds, the provision of information to investors (energy efficiency and RES technologies, examples of good practice derived from buildings constructed, open days for nearly zero-energy buildings), advisory services, and the training of engineering and implementation staff (AN sNES, 2015, page 34).

Table: Intermediate targets for the nearly zero-energy renovation of buildings in the residential and service sector

AN sNES intermediate targets – complete renovation (cumulative)		**2015**	**2018**	**2020**
Residential buildings	m²	76,850		267,500
Multi-family houses	m²	9,753		73.650
Public buildings	m²	53,320	84,126	
Other non-residential buildings	m²	50,030	115,970	

[36] **Action Plan for Nearly Zero-Energy Buildings by 2020 (AN sNES)**, available at http://www.energetika-portal.si/fileadmin/dokumenti/publikacije/an_snes/ansnes_final_apr_2015.pdf

COURTESY TRANSLATION

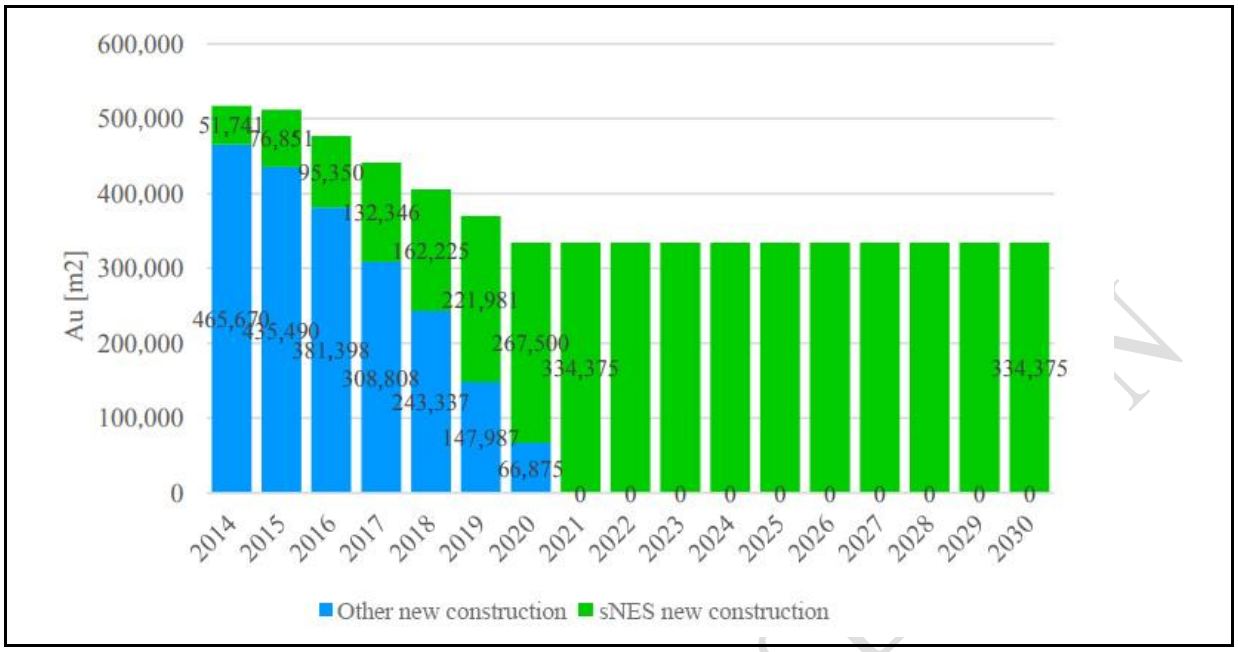
AN sNES intermediate targets – complete renovation (cumulative)		2015	2018	2020
Single-family houses	m²	241,000		2,395,000
Multi-family houses	m²	88,000		596,000
Public buildings	m²		123,000	
Other non-residential buildings	m²		190,000	
Public buildings owned and occupied by central government (3 % under EED)	m²	2,000	20,000	

Source: AN sNES, 2015, page 46.

The below figures show the above presented projection for the construction of new single-family and multi-family nearly zero-energy buildings in comparison to the other newly constructed buildings.

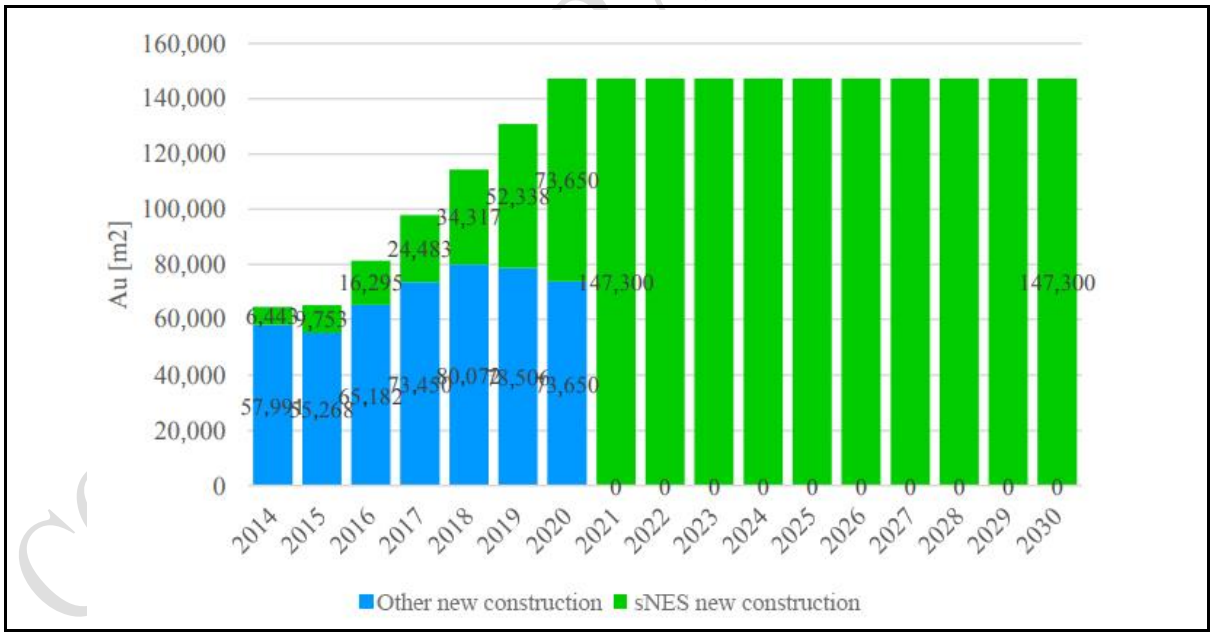
COURTESY TRANSLATION

Figure: Projection for the construction of new single-family houses, with an estimate of the potential for the gradual introduction of construction of nearly zero-energy single-family houses



Source: AN sNES, 2015, page 35.

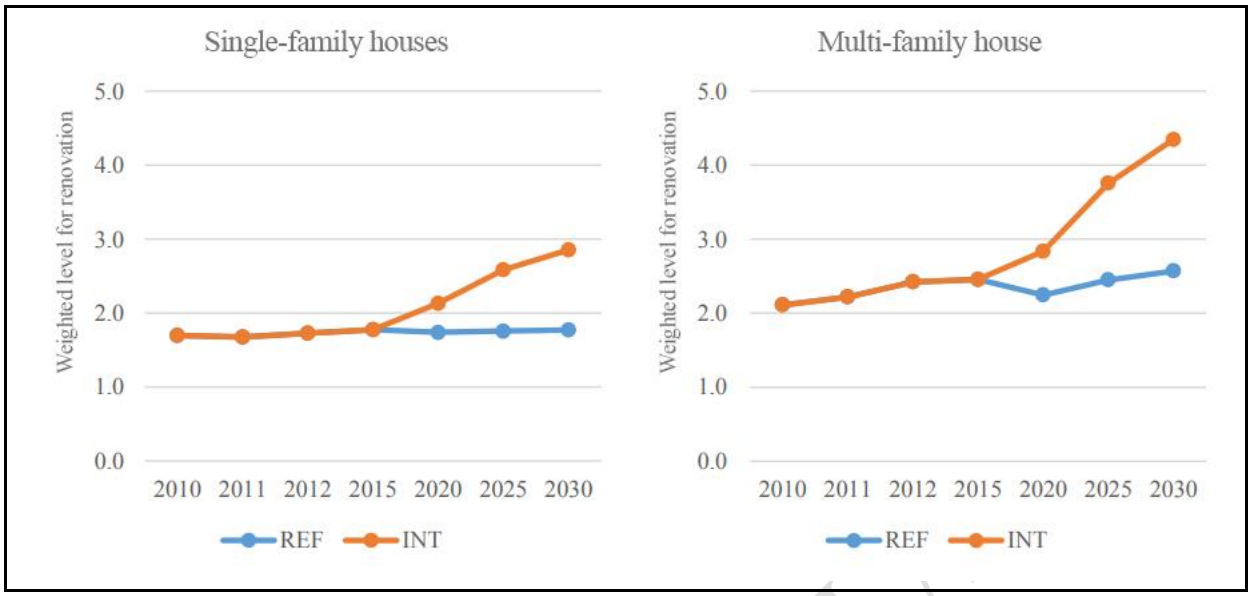
Figure: Projection for the construction of new multi-family houses, with an estimate of the potential for the gradual introduction of construction of nearly zero-energy single-family houses



Source: AN sNES, 2015, page 35.

The projected weighted level for renovation of single-family houses by 2030 is approximately 1.75 % and for multi-family houses 2.5 %.

Figure: Weighted level for renovation in the period for single-family and multi-apartment buildings in the reference (REF) and intensive (INT) strategy



Source: AN sNES, 2015, page 37.

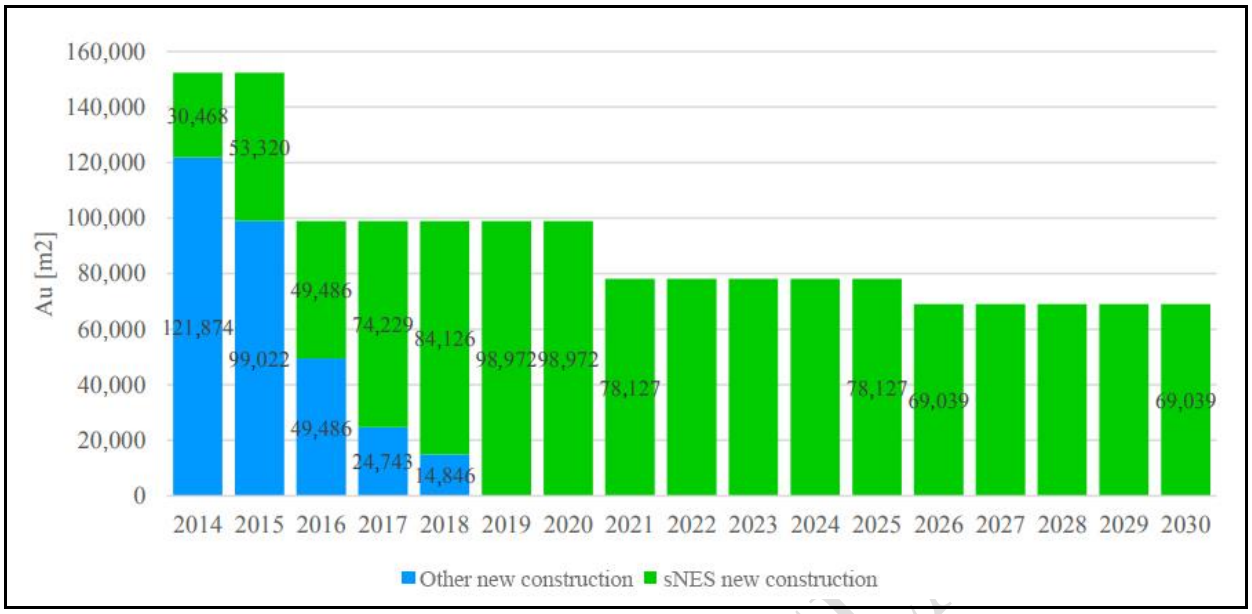
In accordance with recast of Directive 2010/31/EU on the energy performance of buildings, the Member States must ensure that all new buildings will be nearly zero-energy building by 31 December 2018, thus the share of new buildings that will satisfy the requirement of the nearly zero-energy building as of 1 January 2019 will be 100 %.

Pursuant to AN sNES (2015, page 41), the instruments required for ensuring the nearly zero-energy new construction of non-residential buildings are as follows: financial incentives in the form of grants and returnable funds (for the public sector chiefly cohesion funds), international sources of financing, the training of contracting authorities, project designers, contractors and users of nearly zero-energy buildings; the upgrading of regulations and the introduction of certification for sustainable buildings, the promotion of energy efficiency within spatial planning, the development of solutions for the renovation of buildings protected under the regulations on cultural heritage protection and for other special building groups (type-specific solutions for non-residential and public buildings), a link to the support scheme for the supply of heat from RES, the legal bases for target indicators for energy efficiency and RES in the public sector, the rerouting of some financial incentives to demonstration projects (cohesion funds), the monitoring of the indicators of achievement, and promotion.

The below figures show the above presented projection for the construction of new nearly zero-energy buildings in comparison to the other new construction.

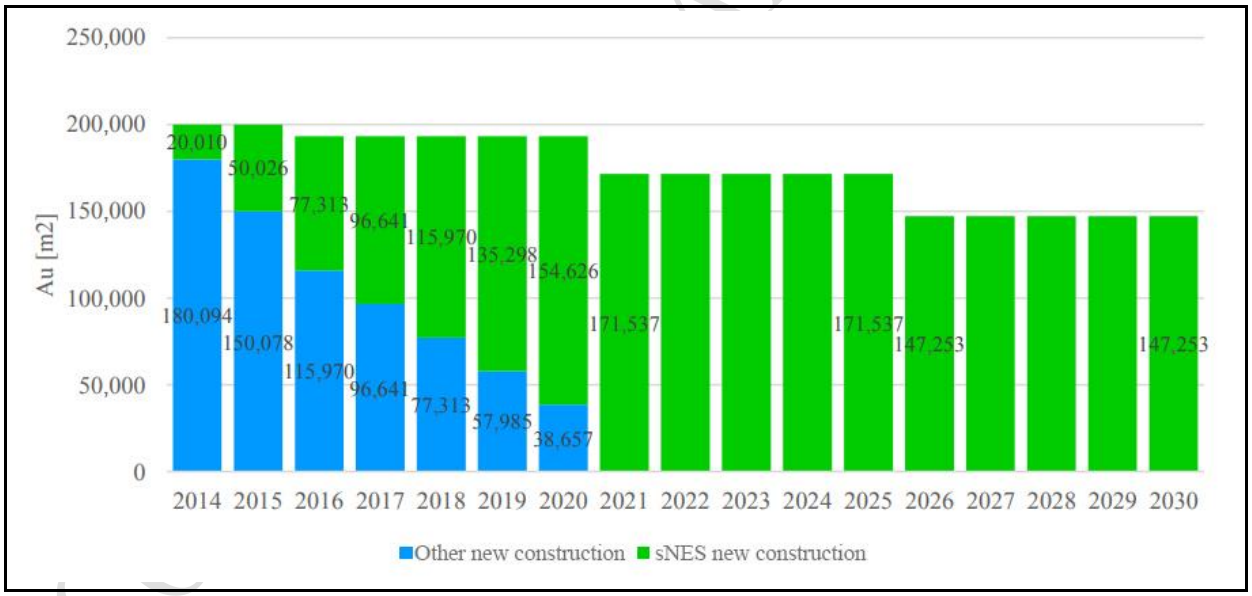
COURTESY TRANSLATION

Figure: Projection for the construction of new public buildings, with an estimate of the potential for the gradual introduction of new nearly zero-energy public buildings



Source: AN sNES, 2015, page 42.

Figure: Projection for other new non-residential buildings, with an estimate of the potential for the gradual introduction of new nearly zero-energy non-residential buildings



Source: AN sNES, 2015, page 42.

The updated report (2018) on the determination of 'cost-optimal levels of minimum energy performance requirements for buildings and building elements' provides a calculation of cost-optimal levels of minimum energy performance requirements for buildings, taking into account the comparative methodological framework and relevant parameters such as climatic conditions and the practical accessibility of energy infrastructure, and compare the results of these calculations with the minimum energy performance requirements in force. Slovenia's building stock has for this purpose been illustrated by means of reference buildings. A total of 18 reference buildings for new and existing buildings that are the object of partial and

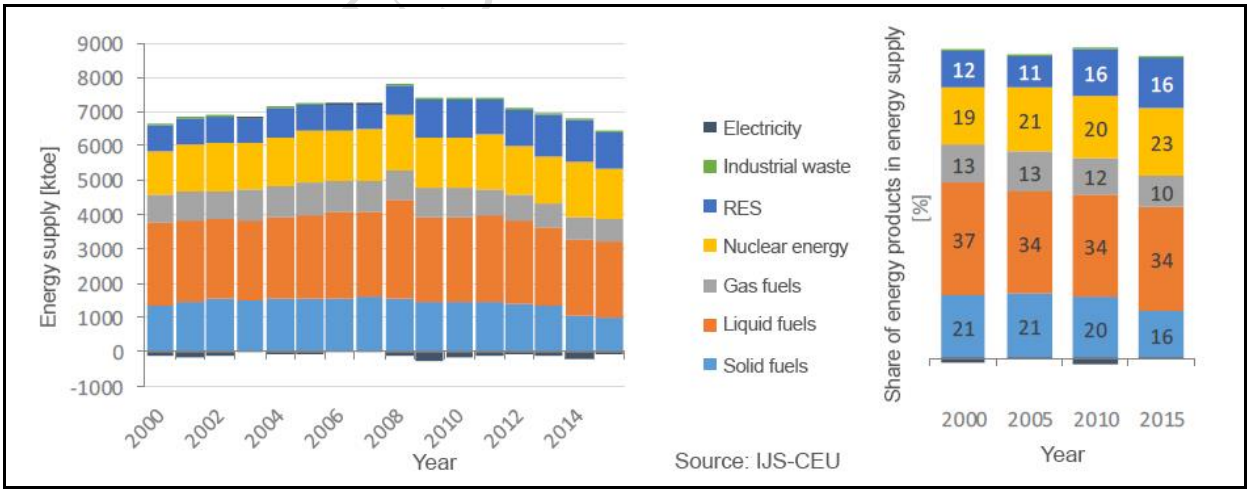
complete renovation have been analysed. The categories represented are single-family houses, multi-family houses, public buildings and non-residential buildings. Energy performance measures have been defined for new buildings and existing buildings in which major renovation work is taking place. Primary energy use has been calculated for the cases under observation according to the Regulation and the Guideline.

In the updated report, the changes in prices of investments in measures that effect the energy performance of new and renovated buildings were taken into consideration, which were the main elements of the 2018 study update. In the period of the last five years after determination of 'cost-optimal levels of minimum energy performance requirements for buildings and building elements' for Slovenia, the increase in investments in construction, craftsman and installation works has been detected; in particular, the increase in prices has been evident in the 2016–2017 period, which can be linked with the renewed economic growth and revival of civil engineering, as well as with the launch of the programme of energy-saving renovation in the country.

4.4 Dimension Energy security

In 2015 **energy supply** was 6,454 ktoe. Compared to 2014 it decreased by 2 %, and compared to 2000 by 1 %. The highest energy consumption was 7,650 ktoe in 2008. In the energy supply structure in 2015, liquid fuels accounted for the bulk (34 %), followed by nuclear energy (23 %), solid fuels and renewable energy sources (RES) both accounting for 16 %, natural gas (10 %) and waste (1 %). Net electricity import accounted for -0,1 % of total consumption (more electricity was exported than imported). Of the fossil fuels, Slovenia only produces solid fuels (AN URE 2020, page 14).

Figure: Energy supply by energy products in the 2000–2015 period, and the share of energy products in energy supply in 2000, 2005, 2010 and 2015



Source: National Energy Efficiency Action Plan 2017–2020, page 15

From 2000 to 2015, **final energy consumption** in Slovenia increased by 6 %. The most significant contributing factor was **final energy consumption in transport**, which rose by 46 % in the same period. In 2015 the share of transport in final energy consumption was 38 %.

