Slovenská elektrizačná prenosová sústava, a.s.

NATIONAL TEN-YEAR NETWORK DEVELOPMENT PLAN FOR THE PERIOD 2017 – 2026

November 2016

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1. Introduction

Slovenská elektrizačná prenosová sústava, a. s., (hereinafter referred to as "SEPS"), as a transmission system operator (hereinafter referred to as "TSO") of the Slovak Republic (hereinafter referred to as "SK"), processes this document, the National Ten-Year Network Development Plan for the Period 2017 – 2026 (hereinafter referred to as "2026 NTYNDP"), under Art. 28, par. 3, subpar. b) of Act No. 251/2012 Coll. on Energy and on amendment and supplementation of certain acts as amended. This paragraph prescribes that every year the transmission system operator shall be obliged to process the transmission system development plan including the development plan for the interconnectors for the period of the following ten years and to hand it over to the Ministry of Economy of the Slovak Republic and to the national regulatory authority (it is Regulatory Office for Network Industries; hereinafter referred to as "NRA") always by 30 November of the respective calendar year including the report on fulfilment of the previous Ten-Year Network Development Plan. It is an obligation incorporated in the legislation of the Slovak Republic within harmonization of the relevant legislative regulations of the European Union (hereinafter referred to as "EU"), in particular the European Parliament and Council Regulation (EC) No. 714/2009 on Conditions for Access to the Network for Cross-Border Exchanges in Electricity.

Pursuant to Art. 29 of Act No. 251/2012 Coll., 2026 NTYNDP shall be based mainly on the present and estimated future condition of the offer and demand for the system capacity, from the appropriate assumptions for electricity production, electricity supply, electricity consumption, and exchanges in electricity with other countries. In the field of cross-border electricity exchanges and development of the transmission system of SK towards abroad, 2026 NTYNDP takes into consideration last ENTSO-E Ten-Year Network Development Plan (hereinafter referred to as "TYNDP") which represents the system development plan for the entire European Union and associated countries. 2026 NTYNDP is also in compliance with the regional investment plan (hereinafter referred to as "RgIP") of the Continental Central East region (hereinafter referred to as "CCE") which was published in the past together with ENTSO-E TYNDP and in the future it will be published in the years when ENTSO-E TYNDP will not be published.

2026 NTYNDP takes into account the SEPS Development Programme, the respective approved SEPS investment plans and the previous NTYNDP.

Pursuant to Art. 29 of Act No. 251/2012 Coll., the Ten-Year Network Development Plan must contain effective measures to ensure the system appropriateness and safety of electricity supplies while providing especially:

a) the main parts of the transmission system which are to be built or upgraded in the following ten years including their assumed implementation dates,

b) all investments in the transmission system related to building new capacities or upgrade of the transmission system the implementation of which was already decided upon by the transmission system operator or which will have to be implemented in the following three years including implementation dates of such investments.

All these assumptions have been considered in this 2026 NTYNDP appropriately in terms of the current knowledge and information available to SEPS at the time of processing of this document.

2. Description of the Current Condition of Slovak Transmission System

The Slovak transmission system is first of all a set of mutually galvanically connected 400 kV, 220 kV technological facilities and the selected 110 kV facilities via which the electricity transmission from its producers to individual customers from the Slovak transmission system, as well as cross-border electricity transmission is carried out. These include the following technological facilities:

- national and cross-border 400 kV, 220 kV and selected 110 kV lines,
- transformers 400/220 kV, 220/110 kV and 400/110 kV,
- 400 kV, 220 kV and selected 110 kV switchyards,
- compensation equipment.

The Slovak transmission system includes also respective supportive, so called secondary facilities lacking which the electricity transmission and control of the Slovak power system would be impossible. These are e.g. information control systems (hereinafter referred to as "ICS"), billing systems, protection and automatic control system and telecommunications transmission facilities, etc.

There are also users directly connected to the Slovak transmission system through their facilities and these users currently include:

- three regional distribution system operators (hereinafter referred to as "DSO"),
- five electricity consumers,
- four electricity producers.

Moreover, the Slovak transmission system is synchronously interconnected with the neighbouring transmission systems in the following extent:

- two single circuit 220 kV lines and three single circuit 400 kV lines towards the Czech Republic (hereinafter referred to as "CZ")
- one double circuit 400 kV line towards Poland (hereinafter referred to as "PL"),
- one single circuit 400 kV line towards the Ukraine (hereinafter referred to as "UA"),
- two single circuit 400 kV lines towards Hungary (hereinafter referred to as "HU"),

These interconnections allow for synchronous interconnections of the Slovak power system with transmission systems in Europe the operators of which are associated together with SEPS in the ENTSO-E association

The topology of the Slovak transmission system, i.e. the scheme of mutual interconnections of the main technological facilities of the Slovak transmission system for electricity transmission including interconnectors towards the neighbouring transmission systems as at time of preparation of this document is shown in the following picture.

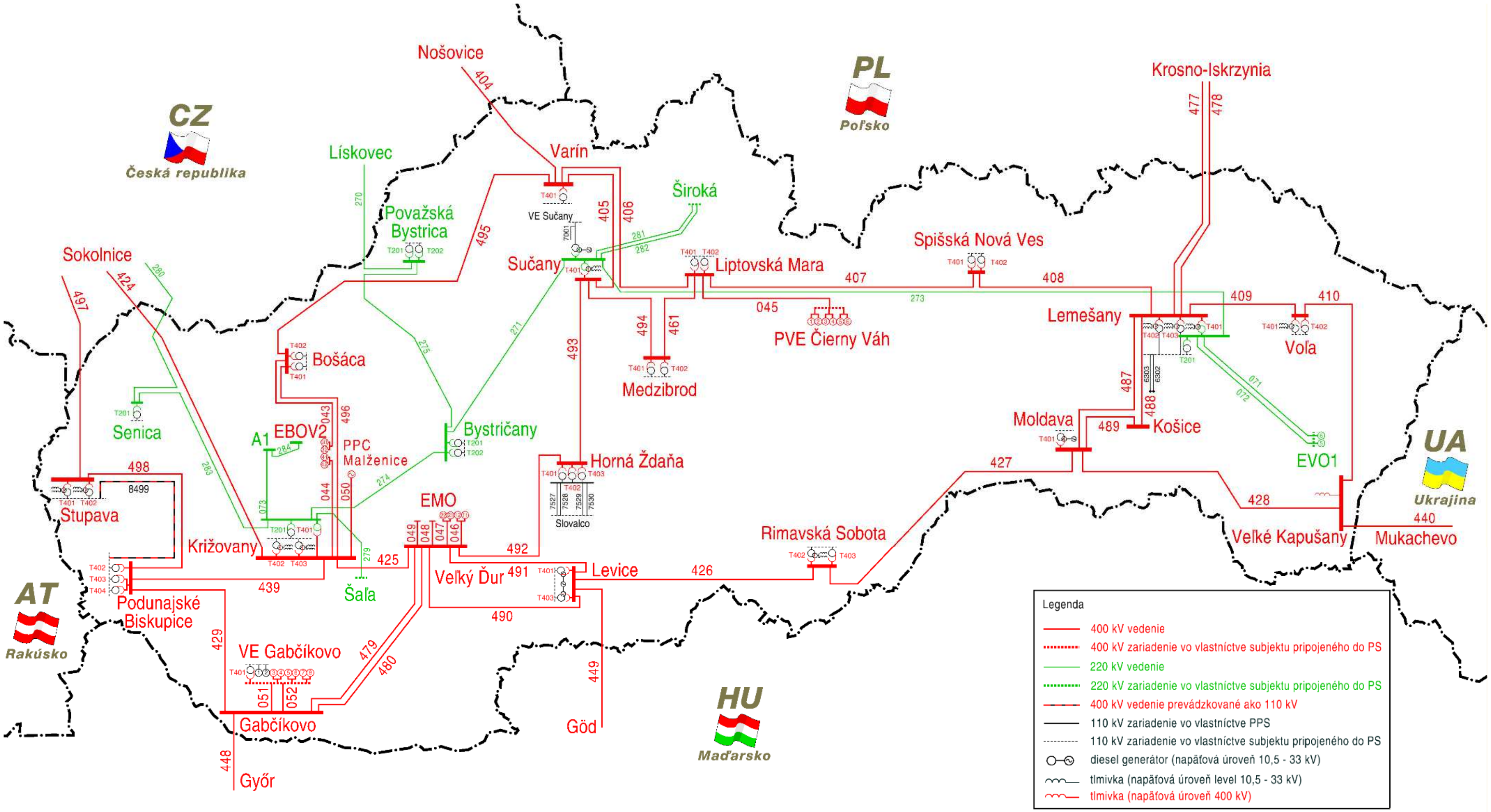


Figure No. 1 Topology of the Slovak transmission system

2.1 Current Condition of the Main Transmission Assets of the Slovak Transmission System

2.1.1 Substations

At present, the Slovak transmission system operates twenty-two substations of which:

- three substations with both 400 kV and 220 kV switchyards including transmission system/ transmission system and transmission system /distribution system transformations,
- twelve substations with 400 kV switchyards and transmission system/distribution system transformation,
- three substations with 220 kV switchyards including transmission system/distribution system transformation,
- four substations with 400 kV switchyards without transmission system/distribution system transformation.

Within the renovation and upgrade, the Slovak transmission system substations are gradually switched to the remote control mode what means the substations are operated without personnel and all relevant facilities are controlled remotely from the dispatch centre of TSO. The following table provide the view of substations connected to the Slovak transmission system and their switchyards which are currently operated in the remote control mode, in the remote manipulation mode and in local control (substations permanently operated and controlled by personnel). Currently, SEPS has fourteen remotely controlled substations.

Substation	Remote control mode CM	Remote manipulation mode MM	Local control mode LC
Bošáca	✓	-	-
Bystričany	-	-	✓
Gabčíkovo	✓	-	-
Horná Ždaňa	-	✓	-
Košice	✓	-	-
Križovany	✓	-	-
Lemešany	✓	-	-
Levice	✓	-	-
Liptovská Mara	-	-	✓
Medzibrod	✓	-	-
Moldava	✓	-	-
Podunajské Biskupice	-	✓	-
Považská Bystrica	-	-	✓
Rimavská Sobota	✓	-	-
Senica	✓	-	-
Spišská Nová Ves	-	-	✓
Stupava	✓	-	-
Sučany	-	-	✓
Varín	-	-	✓
Veľké Kapušany	✓	-	-
Veľký Ďur	✓	-	-
Voľa	✓	-	-
Total	**14**	**2**	**6**

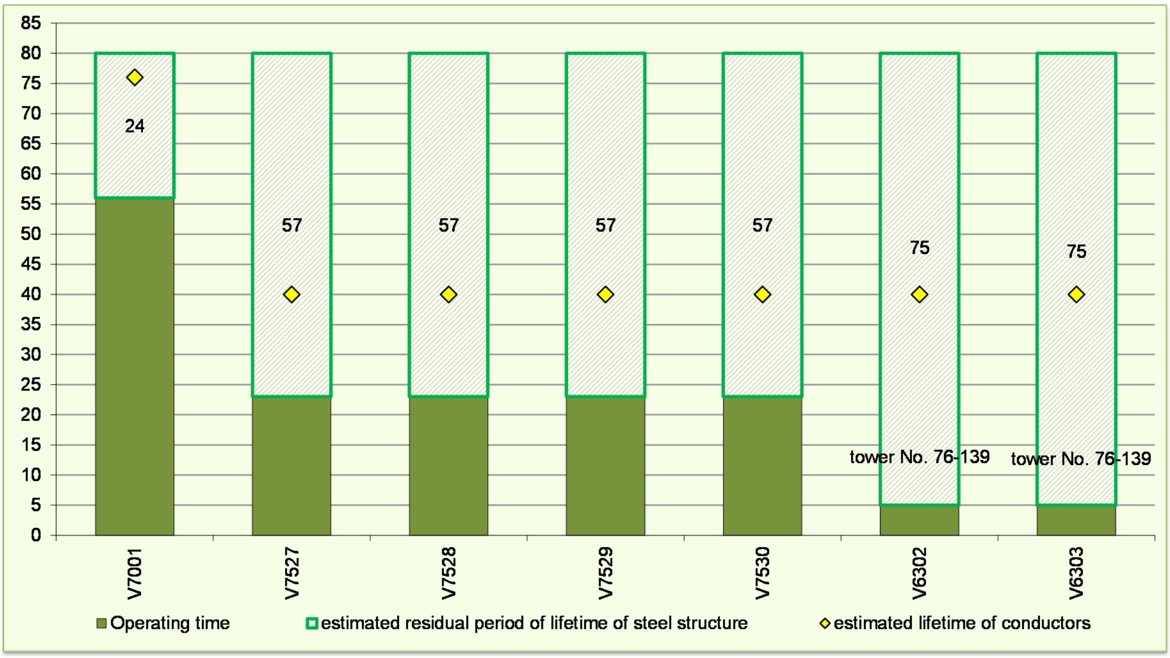
Table No. 1 List of SEPS Substations

The development of the number of switchyards in the period from 2006 to 2015 is available on the SEPS website (http://www.sepsas.sk/seps/TechnickeUdaje.asp?Kod=16).

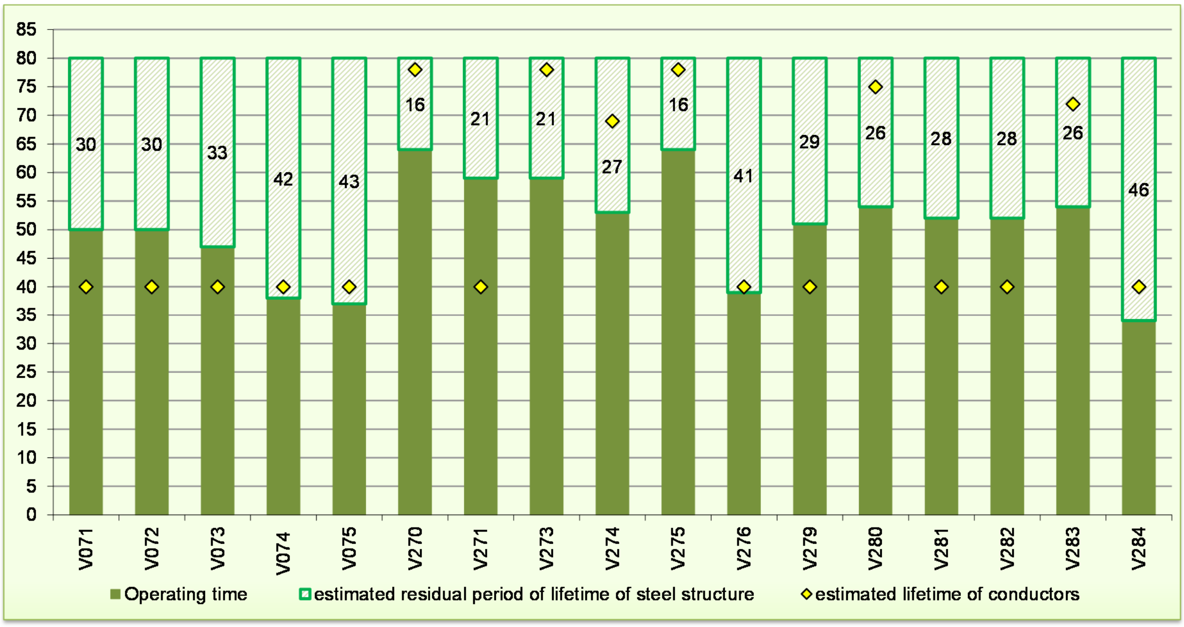
2.1.2 Transmission Lines

Substations in the Slovak transmission system are electrically interconnected via forty-two 400 kV transmission lines with total length of 1,953 km, seventeen 220 kV transmission lines with total length of 826 km and seven 110 kV transmission lines with total length of 80 km owned by TSO. Out of the total number of 400 kV and 220 kV transmission lines in the Slovak transmission system are operated also eight 400 kV and two 220 kV international cross-border transmission lines with total length of approx. 444 km on the territory of the Slovak Republic. These 10 cross-border lines connect the Slovak transmission system with the neighbouring transmission systems of CZ, HU, PL, and UA on the respective cross-border profiles. Further information – for example on the number of towers is published on the SEPS website (http://www.sepsas.sk/seps/TechnickeUdaje.asp?Kod=16).

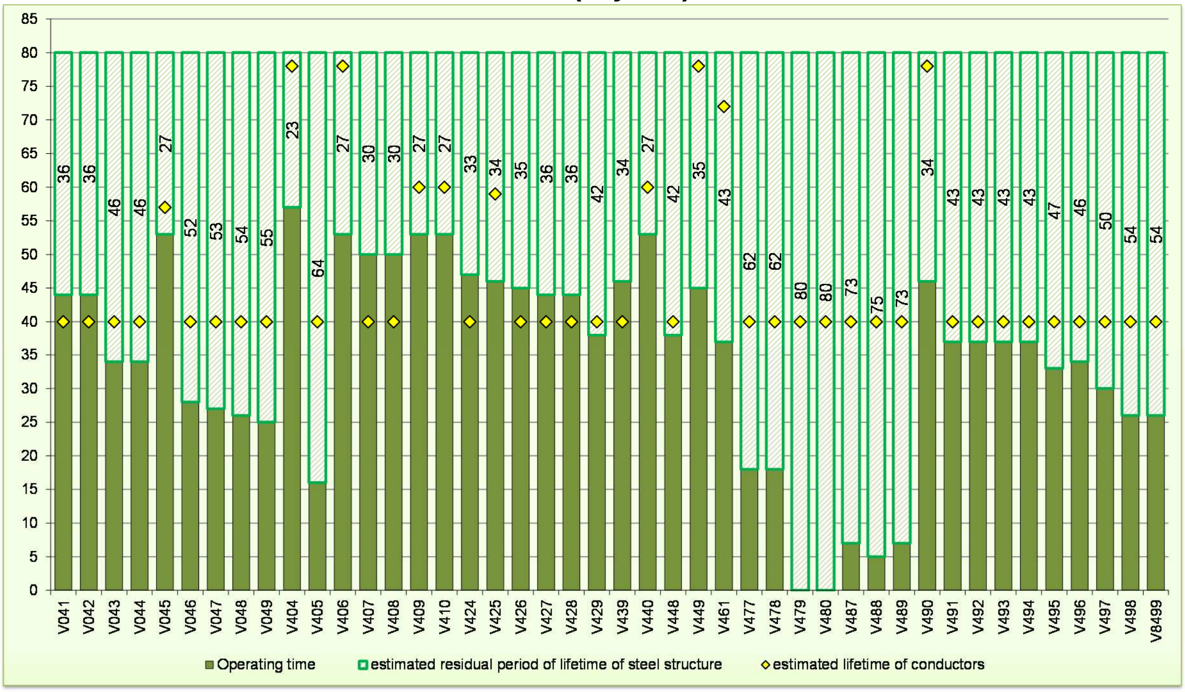
The following three graphs show the operation time of respective 110 kV, 220 kV, and 400 kV lines, the estimated lifetime of the conductors (yellow label) and estimated residual lifetime of the pylons (its metal parts). The estimated lifetime of the transmission line in the SEPS conditions considered, in fact equals the estimated lifetime of the transmission line of pylons (its metal parts). The provided information is important regarding the future SEPS technical-investment planning.



Graph No. 1 Overview of the Operation Period and Estimated Lifetime of 110 kV Lines of SEPS (in years)



Graph No. 2 Overview of the Operation Period and Estimated Lifetime of 220 kV Lines of SEPS (in years)



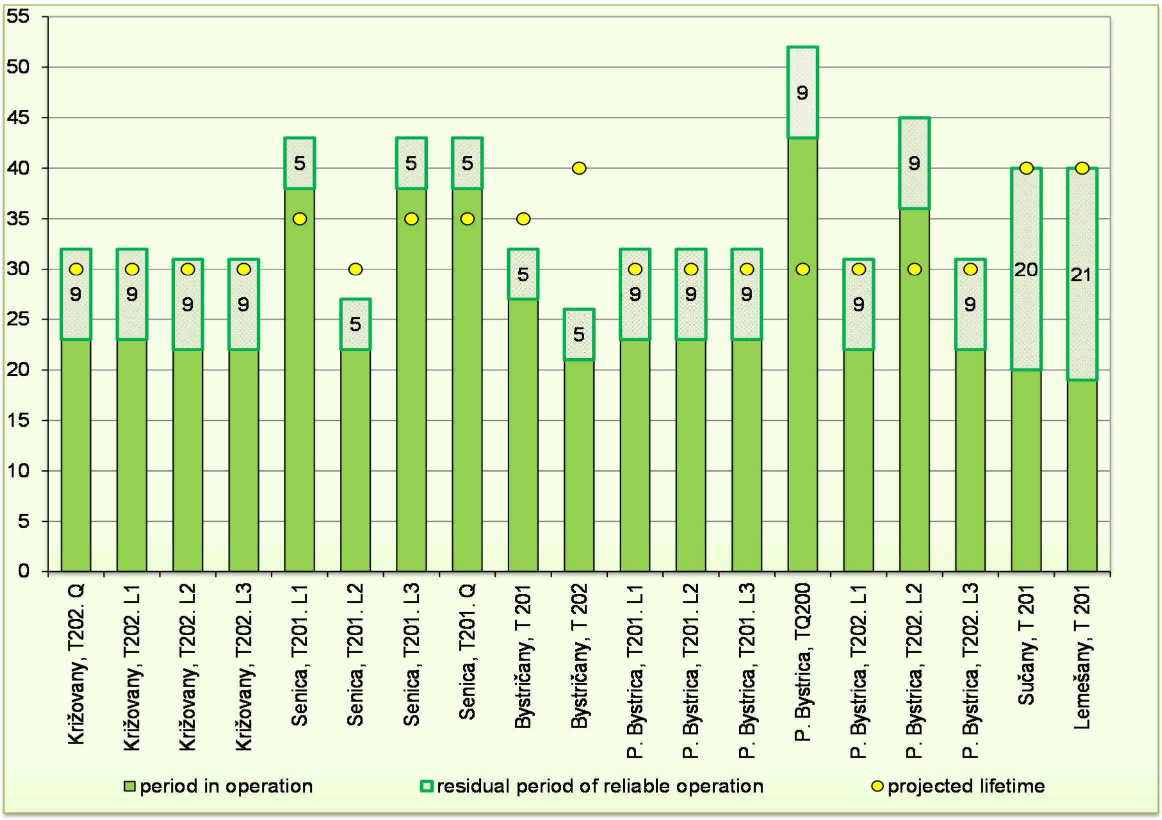
Graph No. 3 Overview of the Operation Period and Estimated Lifetime of 400 kV Lines of SEPS (in years)

The yellow label in all three above-mentioned graphs means that after reaching the line age of 40 (or 80) years, conductors' replacement including insulator suspensions on the respective line is being considered by SEPS. If required so by the condition of conductors and insulator suspensions, their replacement shall be performed sooner or later, as necessary.

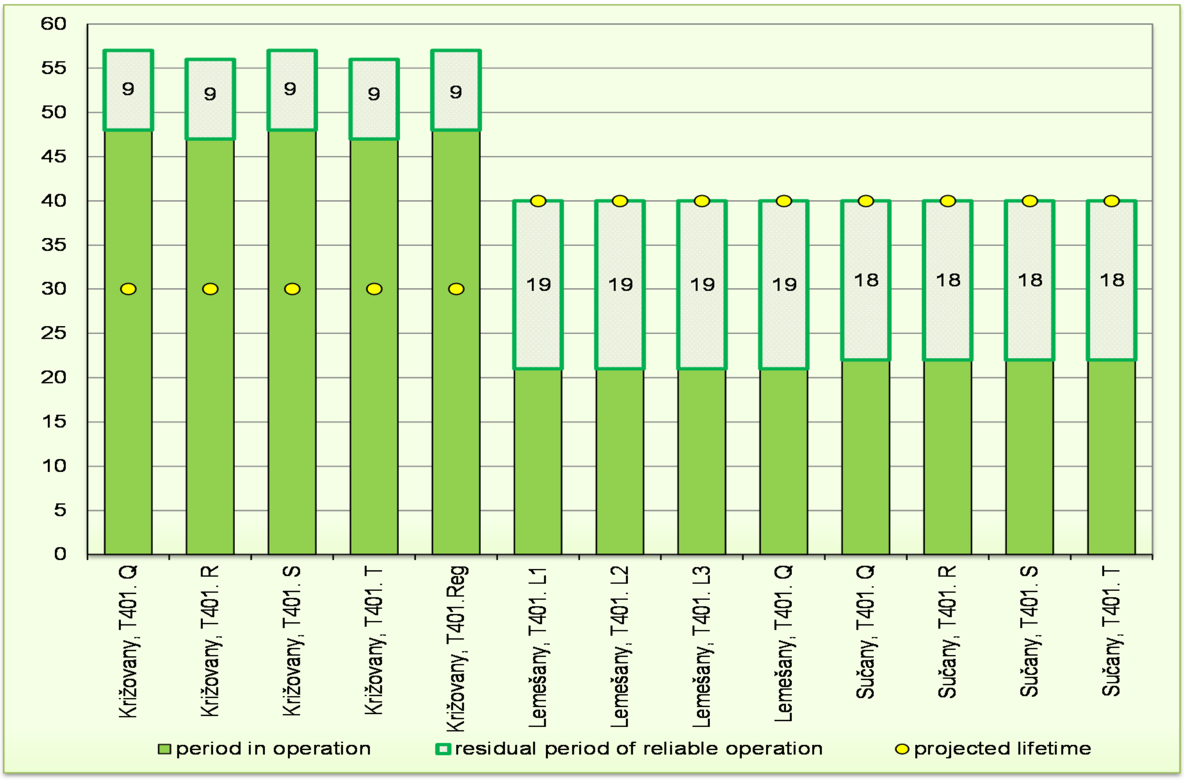
2.1.3 Transformers 400/110 kV, 400/220 kV and 220/110 kV

Power transformers which form the basis of the transmission system with transmission lines are installed almost in all substations owned by SEPS except for Veľký Ďur, Veľké Kapušany, Gabčíkovo and Košice.

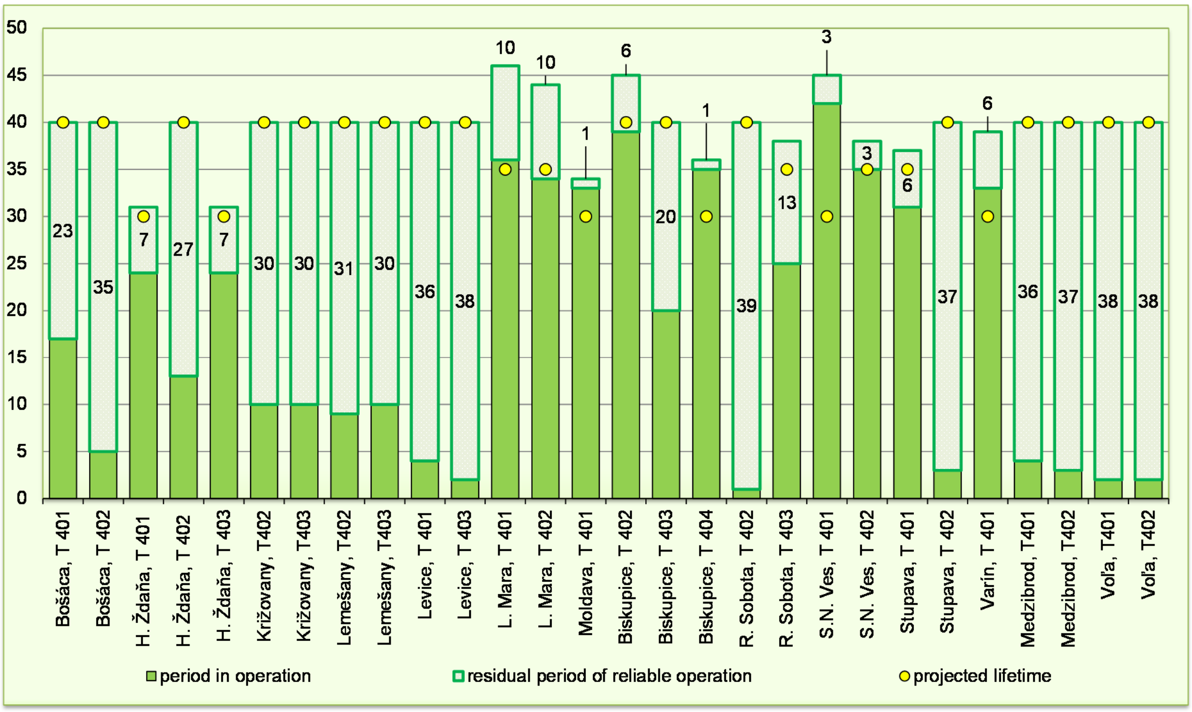
The graphs below show the operation period, residual period of reliable operation, and projected lifetime of respective transformers. The design lifetime is marked with a yellow label. The residual period of reliable operation of SEPS transformers is verified based on their regular diagnostic inspections.



Graph No. 4 Overview of the Operation Period and Estimated Residual Period of Reliable Operation of SEPS 220/110 kV Transformers



Graph No. 5 Overview of the Operation Period and Estimated Residual Period of Reliable Operation of SEPS 400/220 kV Transformers



Graph No. 6 Overview of the Operation Period and Estimated Residual Period of Reliable Operation of SEPS 400/110 kV Transformers

In case of transformers operated after reaching their projected lifetime, the diagnostic measurements with a shorter repetition interval are performed. These measurements proved the possibility of safe operation of transformers even after reaching the projected lifetime. Despite that SEPS prepares replacement of those transformers in short time period. The detailed information on the planned transformer replacements are described in Chapter 4.4 Internal Investment Projects.

More technical details are available on the SEPS website (http://www.sepsas.sk/seps/TechnickeUdaje.asp?Kod=16).

2.1.4 Compensation facilities

Within the Slovak transmission system, SEPS uses only shunt reactors to compensate capacitive reactive power to help to reduce high voltage in the transmission system. Installation of compensation capacitors to increase voltage in the Slovak transmission system is not necessary at present.

The shunt oil reactor directly on the 400 kV level is connected to the Slovak transmission system only in the substation Veľké Kapušany. The basic information on this shunt reactor is shown in the following table

Substation	Production year	Type	Operation period [years]	Q_n [MVAr]	Residual period of reliable operation [years]
Veľké Kapušany, TL1. L1	1972	Oil	44	50	1
Veľké Kapušany, TL1. L2	1991	Oil	25	50	1
Veľké Kapušany, TL1. L3	1972	Oil	44	50	1
Veľké Kapušany, TL1. Q	1971	Oil	45	50	1

Table No. 2 Overview of the Operation Period and Estimated Residual Period of Reliable Operation of Shunt Reactors at 400 kV Voltage of the System

In all other cases, the shunt reactors in the Slovak transmission system are connected to tertiary windings of the transmission system/transmission system or transmission system/distribution system power transformers. Dry-type air-core shunt reactors with rating of 45 MVAr (3x15 MVAr) are mainly used, but also reactors with rating of 60 MVAr (3x20 MVAr) and 90 MVAr (3x30 MVAr) are installed.

The overview of such shunt reactor type in the Slovak transmission system is shown in the following table. Since the dry-type air-core shunt reactors are maintenance-free devices and thus no diagnostics is carried out unlike the oil shunt reactors or transformers, the residual period of reliable operation is not specified.

Transformer	Production year	Type	Operation period [years]	Q_n [MVAr]
Nominal voltage of the system is 33 kV				
Križovany T402	2006	dry	10	2x45
Križovany T403	2006	dry	10	2x45
Lemešany T401	2003	dry	13	2x90
Lemešany T402	2007	dry	9	2x45
Lemešany T403	2007	dry	9	2x45
Stupava T402	2013	dry	3	2x45
Sučany T401	1994	dry	22	2x60
Rimavská Sobota T402	2015	dry	1	2x45
Nominal voltage of the system is 10 kV				
Stupava T401	2005	dry	11	2x45

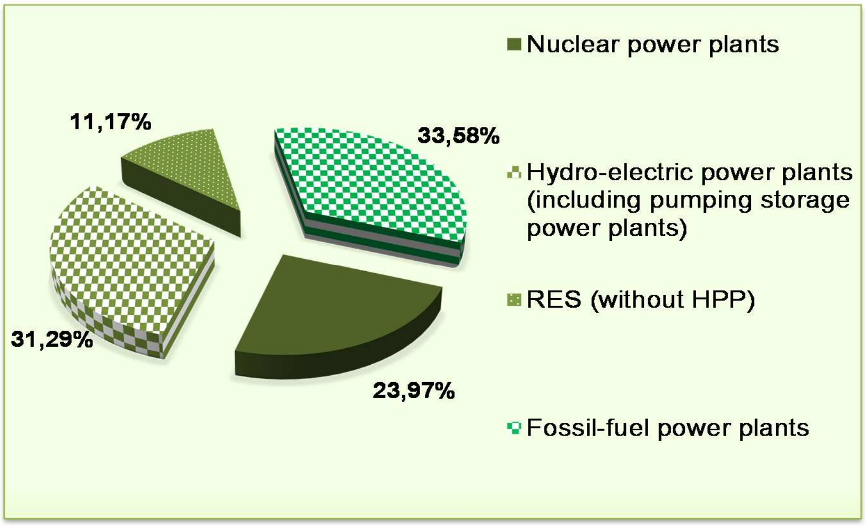
Table No. 3 Overview of Shunt Reactors Connected to Tertiary Windings of Transformers

2.2 Situation of Power Generators Installed Capacity and Electricity Production

In terms of generation adequacy, the Slovak power system has sufficient installed capacity in the generation mix. One third of the installed capacity consists of fossil-fuel power plants including municipal thermal power plants and industrial power plants with prevalence of fossil fuels in the generation mix. The remaining part consists of nuclear power plants, hydro-electric power plants and renewable energy sources (hereinafter referred to as "RES"), the sources based on carbon-free technology. Particular values of the installed capacity and percentage representation of individual technologies in the generation mix of Slovakia as at 31.12.2015 are shown in the following table and graph.

Fuel type	Installed Capacity [MW]
Nuclear power plants	1,940
Hydro-electric power plants (including pumping storage power plants)	2,533
RES (without HPP)	904
Fossil-fuel power plants	2,718
Total	**8,095**

Table No. 4 Installed Capacity of the Slovak Power System Power Plants According to the Primary Energy Type as at 31.12.2015

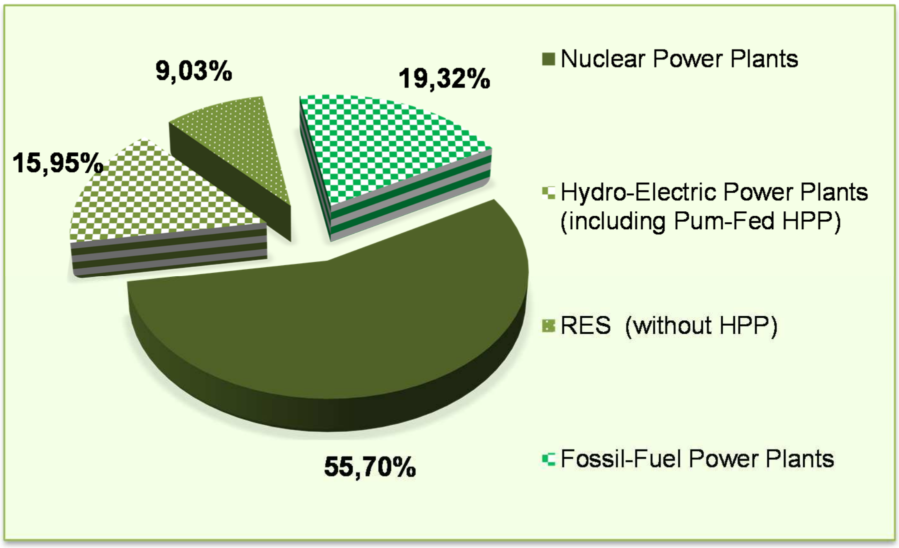


Graph No. 7 Percentage Share of the Installed Capacity of the Slovak Power System Power Plants According to the Technology Type as at 31.12.2015

The electricity generators in the Slovak power system produced the total energy volume of 27,191 GWh. Particular values of electricity production of individual technologies and their percentage share in the total electricity production in the Slovak Republic in 2015 are shown in the following table and graph

Technology Type	Production [GWh]
Nuclear power plants	15,146
Hydro-electric power plants (including pumping storage power plants)	4,338
RES (without HPP)	2,455
Fossil-fuel power plants	5,252
Total	27,191

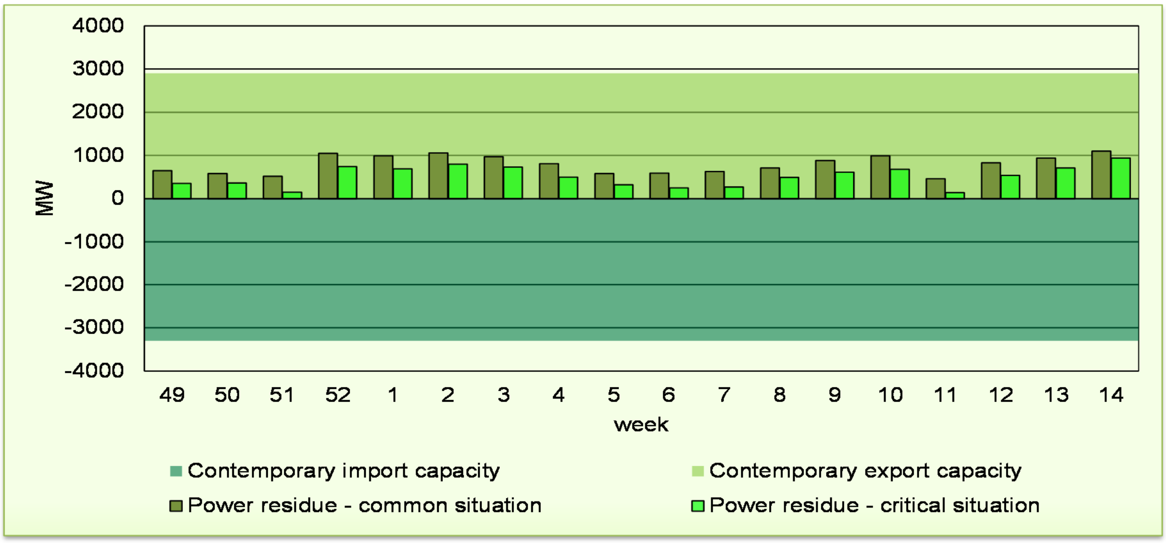
Table No. 5 Overview of Production of the Slovak Power System Electricity Generators According to the Technology Type in 2015



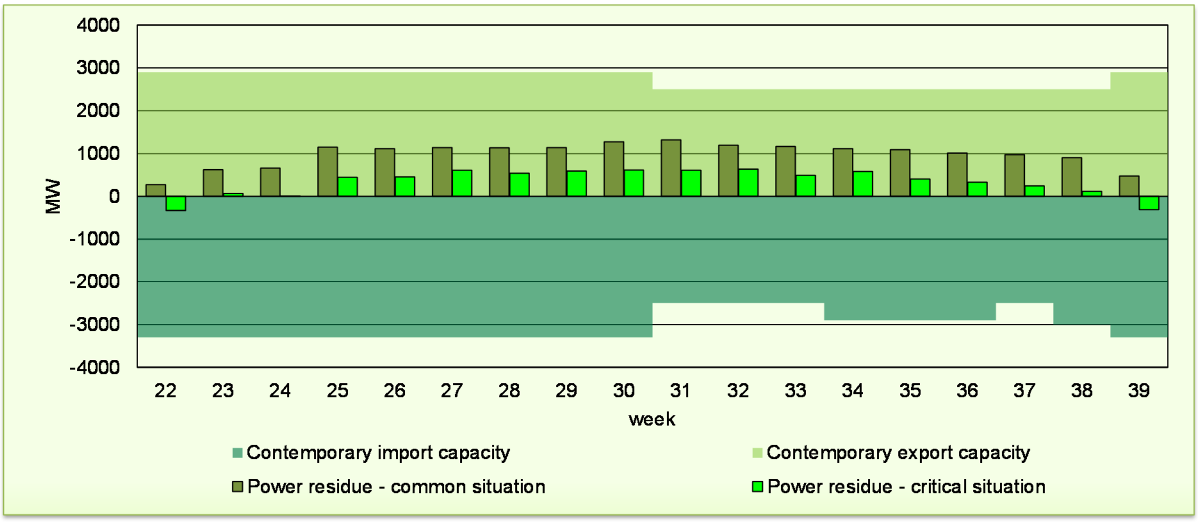
Graph No. 8 Share of Electricity Production in SK According To Individual Fuel Type in 2015

It is obvious from the graph showing comparison of the total electricity production and consumption provided in the following chapter that after the economic crisis (2009) the gradual increase of electricity production due to commissioning of new electricity generators, mainly CCGT and RES, occurred. The production level in the period before decommissioning of the nuclear power plant in Jaslovské Bohunice (2006 and 2008), however, was not achieved. The decrease of production in the period 2013-2015 was caused especially by decommissioning or the failure to operate CCGT Malženice and CCGT Bratislava due to their unfavourable operation from the economic point of view (fuel price, high production costs and electricity price) as well as gradual downturn of production up to decommissioning of Units 1 and 2 of the thermal power plant Vojany I. (2013). Due to emission limits the operation of Units 3 and 4 of the Nováky power plant was terminated.

Despite the aforementioned facts, there is sufficient production capacity to cover load in Slovakia under standard climate conditions. In case of adverse climate conditions, the import capacity of the Slovak transmission system is sufficient to cover the peak loads. However, in terms of loads at cross-border lines and due to unplanned transit flows, more frequently the situations threatening the safe system operation occurs (failure to meet the N-1 criterion) which are addressed by the Slovak transmission system operator in cooperation with the neighbouring transmission system operators by means of remedial measures. Moreover, it is confirmed by the evaluation of the generation adequacy according to the ENTSO-E methodology by means of so called seasonal outlooks published on the ENTSO-E website (https://www.entsoe.eu/publications/system-development-reports/outlook-reports).