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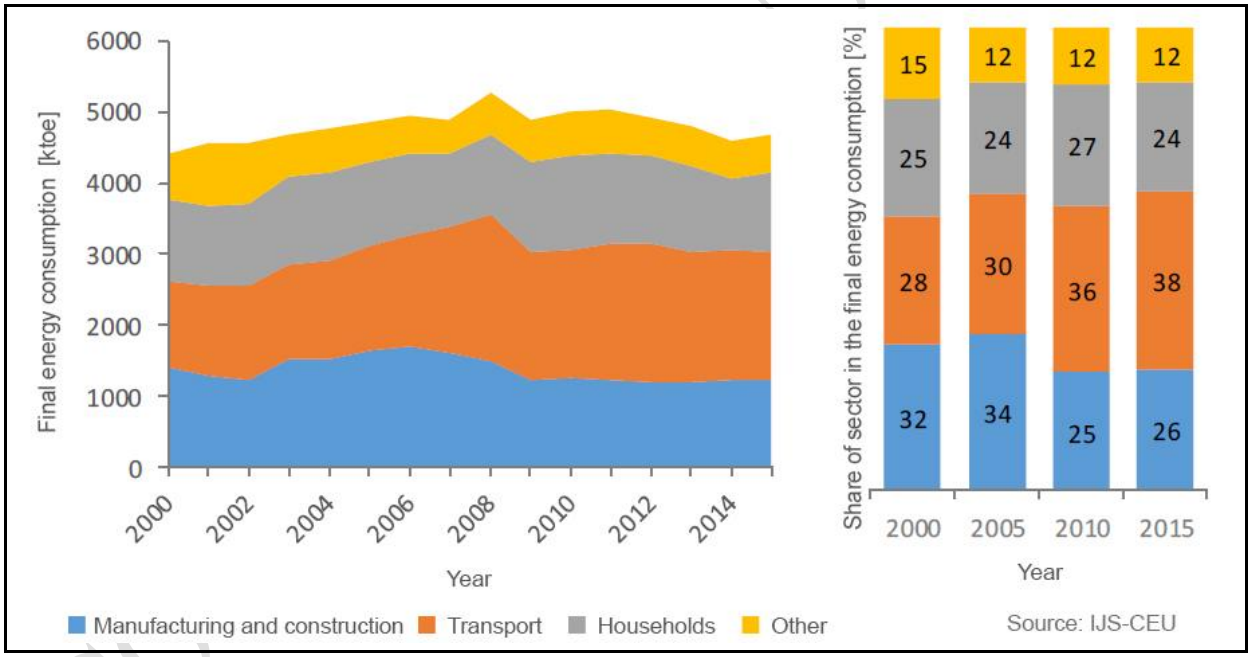
Final energy consumption in transport reached its highest share in 2012 and 2014. Foreign vehicles have a significant impact on energy consumption in transport. Fuel sales to foreign vehicles, which are by far the largest consumer of energy in transport, reached the highest share of total fuel consumption in road transport in 2008 (30 %) and 2012 (28 %). The share decreased after 2012 and stood at 21 % in 2015. Until 2008 domestic and foreign vehicles almost equally contributed to the growth of energy consumption in transport, but after 2008 fuel sales to foreign vehicles decreased, while fuel sales to domestic vehicles remained almost at the same level with some fluctuations. In 2000 the most significant consumer of final energy was industry (manufacturing and construction) with 32 %, while in 2015 it ranked second with a 26 % share, almost matching final energy consumption in households (24 %). Final energy consumption in industry declined from 2006 to 2013, while in 2004 and 2015 it was roughly at the 2009 level. In 2015 final energy consumption in industry was 12 % lower than in 2000. In 2015 final energy consumption in households was 1 %6 lower than in 2000 and 18 % lower in other consumption (National Energy Efficiency Action Plan 2017–2020, page 14).

Figure: Final energy consumption by sector in 2000–2015 and sector shares in final energy consumption in 2000, 2005, 2010 and 2015

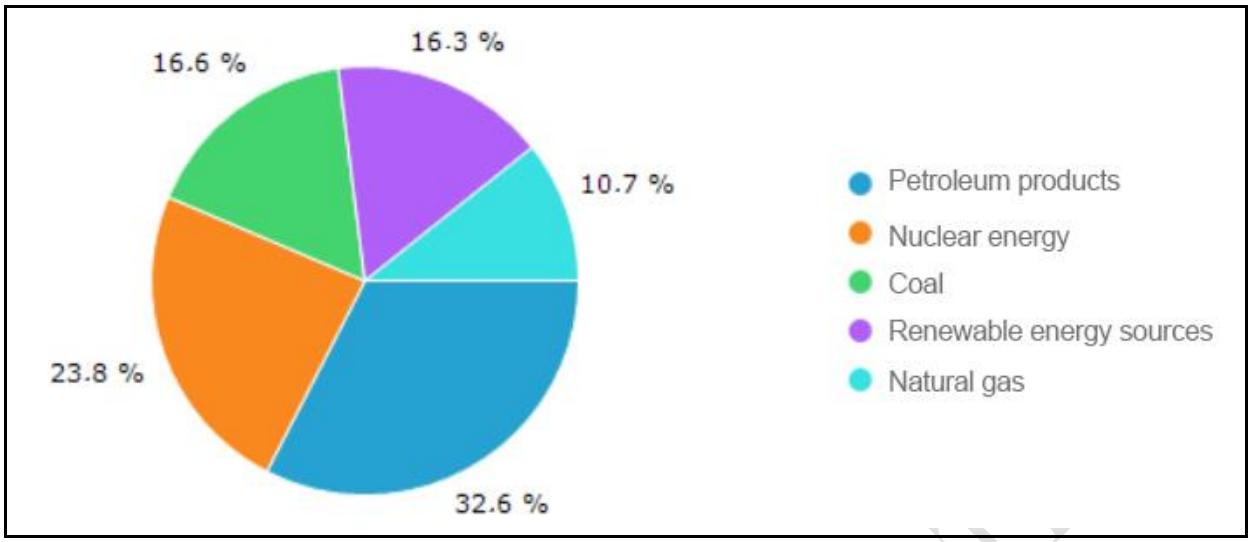


Source: National Energy Efficiency Action Plan 2017–2020, page 15

Total energy supply of Slovenia was 6.8 million toe (= 286 PJ) in 2017. In the energy supply structure, petroleum products accounted for the highest share with 33 %, followed by nuclear energy (24 %), renewable energy sources (including hydropower) and coal each accounting for 16 % and natural gas (11 %) (SURS, 2018a)[37].

[37] **SURS, Energy dependency of Slovenia in 2017 was 48%**, available at https://www.stat.si/StatWeb/News/Index/7412

Figure: Energy supply, Slovenia, 2017



Source: SURS, 2018a

Electricity balance

In past years, Slovenia has virtually always had a negative electricity balance, which has strongly fluctuated over the years as the consequence of high dependence on hydrology. Electricity import or export is the result of the discrepancy between domestic electricity consumption and generation. In the case of insufficient domestic generation sources, electricity is imported from abroad. Taking into consideration only physical conditions, Slovenia is a net exporter. However, as only half of electricity generated at Krško NPP can be considered as a domestic source, Slovenia is actually a net importer. In the time of higher demand, Slovenia covers a large part of demand by importing, while during the time of lower demand, Slovenia is still capable to generate electricity surpluses, which are exported to foreign markets (Transmission System Development Plan of the Republic of Slovenia 2017–2026, page 39)[38].

In Slovenia, **14,984 GWh** of electricity was delivered to the transmission and distribution system in 2017, which was 249 GWh less than in 2016. The delivery from generation facilities using renewable energy sources was 4,479, which is 616 GWh less than the year before, generating plants using fossil fuels contributed 4,539 GWh or 176 GWh less than in 2016. The Krško Nuclear Power Plant delivered 5,966 of electricity or 543 GWh more than the year before. These quantities are taken from the balance sheets of electricity producers on the basis of physical flows (Report on the Energy Sector in Slovenia for 2017, page 14)[39].

In 2017, as many as 1,032 GWh of electricity was delivered from generation connected to the distribution system to the distribution system (which includes closed distribution systems). In the internal consumer networks, additional 353 GWh of electricity or 25 % of all electricity

[38] **Transmission System Development Plan of the Republic of Slovenia for 2017–2026**, available at: https://www.eles.si/Portals/0/Publikacije/Razvojni%20nacrt%202017-2026.pdf

[39] **Report on the Energy Sector in Slovenia for 2017**, available athttps://www.agen-rs.si/documents/10926/38704/Poro%C4%8Dilo-o-stanju-na-podro%C4%8Dju-energetike-v-Sloveniji-v-letu-2017/f9f4df2c-810f-4e12-acdd-943104dd3b66

COURTESY TRANSLATION

generated in facilities connected to the distribution system (and closed distribution systems), which is two percentage points more than in 2016 (Report on the Energy Sector in Slovenia for 2017, page 14).

By taking into account half of the production from the Krško Nuclear Power Plant, **domestic production sources** contributed 12,001 GWh of electricity, and the consumption of end consumers amounted to 14,468 GWh of electricity, of which 90 GWh of electricity exported to Italy from DTSs Vrtojba and Sežana is not included. In 2017, 82.9 % of electricity consumption in Slovenia was covered with domestic production sources, and electricity import dependency was 17.1 % (Report on the Energy Sector in Slovenia for 2017, page 15).

New generation capacity of 18 MW was connected to the Slovenian power system (in 2017); facilities connected to the distribution system contributed 17 MW, while facilities connected to the closed distribution systems contributed 1 MW. New and renovated hydro power plants with the total nominal capacity of 11.1 MW contributed the largest share of this increase. A significant share of the increase in generation capacities was also contributed by new solar power plants with 4.7 MW and units for CHP with 1 MW. There we no major shutdowns of existing generation facilities in 2017 (Report on the Energy Sector in Slovenia for 2017, page 15).

COURTESY TRANSLATION

Table: Electricity delivered to the transmission and distribution systems in 2016 and 2017

Electricity delivered to the transmission system in GWh	2016	2017
Dravske elektrarne Maribor	2,826	2,312
Savske elektrarne Ljubljana	342	289
Hidroelektrarne na spodnji Savi	392	456
Soške elektrarne Nova Gorica	455	396
PSHPP Avče generation	278	271
Total hydro	**4,293**	**3,725**
TPP Šoštanj	4,061	3,909
TPP Brestanica	3	9
TPP Trbovlje	-2	0
Javno podjetje Energetika Ljubljana	333	344
Total TPP and CHP	**4,401**	**4,262**
Nuclear power plant Krško	5,423	5,966
Total nuclear	**5,423**	**5,966**
Electricity delivered to the transmission system	**14,117**	**13,952**

Electricity delivered to the distribution system in GWh	2016	2017
Hydro up to and including1 MW	201	169
Hydro above 1 MW	133	154
Facilities using wood biomass	53	56
Wind power plants	5.73	5.72
Solar power plants	235	250
Facilities using biogas	116	112
Waste-to-energy plants	8.91	7.11
Total RES	**802**	**754**
Total conventional sources	**314**	**277**
Electricity delivered to the distribution system	**1,116**	**1,032**
Total delivery of electricity	**15,233**	**14,984**

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Source: Report on the Energy Sector in Slovenia for 2017, page 15

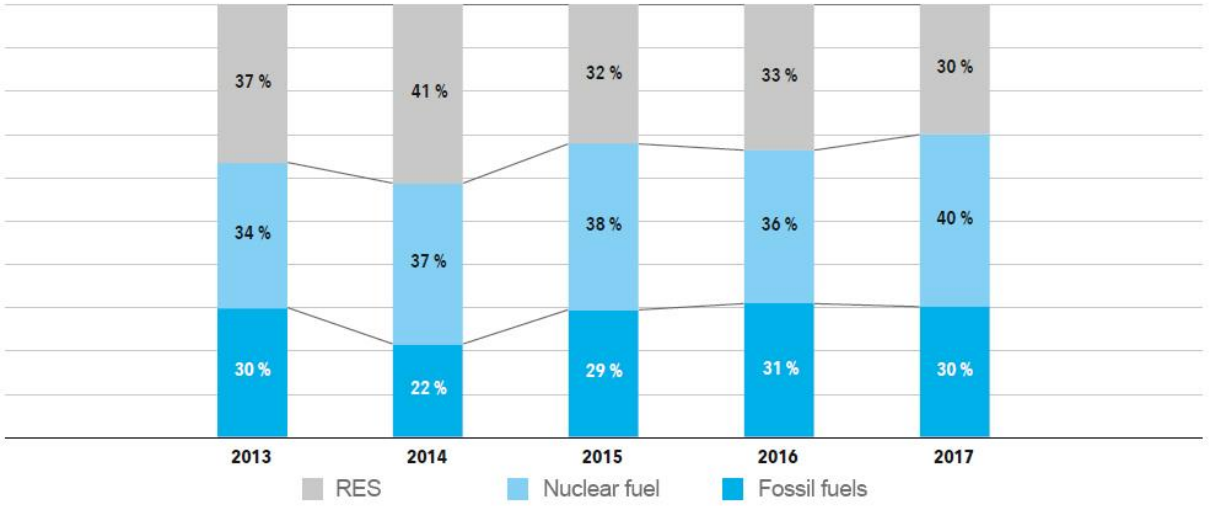
The share of electricity generated in hydro power plants and facilities using RES annually varies, depending on hydrological and other conditions as well as on investments in new generation facilities using RES. In 2017, this share was around 30 % of total electricity produced in Slovenia, which is three percentage points less than the year before. Fossil fuel power plants contributed around 30 %, which is approximately one percentage point less that the previous year, while the Krško Nuclear Power Plant contributed 40 % of total generated electricity (Report on the Energy Sector in Slovenia for 2017, page 16).

Table: Primary energy sources for electricity generation in 2017

Primary energy sources for electricity generation	GWh	Share
Fossil fuels	4,539	30 %
Nuclear fuel	5,966	40 %
RES	4,479	30 %
– hydro	4,048	
– wind	5.72	
– solar	250	
– biomass	175	
Total delivery of electricity	**14,984**	

Source: Report on the Energy Sector in Slovenia for 2017, page 16

Table: Shares of primary electricity sources in 2013–2017

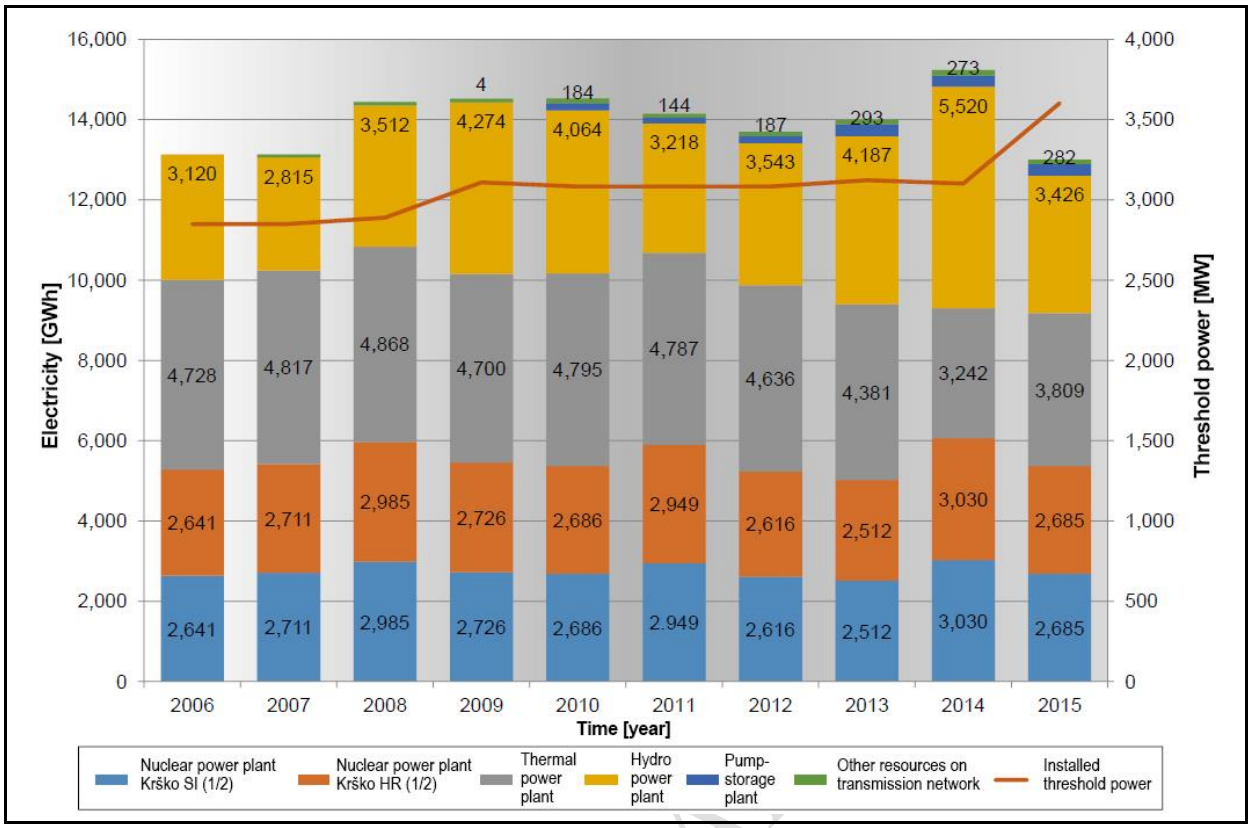


Source: Report on the Energy Sector in Slovenia for 2017, page 17.

Considering the quantity of generated electricity and the overview of installed capacities in the past ten years, most investments were made in peak load electricity generation facilities (HPP on Spodnja Sava, Avče PSP, gas units in TEŠ), whereas investments in base load generation facilities lagged behind, except the construction of TEŠ Unit 6. Generation units connected to Slovenia's transmission system had the total installed capacity of 3,605 MW at the 2015 year-end, of which 696 MW in Krško NPP, 1,778 MW in TPPs, 951 MW in HPPs and 180 MW in PSPs (Transmission System Development Plan of the Republic of Slovenia for 2017–2026, page 12).

COURTESY TRANSLATION

Figure: Electricity generation of HPPs, TPPs, and Krško NPP and installed capacity

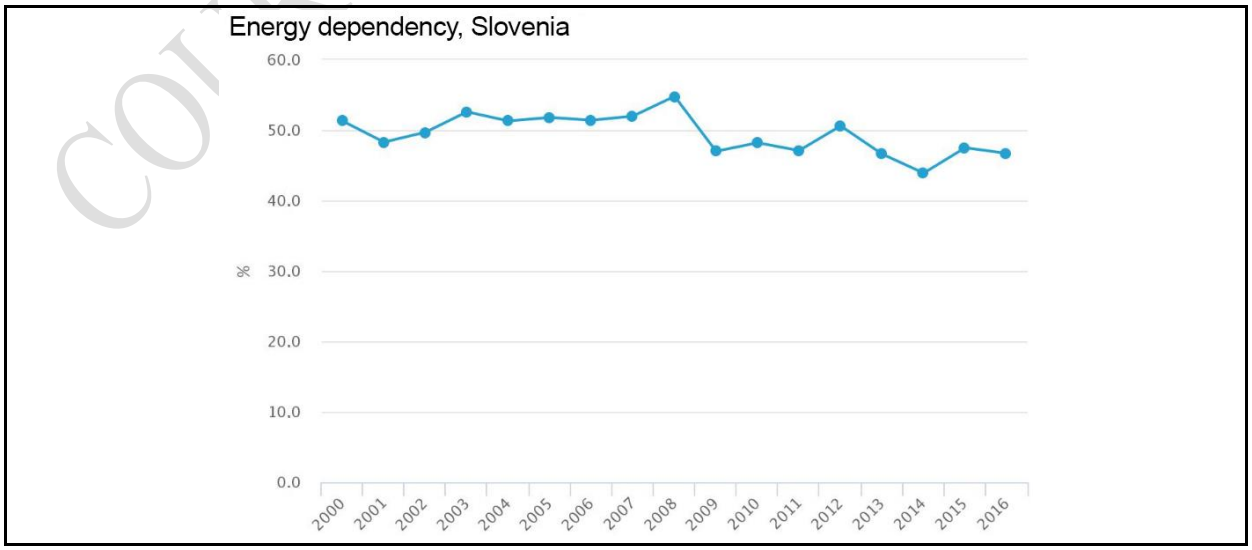


Source: Transmission System Development Plan 2017–2026, page 12

Import dependency

The total amount of domestic electricity sources in Slovenia in 2017 was 3.7 million toe (= 153 PJ), up by 2 % over 2016. Nuclear energy increased the most (by 10 %), followed by geothermal and solar energy (by 2 %). In 2017 Slovenia met 52 % of energy demand with domestic energy sources. The rest of the energy was supplied from imports; the entire quantities of petroleum products were imported (SURS, 2018a).

Figure: Energy dependency, Slovenia



Source: SURS, 2018b.

COURTESY TRANSLATION

Table: Energy indicators, Slovenia, 2000–2017

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Domestic production (1000 toe)	3151	3210	3321	3268	3460	3497	3446	3467	3672	3732	3791	3855	3565	3609	3681	3402	3585	3664
Energy supply (1000 toe)	6395	6665	6730	6823	7030	7207	7216	7243	7650	7090	7209	7280	7007	6820	6572	6505	6728	6839
Final consumption (1000 toe)	4568	4691	4678	4862	4998	5096	5145	5103	5435	5010	5122	5084	4978	4874	4644	4746	4931	4922
Energy dependency (%)	51.3	43.3	49.7	52.6	51.3	51.8	51.4	52.0	54.8	47.0	48.2	47.1	50.6	46.6	43.9	47.5	46.7	47.5

Source: SURS, 2018c.

Electricity import dependency in Slovenia significantly fluctuates. Over the last eight years, it has varied from 1.8 % and up to 18.2 %. Electricity import dependency indicates the coverage of domestic consumption by domestic production sources and therefore it is also dependent on fluctuations of generation and consumption. The largest contribution to electricity production from domestic sources is made by large hydro power plants and the nuclear power plant[40], which are connected to the transmission system in Slovenia. A small part of production from domestic sources is connected to the distribution system. Due to the important share of electricity generation from hydro power plants, total generation is highly dependent on hydrology in a particular period (Report on the Energy Sector in Slovenia for 2017, page 23).

For calculating import dependency in total electricity consumption, losses on the entire power system are taken into account, in addition to the consumption of end consumers on the transmission and distribution systems, wherein the electricity exported to Italy via the distribution system from Vrtojba and Sežana DTSs is deducted. In the section on electricity balance, these quantities are treated as direct consumption on the transmission system (Report on the Energy Sector in Slovenia for 2017, page 23).