Graph No. 9 Evaluation of Generation Adequacy in the Slovak Power System in Winter Period 2015/2016

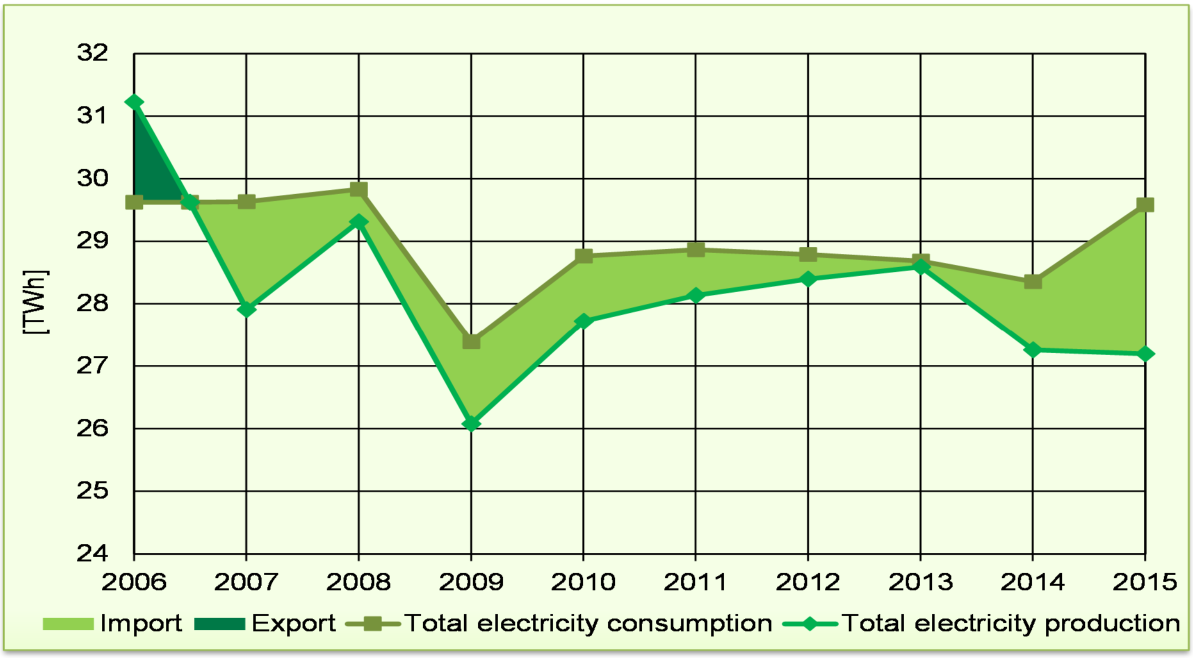


Graph No. 10 Evaluation of Generation Adequacy in the Slovak Power System in Summer Period 2015/2016

2.3 Situation of Electricity Consumption and Load in the Slovak Power System

The total electricity consumption in the Slovak Republic on the level of 29,579 GWh in 2015 proves significant increase by as much as 4.3 % against the previous period of stagnation in electricity consumption (2010 to 2013). It is mainly due to increased economic growth of SK/EU and extremely high temperatures in the summer period in the Slovak conditions. During electricity production stagnation in the Slovak power system the import balance was increased to 2,388 GWh, i.e. 8.9 % share in the total electricity consumption. The deficit was covered by electricity imported from abroad within the cross-border electricity exchanges.

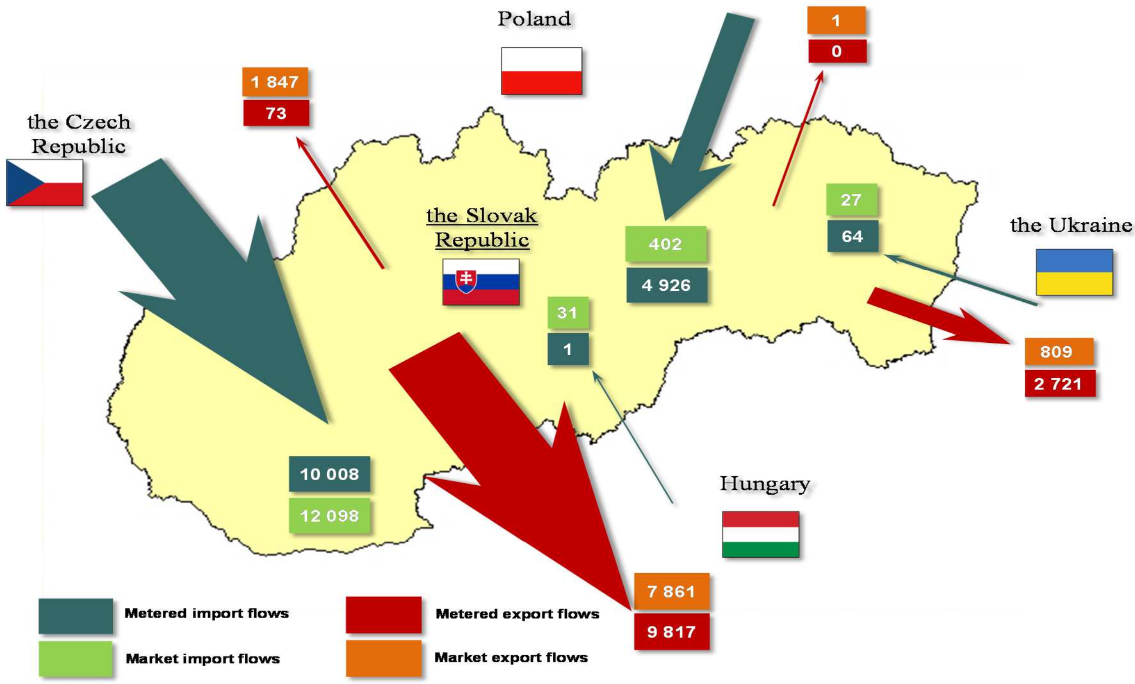
Use of the installed capacity of electricity generators in Slovakia is sufficient to cover electricity consumption, however, the operation of some technologies is unprofitable. It is because the adverse development of electricity production costs and produced electricity prices on electricity market. Electricity traders profit more from purchase and import of electricity from abroad than from purchase from electricity generators located in Slovakia, thus naturally limiting the total Slovak electricity production.



Graph No. 11 Evolution of Total Electricity Production and Consumption in the Slovak Republic in the Period 2006 to 2015

2.4 Situation of Electricity Transmission on Slovak Cross-Border Lines

SEPS has ten joint cross-border transmission lines with the neighbouring transmission system operators, but for Austria (hereinafter referred to as "AT"). The following picture shows cumulative annual market flows among the Slovak Republic and the neighbouring countries and actual cumulative physical cross-border electricity transmission flows. The dominating direction of power flows through the Slovak power system is usually in the north or north-west to south and south-east direction where the exporting countries are mostly the countries with the surplus production balance mostly in the north-west and north of the Slovak Republic. The importing countries are HU and UA or importing Balkan countries south of the Slovak Republic. The flows in the region are influenced by location of the pumping storage power plants in Austria and Switzerland which allow storage of electricity overproduction in the north of Europe.



Market flows:	Σ Import: 12 846GWh,	Σ Export: 10 518 GWh,	Balance: Import 2 328 GWh
Metered flows:	Σ Import: 14 999 GWh,	Σ Export: 12 611 GWh,	Balance: Import 2 388 GWh

Figure No. 2 Market and Physical Cross-Border Electricity Transmission Flows of the Slovak Power System in 2015

Market flows of electricity usually differ from physical transmission flows due to densely interconnected transmission systems in the CCE region and allocation method of market capacities which does not respect impedances of internal transmission systems of individual control areas. Market flows are commercially agreed electricity transmission flows among individual market zones or countries within the interconnected ENTSO-E system. These flows shall be reflected in the real operation in the form of physical flows of electricity on individual cross-border transmission profiles. In some hours, physical flows exceed the planned market exchanges even by more than 100% what may result in the failure to meet the basic safety criterion N-1.

As it was mentioned before, compared to the previous years, the import of electricity to Slovakia increased. This reality is related to economy of electricity generator operation in the Slovak power system and European power systems, i.e. to the evolution of ratio of the electricity wholesale price and the price of primary sources for its production or amount of operating costs of the generators for electricity production.

Graph No. 12 evaluates functioning of 4M MC among CZ-SK-HU-RO in the period from 2012 to 2015. The percentage of business hours with different prices from the total amount of business hours in a year is growing annually. Different prices between two control areas with the joint cross-border profile, however, indicate insufficient market transmission capacity on the respective cross-border profile. The absolute values of the percentage ratio prove exposure of especially the cross-border profile SK-HU where from 2012 to 2015 increase of different prices from 23 % to 61 % occurred. This indicates high demand for tradeable capacity and an congestion on this G-B profile in the central-east EU region. Also due to this reason, SEPS plans to strengthen the SK-HU profile with new cross-border lines.

Note: in the year 2012, there are only 2,665 business hours considered as 100 % of the annual time fund because the Market Coupling with Hungary was commissioned on 12 September 2012. On SK-CZ there are only 2,665 business hours in the year to maintain identical time windows and comparable values.
In other years, there are 8,760 business hours considered as 100 % of the annual time fund or total of 8,784 hours in the leap year 2012.

Graph No. 12 Functionality of the Interconnected Electricity on the Slovak Cross-Border Profiles which are a Part of the Market Coupling 4M MC in the Period 2012 - 2015

At present, in the Central East Europe region[1] (hereinafter referred to as "CEE") the methodology of so called flow-based calculation of cross-border transmission capacities is being developed in several working groups. Termination of its development is expected at the end of year 2017 and the launch of the flow-based Market Coupling for the day-ahead market in the CEE region is expected in the half of the year 2018.

The basis of the idea for the flow-based allocation of capacities is an effort to include the actual topology of the transmission systems in the process of market capacity allocation and consider actual division of physical flows of power on individual cross-border profiles what in other words means elimination of differences between the market and real flows. The main consequences of those differences are unplanned transit flows of electricity with the main reasons of their occurrence described in Chapter 2.4 in the previous processing of NTYNDP. These unplanned flows cause complications in the transmission system operation which in some cases threatens operational safety of the interconnected European transmission grid including the Slovak transmission system.

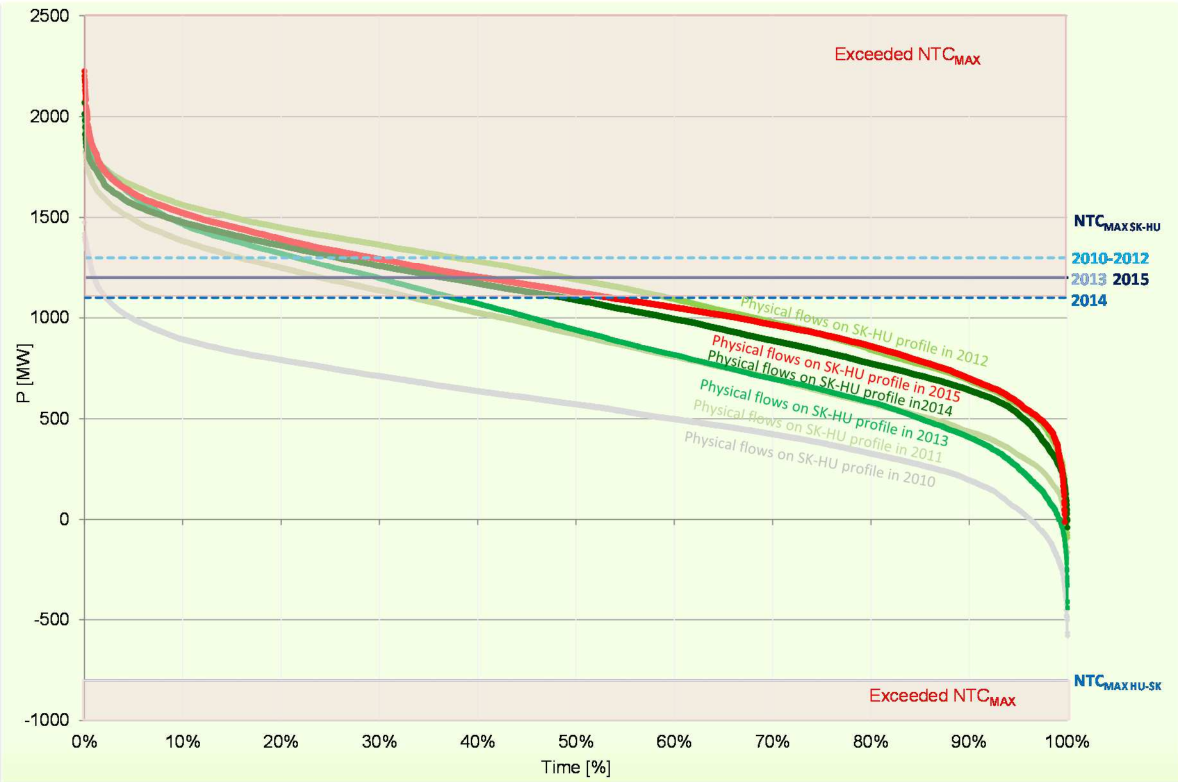
SEPS as the Slovak TSO disposes of very limited options to resolve the aforementioned situations with high transit flows. In order to maintain operation safety of the Slovak power system even during such situations, the transmission system operator must take operational measures. Currently, the only available short-term dispatcher measure for partial restriction of consequences of unplanned transit flows, i.e. to eliminate overload of the transmission system components is reconfiguration of the Slovak transmission system, i.e. operative change of transmission system topology. Performance of reconfigurations in the Slovak transmission system results not only in reduction of transit flows through the Slovak grid but also in reduction of the operational flexibility of the system, increase of losses in the system, risk of failure due to manipulations concerning the change of the Slovak transmission system topology and some other operational restrictions. Thus from the point of view of SEPS, grid reconfiguration is an extraordinary operative measure.

[1] The region defined for the needs of CAO ("Central Allocation Office GmbH").

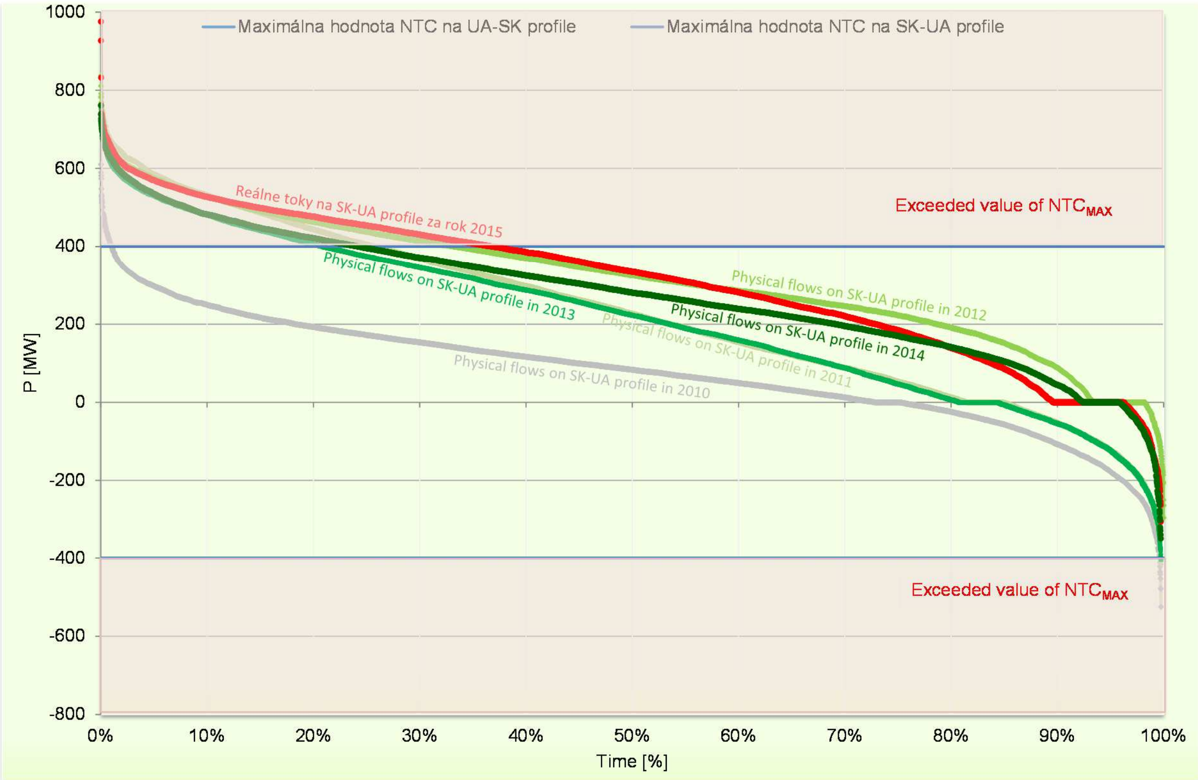
Most frequently such situations in the Slovak transmission system exist on the cross-border profiles SK–HU and SK–UA which are shown in the following charts. An hourly resolution includes the use of cross-border profiles of SK-HU and SK-UA in the period from 2010 to 2015, as well as overreaching the maximum value of the net transmission capacity (NTC) of the profile in a year. The relationship between the total transmission capacity (TTC) of the profile and the net transmission capacity (NTC) of the profile is as follows:

$$\mathbf{NTC} = \mathbf{TTC} - \mathbf{TRM} \quad [MW]$$

Blue lines on the graph No. 13 indicate changes of maximum NTC (hereinafter referred to as "NTC_{MAX}") on the SK-HU profile due to inevitable change of maximum transmission reliability margin (hereinafter referred to as "TRM"). The result of the TRM increase in 2013 on the SK–HU profile was decrease of physical flows on the SK–HU profile to the level of the 2011 values. In 2014, compared to the previous year 2013, even despite further increase of TRM (reduction of NTC_{MAX}), the volume of physical flows on the SK-HU profile increased, what is directly related to configuration of market zones on the electricity in market in the Central European Region or north-west from the Slovak Republic combined with the import balance in the Balkan region. In 2015, the volume of physical flows on the SK-HU profile increased to the 2012 values what could have been caused by reduction of the TRM value (increase of NTC_{MAX}) by SEPS in 2015.



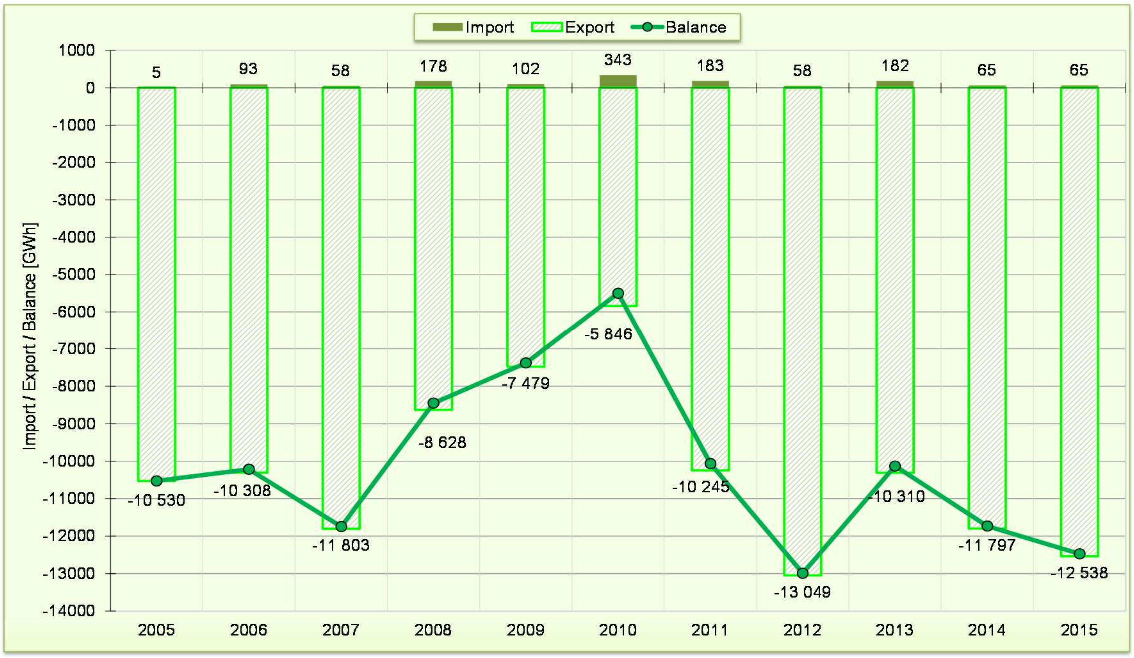
Graph No. 13 Aligned Hourly Physical Flows on the Slovak – Hungarian Profile Compared to Maximum Market Values of NTC_{max} in the Period from 2010 to 2015



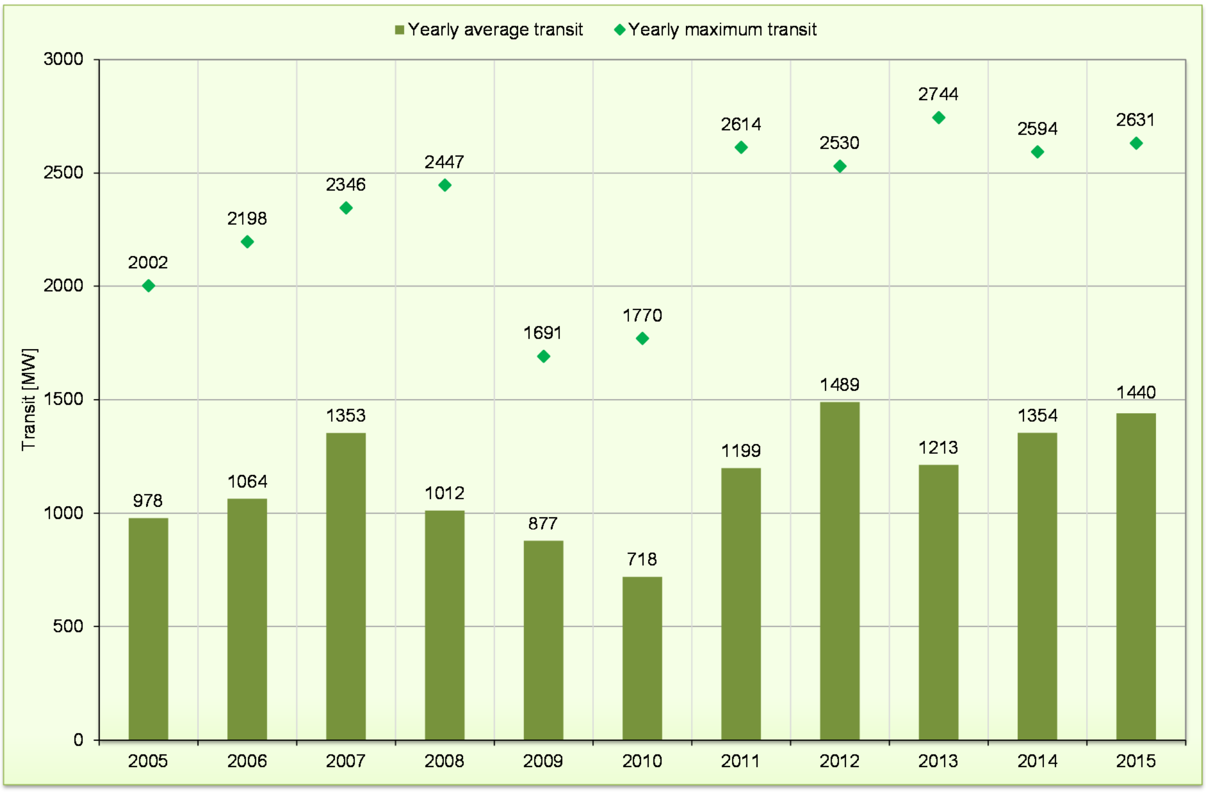
Graph No. 14 Aligned Hourly Physical Flows on the Slovak – Ukrainian Profile Compared to Maximum Market Values of NTC$_{max}$ in the Period from 2010 to 2015

Chart No. 14 shows evident decrease of physical flows on the SK-UA profile in the year 2013 to the 2011 values what resulted from the TRM increase, and thus decrease of NTC$_{MAX}$ on the SK-HU profile. This is a result of strong dependency of the SK–HU and SK–UA profiles in terms of electricity flows since the Ukrainian transmission system is strongly interconnected with the Hungarian transmission system. As in case of the SK-HU profile, similarly on the SK-UA profile in 2014, compared to the previous year 2013, the volume of physical flows increased due to the same reasons as with the SK-HU profile. In 2015, the volume of physical flows on the SK-UA profile increased to the 2012 values, what could have been caused by reduction of TRM, and thus increase of the NTC$_{MAX}$ value on the SK-HU profile in 2015.

The SEPS development documents often evaluate both profiles together as Slovakia - Hungary and the Ukraine (hereinafter referred to as "SK-HU+UA"), what is documented in the following graph. As in case of the SK-HU profile, similarly on the SK-UA profile in 2015, compared to the previous year 2014, the volume of physical flows of electricity increased due to the same reasons as with the SK-HU profile.



Graph No. 15 Total Annual Transmitted Electricity on the Joint SK–(HU+UA) Profile in the Period 2005 to 2015



Graph No. 16 Average and Maximum Annual Values of Electricity Transits via the Slovak Power System in the Period 2005 to 2015

Graph No. 16 shows the development of transit flows evaluated for the past period in the SEPS conditions. Transit flows (both maximum and average) prove increasing trend from 2013 again what for TSO means bigger number of complicated operational situations in the year it must face in the real operation.

Also in 2015, the Slovak transmission system was loaded by the increased cross-border electricity transmission which resulted in increased demands to ensure safe and reliable operation of the Slovak transmission system and increase of losses. The cause of these increased flows is described above in this chapter. To provide for operational safety of the Slovak power system at increased cross-border electricity transmissions and their impacts on the Slovak power system, the reconfiguration of the Slovak transmission system or adjustment of the TRM values is one of the extreme dispatcher measures. Advantages and disadvantages of these measures are described above. Disregarding the aforementioned, SEPS works also on long-term conceptual solutions and measures via investment consisting in strengthening internal and cross-border transmission infrastructure (see Chapter 4.)

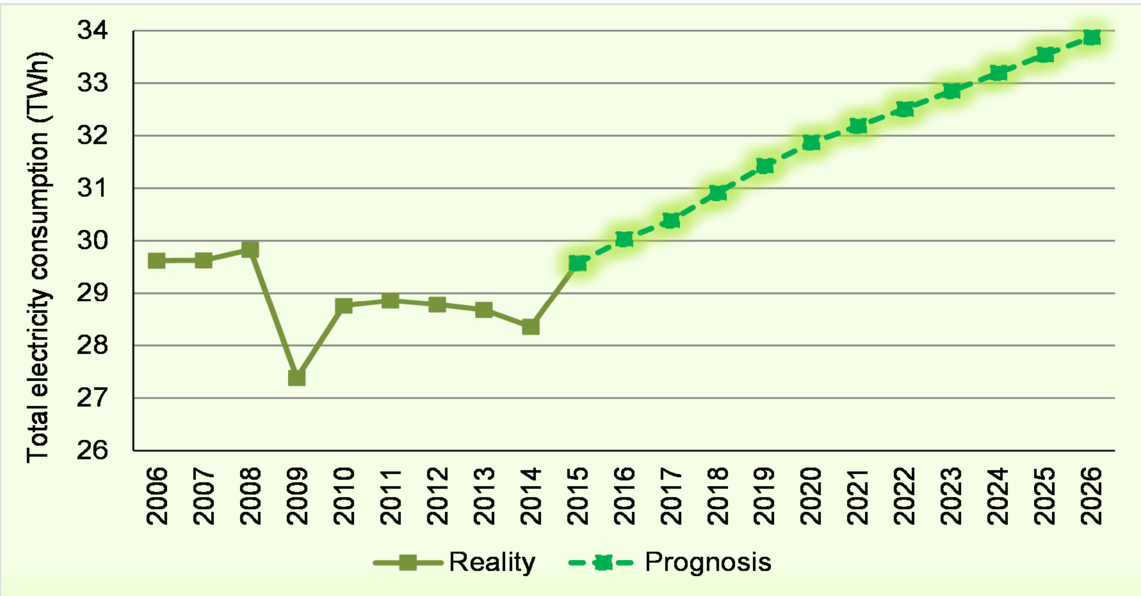
3. Assumed Future Situation of the Offer and Demand for the Transmission Capacity

3.1 Assumptions for Electricity Consumption in the Slovak Power System

Regarding high increase in the electricity consumption in the Slovak Republic in 2015, current increase in 2016 and expected growth of investments in industry in the Slovak Republic in the coming five years, the prognosis of the electricity consumption in the Slovak Republic compared to the previous processing of NTYNDP was updated by means of an external study[2] respecting the assumed development and prognosis of macro energetic, economic and demographic indicators with regard to the objectives of the energy policy of the Slovak Republic and EU.

In the period by 2026, an average annual increase in the electricity consumption in the Slovak Republic on the level of 1.2 % is assumed. Based on this assumption, increase by 4.3 TWh in the electricity consumption by 2026 would occur what is 14.5 % increase compared to the year 2015. Based on the continuously monitored and evaluated statistical data by the processing date of this 2026 NTYNDP, in 2016 the increase of the total electricity consumption in the Slovak Republic by approximately 1.5 % compared to the previous year is assumed, i.e. the total electricity consumption in the Slovak Republic would reach or exceed 30.0 TWh. In 2020, the electricity consumption of 31.9 TWh is assumed and in 2025 the level of 33.5 TWh is expected.

According to the draft Proposal of the Energy Policy of the Slovak Republic (2014) which assumes average annual increase on the level of 1.14 %, the average increase of the electricity consumption in the Slovak Republic compared to the aforementioned assumptions is lower by 0.8 TWh.



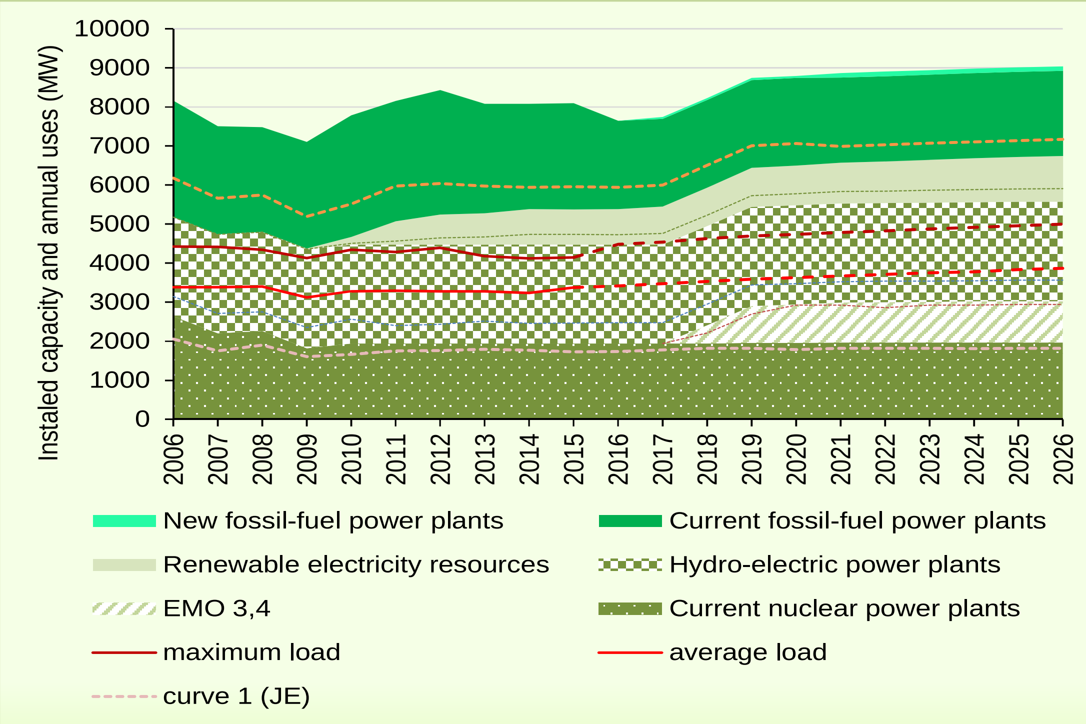
Graph No. 17 Prognosis of the Total Electricity Consumption in Slovakia

3.2 Assumptions for Electricity Production in the Slovak Power System

Within the monitored period, even despite decommissioning of the existing production capacities due to emission limits, the increase of the installed capacity of electricity generators in Slovakia by more than 1,000 MW is expected, what in the electricity production will mean increase by approx. 10 TWh. It is especially the completion of units 3 and 4 of EMO with gradual increase of the installed capacity to

[2] Study: "*Update of prognosis of electricity consumption in the Slovak Republic by the year 2035 by individual years and outlook for the time horizons 2040, 2045 and 2050*", *EGÚ Brno, a.s. 2016*

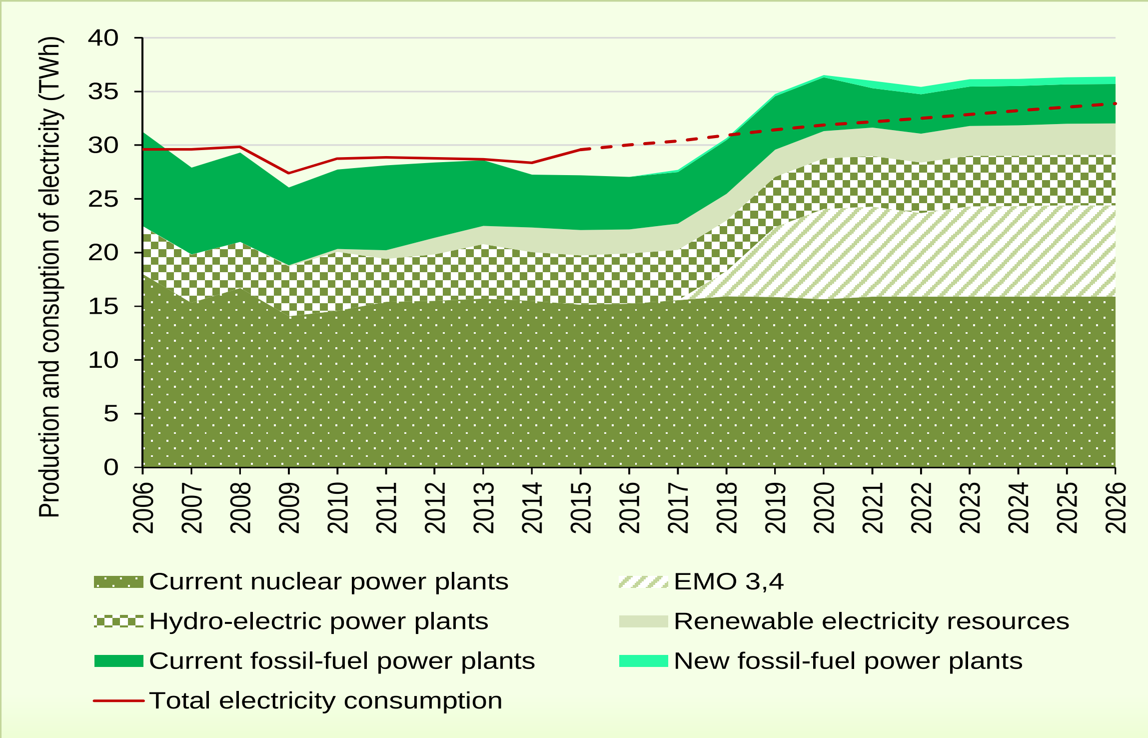
2x530 MW and annual electricity production up to the level of 8.6 TWh. The remaining increase of the installed capacity and electricity production is assumed in RES and in new fossil-fuel power plants.



Graph No. 18 Assumed Development of Installed Capacity of Power Plants and Average and Maximum Load of Electricity by 2026

The aforementioned graph shows average annual use of the installed capacity of generators according to the fuel type of electricity production (dotted line) disregarding the fact whether it is the existing generator of electricity production or a considered new generator. While the NPP installed capacity usage achieves almost 90%, the use of other types of technologies is relatively low. In case of HPP and RES (in case of RES the data are available from 2002, when the first wind turbines were installed in Slovakia) their use strongly depends on the current hydrological and meteorological conditions. The total average use of the installed capacity of generators in the Slovak Power System is sufficient to cover an average load which copies the electricity consumption in Slovakia shown in the following graph.

To ensure adequacy of the electricity generating units in the Slovak power system, however, the conditions have to be created so that the use of mainly flexible fossil-fuel units can be substantially higher for safe operation of the Slovak power system. Coverage of maximum load and thus also balance in hours of maximum load of the Slovak power system shall depend mainly on use of flexible fossil-fuel generating units the operation of which strongly depends on economic indicators and emission limits. The operation of fossil units is inevitable in certain volume to cover the required volumes of ancillary services through which TSO provides for system services for all Slovak power system users.



Graph No. 19 Assumed Electricity Production and Consumption in the Slovak Republic by 2026

The described development in the electricity production on the generators located in Slovakia shall be significantly influenced in the future by electricity generation price development on the markets and by the regulatory framework which significantly influences operation economy of individual technologies for electricity production.

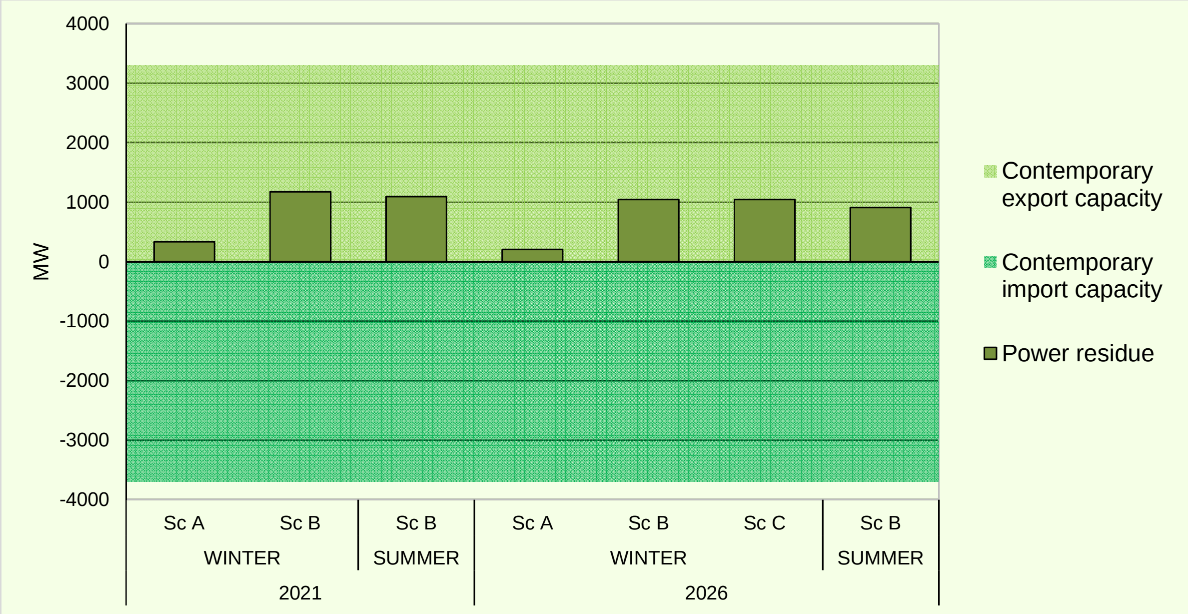
Based on the found facts on the operation of the existing fossil-fuel power plants, the lower volume of the total production is assumed in 2020 by 1.5 TWh and in 2025 by 0.9 TWh compared to the assumptions of the electricity production development according to the approved Proposal of Energy Policy of the Slovak Republic and previous NTYNDP.

Securing sufficient electricity generation to cover different electricity consumption scenarios in Slovakia (so called Generation Adequacy) and securing optimal generation mix in terms of ensuring reliable and safe operation of the Slovak power system (so called System Adequacy) is a complex task also with regard to great extent of uncertainty of the invested cost return in power plants especially due to negative evolution of the ratio of market prices of fuels for electricity production and electricity itself.

The following graph shows a simple analysis of the Generation Adequacy of Slovakia according to the ENTSO□E methodology[3] for the assumed variants of the winter and summer maximum load in important years 2021 and 2026 for scenarios and variants mentioned in Chapter 4.2. After completion of EMO 3, 4 the power system is safe in terms of electricity generation securing even in case of fossil-fuel power plants CCGT Malženice, CCGT Bratislava, Nováky B units 3, 4 and EVO 1 units 1 and 2 are not operated.

In terms of ensuring inevitable volume of system services the situation in case of decommissioning or non-operation of these generators remains tense. The control area of Slovakia shall actually miss approximately 25 to 35 % of the required volume of regulation reserves (especially secondary active power regulation) with the preserved conditions.

[3] Target Methodology for adequacy assessment: https://www.entsoe.eu/Documents/SDC%20documents/SOAF/141014_Target_Methodology_for_Adequacy_Assessment_after_Consultation.pdf



Graph No. 20 Evaluation of Generation Adequacy in the Slovak Power System in Time Horizons of 2021 and 2026

Covering of electricity consumption increase and replacement of important production capacities should be resolved in the future in the national strategic energy documents achieving appropriate and balanced development of new capacities with nuclear, fossil and renewable sources for electricity production including consideration of needs for safe and reliable management and operation of the Slovak power system.

3.3 Assumptions for Electricity Exchanges with Other Countries

Assumed cross-border electricity exchanges in the long-term horizon may be performed only under certain assumptions for electricity production and consumption development and available market capacities what presumes substantial uncertainty to be taken into consideration at such prognoses. In case of the following considerations, the allocated market transactions in 2015 and two possible scenarios of future development of the generation mix, electricity consumption and development of market capacities in the entire area of the ENTSO-E countries, which is documented in the ENTSO-E database for the purpose of processing 2016 ENTSO-E TYNDP, were taken as a basis. In order to define assumptions of electricity exchanges of Slovakia with the surrounding countries, the "EU 2020" scenario from 2016 ENTSO-E TYNDP was used for the year 2020 and "Vision 1" scenario from 2016 ENTSO-E TYNDP was used for the year 2030.