Dependency on electricity imports is determined on the basis of the ratio between electricity production from domestic sources and total electricity consumption. In the observed period 2010–2017, electricity import dependency considerably changed and, except the change in production from domestic sources, it was directly impacted by the change in electricity consumption. In the observed period, electricity import dependency was the lowest in 2014 (1.8 %) when due to exceptionally favourable hydrology electricity generation in hydro power plants was the largest and total consumption was lower than the year before. In 2017, higher import dependency (17.1 %) was recorded as a consequence of lower generation from domestic sources (mainly hydro power plants) and simultaneously increasing electricity consumption (Report on the Energy Sector in Slovenia for 2017, page 23).

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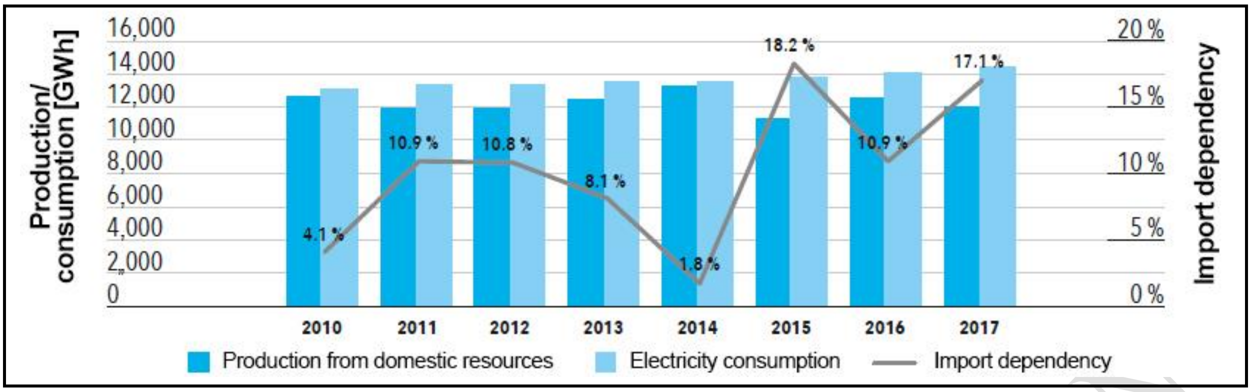
[40] Note: This includes only half of the production from the Krško Nuclear Power Plant.

Figure: Electricity generation, consumption and import dependency in 2010–2017



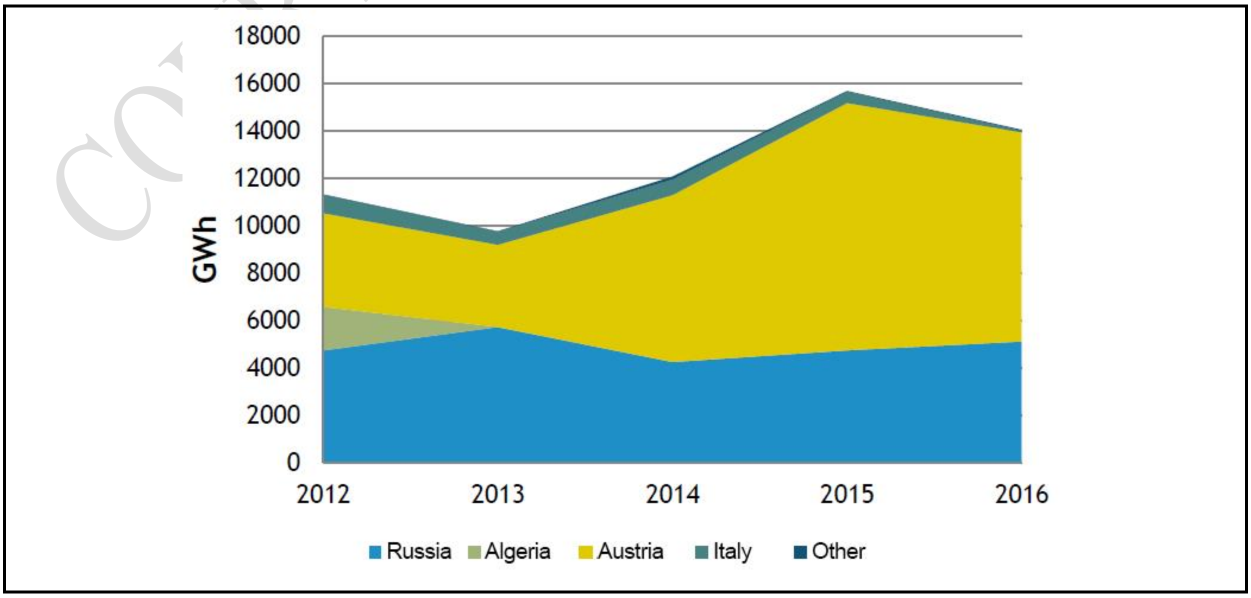
Source: Report on the Energy Sector in Slovenia for 2017, page 23.

The projections of the transmission network operator for Slovenia's electric power system for the coming 10-year period are not promising, as deficit in domestic generation is expected throughout the whole observed period. The difference will thus need to be covered by electricity import from abroad. The generation structure is not expected to change significantly in the coming 10-year period, however, the highest generation growth is expected in the projections, where the needs are also higher (Transmission System Development Plan of the Republic of Slovenia for 2017–2026, page 13).

Supply of natural gas to Slovenia and access to natural gas sources

Due to the lack of own sources, the **supply of natural gas to the Slovenian market** depends entirely on import. The supply of natural gas to Slovenia takes place from Russia and individual hubs of the European gas market. From Austria, natural gas physically flows via the Ceršak entry point, and from Italy via the Šempeter entry point (Gas Transmission Network Development Plan for 2018–2027, page 8). The trading hubs from which natural gas is supplied to Slovenia are supplied with natural gas from the EU, Norway, the Russian Federation and North Africa as well as with liquefied natural gas (LNG) from other locations.

Figure: Sources of natural gas supply to Slovenia



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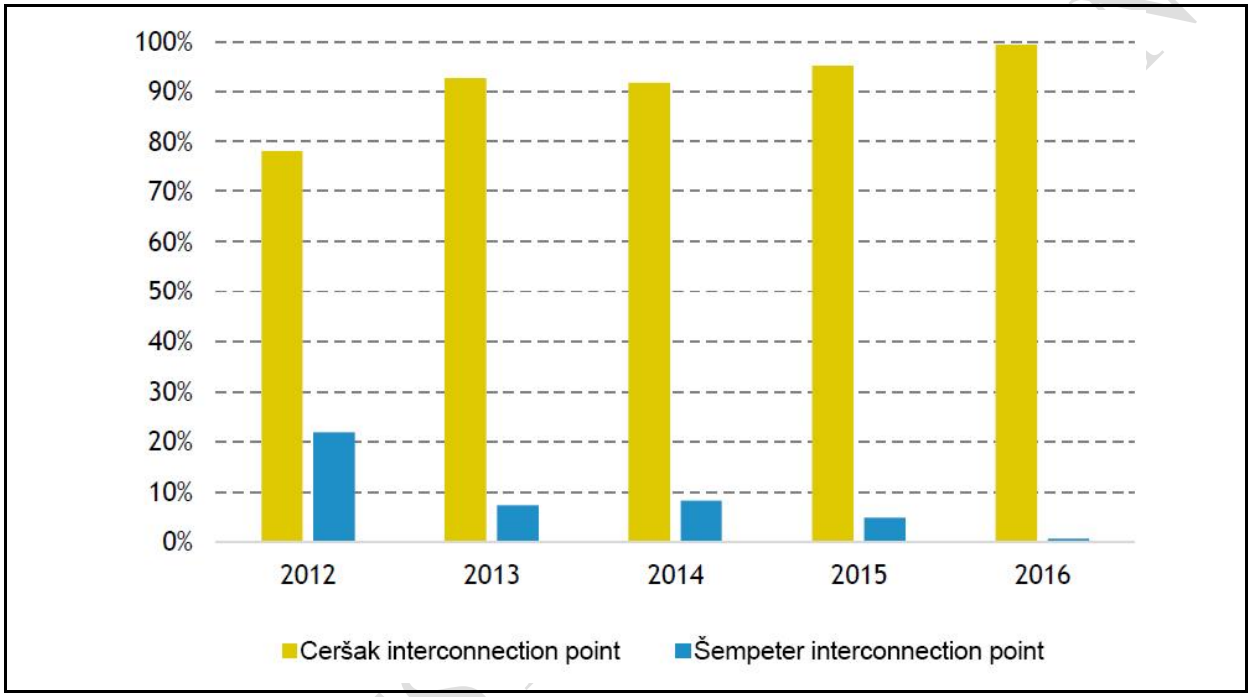
Source: Energy Agency, Important indicators for the supply of electrical energy and natural gas for the year 2016. Gas Transmission Network Development Plan for 2018–2027

Through the Ceršak interconnection point, the transmission system operator can supply all Slovenian consumers, regardless of their location. This is also reflected in the positive trend of increasing the share of supply via the Ceršak point (see the figure below). The suppliers can therefore provide a competitive supply for all consumers where this is not restricted by an interconnection point or a possible bottleneck on the natural gas transmission network (Gas Transmission Network Development Plan for 2018–2027, page 8).

Figure: Natural gas import routes to Slovenia



Source: Gas Transmission Network Development Plan for 2018–2027, page 8.

4.5 Dimension Internal energy market

Slovenia does not have any projections about the energy infrastructure and connections for more than the next ten years – the planning and projections are prepared based on the ten-year plans of ELES d.o.o., the Slovenian transmission system operator.

4.5.1 Electricity interconnectivity

Slovenia's electricity interconnection level was at 83.6 % in 2017 and thereby being already well above the 2020 target of 10 % and the 2030 target of 15 % (Slovenia: Energy Union factsheet, 2017, pages 5–6).

The planning of the transmission network is carried out using the models that allow to capture a wide range of factors by covering the whole transmission network in the context of ENTSO-E. The models are developed based on the data which can be obtained in

COURTESY

publicly available publications and within the framework of ENTSO-E working groups. The method of the dynamic planning process with successive expansion is used in transmission network planning. By using this method, in each year of the observed period (2017–2026) the transmission network must comply with the criteria for transmission network development planning and ensure safe and reliable operation. Apart from that, the condition and age of the existing transmission network, needs and requirements, as well as the EU objectives with regard to the internal energy market, RES integration, etc. have to be taken into account (Transmission System Development Plan of the Republic of Slovenia for 2017–2026, pages 94–95).

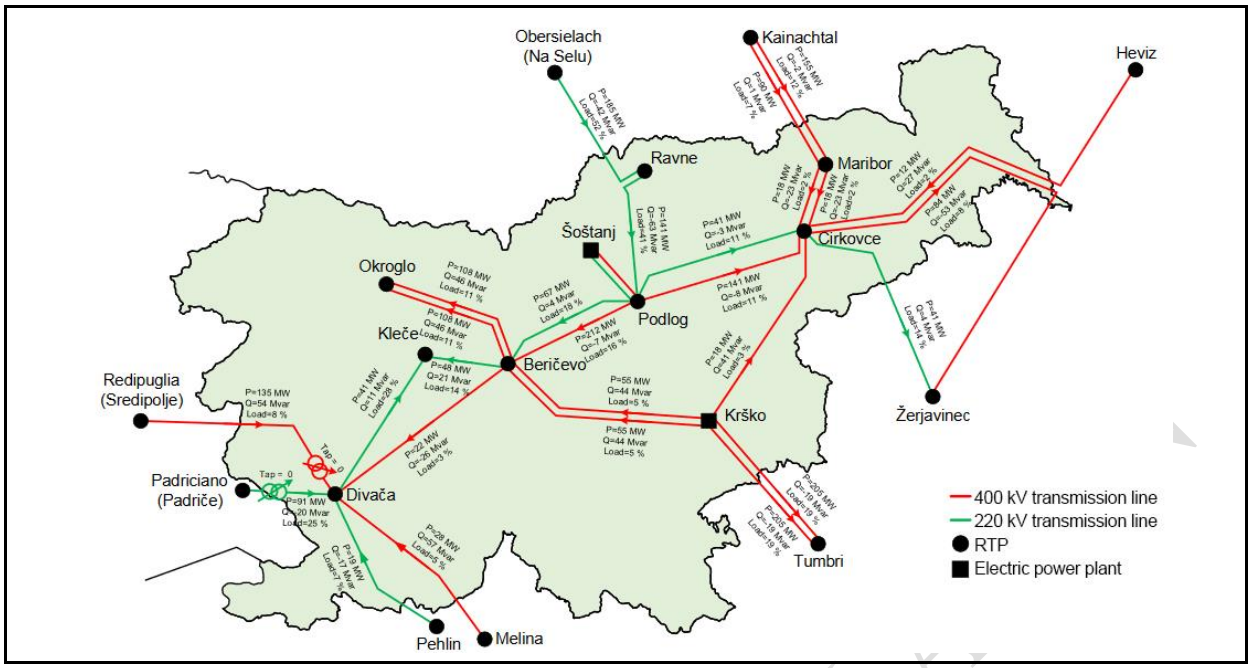
To ensure the safe and reliable operation of Slovenia's transmission network, the following facilities at the 400 kV and 220 kV voltage levels need to be built and reconstructed by 2021 (Transmission System Development Plan of the Republic of Slovenia for 2017–2026, page 95):

- double 400 kV Cirkovce–Pince with SS Cirkovce and 400/110 kV TR in SS Cirkovce,
- double 220 kV Zagrad–Ravne with SS Ravnee and 220/110 kV TR in SS Ravne,
- second 400/110 kV TR in SS Divača,
- 400/110 kV TR in SS Podlog,
- 220/110 kV TR in SS Divača.

The energy situation of Slovenia's transmission network at the 400 kV and 220 kV voltage levels in 2021 is shown in the figure below. The load of the 400 kV and 220 kV transmission network depends more on the balance sheets and exchange of electricity with the neighbouring countries than on demand response. The information about peak load in Slovenia does not provide any information about the maximum possible load on the 400 kV and 220 kV network. The latter points to the need for a multi-scenario approach by using market analysis programs, in which a large number of possible situations that could occur in the electric power system is analysed. This enables to more easily capture the high flows between countries (Transmission System Development Plan 2017–2026, page 95).

Figure: Slovenia's transmission network in 2021

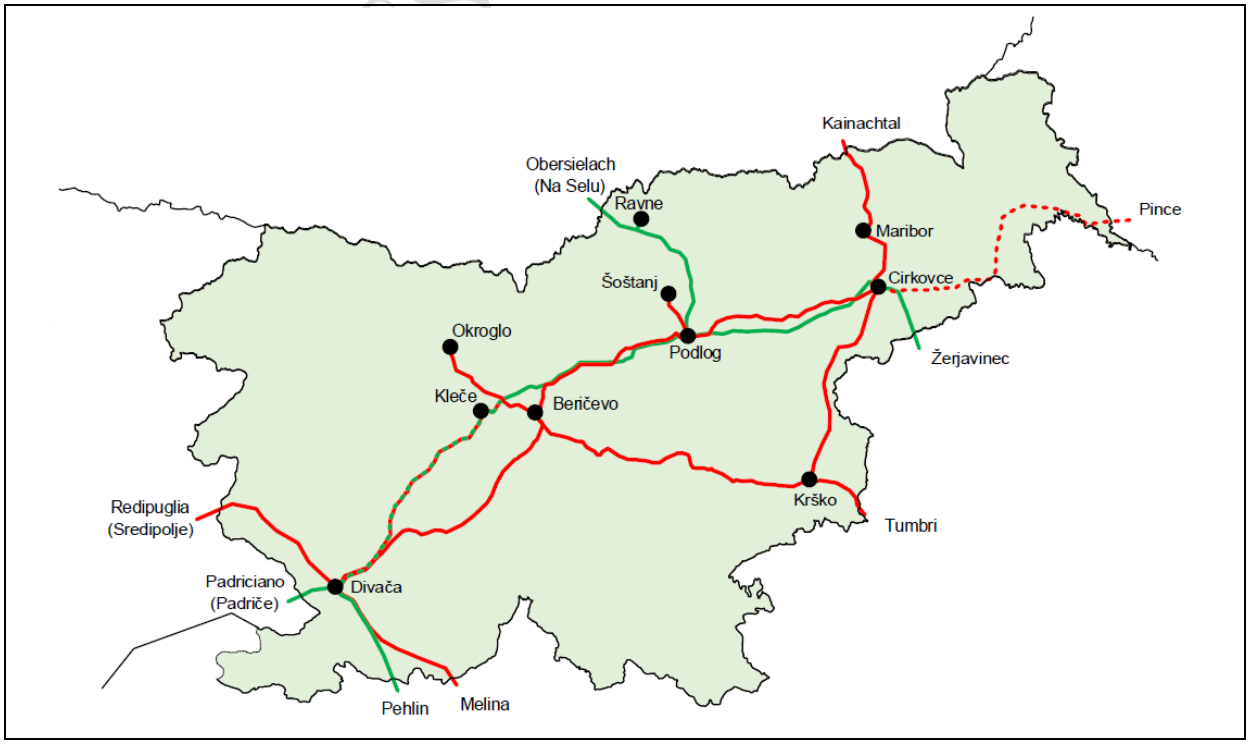
COURTESY TRANSLATION



Source: Transmission System Development Plan 2017–2026, page 95

The most important **improvement of the transmission network** in the coming years will be the construction of the 400 kV Cirkovce–Pince overhead line, which will significantly increase the import capacity of the Slovenian transmission system and enable the import of cheaper electricity from the eastern part of Europe (Report on the Energy Sector in Slovenia for 2017, page 51). In the figure below, the 400 kV Cirkovce–Pince overhead line, which shows the planned strengthening of the Slovenian 400 kV and 220 kV transmission network by 2026, is designated with a dotted line.

Figure: The planned strengthening of the Slovenian 400 kV and 220 kV transmission network by 2026



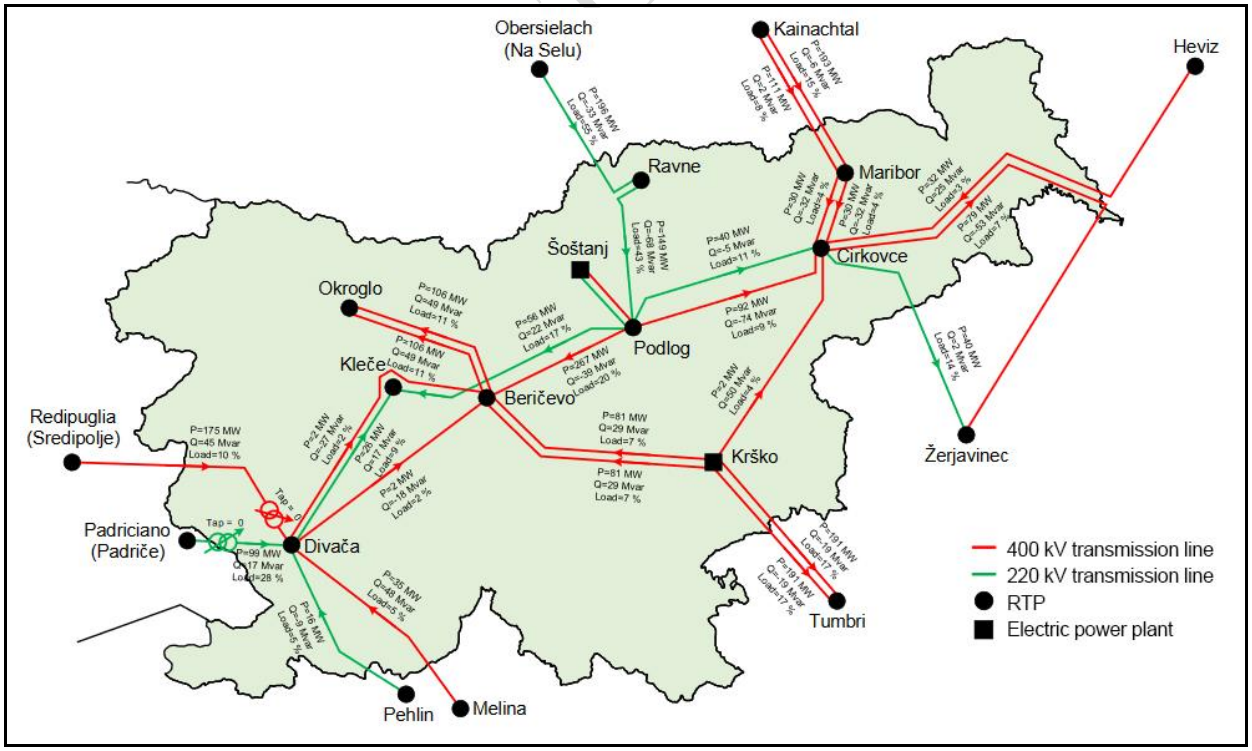
Source: Transmission System Development Plan 2017–2026, page 18

By 2026, the development of the transmission network is planned by making the following investments at the 400 kV and 220 kV voltage levels (Transmission System Development Plan of the Republic of Slovenia for 2017–2026, page 97):

- 400/110 kV TR in SS Beričevo;
- 220/110 kV TR in SS Podlog;
- double 400 kV Beričevo–Kleče–Divača (upgrade from 220 kV to 400 kV) – the project is in the study phase and is expected to be completed after 2025;
- connecting line for PSP Kozjak – if the PSP Kozaj project is economically viable and the investor decides to realise it, an additional 400 kV connection will need to be built in Slovenia's electric power system.

The figure below shows the modelled situation in 2026 with the highest expected consumption in Slovenia. Similarly as in the analysis from past years, high electricity flows towards Italy would be expected; however, due to the rapidly changing situation in the electricity market, this does not happen. In this case, electricity flows from Italy to Slovenia. In ELES, network planning on the basis of a multi-scenario approach using market analysis programs is being implemented in order to identify lower consumption with high flows between countries (Transmission System Development Plan of the Republic of Slovenia for 2017–2026, page 98).