The "EU 2020" scenario stems from the national renewable energy action plans of individual EU member states or similar documents in case of the ENTSO-E members which are not EU members. The "Vision 1" scenario is characterized by the fact it reflects the best possible estimate of individual TSOs associated in ENTSO-E in regard to development of the generation mix, transmission capacities and consumption for the year 2030.

The following picture shows prognosis of the electricity market cross-border exchanges among Slovakia and the neighbouring countries (except for AT) for the year 2026. The data were acquired by linear interpolation of values for the available real and modelled years 2020 and 2030. From the point of view of the Slovak Republic, compared to today, no substantial differences occurred and the estimated annual volumes of market power flows for the year 2026 correspond in fact to the present situation but for increase of the agreed electricity export with UA and CZ and decrease of the agreed import with CZ. These differences are caused by input data used in the ENTSO-E analysis for the years 2020 and 2030 which already include development of the transmission infrastructure of individual interconnected transmission systems, development of generators as well as various input assumptions in individual scenarios such as CO_2 emission price, price of fuels for electricity production, etc.

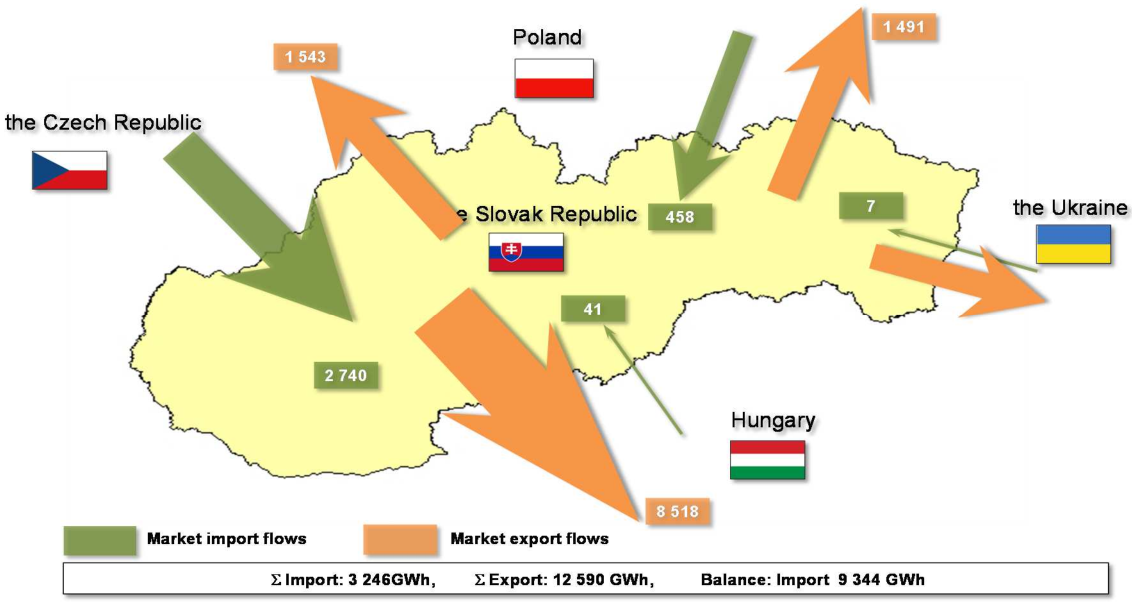


Figure No. 3 Assumed (Modelled) Annual Market Cross-Border Transmission Flows in the Slovak Power System for the Time Horizon 2026 from Simulation Models of the ENTOS-E (Without Consideration of Transit and Loop Flows)

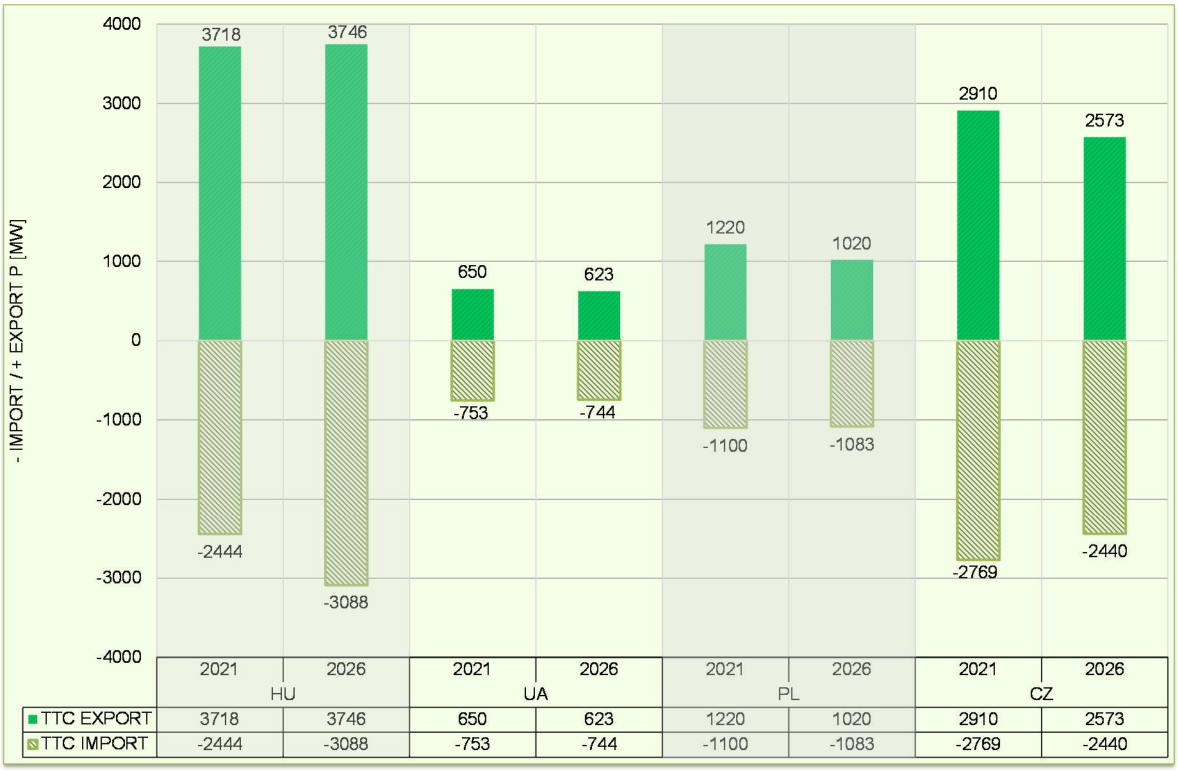
Regarding the current investment decisions by SEPS to increase cross-border transmission capacities, the planned construction of new cross-border interconnections on the SK-HU profile still proves to be reasonable and already considered in the above-mentioned ENTSO-E scenarios. It can be expected that based on the above-mentioned considerations the volume and direction of physical power flows along the cross-border lines of the Slovak transmission system on this profile will be comparable while the change of ratio between electricity transit and export to HU can occur.

Electricity transit through the Slovak transmission system can be expected further mostly in the north-south direction in the approximately identical volume as at present. In regard to the electricity production and consumption assumptions mentioned in Chapters 3.1 and 3.2, prevailingly export character of the Slovak power system can be expected from the year 2018 with comparable volumes of electricity transits as in 2015.

It can be stated that the mentioned assumptions for volume and direction of electricity flows from the Slovak power system or through Slovakia confirm the proposed solutions for strengthening the Slovak cross-border transmission infrastructure. Moreover, it is obvious that volume and direction of power flows depend on development of the transmission infrastructure, generation mix as well as on political decisions not only in Slovakia but also in the countries within the synchronously interconnected ENTSO-E system. The current and the expected development of cross-border electricity flows is the main driver of the decisions on construction of a new cross-border transmission line what is considered also in Chapter 4.3.

3.4 Development of Cross-Border Transmission Capacities

The values of maximum transmission capacities on individual cross-border profiles of the Slovak transmission system were calculated for future time horizons 2021 and 2026 both for import and export direction of power flows at consideration of restrictions only in the Slovak transmission system (see the following graph). These values of maximum transmission capacities of profiles depend especially on the system configuration, location of power plants, their actual committed capacity, and permitted loading of lines. On the other hand, the hourly values of net transmission capacities for the coming year also consider inevitable safety reserves for the case of maintenance conditions (approx. 70% of time in a year), in case of unexpected events, big differences between the market and real flows (so called loop flows). Along with consideration of the aforementioned conditions, the quantification of which is difficult to estimate for the future, the calculated values of net transmission capacities for the horizon 2021 and 2026 would be lower compared to the bellow provided values of maximum transmission capacities.



Graph No. 21 Development of Maximum Transmission Capacity Values on the Slovak Transmission Cross-Border Profiles in Time Horizons of 2021 and 2026 in Both Import and Export Directions

Increase of maximum transmission capacities compared to the present situation in the export direction approximately by 100 % and in the import direction approximately by 50 % within the time horizon of the year 2021 is assumed on the SK-HU cross-border profile. This increase is caused by commissioning of new 400 kV cross-border lines on the SK-HU profile in 2020 (see Chapter 4). This topological change in the Slovak transmission system proves negligible influence on the values of maximum transmission capacities of other Slovak cross-border profiles.

The planned gradual decommissioning of the 220 kV transmission system in Central Slovakia and Western Slovakia regions within the time horizon of the year 2025 including decommissioning of the 220 kV cross-border lines V270 Považská Bystrica (SK) – Lískovec (CZ) and V280 Senica (SK) - Sokolnice (CZ) on the SK-CZ profile has the biggest influence on values of the maximum transmission capacity on this cross-border profile compared to the time horizon of the year 2020. These topological changes may reduce the maximum transmission capacity in both import and export directions on this profile approximately by 13 %. The final impact including the assumed measures to eliminate reduction of the maximum transmission capacity on the CZ-SK profile is described in the conclusions of the joint SEPS and ČEPS (TSO in the Czech Republic) study, see Chapter 4.5. The described topological changes in 220 kV Slovak transmission system prove negligible influence on the values of maximum transmission capacities of other cross-border profiles.

With other cross-border profiles no significant change of values of maximum transmission capacities within the time horizon of the year 2026 is expected both in the export and import directions.

All considerations and assumptions on the development of maximum transmission capacities of individual cross-border profiles of the Slovak transmission system in time horizons described above are based on the SEPS and ENTSO-E analyses and assumptions. The provided values of maximum transmission capacities of these future time horizons of the years 2021 and 2026 shall thus be understood only as informative and non-binding annual values which are applicable exclusively to the analysed variants of the Slovak transmission system development. The values of net transmission capacities for the closest period are or will be specified by the SEPS dispatch centre.

3.5 The Network Development Plan for the European Union and Regional Investment Plans

As indicated in this document, the Slovak transmission system is a part of the synchronously connected European transmission system ENTSO-E. Within ENTSO-E, a ten-year network development plan describing possibilities and possible direction of development of the entire ENTSO-E transnational transmission system for the coming ten years is elaborated every two years. In December 2016, already third ENTSO-E TYNDP will be published (hereinafter referred to as “2016 ENTSO-E TYNDP”). ENTSO-E TYNDP is a non-binding document to ensure bigger transparency regarding investments in the entire European interconnected transmission system as well as support in the decision-making processes on the national, regional, and European level.

According to the Regulation of the European Parliament and of the Council No. 347/2013 on Guidelines for the Trans-European Energy Infrastructure, ENTSO-E TYNDP performs a double role. In addition to the aforementioned, it is a fact that a list of the transmission infrastructure investment projects within ENTSO-E having a character of projects of European interest attributed to them within ENTSO-E TYNDP shall form the basis for selection of the priority European projects addressed to as “Projects of Common Interest” (hereinafter referred to as “PCI”).

A list of the SEPS investment projects of the trans-European significance in the 2016 ENTSO-E TYNDP document is as follows:

- 2x400 kV OHL Gabčíkovo (SK) - Gönyű (HU) including construction of a new switching station in Gabčíkovo[4],
- 2x400 kV line Rimavská Sobota (SK) – Sajóivánka (HU),
- 2x400 kV line Veľké Kapušany (SK) – area of Kisvárda (HU).

Based on the aforementioned, the Union-wide lists of PCI projects are being adopted by the delegated EC regulations. This list of PCI projects is always based on the last valid ENTSO-E TYNDP in the year following the year in which the list of projects of pan-European interest in the ENTSO-E TYNDP document was issued. The current Union-Wide List of PCI Projects from February 2016 is based on 2014 ENTSO-E TYNDP and it includes the following PCI projects with SEPS being their promoter or co-promoter.

- 2x400 kV OHL Gabčíkovo (SK) – Gönyű (HU),
- 2x400 kV line Rimavská Sobota (SK) – Sajóivánka (HU),
- 2x400 kV line Veľké Kapušany (SK) – area of Kisvárda (HU)[5].

The PCI status is to help the concerned projects and their promoters especially in acquiring the required permissions for the project implementation and to ensure so that the national regulator weighted these projects adequately upon forming a regulatory framework regarding the all-European character of the PCI projects. The PCI status can also be used to acquire financial support dedicated to the area of energy infrastructure for the pan-European energy projects for the period 2014 – 2020 from so called Connecting Europe Facility framework established by the Regulation of the European Parliament and of the Council (EU) No. 1316/2013. It is, however, necessary to meet the strict criteria for this purpose, while the financial support amount need not be motivating for the TSOs and project promoters.

As already mentioned in this 2026 NTYNDP, there is also RgIP elaborated within the CCE region together with the ENTSO-E TYNDP report[6]. It identifies the Projects of Regional and National Significance which are not or will not be a part of the ENTSO-E TYNDP document since they fail to meet the status of projects of the European interest and finally they do not correspond to the PCI interest. However, they still play an important role at planning transmission system infrastructure development in the region in order to ensure safe operation of the connected transmission systems.

[4] Currently considered as "2x400 kV line Gabčíkovo (SK) – Gönyű (HU) – Veľký Ďur (SK)

[5] Since the project is planned after horizon of this NTYNDP, this document does not include any further information on it.

[6] Regional Investment Plan 2015-RG CCE-Final.pdf

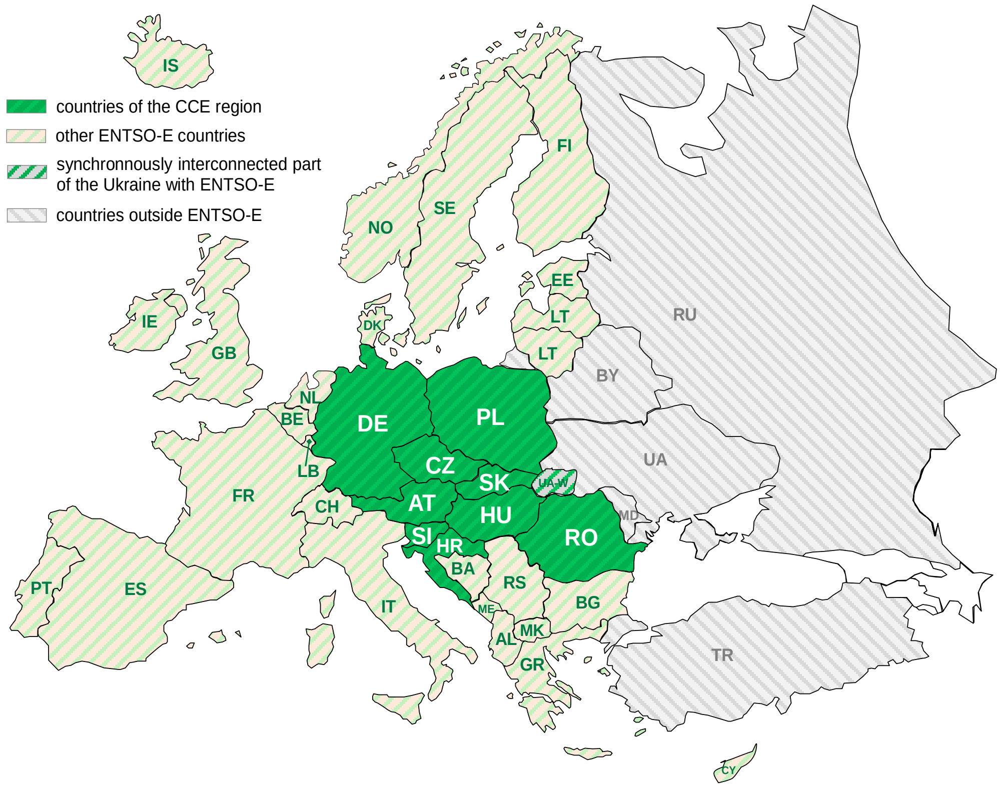


Fig. No. 4 Map of the CCE Region and Other European ENTSO-E Member Countries

In RgIP CCE 2015, SEPS has the following investment projects included:

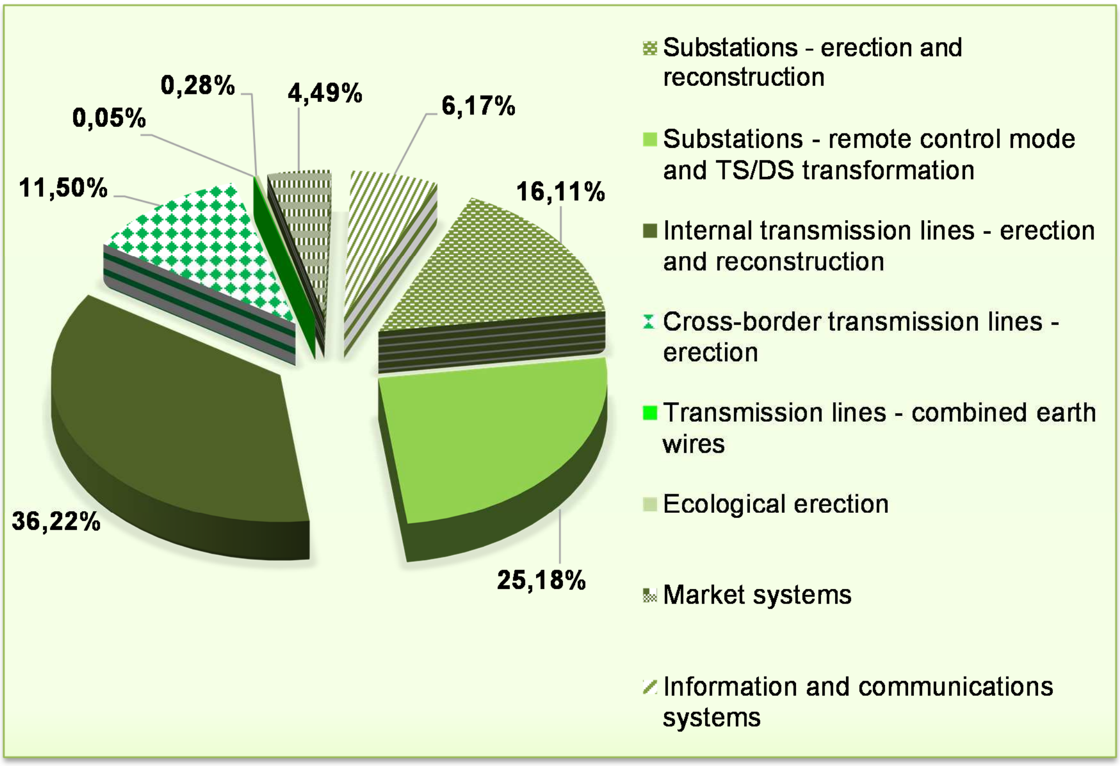
- Investment cluster Bystričany,
- Investment cluster Voľa[7],
- 2x400 kV line Križovany – Horná Ždaňa (with looping one circuit to the new 400 kV switchyard Bystričany),
- Doubling of 400 kV line Lemešany – Veľké Kapušany including extension of 400 kV Lemešany and Veľké Kapušany switchyards,
- 2x400 kV line Gabčíkovo – Veľký Ďur including extension of the 400 kV Veľký Ďur switchyard.

4. Ten-Year Slovak Transmission System Development Investment Plan for the Period 2016 –2025

Many from the investment projects of the SEPS ten-year investment plan by the year 2026 are verified by the SEPS network calculations for the considered scenarios and variants of the power system development for the time horizon of the year 2026 by means of mathematical models of the Slovak power system or ENTSO-E, in relation to different variants of generating units development and variants of the electricity consumption development in Slovakia. The remaining investment projects are included in the ten-year investment plan due to expiry of the projected lifetime of facilities, unfavourable results of diagnostic tests, changes of the respective legislation and technical standards due to fast technological progress, etc.

SEPS intends to invest approx. EUR 694.4 mil. by means of investment projects mentioned in the Ten-Year Investment Plan what means annual average amounting to EUR 69.4 mil. to ensure inevitable increase of the existing capacities and inevitable upgrade of the main parts of the transmission system. The distribution of SEPS investments in individual categories pursuant to the Ten-Year Investment Plan is shown in the following graph.

[7] The investment cluster was completed and commissioned in the course of the year 2014, however, with regard to the process of the 2015 RgIP ENTSO-E preparation it is still included in this ENTSO-E document.