Figure: Slovenia's transmission network in 2026



Source: Transmission System Development Plan 2017–2026, page 98.

TRANSLATION

4.5.2 Energy transmission infrastructure

Electricity transmission infrastructure

The operation of a system operator, which is performed by ELES d.o.o. in Slovenia, is an obligatory national service of general economic interest, which inter alia includes the following (Article 54 of the EZ-1):

1. secure, reliable and efficient operation and maintenance of the transmission system;
2. development of the system that takes into account the anticipated needs of system users, the requirements for safe and reliable system operation, and the guidelines provided by the development plan of the electricity transmission system operators;
3. long-term capacity of the transmission system to meet reasonable demands for connection to the system and energy transmission;
4. control of electricity flows in the transmission system and safeguarding of ancillary services;
5. clearing of imbalances of consumption, delivery and cross-border transfers in the system.

Slovenia's transmission network is intended for the transmission of electricity from production sources to the distribution networks and direct consumers connected to the transmission network as well as for the exchange of electricity with the neighbouring operators. The transmission network is a high-voltage power network, which in Slovenia consists of three voltage levels, i.e. 400 kV, 220 kV and 110 kV (Transmission System Development Plan of the Republic of Slovenia for 2017–2026, page 40).

At the end of 2015, the total length of 400 kV overhead lines added up to 669 km, that of 220 kV overhead lines summed up to 328 km, and the total length of 110 kV lines was 2,597 km. In Slovenia's transmission network there are four different types of substations, i.e. with the transformation of 400/110 kV, 400/220 kV, 220/110 kV and 110/35 kV. The 400/400 kV phase shifting transformer with the capacity of 2 x 600 MVA, installed at SS Divača, was included in Slovenia's electric power system in 2010 (Transmission System Development Plan of the Republic of Slovenia for 2017–2026, page 40).

The figure below shows the the overhead lines with the highest load based on the 95 % probability threshold. According to the situation, there are not many extraordinary events (Transmission System Development Plan 2017–2026, page 44).

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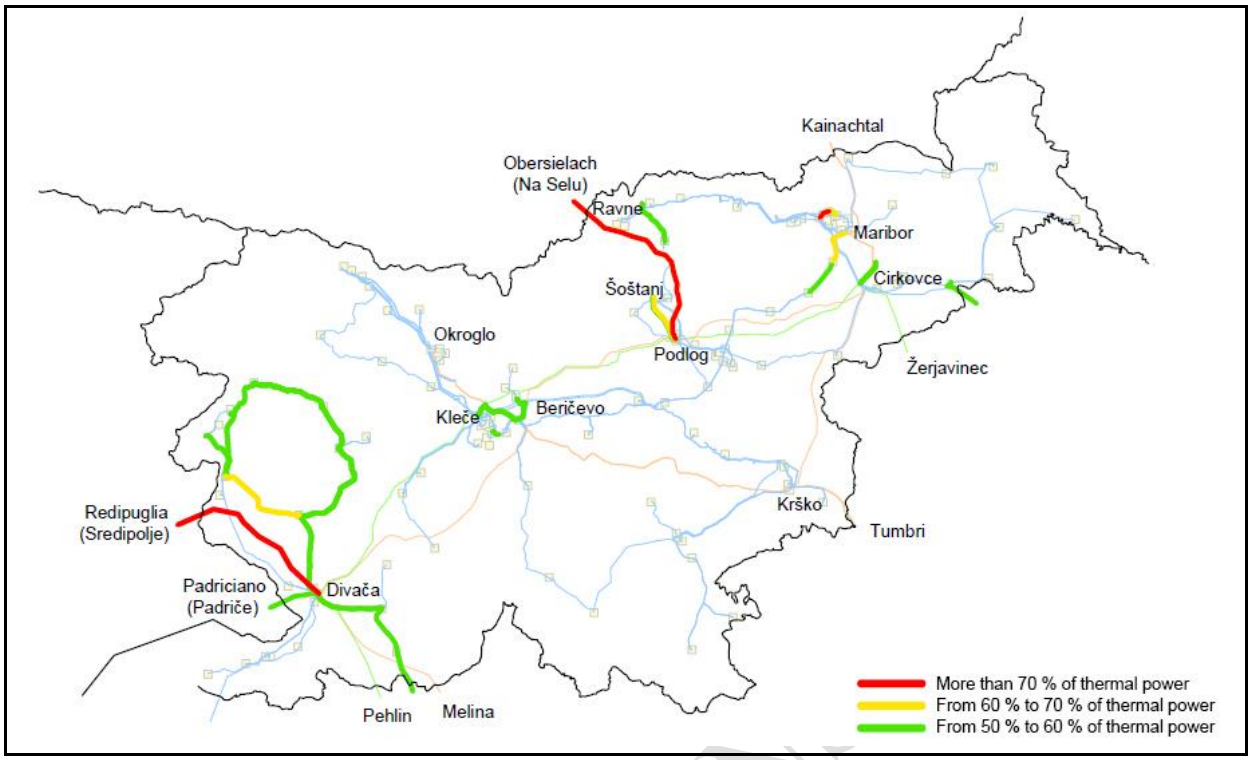
Figure: Overhead lines with the highest load based on the 95 % probability threshold



Source: Transmission System Development Plan 2017–2026, page 45.

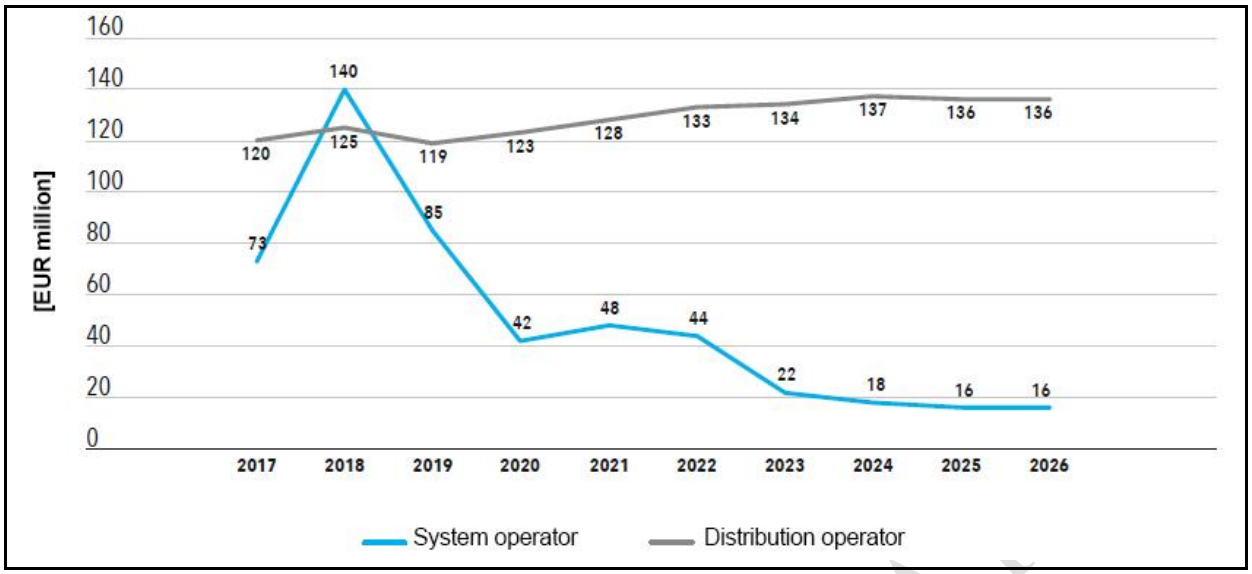
The starting point for planning the network in the system operator's development plan is the analysis of the situation in the transmission system. On the basis of input data on electricity consumption and power, the system operator has to prepare an analysis of different electricity consumption forecasts by taking into account the methodologies of ENTSO-E and own assessment of future economic development. The development plan has to include an analysis of covering consumption with production sources and the sufficiency of production sources as well as an analysis for assessing the needs for transmission capacity that are used as a basis to define the dynamics of planned investments and their financial evaluation (Report on the Energy Sector in Slovenia for 2017, page 50).

In its development plan, the distribution operator has to analyse the period of the previous development plan, perform an analysis of forecast electricity consumption and electric power, and prepare the plan of investments in the power system for the entire country, which has to be financially evaluated (Report on the Energy Sector in Slovenia for 2017, page 50).

In the current development plans to 2026, the operators plan investments in electricity infrastructure in the amount of EUR 504 million for the transmission system and EUR 1 291 million for the distribution system (Report on the Energy Sector in Slovenia for 2017, page 50). The figure below shows the estimated investments from the operators' development plans for 2017–2026.

COURTESY TRANS

Figure: The estimated investments from the operators' development plans for 2017–2026



Source: Report on the Energy Sector in Slovenia for 2017, page 50.

The system operator's development plan by 2026 was developed on the basis of studies on the needs for a new transmission infrastructure by taking into account the state of the network, the needs for technological upgrades in the facilities of the transmission system, the needs of electricity producers and consumers, the criteria for reliable and safe operation of the transmission system, and as well as international agreements and contracts. The general guidelines taken into account in the drafting of new and reconstruction investments include: connecting with the neighbouring electric power systems, managing the power flows and providing adequate voltage conditions in the whole Slovenian electric power system, ensuring reliable and safe operation in accordance with ENTSO-E recommendations and criteria, and the implementation of smart grids so as to better utilise the existing infrastructure and achieve adequate stability and efficiency in the context of fulfilment of European energy requirements. With regard to the latter, the international project for smart grids SINCRO.GRID will continue to be implemented, under which transmission system and distribution system operators of Slovenia and Croatia will tackle the challenges of managing voltage in the transmission system and reducing the capacities required for the secondary reserve. The most important strengthening of the transmission network in the future will be the construction of the 400 kV Cirkovce–Pince overhand line, which will significantly increase the import capacity of Slovenia's transmission system and enable the import of cheaper electricity from the eastern part of Europe as well as improve the reliability of power supply in Slovenia. The projects of transition from the 220 kV transmission network to the 400 kV voltage level and the new one-way connection Slovenia–Italy are still in the study phase and their realisation will largely depend on market conditions in the future (Report on the Energy Sector in Slovenia for 2017, pages 50–51).

In its distribution network development plan by 2026, the distribution operator takes into account the goals related to the set guidelines and objectives of the national energy and environmental policy. Therefore, the development plan provides answers to the questions how

COURTESY TRANSLATION

to satisfy the planned electricity and power demand, how to provide a cost-effective network that matches the infrastructure, and how to ensure long-term stability, reliability and availability of the distribution network, while improving or maintaining the quality of electricity supply, and at the same time enable to achieve the national climate and energy targets. In its development plan, the distribution operator places emphasis on the constructing of a new and the reconstruction of the existing medium-voltage network, as supply continuity is the weakest link in the electric power system, especially in relation to overhead lines. In the case of new facilities, the focus is on the underground construction of medium-voltage cables, while when reconstructing overhead lines non-insulated electrical conductors are replaced with semi-insulated conductors or self-supportive cables. The basic development guidelines of the distribution operator are investments in the development of the operating systems, which include a meshed medium-voltage network, automation and management, the method of neutral point connection and network cabling, as well as improving the quality of supply by implementing the smart grid concept and advanced metering (Report on the Energy Sector in Slovenia for 2017, page 51).

Development of an advanced metering system in Slovenia

In Slovenia, the installation of an advanced metering system is intensively carried out. At the end of 2017, as much as 57 % of consumers connected to the distribution system were equipped with advanced metering infrastructure, while 52 % were actually connected to remote meter data reading. These data place Slovenia among the leading European countries in the introduction of advanced metering. If this trend continues, Slovenia is expected to come close to the goal from the European Directive that by 2020 at least 80 % of consumers should be equipped with advanced metering infrastructure. The development of the advanced metering system is lagging far behind the formal plan for the provision of data services to beneficiaries; furthermore, without making appropriate changes in the context of project implementation, the system will not enable the provision of services and measures required by the future electricity market. This means that the expected benefits of the project will not be provided (Report on the Energy Sector in Slovenia for 2017, page 53). It is important to point out that power distribution companies are quite active in obtaining EU funds for advanced demonstration projects. Over the past years, the Slovenian power distribution companies have participated in (or are still part of) several different EU projects that are directly related to electricity distribution technology, making them the leaders in implementing modern technologies in the broader region.

Natural gas transmission infrastructure

The geographical position of Slovenia is relatively advantageous with respect to the flows of natural gas in Europe. It is in the immediate neighbourhood of the transmission routes from north-east Europe (from Russia via Slovakia and Austria onwards to Italy and Croatia) and shares a border with Italy, where transmission routes from the Mediterranean basin and northern Europe meet. Moreover, the Slovenian system is in the vicinity of the existing and newly planned LNG terminals in the Adriatic Sea (Gas Transmission Network Development Plan for 2018–2027, page 7).

COURTESY TRANSLATION

Slovenia's gas transmission system comprises 1,156 km of pipelines, two compressor stations in Kidričevo and Ajdovščina, and 245 metering and regulation stations or other stations. At key points, the gas transmission system is equipped with the devices through which the system can be controlled and maintained. The remote control and monitoring functions are carried out with an information and telemetry system. The gas transmission system connects most of the industrial and urban centres in Slovenia, with the exception of the Obalno-kraška region, Bela Krajina and parts of the Notranjska and Dolenjska regions. The gas transmission system is controlled and monitored from the dispatch centre, which is connected to the dispatch centres of the transmission system operators from the neighbouring countries and to the distribution network operators and major consumers of natural gas. A major part of the existing gas transmission network is older than 30 years (Gas Transmission Network Development Plan for 2018–2027, page 7).

Table: Main infrastructure – gas transmission pipelines by pipeline diameter and other facilities and equipment

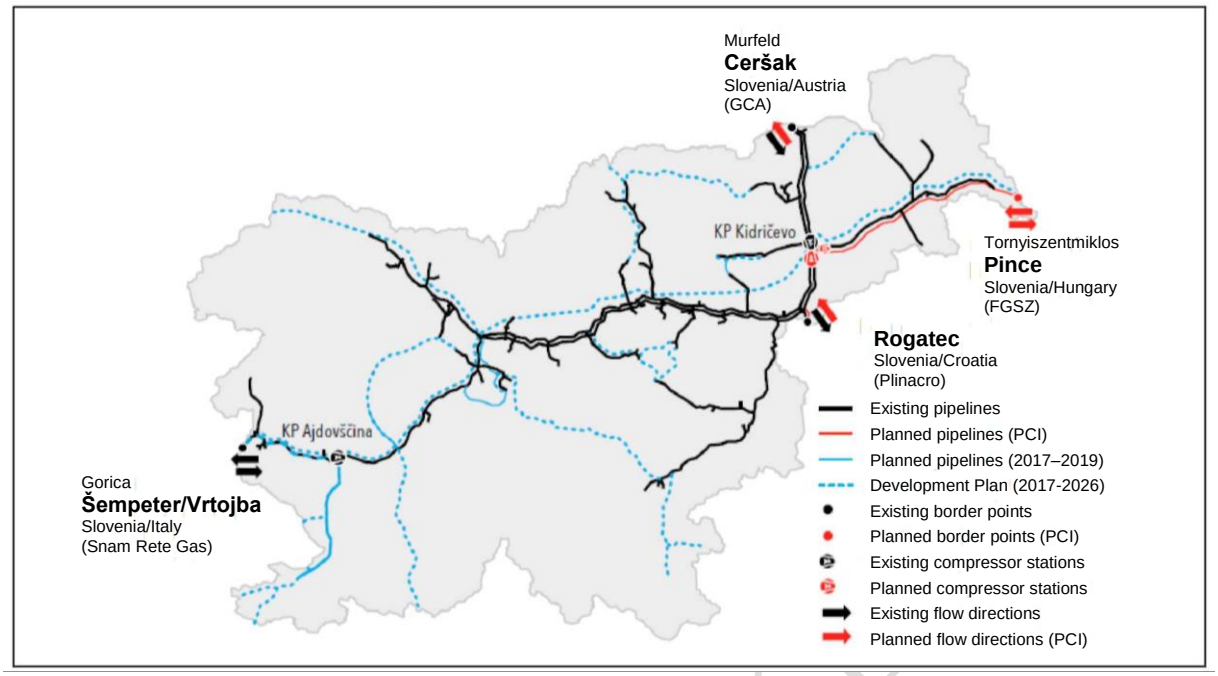
Infrastructure		Status as of 1 January 2017
Gas network	In total	1,156 km
	Pipelines with a diameter of 800 mm	167 km
	Pipelines with a diameter of 500 mm	162 km
	Pipelines with a diameter of 400 mm	197 km
	Other pipelines of smaller diameters	629 km
Facilities and equipment	Compressor stations, total power	CS Kidričevo 10,5 MW, CS Ajdovščina 9 MW
	Cross-border stations	Ceršak, Rogatec, Šempeter pri Gorici

Source: Gas Transmission Network Development Plan for 2018–2027, page 7.

Slovenia's natural gas transmission system began its operations in 1978, after which it was gradually expanded and upgraded. In 2014, the last major investment cycle was completed with the construction of the pipeline from the Austrian border at Ceršak to Vodice near Ljubljana. Apart from providing the additional necessary transmission capacity, the safety and reliability of the transmission system operation were improved (Gas Transmission Network Development Plan for 2018–2027, page 8). With regular inspections and regular maintenance work, Plinovodi d.o.o. as the transmission system operator ensures safe and reliable operation of the transmission system. Based on preventive inspections and maintenance work, the transmission system operator assesses that the gas infrastructure is in a very good operating condition. Thus far, Slovenia has not had any major operational problems that could not have been managed in the framework of the planned maintenance work *(Gas Transmission Network Development Plan for 2018–2027*, page 8).

COURTESY TRANSLATION

Figure: Natural gas transmission system in December 2017



Source: Report on the Energy Sector in Slovenia for 2017, page 125.

The Slovenian gas transmission system is connected with the gas transmission systems of the neighbouring countries via cross-border interconnection points, which are managed by various transmission system operators. The cross-border interconnection points of the Slovenian transmission system operator with the neighbouring transmission systems are as follows (Gas Transmission Network Development Plan for 2018–2027, page 26):

- the Austrian transmission system operator Gas Connect Austria via the Ceršak cross-border interconnection point;
- the Italian transmission system operator Snam Rete Gas via the Šempeter cross-border interconnection point, and
- the Croatian transmission system operator Plinacro via the Rogatec cross-border interconnection point.

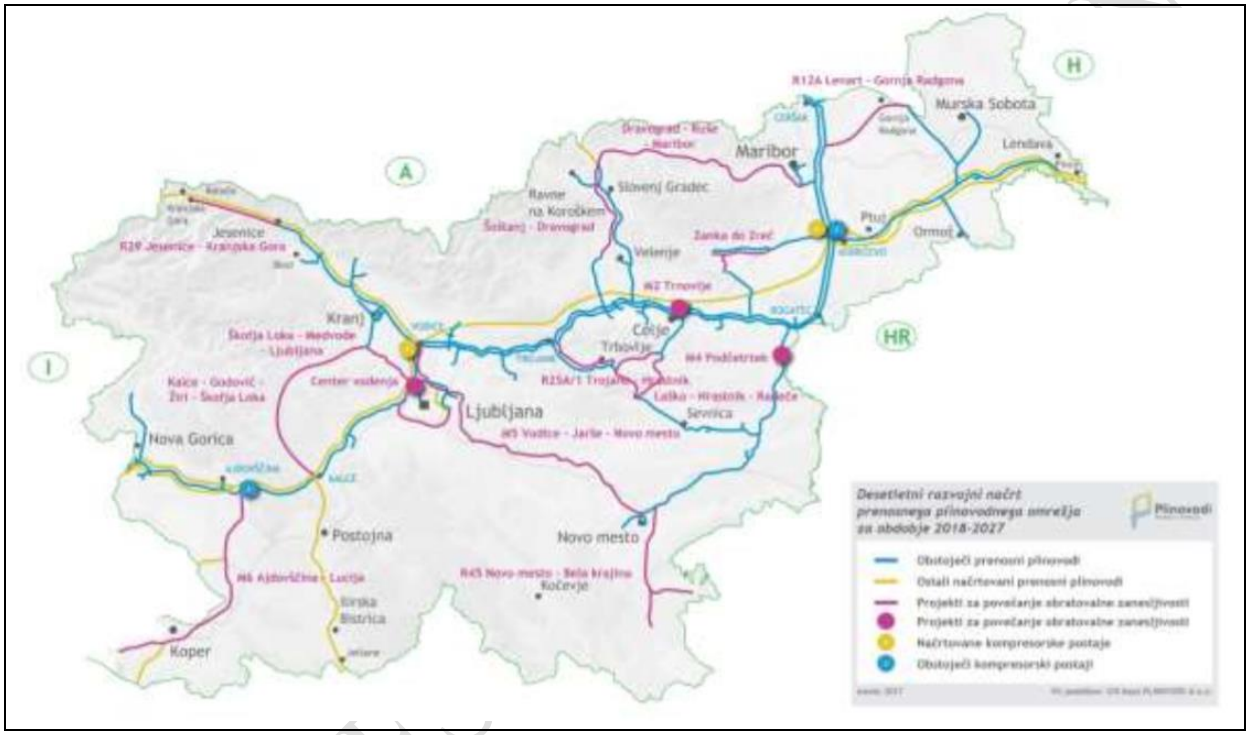
Investments in the natural gas transmission system

After the end of the intensive investment cycle in 2015 investments activities reached the lowest level, but from 2016 the level of investments has been gradually increasing. The most important future investment activities remain the same as in the previous year. It is planned to building a new management centre, which will allow content and technological upgrades. The construction of the connecting pipelines M5 Vodice–Jarše and R51 Jarše–TE-TOL will enable the connection of a thermal power plant. Construction works will continue on the pipeline M6 Ajdovščina–Lucija, which will bring gas to the Obalno-kraška Region. The final works began to enable a bidirectional flow at the metering-regulation station Rogatec. Building the system loop R51c Kozarje–Vevče will increase the reliability of supply of Ljubljana with its surroundings. Works will also continue on the potential gas connection between Slovenia and the Hungarian gas market (Report on the Energy Sector in Slovenia for 2017, page 125).