Graph No. 22 Distribution of SEPS Investment Needs by 2026

4.1 Transmission System Development and Requirements of the Slovak Transmission System Users

The Slovak transmission system development and the related need of planning individual investment measures reflects the requirements of both existing and potential new Slovak transmission system users. The requirements of new Users of the distribution system operator type, direct electricity consumer from the transmission system or electricity producer connected to the transmission system leading to the need of the Slovak transmission system topology strengthening are usually submitted to SEPS "directly" via an application for connection to the transmission system or via the request for the SEPS opinion on issuance of the certificate for construction of energy facility pursuant to Act No. 251/2012 Coll. (hereinafter referred to as "Requests for TSO Opinion"). These requirements are assessed comprehensively in the next elaborated SEPS Development Programme and they are always verified by an independent Feasibility study.

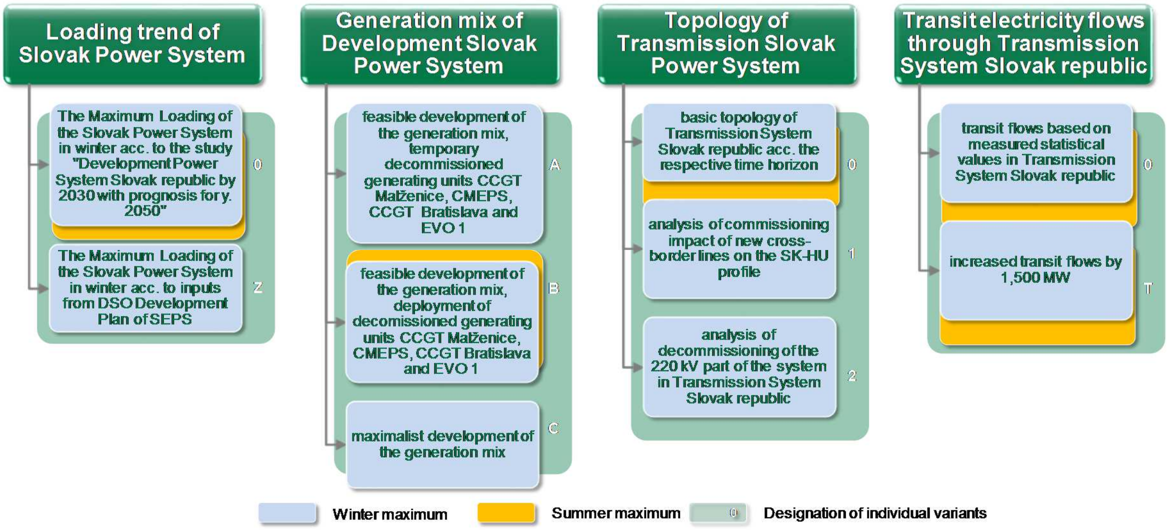
The need to extend the Slovak transmission system, however, may also be based on the conclusions of the SEPS Development Programme since pursuant to Act No. 251/2012 Coll. and the SEPS Network Code (Document A, Chapter A3) all Slovak transmission system users shall be obliged to submit inputs for processing the SEPS Development Programme. Moreover, the SEPS Development Programme considers the development of the neighbouring transmission system operators and it is in compliance with the ENTSO-E TYNDP.

As for the requirements of the existing distribution system operators, these have an option to ask SEPS to strengthen the transmission system in compliance with the Operation Rules of the Transmission System Operator Slovenská elektrizačná prenosová sústava, a. s. Moreover, electricity consumers and producers connected to the Slovak transmission system intending to change the technical parameters of their facilities connected to the Slovak transmission system due to which the adjustment of facilities in the Slovak transmission system may be required, follow, also these Operation Rules.

4.2 Scenarios and Variants for Verification of the Future Slovak Transmission System Development

SEPS as TSO pursuant to Art. 28, par. 2, subpar. d) of Act No. 251/2012 Coll. shall be obliged to provide for the system coordination and development. For the purpose of the Slovak transmission system development planning, all entities directly connected to the Slovak transmission system are obliged to provide SEPS with inputs within the range defined by the SEPS Network Code, publicly available on the SEPS website[8]. Based on those inputs and experience in the Slovak power system operation and its development and based on analyses of future facts which may occur in the Slovak power system, the mathematical calculation models of the Slovak power system and of the neighbouring countries were created for the needs of recent processing of the internal document SEPS Development Programme for the time horizons 2021 and 2026 and for individual variants of the possible Slovak power system development. When preparing individual variants, it is necessary to consider basic parameters of inputs for the Slovak power system development which are graphically shown on Graph No. 23. In all variants winter and summer period is included. The graph shows them in blue colour (winter period) and yellow colour (summer period). Subsequently, for all variants of time horizons 2021 and 2026 network calculations and analyses were performed. These calculations resulted in verified adequacy, appropriateness, and importance of proposals of long-term planned SEPS investment projects.

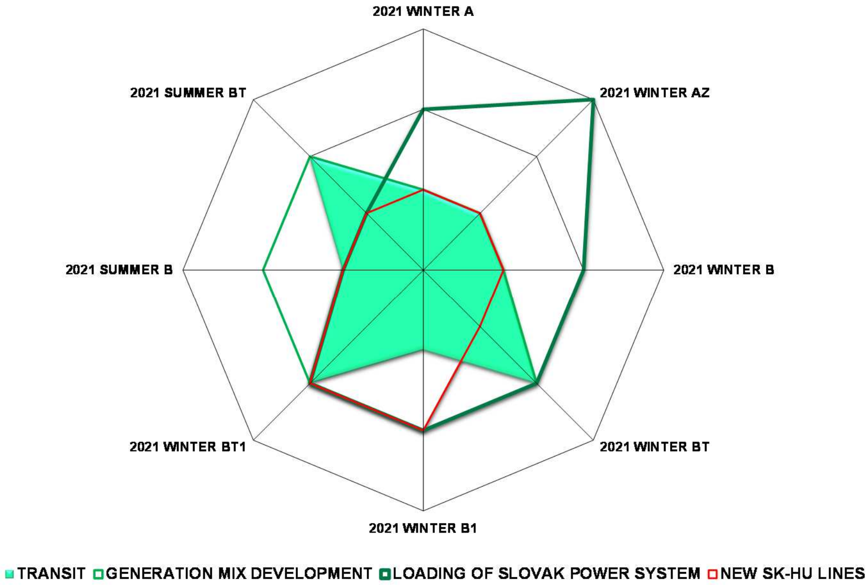
As for analysis of influence of the increased transit power flows through the Slovak transmission system on the system operational safety, the calculations used the basic transit based on the annual average value of electricity transit through the Slovak transmission system in 2012 which was the highest in recent years, and thus the worst for the Slovak transmission system operation. The selected "transit" variants considered the additional transit of 1,500 MW through the Slovak transmission system in the direction from CZ and PL to HU.



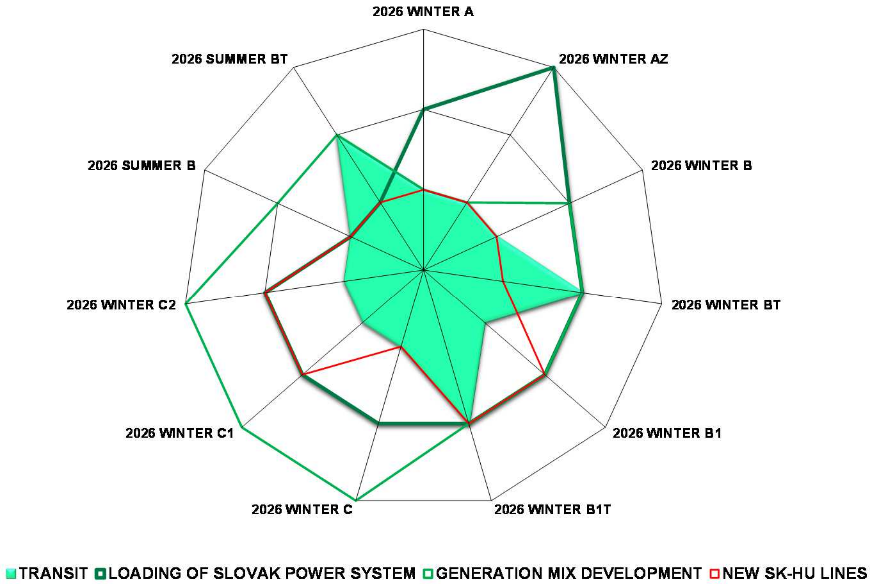
Graph No. 23 Graphic Representation of Basic Parameters of Inputs for the Slovak Power System Development

The simplified schematic quantification of basic parameters of inputs for the Slovak power system development in individual variants of time horizons 2021 and 2026 is shown in the following diagrams. Corners of the diagram polygon represent individual reviewed variants while the displayed curves and green area show quantification and importance of individual considered basic input parameters.

[8] http://www.sepsas.sk/seps/TechPod.asp?kod=281 (in Slovak)



Graph No. 24 Overview of Scenarios and Variants in the SEPS Development Programme 2017-2028 in the Time Horizon 2021 and Informative Quantification of Basic Monitored Parameters at Their Creation



Graph No. 25 Overview of Scenarios and Variants in the SEPS Development Programme 2017-2028 in the Time Horizon 2026 and Informative Quantification of Basic Monitored Parameters at Their Creation

Both graphs show what basic parameters of inputs for the Slovak power system development were considered in the respective variants and time horizons. Graphs No. 24 and 25 shall be read together with graph No. 23. Variant 2026 winter AZ which includes the following is provided as an example:

- the Slovak power system loading in winter maximum considered according to the input data from DSO,
- modelled basic transit,
- considered unrealistic development of the generation mix, temporarily decommissioned CCTG Malženice, CMEPS TG5, CCTG Bratislava and EVO 1, and
- considered basic topology of the Slovak transmission system to the time horizon 2026, without considering the impact of commissioning of new SK-HU.

In close future, at scenario preparation for the development documents, SEPS plans to use probabilistic mathematical models of the generating unit operation while the results of calculations cover all hours in a year, not only selected time points. Based on result analyses of such probabilistic models selection of individual time points shall be made which shall subsequently be subject to network calculations. Such preparation process of individual scenarios and variants is carried out in the ENTSO-E TYNDP processes and due to synchronization of preparation processes of the ENTSO-E and SEPS development documents, SEPS intends to introduce this preparation process of scenarios also in its conditions.

Main objectives, input assumptions and the preparation process of individual time horizons, scenarios and variants which were subject to network analysis and analysis of generating units operation and calculations in a two-year process of the 2016 ENTSO-E TYNDP preparation, are mentioned in the final report "2016 TYNDP Scenario Development Report"[9].

4.3 Investment Needs for the Slovak Transmission System Development

In case of reconstructions of the existing and building new substations within the Slovak transmission system, the SEPS long-term objective is to use the most up-to-date devices and equipment which comply with strict requirements for safe and reliable operation of the Slovak transmission system as well as requirements for sufficiently long trouble-free operation of this equipment with minimum demands for revision and maintenance activities. The same applies to building or reconstruction of transmission lines and to all secondary equipment required for the operation, management and control.

The principal decision of TSO in terms of the future Slovak transmission system development includes building of new Slovak transmission system facilities only on the 400 kV voltage level since the transmission system on the 220 kV voltage level gradually reaching the end of its lifetime what SEPS cannot prevent even by regular maintenance and repair interventions. Another factor is that installed capacity to the 220 kV transmission system decreases (decommissioning of the nuclear power plant Jaslovské Bohunice V1, 880 MW, unclear future of the power plant Vojany, units 5 and 6).

Controlled attenuation of such large infrastructure is a complex, long-term and ambitious strategic objective. At present, a time schedule of gradual controlled attenuation of the 220 kV Slovak transmission system is being processed in a way so as not to have negative operational or economic impact on the SEPS activity. The following time schedule of the 220 kV Slovak transmission system decommissioning shown in the following tables provides a basic overview of currently operated 220 kV lines and 220 kV switchyards in individual SEPS substations.

Line	Assumed Year of Decommissioning
V073 and V284	2017
V274	2021
V071, V072, V273	2022
V280 and V283	2023
V270, V271 and V275	2025

Note: *Decommissioning of V073 and V284 in the year 2017 is conditioned by securing reserve supply of EBO V2 only from the 110 kV system of the respective DSO*

Table No. 6 Overview of Decommissioning of 220 kV Lines

Name of substation with respective 220 kV switchyard	Assumed Year of Decommissioning
Lemešany	2022
Bystričany	2022
Križovany, Senica	2023
Považská Bystrica[10]	2025

Table No. 7 Overview of Decommissioning of 220 kV Substations

SEPS still assumes full termination of the 220 kV transmission system but for several exceptions approx. in 2025. It shall be emphasized that, however, not in all cases, automatic direct replacement of the decommissioned 220 kV facility by the similar 400 kV facility occurs. In cases when importance of such

[9] TYNDP 2016 Scenario Development Report.pdf

[10] Particular investment measure shall be included in the SEPS investment plan only after evaluation of the Study results.

replacement is not proved and SEPS should perform definite dismantling of such facility, the use of some 220 kV facilities on the distribution system (hereinafter referred to as “DS”) level may be considered.

The controlled attenuation of the 220 kV Slovak transmission system is carried out under close coordination with all concerned Slovak transmission system users. SEPS arranges regular discussions on this topic with the concerned subjects in the form of joint bilateral and multilateral meetings. There is a discussion with SE concerning transition of units 5 and 6 of EVO 1 to 400 kV Slovak transmission system what enables gradual decommissioning of the entire east part of the Slovak transmission system on the 220 kV voltage level up to substation Lemešany. The decision is conditioned by further approach of SE to the future of the Vojany power plant, what is at the time of publication of this NTYNDP a subject to SE internal analyses and SEPS will assimilate to such decision.

The future of the 220 kV part of the system in the region of the Central Slovakia where Stredoslovenská energetika – Distribúcia, a. s., (hereinafter referred to as “SSE-D”) operates is subject to the joint technical-economic study "Supply of Node Areas of P. Bystrica, Varín, Sučany, Liptovská Mara and the Consumer OFZ, a.s., After 2025" (hereinafter referred to as "Study"). At the time of processing of this NTYNDP, the Study is in phase of its final synthesis and approval of the Study results by SEPS and SSE-D.

SEPS assumes that roughly by 2025, only lines V281/282, switchyard 220 kV Sučany and transformers T401, 400/220 kV, and T201, 220/110 kV, Sučany (supplying OFZ, a. s. and SSE-D) are in operation in the Slovak power system on the 220 kV voltage level as the last ones. All other 220 kV lines including cross-border lines V270 and V280 will be decommissioned. The future of connection of direct consumers DUSLO, a. s., and OFZ, a. s. to the transmission system after decommissioning of the 220 kV Slovak transmission system is subject to independent negotiations. In both cases, mutually satisfying solution for maintaining supply for these consumers from the transmission system level is subject to joint search.

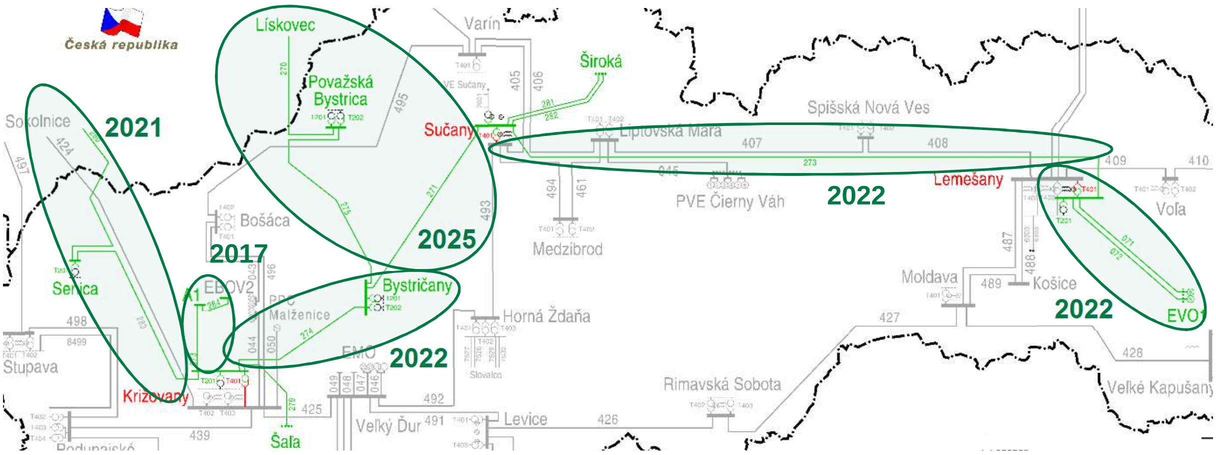


Fig. No. 5 Schematic Representation of Continual Decommissioning of the 220 kV Slovak Transmission System

SEPS shall continue in reconstruction of its substations concerning remote control mode. Transition of substations to remote control means these substations are being significantly upgraded and assimilated to the new operational, safety and reliability requirements along with the requirements for high energy efficiency of the transmission. Currently, there are 14 substations under the remote control mode out of 22 substations owned by SEPS. By 2026, SEPS considers implementation of the remote control mode in the substation Liptovská Mara, substation Podunajské Biskupice, substation Spišská Nová Ves and substation Varín. In case of substations on the 220 kV voltage level with 220/110 kV transformation – with regard to the aforementioned – no remote control mode is considered in such substations. To be implemented this does not cover 220 kV substation Senica which is currently under remote control mode. After 2026, 86 % of substations owned by SEPS will be under remote control mode.

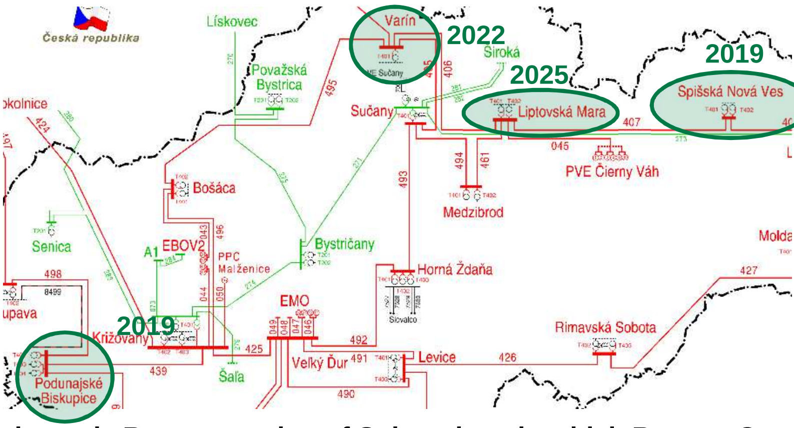


Fig. No. 6 Schematic Representation of Substations in which Remote Control Mode is Planned

The controlled attenuation of the 220 kV Slovak transmission system is deemed by SEPS a measure related to ensuring management of the transmission system energy efficiency. In this way, SEPS decommissions old and energy-demanding 220 kV transmission system facilities and replaces them by up-to-date 400 kV transmission system facilities, if necessary. It is a conceptual and cost-effective measure to improve energy efficiency and reaching savings of own electricity infrastructure of SEPS. Moreover, further such investments also include replacement of TS/DS transformers since current modern transformers comply with much stricter criteria as for amount of losses at electricity transformation. This can also be stated in regard to new types of wires of transmission lines when increase of the transmission capability of lines occurs (where necessary) without the need to break down the line and build new one (including towers), over-dimensioned to the higher transmission capacity. New types of wires used at planned replacement meet the condition of higher transmission capability also at use of the original towers. Energy efficiency of the transmission is being improved by every implemented SEPS investment.

4.4 Internal Investment Projects

Within gradual attenuation of the 220 kV Slovak transmission system, substation Bystričany and substation Senica will be subject to significant changes by 2026. Regarding the physical age and the current technical condition of the 220 kV system facilities, SEPS considers transition from 220/110 kV transformation to the 400/110 kV transformation in their case, thus causing natural decommissioning of the 220 kV substations. Moreover, remote control mode will be implemented in these substations. The decision on the future of the substation Považská Bystrica which is connected on the 220 kV voltage level will be made together with the concerned distribution system operator after completion of the technical-economic study “Connection of Node Areas P. Bystrica, Varín, Sučany, Liptovská Mara and OFZ, a.s. Consumer after the Year 2025”. The study covers the future optimal transmission system and distribution system development in the area of north-west Slovakia in relation to OFZ, a.s. as a direct electricity consumer from the transmission system. In this regard, in case of substation Považská Bystrica, substitution of the transformation 220/110 kV by the transformation 400/110 kV in the new substation Ladce is considered.

The significant internal project in the west part of the Slovak transmission system was a cluster “2x400 kV OHL Gabčíkovo – Veľký Ďur”. This set of investment is important in term of reliability increase of power export from hydroelectric power plant Gabčíkovo, supply of Bratislava as a capital of Slovakia in some transmission system operational situations as well as from the point of securing more reliable export of power from units 3 and 4 of the nuclear power plant Mochovce after its completion. This cluster consists of the following investment:

1. 400 kV Veľký Ďur switching station – extension,
2. 400 kV Gabčíkovo switching station,
3. 2x400 kV line, switching station Gabčíkovo - 400 kV Veľký Ďur switching station.