COURTESY TRANSL

Depending on its purpose, the planned infrastructure is divided into: projects for increasing operational security, projects for connecting new natural gas consumers or changing the operational characteristics of the gas infrastructure, and projects for developing interconnection points. The group of projects allowing the increase of operational security includes energy loops, displacements of pipeline sections due to specific settlement modifications and prevention of landslides. In several cases, these projects provide the possibility of connecting new municipalities *(Gas Transmission Network Development Plan for 2018–2027*, page 34).

Figure: Projects to increase security of operations

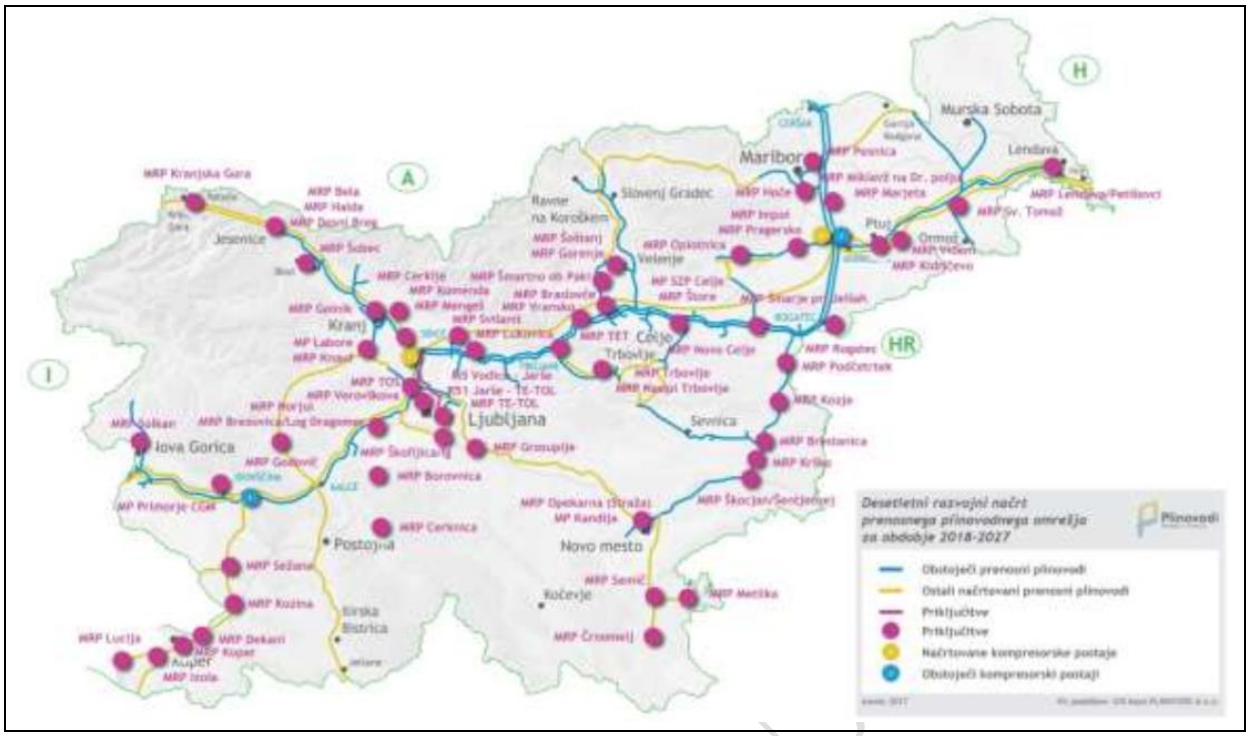


Source: *Gas Transmission Network Development Plan for 2018–2027, page 34*

This group of connection projects includes connecting new consumers, changing the operational characteristics of pipeline structures for existing consumers, and connecting producers of natural gas. They are placed on the list on the basis of enquiries, connection agreements and/or connection contracts. The connection projects also include projects for the connection of users, under which the infrastructure of CNG filling stations − compressed natural gas for powering vehicles is built. These projects include the connection of a natural gas producer to the transmission pipeline system in the Pomurje region. The producer is the holder of concession rights for the extraction of mineral resources, crude oil, natural gas and gas condensate in the area of the Mura Depression, i.e. in the gas and oil fields Dolina and Petišovci pri Lendavi (Gas Transmission Network Development Plan for 2018–2027, page 38).

COURTESY TRANSLATION

Figure: Locations of projects for new connections



Source: Gas Transmission Network Development Plan for 2018–2027, page 38.

The projects of developing interconnection points (interconnections) with the neighbouring transmission systems are aimed at establishing new interconnection points with the neighbouring systems, increasing the existing transmission capacities, establishing reverse flows, and meeting the N-1 infrastructure standard. The project linking Slovenia's and Hungary's transmission systems managed by the FGSZ Ltd has the status of a "Project of Common Interest" in line with the Regulation 347/2013/EU. The project envisages the construction of a 73-km pipeline and expansion of the existing Kidričevo compressor station with additional compressor units. The purpose of this project shown in the figure below is to connect the thus far unconnected Slovenian and Hungarian transmission systems, provide Slovenian suppliers access to Hungarian underground storage facilities, and provide Hungarian suppliers access to the western gas markets and LNG sources in Italy and the North Adriatic. The project will also improve the N-1 infrastructure standard.

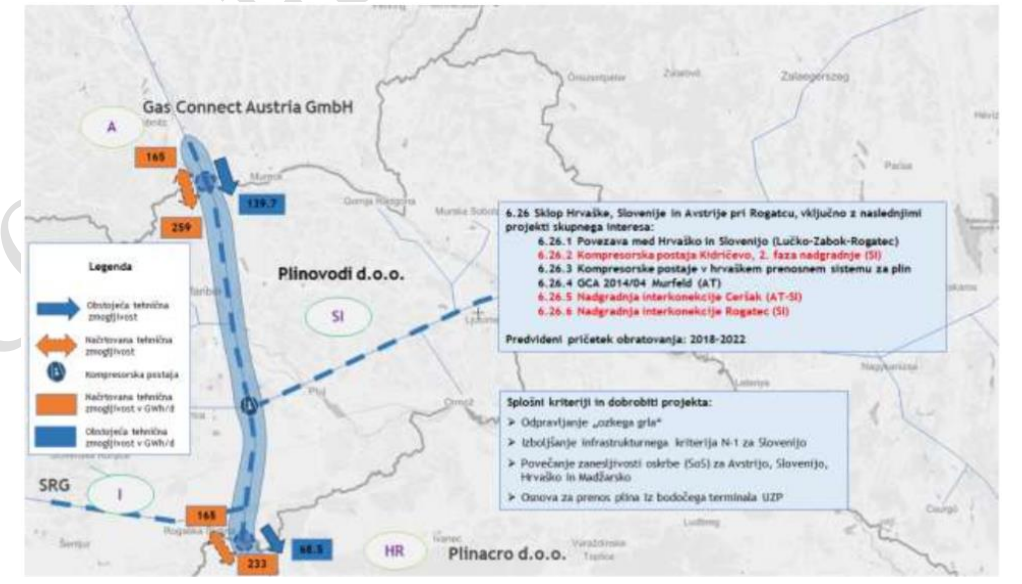
COURTESY TRANS

Figure: Interconnection Hungary–Slovenia Project

Source: Gas Transmission Network Development Plan for 2018–2027, page 41.

The group of projects in the corridor of Austria, via Slovenia and towards Croatia have the status of a project of special interest. It involves the upgrade of the capacity of the existing transmission systems and the establishment of reverse flows between the systems managed by Slovenia, Gas Connect Austria GmbH and Plinacro d.o.o. The figure below shows the harmonised technical parameters and the time line of project implementation. In the Slovenian system, this project envisages the following: the reconstruction of Rogatec interconnection, the reconstruction of Ceršak interconnection and the extension of Kidričevo compressor station (Gas Transmission Network Development Plan for 2018–2027, page 41).

Figure: Interconnection of Croatia, Slovenia and Austria at Rogatec Cluster Project

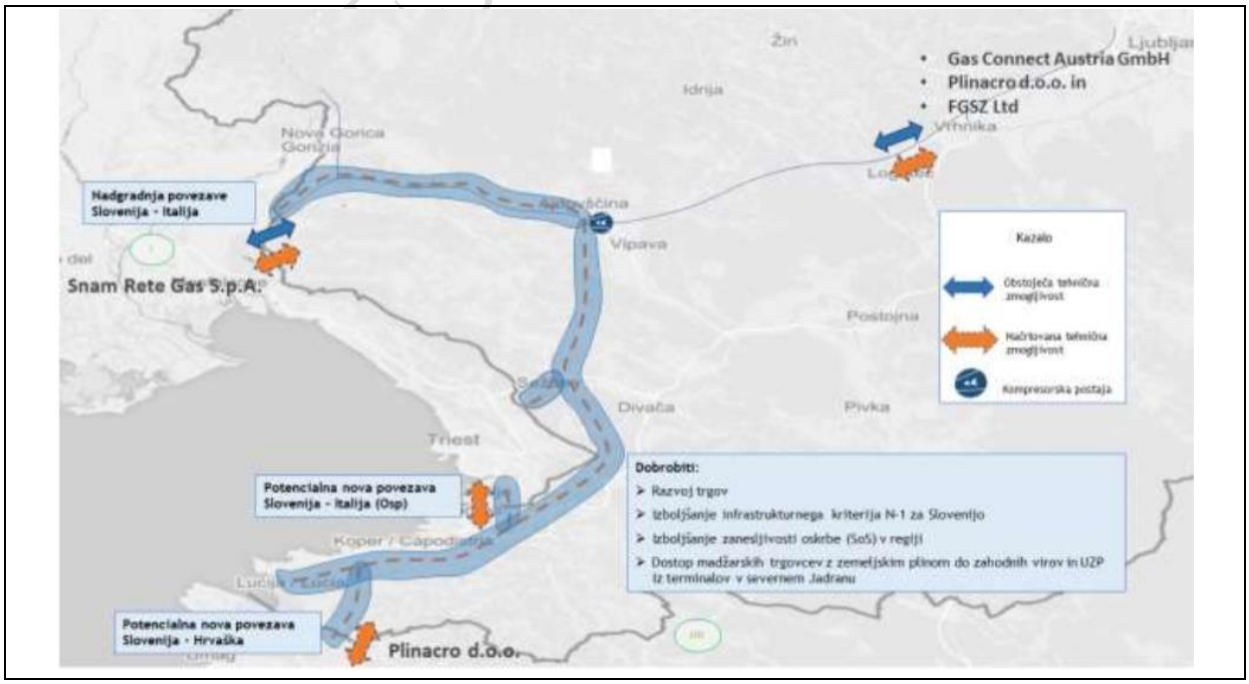


Source: Gas Transmission Network Development Plan for 2018–2027, page 42.

The interconnection hub in Eastern Slovenia is CS Kidričevo. The further development of this point is designed to cover large or small requirements for additional operating capacities in the direction of Austria, Croatia and Hungary via the planned R15/1 pipeline. Due to the strengthening of the regional gas market and the establishment of the southern gas corridor, the projects of which will bring natural gas and liquefied natural gas to the region, the strengthening of the connection of Slovenia's system with Italy's transmission system in Gorizia is becoming increasingly important. According to the realisation of the development plan prepared by Snam Rete Gas S.p.A. for the 2016–2025 period and the new development plan for the 2017–2026 period, which is being developed, upgraded bidirectional connections in the direction of the north of the Union and the east of the Union will be established in the northern part of Italy after 2018. In 2019, they will be technically operational, which means that the Slovenian system will have to be adapted to the newly created pressure conditions in the Italian system due to the bidirectional operation (Gas Transmission Network Development Plan for 2018–2027, page 42).

In the case of market demands for a significant increase in capacity at the Nova Gorica entry/exit point, the second stage of the CS Ajdovščina extension project and the M3/1 pipeline interconnection from Vodice to Nova Gorica will have to be implemented. The construction of the M6 pipeline, which will supply the Obalno-kraška region and run from Ajdovščina to Lucija, and in its course approach the national border with the Republic of Italy, will enable the implementation of an additional interconnection of the Italian and Slovenian transmission networks at Osp. Thus, the M6 project provides a new interconnection, which is included in the Snam Rete Gas S.p.A. development plan for the 2016–2025 period and the new development plan for the 2017–2026 period.

Figure: Upgrade of the interconnection Slovenia–Italy and potential new interconnection with Italy at Osp

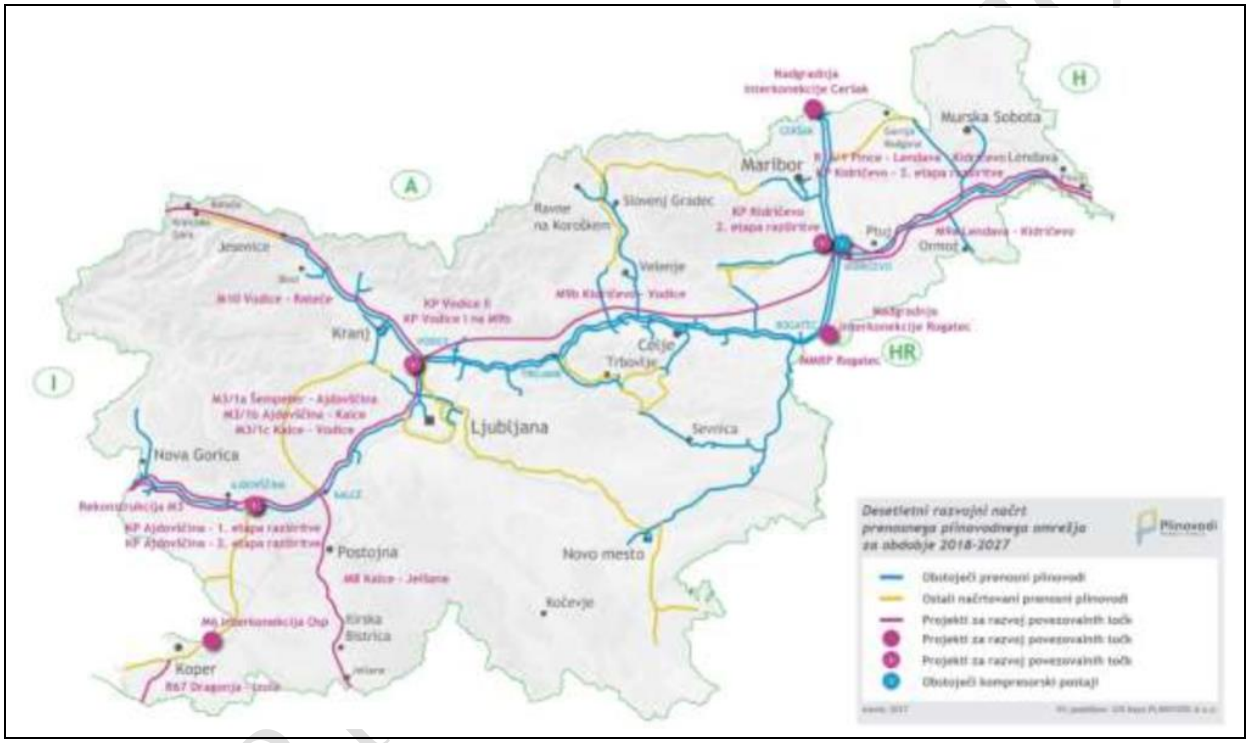


Source: Gas Transmission Network Development Plan for 2018–2027, page 43.

TSY TRANSLATION

A new interconnection with Croatia's transmission system is also planned. The construction of the 60-km pipeline M8 Jelšane–Kalce is planned, which will enable the transmission of natural gas from the potential LNG terminal on the Island of Krk in Croatia and/or the potential IAP transmission system (Ionian Adriatic Pipeline). The project to build the 100 km M3 pipeline from Šempeter to Vodice is also related to the project to transport Croatian LNG across Slovenia; in addition to providing transmission to Italy's transmission system, the pipeline will also provide transmission of the same gas to the extended interconnection point Ceršak and onwards to Austria's system *(Gas Transmission Network Development Plan for 2018–2027, page 43).*

Figure: Projects for the development of interconnection points with the neighbouring transmission systems



Source: Gas Transmission Network Development Plan for 2018–2027, page 44.

4.5.3 Electricity and gas markets, energy prices

Electricity market

The Slovenian electricity market is situated at the juncture of the three large European markets, i.e. German-Austrian, Italian and South-East European. The activities for separating the German and Austrian markets are under way, however, in 2017 they had not yet been realised. Considering the fact that in fragmented markets of the South-East Europe liquid power exchanges are not yet operational, it can be claimed that the common market of Germany and Austria and the Italian market have the greatest impact on the Slovenian market. On both markets, electricity production in wind and solar power plants, which belong to unpredictable and weather-dependent energy sources, has rapidly increased over the past years. An additional impact on the market situation had the fact that most generation facilities

using wind and sun are included in the national support scheme, thus electricity prices on the market can be very low. As a result, in recent years prices have dropped, but in 2017 this trend stopped for several reasons and turned in the opposite direction (Report on the Energy Sector in Slovenia for 2017, page 70).

Market conditions are significantly influenced by day-ahead market coupling. In 2017, the Slovenian market was included in multi-region day-ahead market coupling at the borders with Austria and Italy. Since the power exchange in Croatia was established much later than in other neighbouring countries, the border between Slovenia and Croatia has not yet been coupled. Market coupling is expected in June 2018. In intraday trading, only bilateral market coupling with Italy is established, which is carried out through complementary implicit auctions. In the coming years, due to the gradual implementation of European regulations laying down the guidelines for setting network codes, day-ahead and intraday market coupling is expected to be implemented on all European borders. In addition, the exchange of balancing energy among countries will take place (Report on the Energy Sector in Slovenia for 2017, page 70).

In 2014, the average base price on the power exchange in Slovenia was 40.4 EUR/MWh, and in 2016 only 35.6 EUR/MWh. In 2017, a significant increase in price was recorded, i.e. by as much as 39 % compared to the year before – the average base price on the power exchange in Slovenia was 49.5 EUR/MWh. Compared to the previous year, peak prices on the day-ahead market in 2017 also increased. In 2014, the average peak price on the power exchange in Slovenia was 45.8 EUR/MWh, and in 2016 it was 39.9 EUR/MWh. In 2017, the average peak price was 56.5 EUR/MWh, which is almost 42 % more than in 2016 (Report on the Energy Sector in Slovenia for 2017, pages 70–71).

There were several reasons for the increase in base and peak prices in all the observed day-ahead markets in 2017. Perhaps the most important reason was bad hydrology in the whole region and consequently relatively low electricity production in hydro power plants. Higher prices were also the result of economic and industrial growth in EU Member States, which increased demand for energy (Report on the Energy Sector in Slovenia for 2017, page 72).

The final consumer is increasingly involved in the development of the electricity market and energy supply. Digitization and computerisation of energy management and an open market allow consumers to participate in the active management of energy, both in production and demand response. The fulfilment of conditions for an active involvement of consumers is the challenge of smart grid development and innovative activities. In this area, energy companies are implementing different development projects (Report on the Energy Sector in Slovenia for 2017, page 8).

Demand and peak load forecasts

Electricity demand and load is the basis for transmission network planning. For the purpose of the ten-year development plan, electricity demand forecast, which is prepared by the electric power network operator, is duly and professionally made by using the internationally

COURTESY TRANSLATION

established models for long-term electricity demand assessment MEDEE (fr. *Modèle d'Evolution de la Demande d'Energie*). The future electricity needs are assessed at the level of final consumption and separately by energy product and sector – industry, transport and other. This is a complex process, which involves a certain level of uncertainty. All the input data for the model assessments are assessed based on the current situation and expected development of the society and economy not only in Slovenia but also worldwide (Transmission System Development Plan of the Republic of Slovenia for 2017–2026, page 50).

Electricity consumption is affected by many factors, the most important among them being the structure, size and level of economic growth, demographic trends, the development level of the whole society, the technological development level, climate conditions, environmental awareness the awareness of the necessity of environmentally friendly and sustainable development, as well as the movement and parity of energy prices in relation to the purchasing power. Both worldwide and in Slovenia, the economic activity, the measure of which is gross domestic product (GDP) or value added (VA), is the factor which most decisively impacts electricity consumption. The level of future GDP is separately assessed based on the macroeconomic theoretical multi-sector exogenous growth model, and on the dynamic stochastic general equilibrium (DSGE) model. In addition to the economy, energy consumption is influenced by demography, population distribution, the general standard of living and welfare, available machinery, devices and equipment, implementation of new technologies and energy efficiency measures (EE), as well as the realisation of energy policies. Apart from that, energy consumption is strongly affected by weather and outside temperature, resulting in deviations or fluctuations between the actual and the forecast GDP, as these fluctuations are very difficult or impossible to accurately predict (Transmission System Development Plan of the Republic of Slovenia for 2017–2026, page 50).

Table: Used projections in EUR million (permanent prices compared to 2000)

	Lower projection		Higher projection	
	GDP	Average annual growth rate	GDP	Average annual growth rate
2017	25,164	1.3%	25,495	1.8%
2020	26,757	2.1%	27,670	2.8%
2025	29,603	2.0%	31,855	2.9%
2030	32,162	1.7%	36,172	2.6%

Source: Transmission System Development Plan 2017–2026, page 50.

The estimate of demographic parameters is derived from the Eurostat's EUROPOP2013 projection. Total population is expected to increase by 2024 and then to slowly decrease. In the population structure, the share of people over 67 years will significantly increase. The growth rates of (active) population are relatively low compared to the growth rates of technology and human capital, which means that the population dynamics is not expected to substantially affect the long-term economic growth or to have a decisive impact on the growth of electricity consumption; however, it has an impact in combination with economic

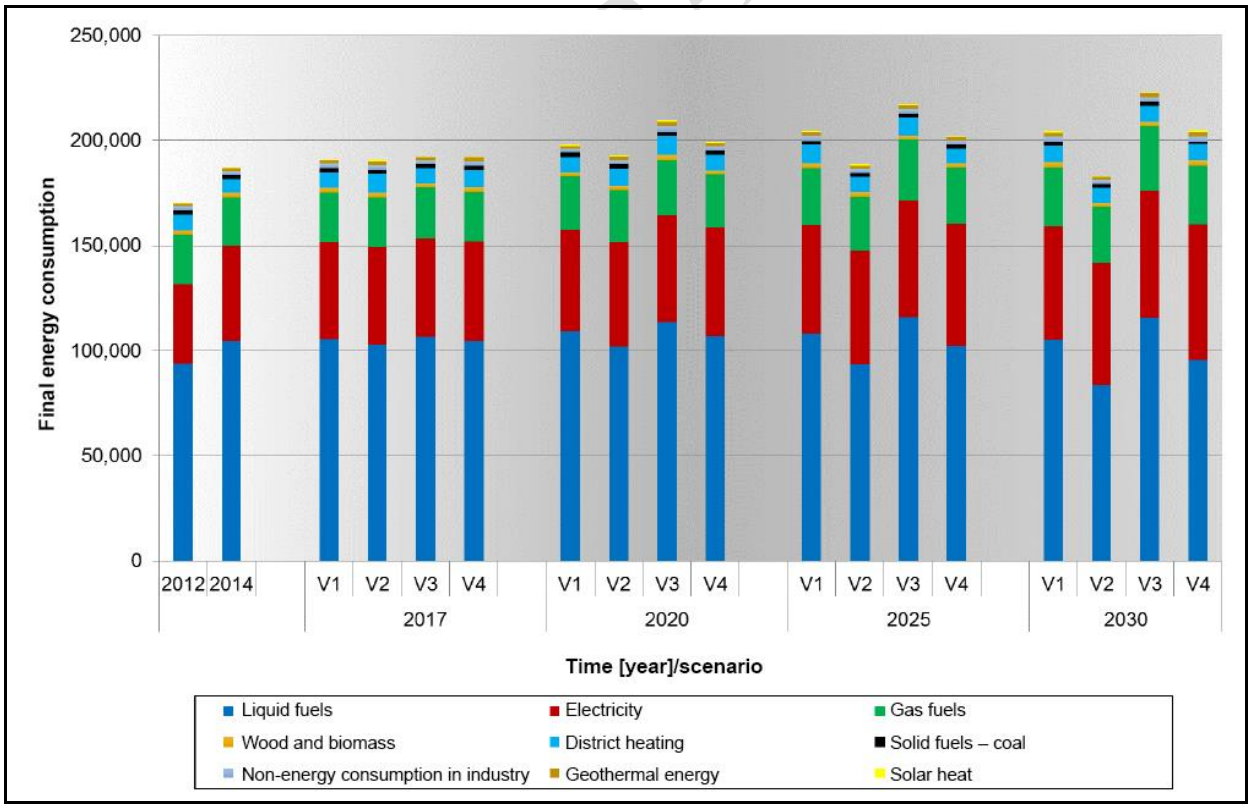
COURTESY TRANSLATION

development, which is reflected in the increase in the standard of living (Transmission System Development Plan of the Republic of Slovenia for 2017–2026, page 51).

Future electricity consumption scenarios follow the ENTSO-E TYNDP methodology to the greatest possible extent, which defines four development visions; these visions differ from one another in various parameters, i.e. the future level of economic activity, energy prices, stages of integration of generation from RES, the development of technical and technological parameters, utilisation, efficient energy use, etc. The visions are drawn up in such a way so as to include extreme but still very realistic future scenarios. The actually achieved future situation will largely depend on the energy policy of the European Union and individual Member States (Transmission System Development Plan of the Republic of Slovenia for 2017–2026, page 51).

The result of MEDEE model assessments is the consumption of total energy at the level of final energy. According to the results, compared to other energy products electricity demand will increase the most in relation to the 2012 base year, i.e. between 13.9 % and 28.5 %. The average annual growth rate of electricity consumption between 2015 and 2020 will be 1.09–1.99 % and between 2020 and 2025 it will be 1.18–2.27 % (Transmission System Development Plan of the Republic of Slovenia for 2017–2026, pages 52-53).

Figure: Future energy needs in the Republic of Slovenia



Source: Transmission System Development Plan 2017–2026, page 53.

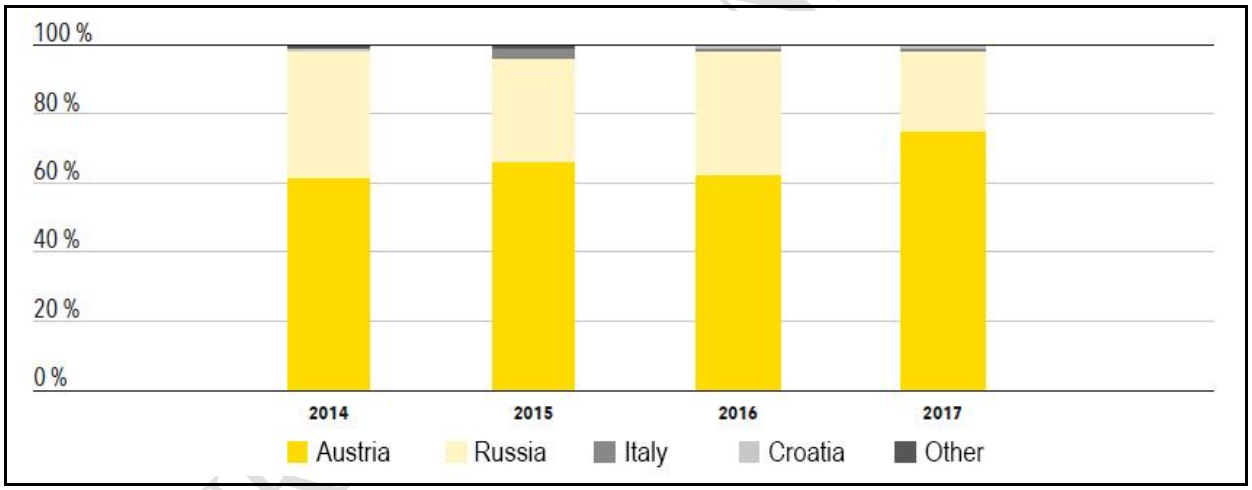
TRANSLATION

Natural gas market

Wholesale market

As Slovenia does not have any sources of natural gas, natural gas storage facilities or liquid natural gas terminals of its own, the wholesale natural gas market in Slovenia is limited by the import of natural gas from neighbouring natural gas transmission systems. The traders, who are also natural gas importers, supply Slovenia's transmission system from neighbouring transmission systems. The natural gas traded on the wholesale market comes from the transmission systems of the neighbouring countries that have their own sources of natural gas. Slovenia's wholesale market is supplied with gas from Austria, Italy and Croatia[41]. Among the described possibilities, the Slovenian traders or suppliers still mostly use the connection with Austria by using the Baumgarten gas hub and Austrian storage facilities to buy the largest quantities of gas[42]. Due to the liberalisation of the relevant market, natural gas import from Russia declined, whereas import from Austria increased. In the four-year observed period, it was higher by 60 %, and in 2017 it rose to 75 %. Adverse price differences were the reason that the share of gas imported from Italy decreased (Report on the Energy Sector in Slovenia for 2017, page 139).

Figure: Natural gas sources in 2014–2017



Source: Report on the Energy Sector in Slovenia for 2017, page 140.

As a result of market liberalisation, the number of long-term contracts signed directly with natural gas producers in Russia has been decreasing. They are being replaced by short-term contracts concluded at gas hubs, power exchanges and other points within the EU. In 2017, over 62 % of natural gas was bought on the basis of short-term contracts. Compared to 2016, this is a major change because at that time the share of gas bought under long-term contracts was almost equal to the share of gas bought under long-term contracts. The maturity of contracts or the relationship between long-term and short-term contracts can affect supply

[41] Under the normal circumstances, the supply from Croatia is (still) not possible due to the low pressure in the transmission system. In the event of an emergency situation in Slovenia (and supply to Croatia via Hungary), this would have been possible. In 2019, it is planned to complete the option of a reverse flow from Croatia to Slovenia.

[42] A connection with Hungary will allow Slovenia not only access to the Hungarian natural gas trading hub but also a connection with the natural gas storage facilities in Hungary.

reliability, as in the event of a gas shortage insufficient gas supply could occur if it were not possible to buy the required quantities on spot markets (Report on the Energy Sector in Slovenia for 2017, page 140).

In 2017, the largest market share was again held by Geoplin, d.o.o, Ljubljana, while Petrol Energetika, d.o.o. held slightly over 25 %. The retail market shares indicate that the largest suppliers on the retail market purchase gas independently on the foreign markets, while small suppliers buy it from importers. Market concentration measured by HHI shows a very high concentration on the Slovenian wholesale market (Report on the Energy Sector in Slovenia for 2017, pages 140–141).

Retail market

On the retail market, the consumers can choose between the suppliers offering natural gas in their local community. Active in the market are also natural gas suppliers that supply gas only to certain local communities. Consumers pay for the supplied natural gas according to the actual consumption or based on the gas quantities determined by distribution system operators in the case of annual meter readings. In 2017, as many as 28 natural gas suppliers were active in the Slovenian retail market, which based on the contracts supplied gas to 133,630 consumers. Six new suppliers entered the retail market in 2017, of which only RWE has provided natural gas to household consumers since October 2017. The remaining five suppliers sold gas to business consumers exclusively in a restricted (industrial) area. No supplier left the Slovenian retail market in 2017 (Report on the Energy Sector in Slovenia for 2017, page 144).

Suppliers offer natural gas in the form of various products. In addition to the products based on regular tariffs, suppliers provide special offers (the special price is valid for a certain period) and bundled offers (apart from natural gas, other services are included or a specific payment method is available). Special and bundled offers can be limited to a specific circle of consumers and generally contain contractual penalties in the event of early termination of the contract. Regular offers for individual consumer types are based on regular tariffs43 and available to all natural gas consumers in Slovenia. In the case of the latter, consumers can switch their supplier at any time. The suppliers are required to publish their offers for household and small business consumers on their website, and consumers have the right to be informed about natural gas prices in a comprehensive manner and to be able to compare them. In the context of price comparison at the single point of contact on the Agency's website, the consumers are able to compare prices only for the suppliers' regular offers (Report on the Energy Sector in Slovenia for 2017, page 144).

Retail natural gas prices

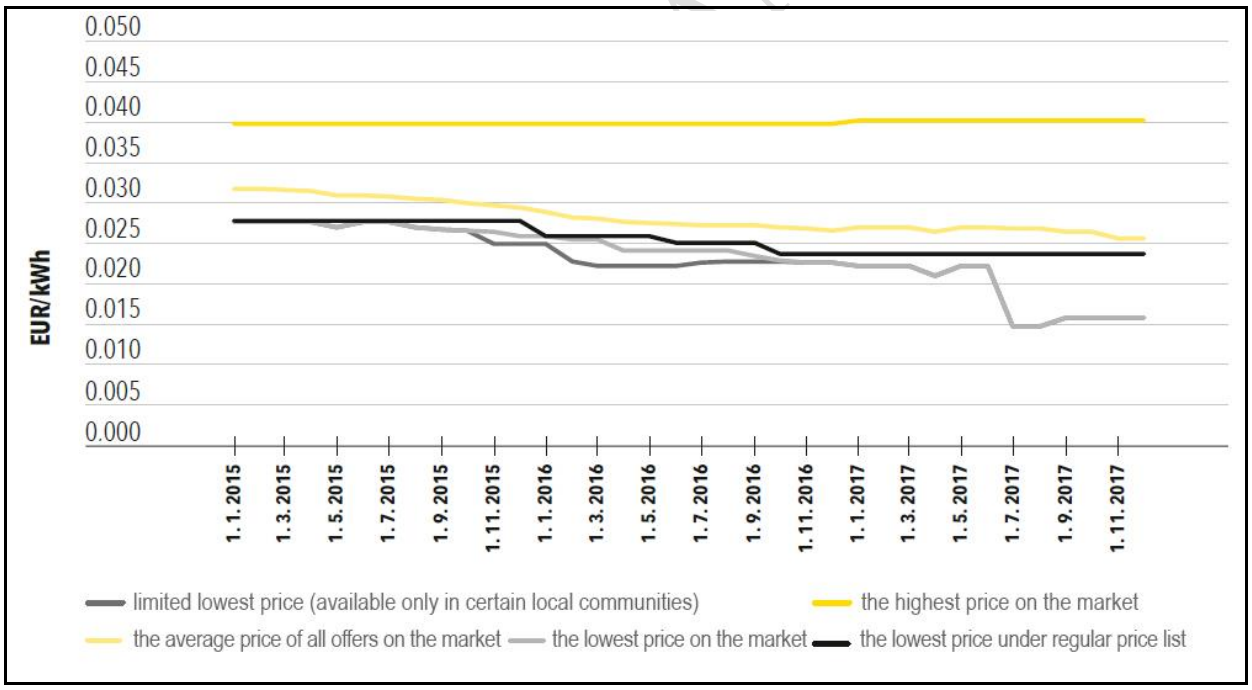
The Energy Agency monitors prices in the retail market on the basis of public data and data on the offers on the market for household and small business consumers, which it monthly obtains from the suppliers in the context of price comparison at the single point of contact. For the sixth year in a row, natural gas prices have been falling. This was a result of favourable conditions on wholesale markets, improved competitiveness, new suppliers,

COURTESY TRANSLATION

marketing activities and new sales approaches. The individual suppliers which in the past supplied only electricity also entered the natural gas market and vice versa (Report on the Energy Sector in Slovenia for 2017, page 145).

Since 2011, a decrease in natural gas prices has been recorded, which is a result of price movements in the wholesale markets and a significant increase in competition in the retail market. The year 2017 was also marked by the decline in individual prices for consumers. The lowest price in the market, which was available under a specific offer in all local communities, ranged between 0.01466 and 0.01585 EUR/kWh in the second half of 2017. The average price in 2017 had been dropping as a consequence of lower gas prices in the most favourable offers of individual suppliers. It can be concluded that the decrease in prices in the second half of 2017 caused an increased number of supplier changes in this period (Figure 139). The same supplier has had the highest price on the market since the beginning of 2012, which even slightly increased in 2017, and it has not significantly changed over the last five years. It was again confirmed that it pays to monitor the prices on the market, because the highest price was 2.7 times higher than the lowest price on the market (Report on the Energy Sector in Slovenia for 2017, pages 145–146).

Figure: Retail price index and some typical natural gas prices excluding the network charge, excise duties and VAT in 2015–2017



Source: Report on the Energy Sector in Slovenia for 2017, page 145.

Since early 2016, natural gas prices have been falling for all consumer groups. Compared to 2016, the largest decrease in prices was seen for the group of the smallest consumers – D1, for which the price in the second half of 2017 was lower by almost 20 % than in the first half of 2016. In most EU countries, natural gas prices decreased compared to 2016, which is reflected in the average price at the EU-28 level, which also declined. Natural gas price in

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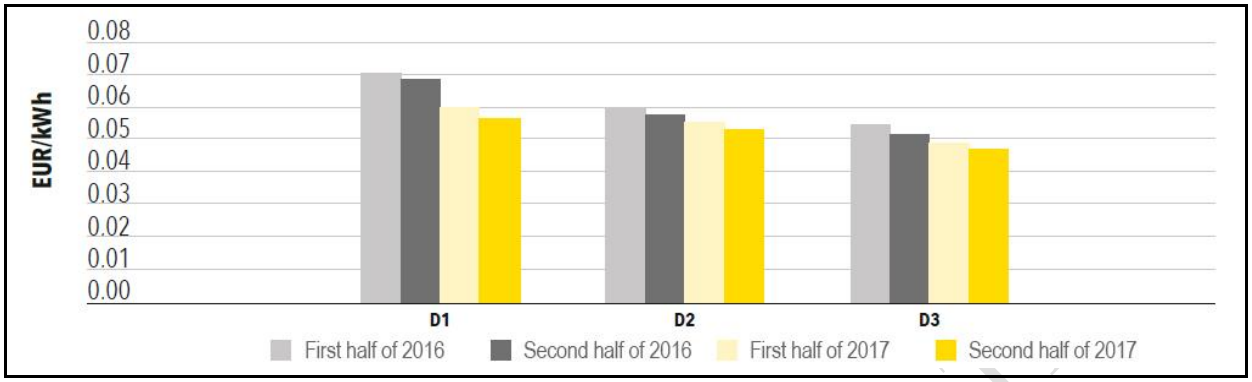
Slovenia remained below the EU-28 average (Report on the Energy Sector in Slovenia for 2017, page 146).

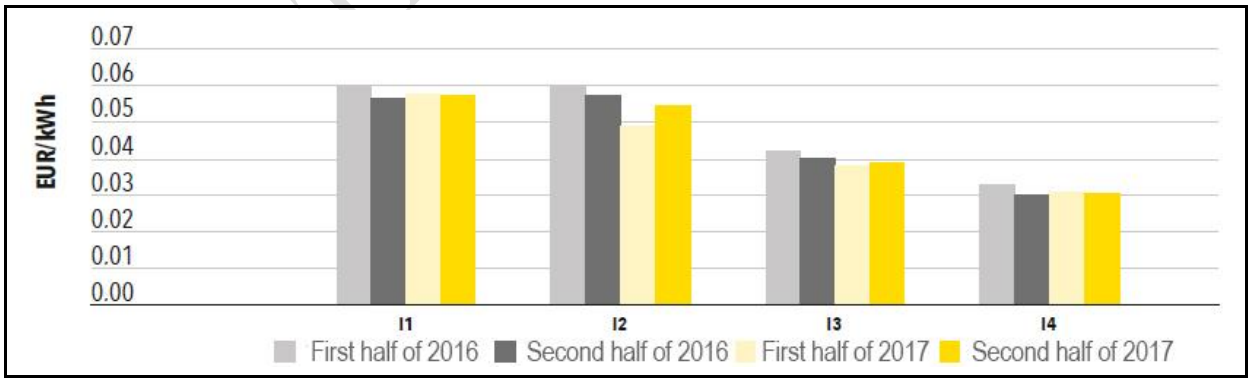
Figure: Final natural gas price including all taxes and levies for household consumers in Slovenia in 2016 and 2017



Source: Report on the Energy Sector in Slovenia for 2017, page 146.

Compared to 2016, the final prices of natural gas for business consumption decreased for the groups I2 and I3, and increased for the groups I1 and I4. The prices for individual groups were lower in the first half of 2017 and then increased in the second half of the year. The largest decrease in prices compared to 2016 was recorded in the group I2. Individual increases in final prices can be attributed to a significant increase in natural gas prices on the wholesale markets in the second half of 2017. Compared to 2016, the final prices of natural gas for typical household consumers – group D2 with an annual consumption ranging from 5,556 kWh to 55,556 kWh in Slovenia and EU countries decreased in most countries, which is reflected in the average price at the EU-28 level, which also declined. In 2017, natural gas price in Slovenia remained below the EU-28 average.

Figure: Final natural gas prices including all taxes and levies for industrial consumers in Slovenia in 2016 and 2017



Source: Report on the Energy Sector in Slovenia for 2017, page 147.