This project is important with regard to the Slovak transmission system cross-border capacities development. In particular, to strengthen the cross-border profile between the Slovak Republic and Hungary since one circuit of this new double-line will be connected to Hungary (more information is available in the following chapter). The investment “400 kV switching station Veľký Ďur – extension” was caused due to connection of the new 2x400 kV line of the 400 kV switching station Gabčíkovo – 400 kV switching station Veľký Ďur. The subject to the investment was extension of the 400 kV switching station Veľký Ďur by two new fields. This investment has already been made. In 2016, SEPS assumes completion of the line and the switching station Gabčíkovo.

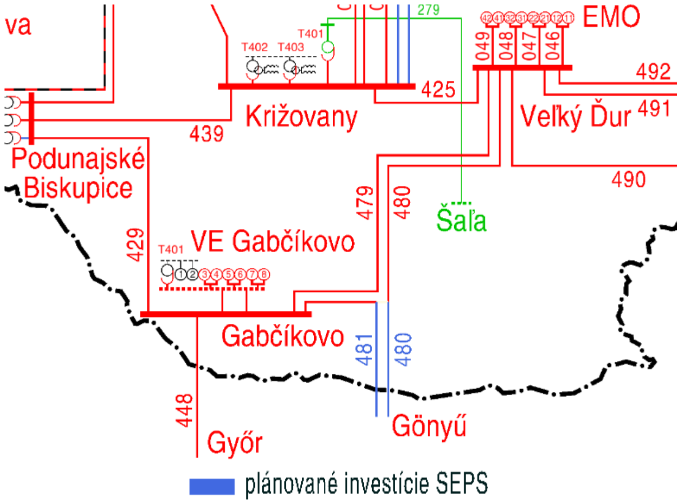


Fig. No. 7 Schematic Representation of the Planned Investments in Area of Switching Station Gabčíkovo

The new switching station Gabčíkovo shall enable SEPS, if necessary, to perform various operating modes and, moreover, it means further perspective development of the Slovak transmission system in this location, since spatial options of the existing capsulated switchyard in the hydroelectric power plant Gabčíkovo are substantially limited by its technical solution (capsulated switchyard).

Implementation of the project "Transformation 400/110 kV Bystričany" will result in significant shift in the area of gradual substitution of the 220 kV system within the Slovak transmission system. This cluster shall be co-financed from the BIDSF supporting fund administered by the European Bank for Reconstruction and Development which is intended for elimination of consequences of EBO V1 nuclear power plant premature decommissioning. This set of investments includes the following items:

1. 400 kV switchyard Bystričany,
2. 2x400 kV OHL Horná Ždaňa – Oslany area,
3. 400 kV switchyard Horná Ždaňa – extension,
4. 2x400 kV OHL Bystričany - Križovany
5. 400 kV switchyard Križovany – extension,
6. transformation 400/110 kV Bystričany – T401 and T402 transformers.

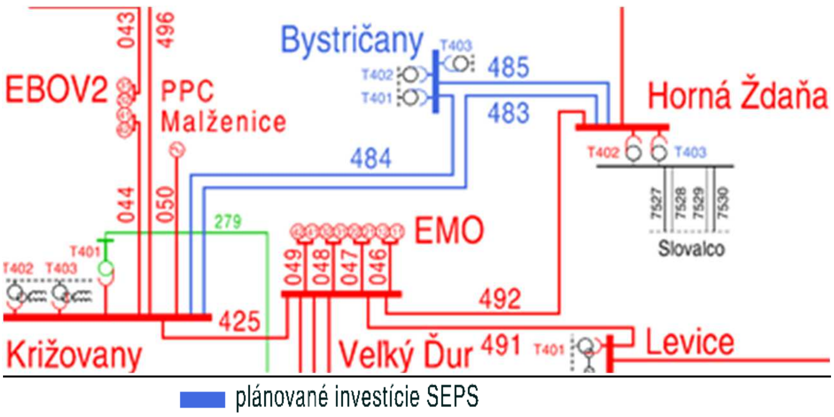


Fig. No. 8 Schematic Representation of the Planned Investments in Substation Bystričany

One circuit of the prepared 2 x 400 kV line Bystričany – Križovany shall be temporarily operated as the original 220 kV line Bystričany – Križovany while for this new line the corridor of the original 220 kV line V274 Križovany – Bystričany will be used. The second circuit of this line shall be operated as 400 kV line Bystričany – Križovany and it shall be interrupted in the Oslany area and connected to R400 kV Horná Ždaňa. It is a temporary condition before the final termination of the transformation 220/110 kV operation in Bystričany with regard to time-limited drawdown of finances from the BIDSF fund for this. Completion of the entire cluster is expected in 2021. At present, the project is tightly before construction stars and it is carried out in close coordination with SSE-D.

In the western part of the Slovak transmission system, SEPS plans further two important investment projects. The first one is the aforementioned transition of the substation Senica from the 220 kV voltage level to 400 kV. The name of this project is "Transformation of 400/110 kV Senica" and it consists of the following investments:

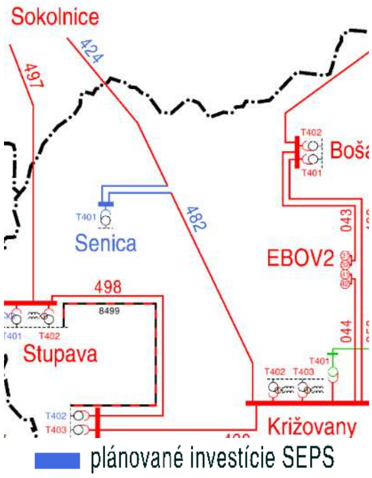


Fig. No. 9 Schematic Representation of the Planned Investments in Substation Senica

1. 400 kV switchyard Senica - reconstruction of 220 kV switchyard to 400 kV
2. transformation 400/110 kV Senica,
3. connection of V424 line to 400 kV switchyard in substation Senica.

Implementation of the investment project focuses especially on securing long-term connection of the Senica node area, in coordination with the concerned distribution company after gradual attenuation of the transmission system on the 220 kV voltage level. Transition to the 400 kV level in this substation shall be ensured by building the new 400 kV switching station within the scope of five fields, by looping of the existing 400 kV line V424 (Križovany (SK) – Sokolnice (CZ)) to the new 400 kV switchyard and by building the transformer 400/110 kV, 350 MVA. At the same time, building R400 kV Senica will lead to definite decommissioning of the existing 220 kV switchyard Senica. The project is in the preparatory phase on the feasibility study level. It is being prepared in close coordination between SEPS and respective DSO (Západoslovenská distribučná, a. s.; hereinafter referred to as "ZSD"). Assumed time framework for this project falls between the years 2020 and 2021.

Another one is the investment event "Remote control and replacement of transformer T404 in substation Podunajské Biskupice". Within the mentioned investment project, two investments are carried out in parallel. First one is transition of 400 kV substation Podunajské Biskupice from the remote manipulation mode to the remote control mode. This part of the investment includes transition of the existing 400 kV switchyard Podunajské Biskupice to a new type of switchyard with tubular bus bars and field width of 18 m. The other part of this event carried out in parallel is the replacement of the existing transformer T404,

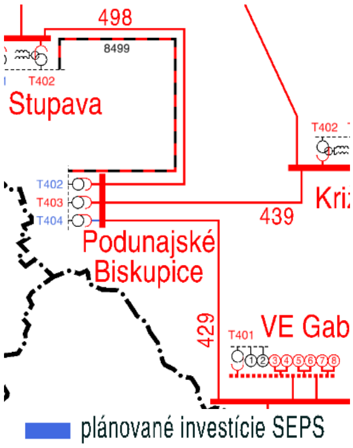


Fig. No. 10 Schematic Representation of the Planned Investments in Substation Podunajské Biskupice

400/110 kV, 250 MVA, by the new transformer T404, 400/110 kV, 350 MVA. Replacement of the transformer T404 was required by the distribution company ZSD for increase of the transformation power in the meter point Podunajské Biskupice. The cluster should be completed in 2019. The project is in the phase of engineering and project activities and it is carried out in close coordination with ZSD.

“Replacement of transformer T401, installation of shunt reactors and remote control mode in substation Varín” is a significant investment project in the middle part of the Slovak transmission system. It shall include transition to the remote control mode along with replacement of the existing transformer T401 by a new one with the nominal output of 350 MVA. Moreover, tertiary switchyard 33 kV for connection of shunt reactors 2x45 MVAr and the houseload transformer to tertiary winding of the new transformer T401 shall be built. The project is in the preparatory phase (feasibility study) and the assumed horizon of its implementation is currently the year 2022. By 2026, the replacement of the transformers T401 and T402 in the substation Liptovská Mara and its transition to the remote control mode is planned in the middle part of the Slovak transmission system. At present, this project is in the consideration phase. The feasibility studies will be conducted in the coming years.

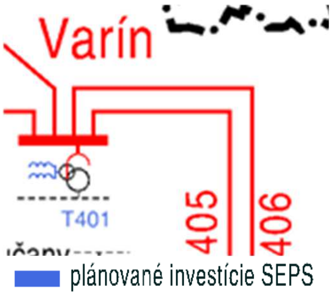


Fig. No. 11 Schematic Representation of the Planned Investments in Substation Varín

Fig. No. 12 Schematic Representation of the Planned Investments in Substation Liptovská Mara

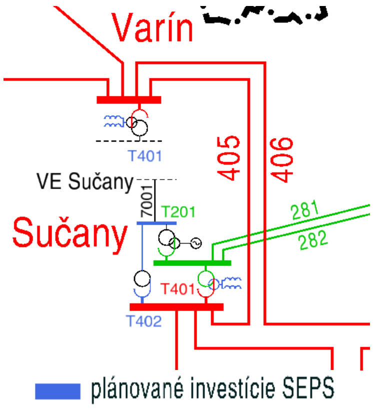


Fig. No. 14 Schematic Representation of the Planned Investments in Substation Sučany

An important plan in terms of security of supply of industrial electricity wholesale consumer, OFZ, a.s., which is a direct consumer of electricity from the transmission system, and SSE-D, is the planned implementation of transformation T402, 400/110 kV, 350 MVA in substation Sučany. This project will enable SEPS to gradually decommission the 220 kV line V273 (including the related equipment in substation Lemešany) while observing quality and safety of electricity supply for OFZ, a. s. and SSE-D. The project is in the feasibility study phase. In substation Sučany the project “Increase of the compensation power in substation Sučany” is under preparation. Within the project two groups of shunt reactors 33 kV, 3x30 MVAr will be connected to the tertiary winding of transformer T401. This will result in the required increase of the reactor installed power from 120 MVAr to 180 MVAr. The project will be merged with the implementation of T402 in Sučany. Original shunt reactors from T401 will be shifted and used in other SEPS substations.

In the east part of the Slovak transmission system the implementation of the investment project “Replacement of transformers T401, T402 and remote control mode in substation Spišská Nová Ves” is prepared. Within this action transition of the substation to the remote control mode will be performed along with replacement of the transformers T401 and T402 reaching the end of their lifetime by new ones with nominal output of 250 MVA. At present, there is a tender for the contractor conducted. This project is implemented in close cooperation with respective DSO, the company Východoslovenská distribučná, a. s., and its completion is expected by 2019.

Fig. No. 13 Schematic Representation of the Planned Investments in Substation Spišská Nová Ves

By 2026, in the field of transmission system/distribution system transformation, supplementation or replacement of physically obsolete transformers with which it is assumed their technical condition after their lifetime expiry shall not allow their further safe and reliable operation is expected. Apart from the aforementioned replacements of transformers within other sets of investment events, the following projects are involved:

1. replacement of T401 in substation Moldava,
2. replacement of T401 in substation Stupava,
3. replacement of T402 in substation Podunajské Biskupice,
4. replacement of T401 and T403 in substation Horná Ždaňa.

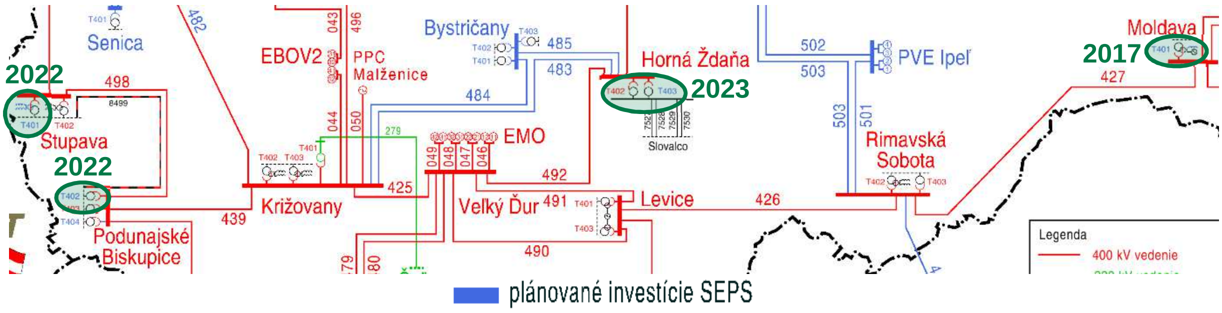


Fig. No. 15 Schematic Representation of the Planned Replacements of the Transmission System/Distribution System Transformers by 2026

4.5 Cross-Border Investment Projects

The most expected cross-border projects to be implemented by SEPS by 2026 are projects concerning building transmission lines to Hungary. It is 2x400 kV line Gabčíkovo (SK) - Gönyű (HU) - Veľký Ďur (SK) and 2x400 kV line Rimavská Sobota (SK) – Sajóivánka (HU). In order to accelerate their implementation, in June 2014 a contract on common proceeding at defining crossing points of the Slovak-Hungarian state border for both aforementioned lines was signed with the Hungarian transmission system. Negotiations on the contract covering building these lines between SEPS and MAVIR were finished in spring 2015 with the result that a draft contract approved on the working level was approved by the SEPS Board of Directors in the first half of June 2015. Since then the draft contract is subject to the approval procedure in MAVIR in fact up to date. Due to this reason, preparation of both investment projects is slightly delayed according to the original time schedule by one year and thus the assumed date of line commissioning is December 2020.

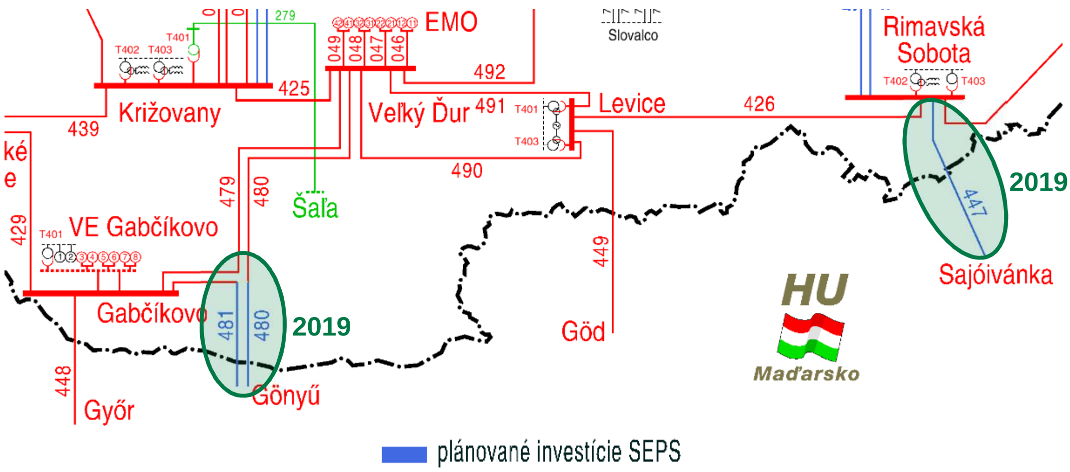


Fig. No. 16 Schematic Representation of the Planned Investment Event Concerning Building New Cross-Border Lines on the SK-HU profile

With a financial contribution from the "Connection Europe Facility" instrument of the European Union, SEPS started designing and engineering works on both lines. Since these are projects having a status of the Project of Common (European-wide) Interest, the European Commission through the respective directorate starts to pay increasingly more intense attention to them.

By 2026, SEPS does not plan to strengthen other cross-border profiles, however, in the period of years 2024 and 2025 a reconstruction of the cross-border line V404 Varín (SK) – Nošovice (CZ) is scheduled. Decommissioning of the transmission system on the 220 kV voltage level will also affect cross-border lines 220 kV on the CZ – SK profile (V270 and V280) in the future. In this regard, a common study was conducted with ČEPS investigating the influence of decommissioning of these two 220 kV lines on the total transfer capacity (TTC). The study results prove the change of TTC on the +300 MW to -340 MW level what means approximately ±10 % of the market capacity of this profile. Thus within reconstruction carried out by SEPS, the transmission capacity of the V404 line will increase to approximately 2,500 A, what shall compensate the mentioned decrease of TTC.

In case of development of cross-border connections, it is necessary to consider it is related mainly to the situation and development of electricity consumption in the Slovak power system and installed capacity of electricity generating units or their production in the Slovak power system. Moreover, this takes into account the situation and development of the power system in the neighbouring countries, interests and approaches of their operators and support of cross-border electricity exchange development or trading in electricity within EU and adjacent economies from electricity point of view. In this sense, thus SEPS further maintains and develops coordination activities with the transmission system operators of Hungary, Poland, the Czech Republic and the Ukraine, both on the ENTSO-E and bilateral level. Negotiations with the Austrian transmission system operator are currently not carried out, since even in the long-term horizon no mutual interconnection of the Slovak transmission system and Austria is envisaged. It is, however, necessary to state that after a longer pause, the communication with the transmission system operator in the Ukraine was successfully established. The current discussion concerns especially a technical condition and future of the existing 400 kV connection of Veľké Kapušany (SK) – Mukacheve (UA). This cross-border profile is often a bottleneck (together with the Hungarian profile) in case of cross-border electricity transmissions and it causes operational problems and control problems also to the Slovak national dispatch centre. There is a real assumption that cooperation within the next months will be specified in the form of the cooperation agreement.

Moreover, it is inevitable the development and construction of new cross-border interconnections must be in compliance with the development and possibilities of internal interconnections while new inter-interconnections can be built to such extent so as not to threaten safety and reliability of the Slovak transmission system or Slovak power system operation.

4.6 Investments in the Transmission System for the period 2017 to 2026

The investment projects for creation of new capacities or for upgrade of the Slovak transmission system are documented in the table below and the principal national and cross-border investment projects are shown in the following picture.