Forecast of natural gas consumption and transmission capacity lease for 2018–2027

The forecast of the transmission system operator's lease of transmission capacity is the key element in reviewing the future development of the natural gas market and is based on numerous elements, which the transmission system operator includes in forecast preparation. The forecast of

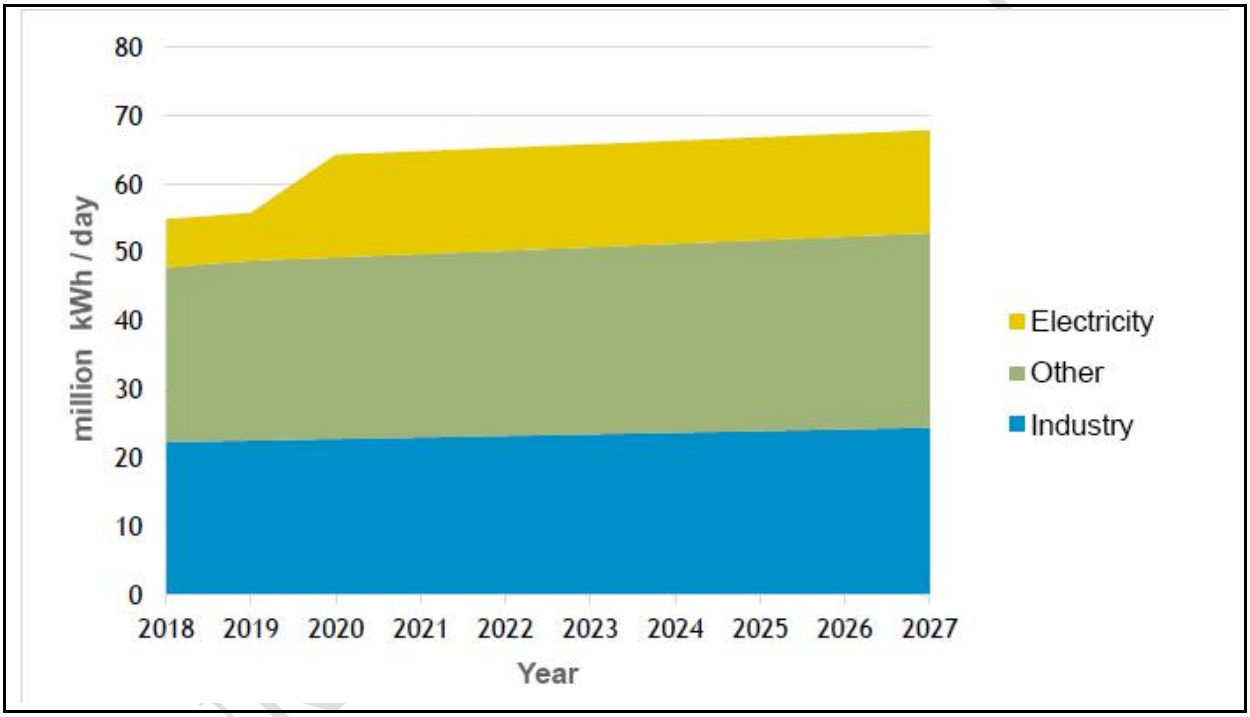
jointly planned transmission capacity lease by 2027, which was prepared by the transmission system operator, indicates an increase in transmission capacity lease, which is in line with the company's development plans and the construction of additional transmission capacity (Gas Transmission Network Development Plan for 2018–2027, pages 24–25).

Table: Forecast of transmission capacity lease by 2027 – total (in million kWh/day)

Sector	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Industry	22.395	22.619	22.846	23.074	23.305	23.538	23.773	24.011	24.251	24.494
Other	25.508	26,213	26.476	26.742	27.010	27.281	27.555	27.832	28.111	28.393
Electricity	6.995	6.995	15.005	15.005	15.005	15.005	15.005	15.005	15.005	15.005
In total	54.898	55.827	64.327	64.821	65.320	65.824	66.333	66.848	67.367	67.892

Source: Gas Transmission Network Development Plan for 2018–2027, page 25.

Figure: Estimate of transmission capacity lease for the 2018–2027 period



Source: Gas Transmission Network Development Plan for 2018–2027, page 25.

When preparing forecasts of future transmission capacity lease, the transmission system operator uses different sources. Due to the increasing dynamics and the evolving natural gas market, the transmission system operator points out that long-term forecasts, i.e. forecasts exceeding 3 years, are in fact only indicative forecasts, which depend on various factors that cannot be directly influenced by the transmission system operator. The most reliable source of forecast used by the transmission system operator are the agreements and contracts that have already been signed. The transmission system operator observed an ever more pronounced trend of short-term transmission capacity lease, as system users tend to use short-term services more frequently. The increasing liquidity and liberalisation of the natural gas market provides additional opportunities for system users, while increasing the flexibility of natural gas supply and reducing the reliability of the transmission system operator's lease forecast.

The demand received is an important source for the preparation of a forecast, but it is very limited in terms of duration. When preparing a forecast, the transmission system operator also monitors the development of the domestic and foreign energy markets and the plans for the construction of power facilities. The transmission system operator continuously monitors the competitiveness of the transmission routes in the region in order to ensure the appropriate competitiveness of the transmission route through Slovenia (*Gas Transmission Network Development Plan for 2018–2027*, pages 25–26).

Table: Forecast of natural gas consumption in the domestic gas market for the coming ten-year period

Sector	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Industry	5,239	5,291	5,344	5,397	5,451	5,506	5,561	5,617	5,673	5,729
Other	4,099	4,140	4,181	4,223	4,265	4,307	4,351	4,394	4,438	4,482
Electricity	50	50	2,136	2,136	2,136	2,136	2,136	2,136	2,136	2,136
In total	9,388	9,481	11,661	11,756	11,852	11,949	12,048	12,147	12,247	12,347

Source: Gas Transmission Network Development Plan for 2018–2027, page 26.

In preparing forecasts for future natural gas consumption, in addition to other elements, the transmission system operator takes into account not only the individual forecasts of natural gas market players but also the general forecasts of natural gas market development and economic growth. Energy efficiency measures were taken into account in the forecasts, but the transmission system operator estimates that their impact will be superseded by the increased consumption (*Gas Transmission Network Development Plan for 2018–2027*, page 26).

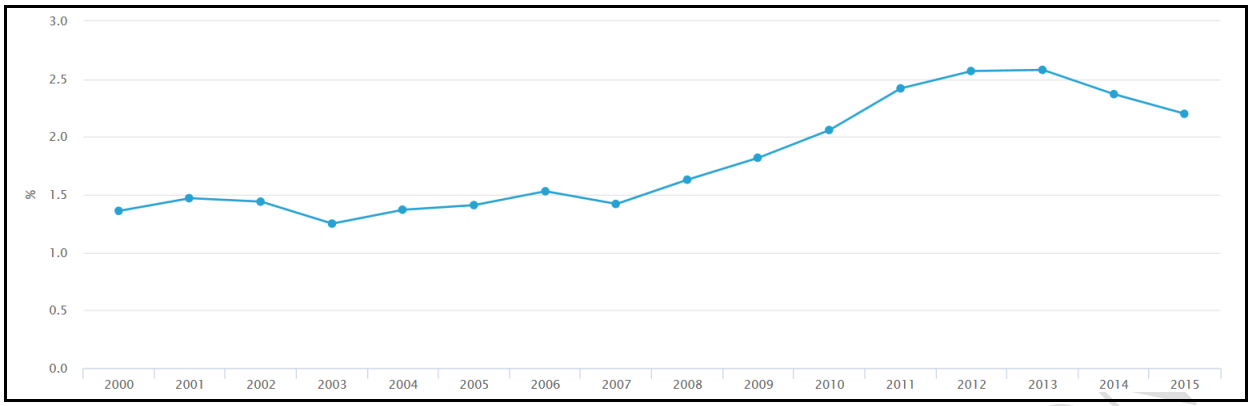
4.6 Dimension Research, innovation and competitiveness

According to the data on the research and development activity (R&D) for 2016, EUR 812 million or 2.01% of GDP was spent on R&D in all sectors in Slovenia in 2016. Compared to the previous year (2015), the R&D funds decreased in nominal terms by 4.8 % or EUR 41.1 million; they totalled EUR 853.1 million. If they are expressed as a share of GDP, they dropped by 0.19 percentage point. In absolute terms, the highest decline in the R&D funds was recorded in the business enterprise sector (which spends most R&D funds); in nominal terms, the R&D funds in the business enterprise sector were EUR 35.9 million or 5.5 % lower than the year before (SURS, 2018)[43].

[43] *SURS, 2018,* ***Research and development activity****, 2016, available at* https://www.stat.si/StatWeb/News/Index/7277

COURTESY TRANSLATION

Figure: Gross domestic expenditure on R&D, Slovenia



Source: SURS, 2018

The table below, which presents gross domestic expenditure on R&D by source of funds in 2016, shows that the highest share for R&D is spent by companies (almost 70 %), followed by the government sources and sources from abroad (primarily EU funds).

Table: Gross domestic expenditure on R&D by source of funds in 2016

(in 1 000 EUR)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	% in 2016
Financing sources – IN TOTAL	500508	616949	656882	745942	894213	928306	935006	890231	853067	811953	**100.00 %**
Companies	291636	387494	380884	435450	547505	577610	596981	608828	590398	562259	**69.25 %**
Government sources	178210	193101	234241	263077	281764	266190	251263	193930	169644	163940	**20.19 %**
Higher education	1783	1801	1889	2118	2062	4021	3236	4572	2893	3204	**0.39 %**
Private non-profit organisations	62	73	203	459	97	994	194	422	66	46	**0.01 %**
Sources from abroad	28817	34480	39665	44838	62785	79491	83330	82479	90066	82505	**10.16 %**

Source: SURS, 2018

The table below, which presents gross domestic expenditure on R&D in Slovenia from government sources in the 2007–2016 period, shows that since 2007 the share of government sources in gross domestic expenditure on R&D has declined until 2015 when it stabilised and began to gradually increase.

Table: Gross domestic expenditure on R&D in Slovenia from government sources in the 2007–2016 period

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Financing sources – IN TOTAL	500508	616949	656882	745942	894213	928306	935006	890231	853067	811953
Government sources	178210	193101	234241	263077	281764	266190	251263	193930	169644	163940
%	35.61%	31.30%	35.66%	35.27%	31.51%	28.67%	26.87%	21.78%	19.89%	20.19%

Source: SURS, 2018

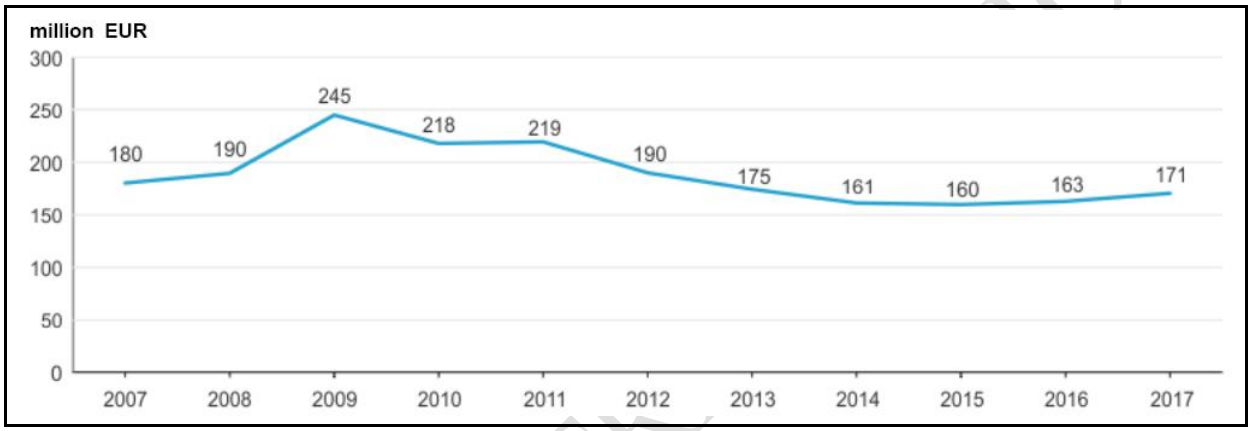
According to the final budget data for 2017, government budget allocations for R&D (GBARD) in Slovenia amounted to EUR 170.5 million, an increase of EUR 7.8 million or 4.8 % over the previous year. This is the second increase in a row. Compared to 2016, the share of GBARD in GDP in 2017 remained the same at 0.40 %. According to the initial budget for 2018, GBARD should be higher than the planned and used GBARD in 2017. The initial

COURTESY TRANSLATION

GBARD in 2018 amount to EUR 199.4 million, which is EUR 28.9 million more funds on R&D than the government actually spent in 2017 (SURS, 2018b)[44].

In 2017, half (49.8 %) of total GBARD was spent for the general progress of knowledge, followed by industrial production and technology (10.8 %) and health (10.5 %). The structure of the planned GBARD for 2018 by socio-economic objectives will be approximately the same as the structure of GBARD spent in 2017. The bulk of GBARD (91.7 %) in 2017 was spent in the government and higher education sectors with 54.3 % and 37.4 % respectively. The remaining tenth of GBARD was spent on R&D in the business enterprise sector (6.6 %), the private non-profit sector (0.9 %) and abroad (0.7 %) (SURS, 2018b).

Figure: Government budget allocations for R&D (final budget), Slovenia



Source: SURS, 2018b.

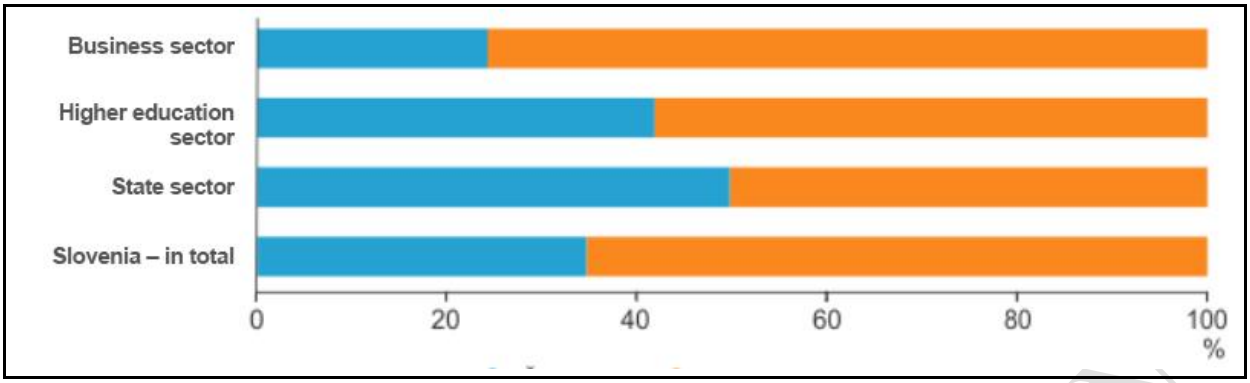
Among 20,022 persons regularly employed in R&D in 2016, as many as 11,282 (i.e. 56 %) were researchers of both genders. If the number of R&D personnel (full-time and external personnel) is expressed in full-time equivalent (FTE), the aim of which is to avoid underestimating or overestimating the data on R&D personnel, as many as 14,403 persons with full-time employment were involved in R&D in 2016, of whom 8,119 (56 %) were researchers of both genders (SURS, 2018).

According to the data, women are a minority among researchers. In 2016, women accounted for 35 % of all researchers in Slovenia (expressed in head count). If the number of researchers (full-time and external personnel) involved in R&D is expressed in FTE, women accounted for 33 % of all researchers. The distribution of women and men in the three most important sectors in 2016 was the same as in previous years: the highest share of women among researchers was in the government sector (50 %), followed by 42 % of women researchers in the higher education sector, whereas in the business enterprise sector the share of women was again very low (24 %) (SURS, 2018).

COURTESY TRANSLATION

[44] *SURS, 2018,* ***Government budget allocations for R&D increased for the second consecutive year****, available at https://www.stat.si/StatWeb/News/Index/7681*

Figure: The share of researchers by sector of employment and gender



Source: SURS, 2018

Slovenia does not have accurate data on the number of patents related to low-carbon technologies. Therefore, only some partial publicly available data are stated below.

According to the Eco-Innovation Output component in the EIO Country Profile for Slovenia for 2017, eco-innovation related media coverage (per number of electronic media) significantly increase in 2016 and 2017 compared to 2015, thus surpassing the EU average. Similarly, the number of eco-innovation related publications (per million population) in 2017 increased compared to 2015, thus surpassing the EU average. In contrast, the number of eco-innovation related patents remains low, not reaching the EU average (EIO, 2017)[45].

Table: The number of eco-innovation related patents, media coverage and publications in Slovenia in 2010–2017

	Number of eco-patents per million population (original data)	Number of publications per million population (original data)	Hits per electronic media (original data)
EU AVERAGE	18.34	20.53	1.00
Slovenia 2017	**9.82**	**45.54**	**1.47**
Slovenia 2016	17.89	25.21	1.24
Slovenia 2015	10.31	29.60	0.18
Slovenia 2014	10.00	18.94	0.10
Slovenia 2013	2.56	17.03	0.05
Slovenia 2012	1.99	11.22	0.04
Slovenia 2011	1.99	2.44	0.05
Slovenia 2010	0.00		

Source: EIO, 2017

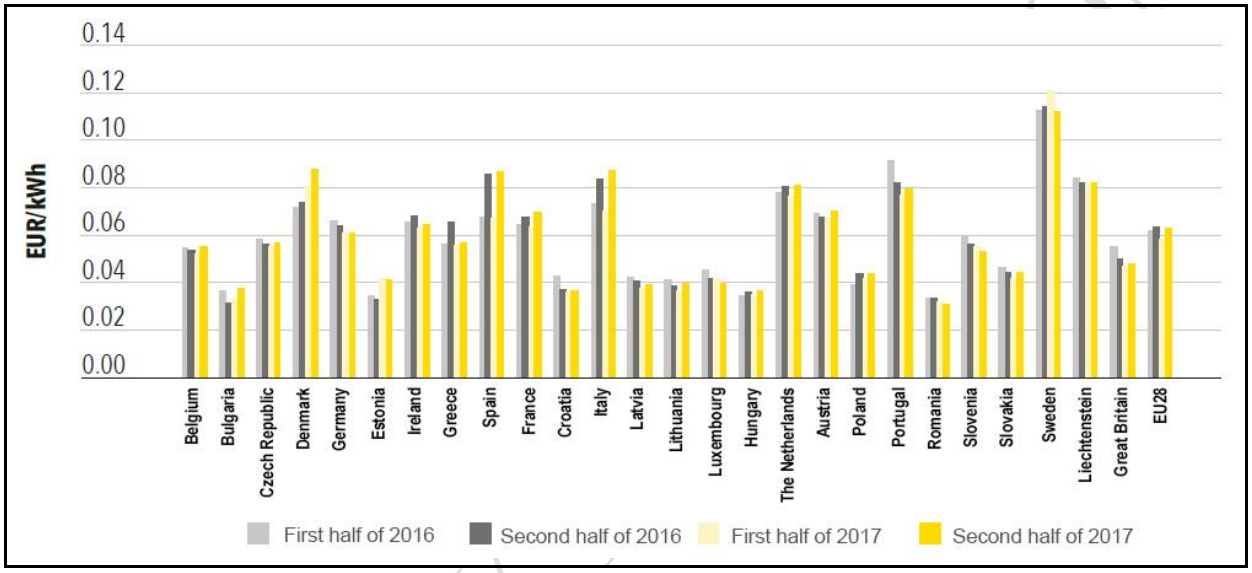
[45] EIO, 2017, **Eco-innovation in Slovenia**, available at: https://ec.europa.eu/environment/ecoap/sites/ecoap_stayconnected/files/field/field-country-files/slovenia_eio_country_profile_2016-2017_1.pdf

COURTESY TRANSLATION

Natural gas prices

The figure below shows the final prices of natural gas for typical household consumers – group D2 with an annual consumption from 5,556 kWh to 55,556 kWh in Slovenia and EU countries. In most countries, natural gas prices decreased compared to 2016, which is reflected in the average price at the EU-28 level, which also declined. The largest increase in natural gas prices was recorded in Estonia, and the largest decrease in Great Britain. Natural gas price in Slovenia remained below the EU-28 average (Report on the Energy Sector in Slovenia for 2017, page 146).

Figure: Final natural gas prices including all taxes and levies for typical household consumers (D2) in Slovenia and individual EU countries in 2016 and 2017

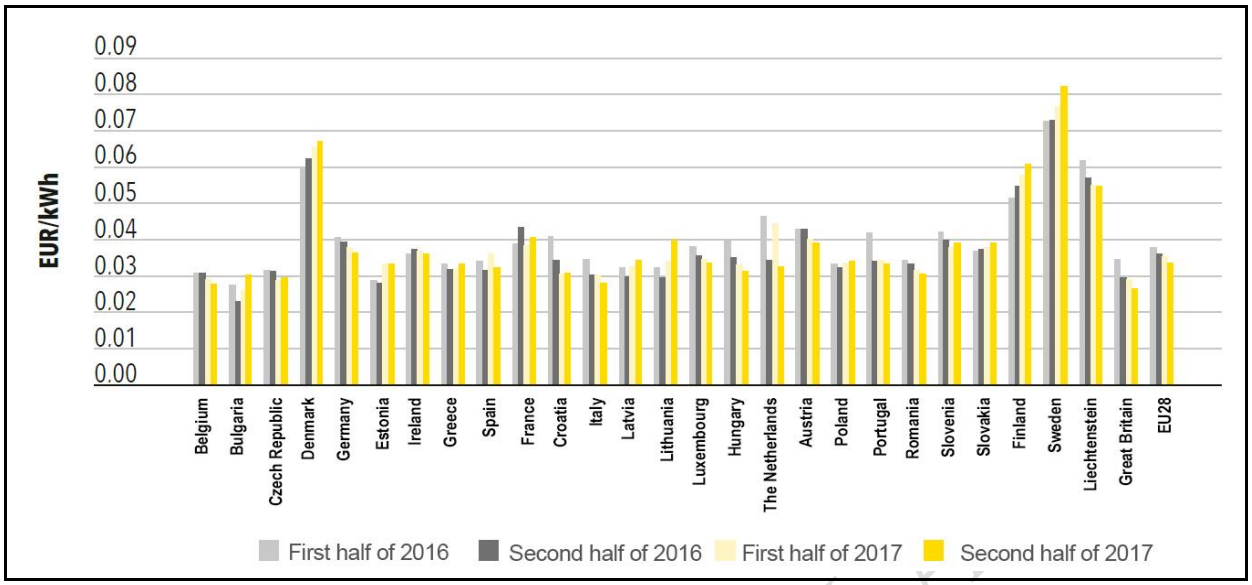


Source: Report on the Energy Sector in Slovenia for 2017, page 146.

The figure below shows semi-annual natural gas price movements including all taxes and levies in 2016 and 2017 in Slovenia and EU countries for large industrial consumers (group I3) with annual consumption between 2,777,800 kWh and 27,778,000 kWh. In more than half of the EU countries, the prices for this group decreased compared to 2016; moreover, the average EU-28 price also decreased. The largest increase in natural gas prices was recorded in Lithuania, and the largest decrease in Croatia. The natural gas price in Slovenia remained below the EU-28 average also in 2017 (Report on the Energy Sector in Slovenia for 2017, page 147).

COURTESY TRANSLATION

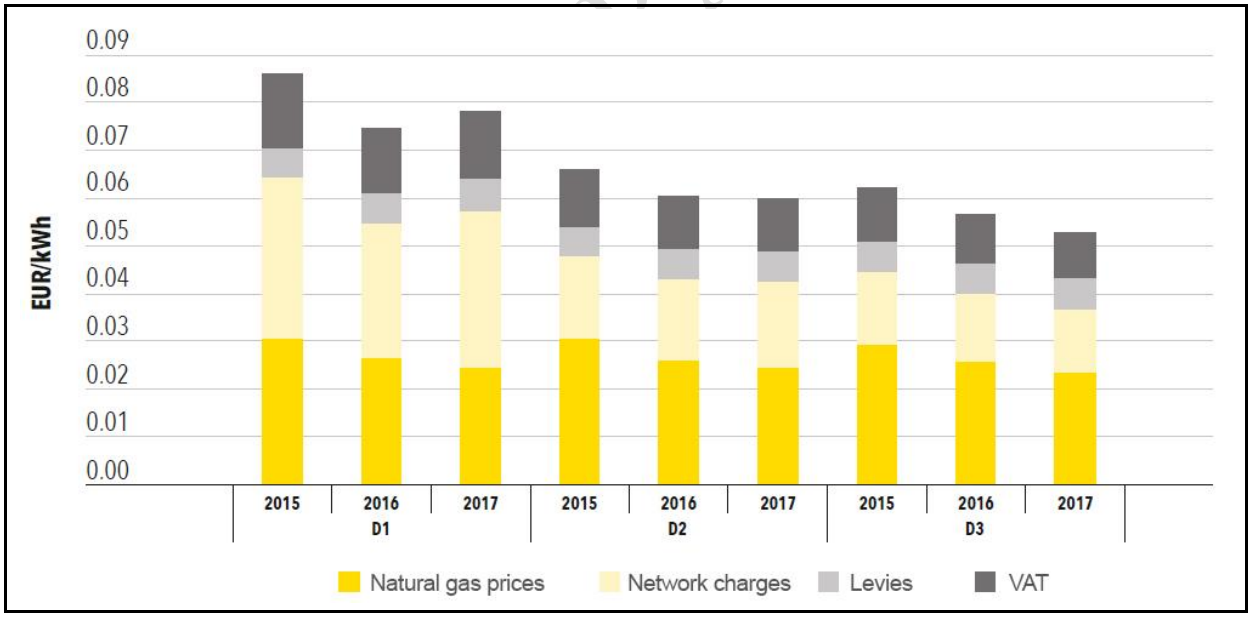
Figure: Final natural gas prices including all taxes and levies for typical industrial consumers (I3) in Slovenia and individual EU countries in 2016 and 2017



Source: Report on the Energy Sector in Slovenia for 2017, page 147.

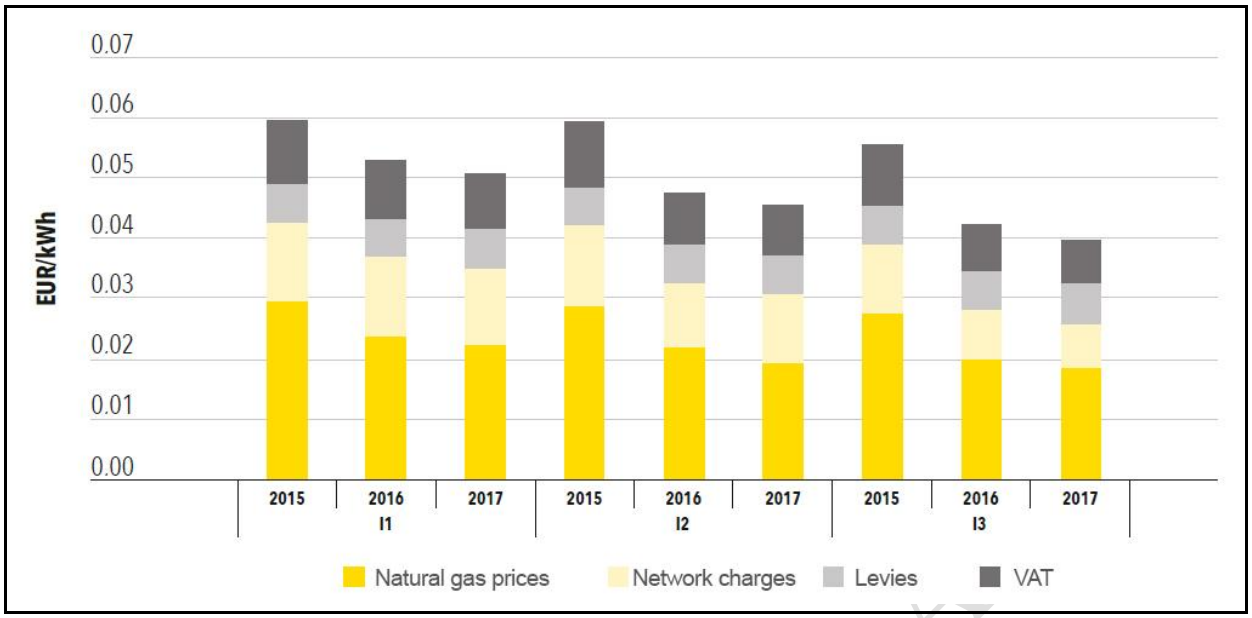
The figures below show the structure of the final price for typical household and business consumers connected to the distribution systems in the 2015–2017 period.

Figure: Structure of the final natural gas price for household consumers in the period 2015–2017



Source: Report on the Energy Sector in Slovenia for 2017, page 148.

Figure: Structure of the final natural gas price for business consumers in the period 2015–2017



Source: Report on the Energy Sector in Slovenia for 2017, page 148.

The structure of final prices did not change significantly in the 2015–2017 period and, due to the favourable conditions on the natural gas markets, the final price for natural gas was decreasing as a result of the lower share of the energy product in the final price. The exception was group D1, for which the final price increased due to the higher network charge. The energy product price has a dominant influence in the final price structure, therefore an individual low increase in levies or the network charge does not affect the final price of gas (Report on the Energy Sector in Slovenia for 2017, page 148).

Electricity prices

The electricity market is open and competitive, therefore the final electricity prices are affected by market conditions and factors. The Energy Agency regularly monitors the prices in the household and business markets by receiving monthly information on price changes or supply offers in the retail market from suppliers. The market for large business consumers is analysed at an annual level on the basis of the data received from the EPOS system, which is managed by the Ministry of Infrastructure (Report on the Energy Sector in Slovenia for 2017, page 84).

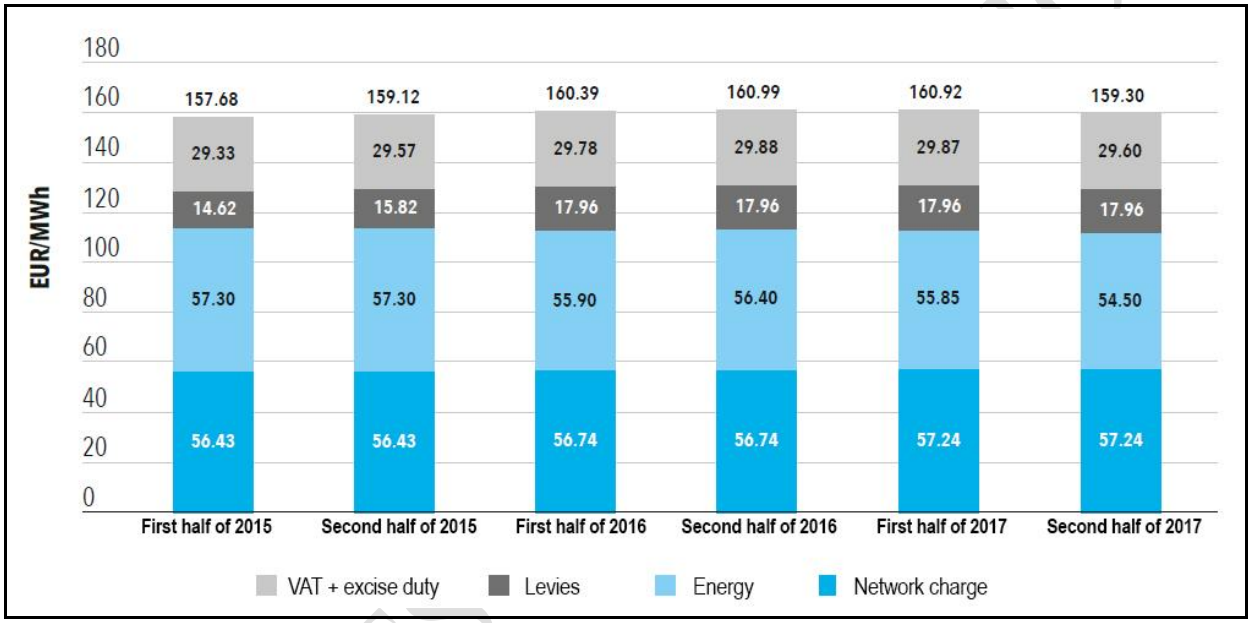
Suppliers offer electricity in the form of various products, which can be divided into regular supply offers (which are based on regular tariffs and their terms of supply set out by the EZ-1) and other supply offers; the latter are further divided into special offers (based on regular tariffs), bundled offers (which include other services in addition to electricity supply) and other offers, which cannot be allocated to any of these categories due to their specificity (Report on the Energy Sector in Slovenia for 2017, page 84).

COURTESY TRANSLA

The figure below shows the **analysis of the structure of final electricity prices for typical household consumers.** The final electricity price for the consumer consists of (Report on the Energy Sector in Slovenia for 2017, page 84):

- the electricity price freely set on the market;
- the network charge (for the transmission and distribution networks);
- levies (for electricity production from CHP and RES, energy efficiency and the operation of the operator's market);
- excise duties for electricity and
- value added tax (VAT).F

Figure: Movements of the final electricity price for typical household consumers in Slovenia (Dc – 2,500–5,000 kWh per year) in 2015–2017



Source: Report on the Energy Sector in Slovenia for 2017, page 87

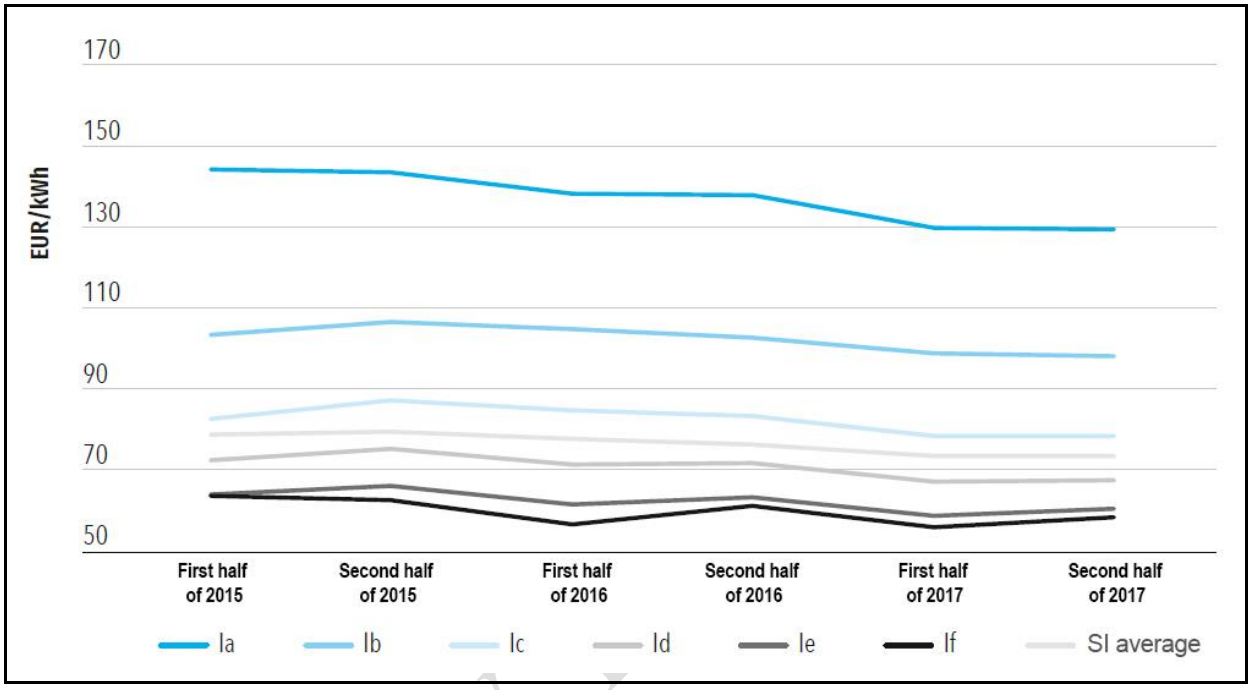
Compared to 2016, the final electricity price in 2017 decreased due to the decline in the electricity price in the final price structure. Over the past three years, the fluctuation of this price did not exceed a 2 % increase in relation to the lowest value reached in the first half of 2015 (Report on the Energy Sector in Slovenia for 2017, page 87).

The average final **electricity price for business consumers** without VAT was 80.7 EUR/MWh in the second half of 2017, down by 5.1 % compared to the same period in 2016. The reduction in the retail price does not reflect prices in the wholesale markets, as prices in these market significantly increased. The pricing models of suppliers are tailored to consumers and are directly or indirectly connected with wholesale prices. It can be assumed that the suppliers bought most energy for their portfolio in advance on future markets when the electricity price was considerably lower (at the end of 2016). The figure below shows that, compared to the first half of 2017, the prices for the consumer groups If and Ie increased in the second half of 2017, whereas for other consumer groups they dropped. It can be concluded that high prices in the wholesale market already had some impact on retail prices. The

COURTESY TRANSLATION

consumer groups If and Ie are the largest among the observed groups. Assuming that the contract price for the largest consumers is at least partly linked to the stock exchange index, then higher annual consumption also means higher risks for a consumer in the event of unfavourable electricity prices for a supplier on spot markets (Report on the Energy Sector in Slovenia for 2017, page 88).

Figure: Movements of the final electricity price for typical business consumers in Slovenia in 2015–2017

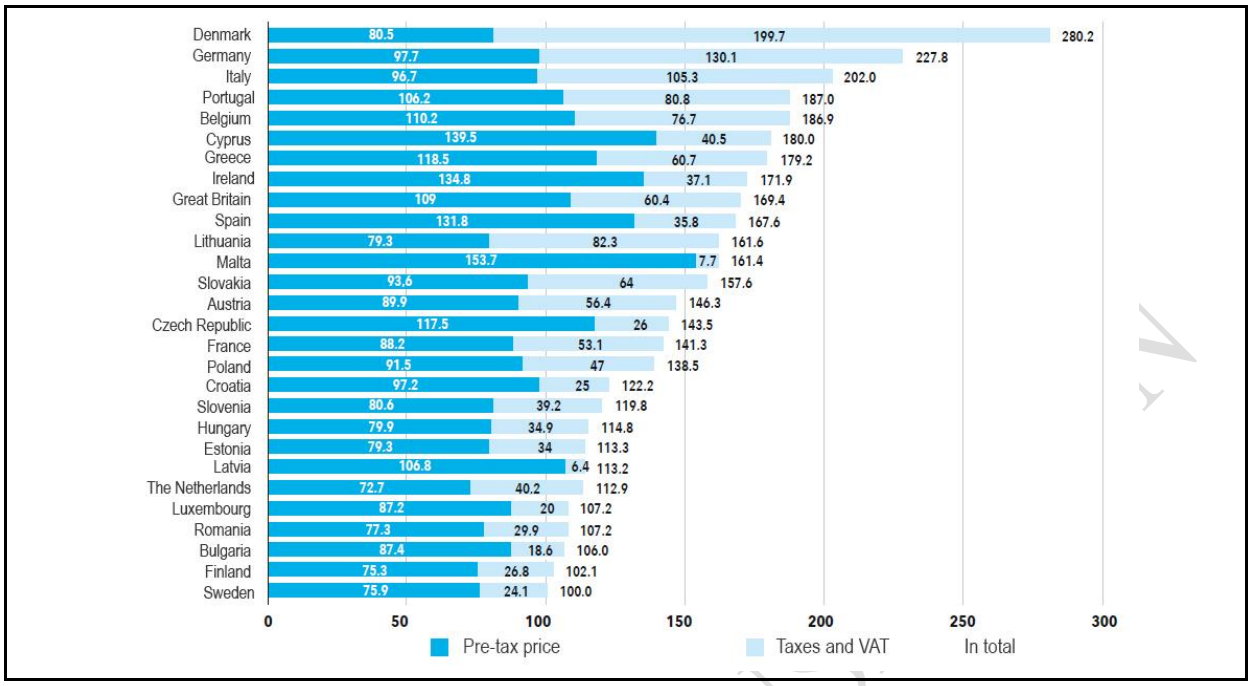


Source: Report on the Energy Sector in Slovenia for 2017, page 88.

The figures below show the comparison of final electricity prices in the EU Member States in 2017 for two typical business consumers, selected in accordance with the Eurostat methodology. In Slovenia, levies and taxes include levies, excise duty and VAT, while the price without levies and taxes includes the price of energy and the network charge. For the third consecutive year, the highest price for business consumers in the EU was in Denmark, where levies and taxes accounted for the bulk of the final price. Compared to 2016, the final electricity price in Slovenia decreased for both consumer groups and was lower than the average EU price, which is good for the competitiveness of the industry (Report on the Energy Sector in Slovenia for 2017, page 88).

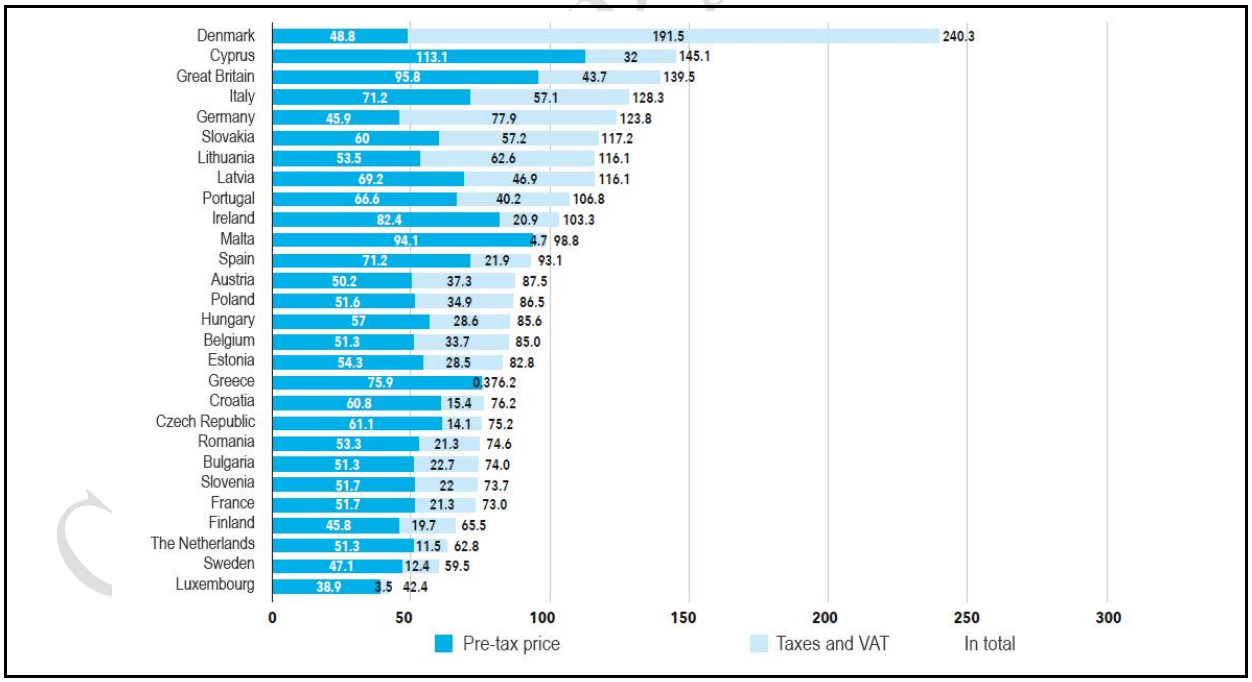
COURTESY

Figure: Comparison of electricity prices for a typical business consumer with the annual consumption of 20–500 MWh (Ib) in the EU and Slovenia in 2017 in EUR/MWh



Source: Report on the Energy Sector in Slovenia for 2017, page 89.

Figure: Comparison of electricity prices for a typical business consumer with the annual consumption of 20–70 GWh (Ie) in the EU and Slovenia in 2017 in EUR/MWh



Source: Report on the Energy Sector in Slovenia for 2017, page 89.

Subsidies

The subsidies increased in 2016, which is contrary to achieving the GHG emission reduction targets. They amounted to EUR 123.6 million. For the promotion of measures to reduce GHG emissions in the public sector, households and transport, EUR 24.6 million in non-refundable funds was provided, which is 52 % less than the year before (Podnebno ogledalo, 2018b, page 5).