Table No. 8 Overview of Implementation of Investment in the Transmission System for the Period 2017 to 2026

Order No.	Investment projects	Identification number	Beginning and end of investment projects		Assumed costs [EUR mil.]	Incurred costs by 31.12.2015 [EUR mil.]	Project status
Substations - construction and reconstruction							
1	Switching station 400 kV Gabčíkovo – construction of a new station [**RGI code: 214**] [**ENTSO-E TYNDP code: 48.214**] [**PCI code: 3.16**]	2013-4	2008	2017	29.532	3.557	
2	Adjustments in related facilities in switching station Gabčíkovo and substation Veľký Ďur [**RGI code: 214**] [**ENTSO-E TYNDP code: 48.214**] [**PCI code: 3.16**]	2015-1	2019	2020	0.149		
3	400 kV switchyard Bystričany – construction of a new 400 kV switchyard [**RGI code: 297**]	2013-5	2014	2019	14.384	0.308	
4	400 kV switchyard Horná Ždaňa – extension [**RGI code: 845**]	2013-6	2014	2019	6.645	0.49	
5	400 kV switchyard Križovany – extension [**RGI code: 845**]	2013-7	2015	2021	7.169	0.091	
6	400 kV switchyard Rimavská Sobota - extension [**RGI code: 695**] [**ENTSO-E TYNDP code: 48.214**] [**PCI code: 3.17**]	2013-9	2018	2019	4.06		
7	Automatic decay in substation Veľký Ďur	2013-14	2016	2017	0.25		
8	Replacement of bus bar wires in substation Stupava	2015-2	2014	2018	0.8	0.035	
9	Replacement of bus bar wires in substation Veľký Ďur	2015-3	2016	2019	1.959		
10	Replacement of bus bar wires in substation Levice	2015-5	2017	2019	1.463		
11	Replacement of disconnectors in 400 kV switchyard in substation Sučany	2015-6	2013	2021	1.9	0.1	
12	Reconstruction of 220kV switchyard in Sučany	2015-8	2017	2018	4.6		
13	Innovation of ICS facilities for control of 220 kV switchyard in Lemešany	2013-16	2019	2019	0.5		
14	Innovation of ICS facilities for control of 110 kV switchyard in substation Horná Ždaňa	2013-18	2016	2017	1.5		
15	Innovation of ICS - switchboard in substation Lemešany 400 kV	2015-9	2017	2017	0.683		
16	Innovation of ICS in substation Bošáca	2015-10	2017	2018	1.38		
17	Innovation of ICS - switchboard in switching station Košice	2015-11	2018	2018	0.42		
18	Innovation of ICS - switchboard in substation Veľké Kapušany	2015-12	2018	2018	0.48		
19	Innovation of ICS - switchboard in substation Horná Ždaňa 400 kV	2015-13	2019	2019	0.48		
20	Innovation of ICS in substation Križovany 400 kV	2015-14	2020	2021	2.55		
21	Innovation of ICS - switchboard in substation Veľký Ďur	2015-15	2021	2021	0.55		
22	Innovation of ICS - switchboard in substation Levice	2015-16	2021	2021	0.48		
23	Innovation of ICS - switchboard in substation Medzibrod	2015-17	2022	2022	0.42		
24	Innovation of ICS - switchboard in ST Voľa	2015-18	2022	2022	0.48		
25	Innovation of ICS - switchboard in substation Stupava	2016-4	2022	2022	0.48		
26	Innovation of ICS - switchboard in substation Rimavská Sobota	2016-5	2023	2023	0.48		
27	Innovation of ICS in substation Veľké Kapušany	2015-19	2024	2024	1.18		
28	Innovation of ICS in substation Lemešany 400 kV	2015-20	2023	2024	1.75		
29	Innovation of ICS in substation Moldava	2015-21	2024	2025	1.18		
30	Innovation of ICS in substation Horná Ždaňa 400 kV	2015-22	2025	2026	1.18		
31	Innovation of ICS in switching station Košice	2016-6	2026	2026	0.92		
32	Refurbishment of secondary technology in substation Sučany	2015-23	2018	2019	1.08		
33	Refurbishment of secondary technology in substation Lemešany 400 kV	2015-24	2017	2017	0.76		
34	Refurbishment of secondary technology in substation Križovany 400 kV	2015-26	2018	2018	0.35		
35	Refurbishment of secondary technology in substation Horná Ždaňa 110 kV and 400 kV	2015-27	2019	2019	0.75		
36	Innovation of TIS in substation SEPS	2015-29	2020	2020	0.193		
37	Refurbishment of secondary technology in substation Liptovská Mara	2015-30	2020	2020	0.14		
38	Refurbishment of secondary technology in substation Križovany 400 kV	2015-31	2021	2021	2.1		
39	Refurbishment of secondary technology in substation Stupava	2015-32	2021	2021	0.36		
40	Refurbishment of secondary technology in substation Horná Ždaňa 110 kV	2015-33	2024	2024	1.35		

Order No.	Investment projects	Identification number	Beginning and end of investment projects		Assumed costs [EUR mil.]	Incurred costs by 31.12.2015 [EUR mil.]	Project status
41	Refurbishment of secondary technology in substation Lemešany 400 kV	2015-34	2024	2024	1.08		
42	Refurbishment of secondary technology in substation Veľké Kapušany	2015-36	2024	2024	1.35		
43	Refurbishment of secondary technology in substation Moldava	2015-37	2024	2025	0.82		
44	Refurbishment of secondary technology in substation Rimavská Sobota	2015-38	2025	2025	0.14		
45	Refurbishment of secondary technology in substation Spišská Nová Ves	2015-39	2025	2025	0.14		
46	Refurbishment of secondary technology in substation Levice	2015-40	2025	2025	0.15		
47	Refurbishment of secondary technology in substation Horná Ždaňa 400 kV	2016-7	2026	2026	0.7		
48	Innovation of TIS in substation SEPS	2016-8	2026	2026	0.215		
49	Refurbishment of secondary technology in switching station Košice	2016-9	2026	2026	0.88		
50	Transfer of 1st group of shunt reactors from T401 from substation Sučany to substation Voľa for T402 and connection of new shunt reactors to T401 Voľa	2013-11	2014	2017	0.987	0.083	
51	Refurbishment of secondary technology in substation Bošáca	2014-1	2017	2018	1.3		
52	Position of the reserve transformer for the Slovak transmission system in substation Varín	2015-43	2015	2017	0.401	0.011	
53	400 kV switchyard Senica - reconstruction of 220 kV switchyard to 400 kV	2014-3	2017	2021	12.439		
54	Simplified monitoring system of T201 Sučany and T401 transformers in substation Varín	2016-2	2017	2017	0.256		
55	New station and field 33 kV for reactors 90 MVAr in substation Sučany	2016-3	2017	2018	0.58		
56	400 kV switchyard Ladce	2016-1	2022	2026	19.2		
57	400 kV switchyard Veľký Ďur — extension	2015-44	2024	2026	4.249		
58	400 kV switchyard Levice — extension	2015-45	2024	2026	4.648		
Substations - remote control and transmission system/distribution system transformation							
59	Remote control mode and replacement of transformer T404 in substation Podunajské Biskupice, transition of 400 kV switchyard Podunajské Biskupice to the switchyard of a new type	2013-20	2004	2019	37.465	1.204	
60	Remote control mode and replacement of transformers T401 and T402 in substation Spišská Nová Ves	2013-24	2006	2019	28.207	1.012	
61	Remote control mode of substation Sučany	2013-25	2025	2029	9.005		
62	Remote control mode and replacement of transformers T401 and T402 in substation Liptovská Mara	2013-26	2021	2026	14.34		
63	Remote control mode and replacement of T401 and new shunt reactors in substation Varín	2013-27	2012	2022	17.535	0.069	
64	Replacement of transformer T401 and new household transformer in substation Moldava	2013-28	2014	2018	9.152	0.366	
65	Replacement of transformer T402 in substation Podunajské Biskupice	2013-29	2021	2022	5.311		
66	Replacement of transformers T401 and T403 and household transformer in substation Horná Ždaňa	2013-30	2020	2023	10.622		
67	Transformer station 400/110 kV Bystričany — T401	2013-31	2016	2019	13.2		
68	Transformer station 400/110 kV Bystričany — T402	2014-4	2017	2021	11.5		
69	Replacement of transformer T401 in substation Stupava	2013-32	2021	2022	5.311		
70	Transformer T402 400/110 kV in substation Sučany	2015-46	2019	2021	10.01		
71	Transformer station 400/110 kV Senica	2014-5	2018	2021	5.311		
72	Transformer station 400/110 kV Ladce	2016-13	2022	2026	12.2		
73	Replacement of transformer T403 in substation Rimavská Sobota,	2016-10	2026	2029	5.311		
Internal electric lines - construction and reconstruction							
74	2x400 kV OHL Gabčíkovo - Veľký Ďur [RGI code: 298]	2013-34	2007	2017	103.141	87.641	
75	2x400 kV OHL Bystričany – Križovany [RGI code: 845]	2013-35	2012	2019	74.197	3.267	
76	2x400 kV line Horná Ždaňa – Oslany [RGI code: 845]	2013-36	2012	2019	34.298	0.72	
77	Connection of the V484 line (circuit 220 kV) to 400 kV switchyard Križovany and Bystričany [RGI code: 845]	2016-11	2021	2021	1.85		
78	Tower reconstruction of 400 kV line V426 Levice - Rimavská Sobota	2015-47	2017	2017	3.3		
79	V427 insulator replacement	2015-48	2019	2020	5		
80	V425 insulator and conductor replacement	2013-43	2018	2019	7.6		

Order No.	Investment projects	Identification number	Beginning and end of investment projects		Assumed costs [EUR mil.]	Incurred costs by 31.12.2015 [EUR mil.]	Project status
81	V428 insulator and conductor replacement	2015-49	2021	2022	5		
82	V424 insulator and conductor replacement	2013-44	2020	2022	10.2		
83	Replacement of conductors, insulator replacement V498 (in the section of tower 126 - Podunajské Biskupice portal)	2013-45	2017	2017	1.2		
84	V429 insulator and conductor replacement	2013-46	2022	2023	6		
85	V448 insulator and conductor replacement	2013-47	2021	2023	1.7		
86	V044 insulator replacement	2013-48	2021	2022	1		
87	V043 insulator replacement	2013-49	2021	2022	3		
88	V496 insulator replacement	2013-50	2021	2023	3.2		
89	V041 insulator and conductor replacement	2015-50	2021	2021	0.7		
90	V408 line innovation	2013-52	2022	2024	36		
91	V491 insulator and conductor replacement	2015-52	2023	2023	0.2		
92	V407 line innovation	2013-51	2023	2025	32		
93	V461 insulator and conductor replacement	2015-53	2024	2025	4.5		
94	Connection of the line V424 line switchyard 400 kV in substation Senica	2014-7	2018	2021	6.91		
95	Looping of V495 in substation Ladce	2016-17	2024	2026	1.6		
96	1x400 kV line Veľký Ďur - Levice	2015-54	2025	2026	9.945		
97	V045 conductor replacement, insulator replacement	2016-12	2026	2027	10		
Cross-border lines — building							
98	2x400 kV line Gabčíkovo - Gönyű (HU) - Veľký Ďur (the part Veľký Meder — state border with HU) [**RGI code: 214**] [**ENTSO-E TYNDP code: 48.214**] [**PCI code: 3.16**]	2013-53	2015	2020	22.344	0.038	
99	2x400 kV line Rimavská Sobota – Sajóivánka (HU) (the part up to the state border with HU) [**RGI code: 495**] [**ENTSO-E TYNDP code: 48.495**] [**PCI code: 3.17**]	2013-54	2015	2020	33.963	0.036	
100	V404 line innovation	2016-14	2021	2025	23.76		
Electric lines — combined earth wires							
101	Optical interconnection of substation Varín - SED Žilina (V495)	2013-55	2014	2017	0.411	0.071	
Environmental investments							
102	Substation Bošáca - waste water treatment plant	2015-55	2018	2018	0.31		
103	Substation Lemešany - waste water treatment plant	2015-57	2018	2018	0.4		
104	Substation Liptovská Mara - waste water treatment plant	2015-58	2021	2021	0.42		
105	Substation Križovany - waste water treatment plant	2015-59	2021	2021	0.42		
106	Substation Moldava - waste water treatment plant	2015-60	2022	2022	0.42		
Commercial systems							
107	Innovation of the ADC System	2013-59	2015	2017	5.786	2.315	
108	Innovation of the information billing system	2013-66	2017	2018	1.5		
109	Modifications of ADC System according to the requirements of legislation and users	2013-58	2021	2023	4.0		
110	Innovation of the quality measurement system	2013-60	2018	2020	2.6		
111	Innovation of measurement sets	2013-64	2018	2020	2		
112	Upgrade of the DaE system	2013-63	2013	2017	3.743	1.743	
113	Innovation of the DaE system	2015-61	2021	2022	8		
114	Upgrade of the DaE system	2015-62	2023	2031	2.3		
115	Innovation of the ADC System	2015-63	2021	2023	6		
116	Modifications of ADC System according to the requirements of legislation and users	2013-65	2026	2027	4		

Order No.	Investment projects	Identification number	Beginning and end of investment projects		Assumed costs [EUR mil.]	Incurred costs by 31.12.2015 [EUR mil.]	Project status
117	Innovation of the information billing system	2015-64	2023	2024	1.5		
ICT systems							
118	Upgrade of ICS SED	2013-67	2012	2017	17.867	0.212	
119	Upgrade of load-bearing telecommunication network of SDH	2013-68	2016	2017	1.7		
120	Upgrade of F-MUX facilities	2013-71	2017	2017	1.8		
121	Implementation of the security system	2013-72	2017	2017	1.404		
122	Upgrade of security systems	2013-73	2015	2017	0.8	0.187	
123	Data backup centre in Podunajské Biskupice	2016-15	2016	2017	3.0		
124	Second optical interconnection of SEPS headquarter in Bratislava to substation Podunajské Biskupice	2016-16	2016	2017	0.5		
125	Software for use of data exchange on the system deviation of SEPS and ČEPS	2013-75	2019	2021	0.524		
126	Upgrade of ICS SED	2015-65	2023	2025	20		
	TOTAL Investment Projects				874.012	103.382	

Investments:

investments to be implemented in the following three years

investments already decided upon by the transmission system operator

other investments related to the transmission system upgrade

Project situation – this indicator is applicable to the investment a categories

there are execution works performed

there are project and engineering activities performed

works on the project have not started yet

[PCI code: x.xx] - PCI projects [RGI code: x.xx] - RGI projects [ENTSO-E TYNDP code: xx.xxx] - ENTSO-E TYNDP projects

Notes:

1. The mentioned investment costs are set up by the qualified estimate of the SEPS employees while considering the price level at the time of incorporation of investments in the investment plan, free of inflation impact and eventual change of the technical solution at the time of the investment implementation. In case of further NTYNDP processing, the investment costs shall be updated.
2. A list of investments in the transmission system for the period 2017 to 2026 does not consider all SEPS investment needs in the next ten-year horizon, but only the investment projects related to ensuring inevitable increase of the existing capacities and necessary upgrade of the main parts of the transmission system.

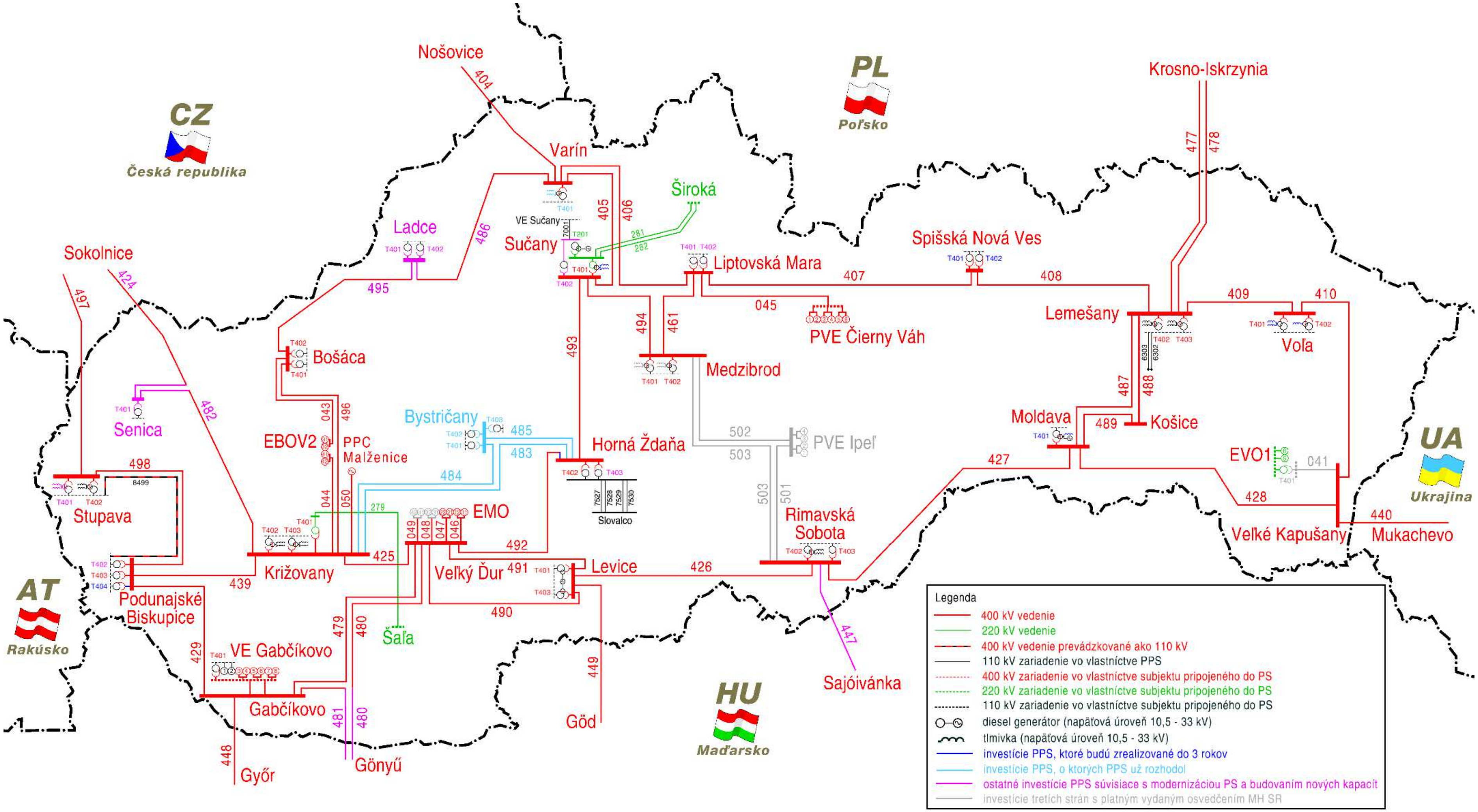


Figure No. 17 Assumed Situation of the Transmission System in 2026

5 Conclusion

At preparation of this 2026 NTYNDP, SEPS stemmed from the current and expected future condition of offer and demand for the system capacity, from the assumptions of future electricity production, electricity consumption, and exchanges in electricity with other countries while taking the ENTSO-E TYNDP and RgIP CCE into account. This document, however, reflects the SEPS Development Programme, the respective approved SEPS investment plans and the recent 2025 NTYNDP approved by NRA. The document was subject to the comment procedure by all Slovak transmission system users, NRA and the Ministry of Economy of the Slovak Republic. All these assumptions are described and considered in the 2026 NTYNDP appropriately to the current knowledge and information available to SEPS as to the Slovak transmission system operator, as at time of the 2026 NTYNDP handover to NRA for approval.

The substantial and long-term decisions of SEPS in the field of further development and use of the Slovak transmission system include building new facilities only on the 400 kV voltage level. It is still applicable that the Slovak transmission system on the 220 kV voltage level due to gradual decommissioning of electricity generators connected to it and with regard to its age and worsening technical condition gradually becomes meaningless. Due to gradual decommissioning of parts of the 220 kV transmission system these parts shall not be replaced by similar facilities of the same voltage level. SEPS will build only 400 kV facilities only if based on thorough consideration it is inevitable in terms of the Slovak transmission system safety and reliability as well as in terms of electricity supply safety and reliability.

Along with transition from 220 kV to 400 kV, the significant upgrade of SEPS substations occurs with regard to current criteria and requirements for efficient electricity transmission. All such reconstructed substations are put immediately in the remote control mode. Reaching this operational and control mode in all substations is another long-term strategic SEPS objective.

Regarding neighbouring countries, SEPS long-term priority is building new 400 kV interconnections towards Hungary which were included in the list of PCI projects. This confirms their significance and importance not only for the Slovak transmission system and Hungary but for the wider CCE region. SEPS deals with the projects in the phase of design and engineering works which shall be completed by obtaining a building permit.

The SEPS priorities in the next ten years shall include - based on the aforementioned - investment projects which shall ensure:

- replacement of the gradually decommissioned parts of the 220 kV transmission system,
- transition of the remaining substations from local and remote manipulation mode to the remote control mode,
- increase of the transmission capacity of the existing SK-HU transmission profile.

The main SEPS investment projects provided in this 2026 NTYNDP are not only in compliance with the aforementioned priorities but they also correspond to the 2016 ENTSO-E TYNDP document which is the recent valid plan of the system development for the entire European Union. Moreover, a list of investment projects was within confirmation of the main SEPS investment decisions, further verified by the network calculations within processing of the SEPS Development Programme for the years 2018 – 2027 with the use of inputs from all concerned entities within the Slovak Republic.

6 List of abbreviations

ADC System	-	Automated Data Collection System
AT	-	Austria (ISO code)
BIDSF	-	Bohunice International Decommissioning Support Fund (International fund of the European Bank for Reconstruction and Development for support of JE V1 decommissioning)
CAO	-	Central Allocation Office GmbH
CCE	-	Continental Central East
CEE	-	Central East Europe
CMEPS	-	CM European Power Slovakia
CZ	-	the Czech Republic (ISO code)
DaE	-	Damas Energy (complex information system for commercial management of the transmission system)
DE	-	Germany (ISO code)
DS	-	Distribution System
EBO	-	Jaslovské Bohunice Nuclear Power Plant
EMO	-	Mochovce Nuclear Power Plant
ENTSO-E	-	European Network of Transmission System Operators for Electricity
ENTSO-E TYNDP	-	ENTSO-E Ten-Year Network Development Plan
ESt	-	Substation
EU	-	European Union
EVO 1	-	Vojany 1 Power Plant
GDP	-	Gross Domestic Product
HU	-	Hungary (ISO code)
MAVIR	-	Hungarian transmission system operator
N		Number of the system elements in basic load
NTC	-	Net Transfer Capacity
NTYNDP	-	National Ten-Year Network Development Plan
PCI	-	Projects of Common Interest
PL	-	Poland (ISO code)
R	-	Switchyard
RES	-	Renewable Energy Sources
RgIP	-	Regional Investment Plan
RO	-	Romania (ISO code)
SDC	-	System Development Committee
SDH	-	Synchronous digital hierarchy
SE	-	Slovenské elektrárne, a. s.
SED	-	Slovak National Dispatch Centre
SEPS	-	Slovenská elektrizačná prenosová sústava, a. s.
SK	-	the Slovak Republic (ISO code)
SSt	-	Switching station
T	-	Transformer

TG	-	Turbo-Generator
TL	-	Shunt reactor
TR	-	Transformer station
TRM	-	Transmission Reference Margin (safety reserve on the transmission profile)
TSO	-	Transmission system operator
TTC	-	Total Transfer Capacity; total transmission capacity of the profile consisting of NTC and safety margin (TTC = NTC + safety margin)
UA	-	the Ukraine (ISO code)
V	-	Line