OPERATION

Ensuring uninterrupted system operations.

The system is managed optimally under normal operating conditions and effectively under critical conditions.

Electricity offtake and input: Producers fed a total of 13,952GWh into the network, while the total energy offtake from the transmission network excluding losses amounted to 13,149GWh (3 % more than in 2016).

13,952
GWh was fed in by producers in 2017

Congestion and right to use cross-border transmission capacities: In 2017, net transmission capacities (NTC) from Austria to Slovenia amounted to 747MW on average, which is 13 % more than in 2016 and 24 % less than planned. Considering the allocation of cross-border transmission capacities, 2017 passed without any noteworthy incidents.

13,149
GWh total energy input from the transmission system

747
MW of net transmission capacities from Austria to Slovenia

Quality of electricity transmission: In 2017, no short disconnection due to own causes was recorded; however, there were 15 long disconnections at 13 change-of-title points.

System services: The leased volume of reserve active power for secondary frequency control in 2017: ±60MW. Energy exchange in both directions through a settlement mechanism for unintentional deviations (INC): 136GWh of energy.

Demanding operating conditions resulting from severe weather and the vulnerability of the transmission system were fully and efficiently managed, partly due to intensive preparations for such situations.

Strengthening European links: Activities were carried out to connect as soon as possible with the trans-European exchange mechanism for unintentional deviations (IGCC). A major part of research and development was focussed on the implementation of grid codes. European transmission system operators are in charge of developing some 140 new methodologies and introducing them into existing or new work processes, which is why ELES experts are involved in the relevant regional and trans-European projects.

Market coupling: Major progress has been made in the coupling of the Slovenian and Croatian day-ahead electricity markets.

Planning cross-border transmission capacities: An active part is taken in the development of methodologies to calculate optimum day-ahead and intraday cross-border transmission capacities. 2017 brought challenges in the development of new methodologies for a common/harmonised calculation.

Monitoring generation from RES: Using our own know-how, the Company set up a network of reference solar power plants and agreed with producers and distribution companies to exchange data close to real-time for 94 measurements of plant generation. This is the key data support for the inclusion of RES in the network.

2.1.1 OPERATIONAL NETWORK SECURITY

DESCRIPTION OF ACTIVITIES

The goal of Company activities is to make the electricity system operation in Slovenia safe and secure. The task entrusted by the Republic of Slovenia with a concession is fulfilled:

- by maintaining a balance between electricity production and purchase,
- by rendering system services,
- in cooperation with management centres abroad.

DESCRIPTION OF ACTIVITIES

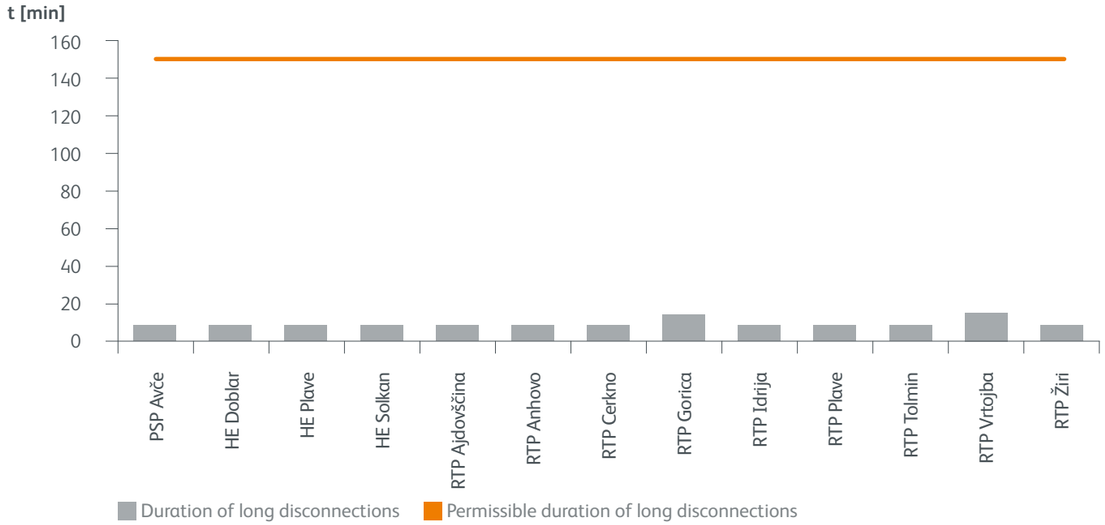
Quality of electricity transmission: Operation within the scope of permitted electrical values of the entire electricity system is one of the most important factors affecting the quality of electricity transmission as defined in the Slovenian SIST EN 50160 standard. It is ensured with appropriate control infrastructure, the control of electricity system plants and with adequate sources for taking action in critical situations. It is also important to have quality communication and cooperation with the owners of all parts in the electricity system, which is laid down in the European and Slovenian legislation with contracts, agreements, operating procedures and so on.

Data from continuous monitoring of transmission network voltage quality shows that quality voltage in the transmission network is, on average, provided at all quality parameters other than the flicker value (flicker is a perceivable phenomenon resulting from the fluctuation of voltage amplitude in a specific frequency zone and takes place due to the action of non-linear consumers), which is exceeded in some of the metering points practically throughout the year. Increased flicker levels appear in three areas where large consumers are located (electric arc furnaces), from which users purchase intermittent current of inductive character, i.e. throughout the Gorenjska region, in the Koroška region and, with a somewhat smaller impact, in the surroundings of Celje.

Furthermore, pursuant to the System operating instructions for electricity transmission network (SONPO), the maximum number of short disconnections (shorter than 3 minutes) and the total duration of long disconnections (longer than 3 minutes) has been laid down for each change of title point in a particular year. Disconnections only include disconnections resulting from own causes. Pursuant to the law, only one short disconnection is permitted for each change of title point, while the maximum allowed duration of long disconnections amounts to 150 minutes.

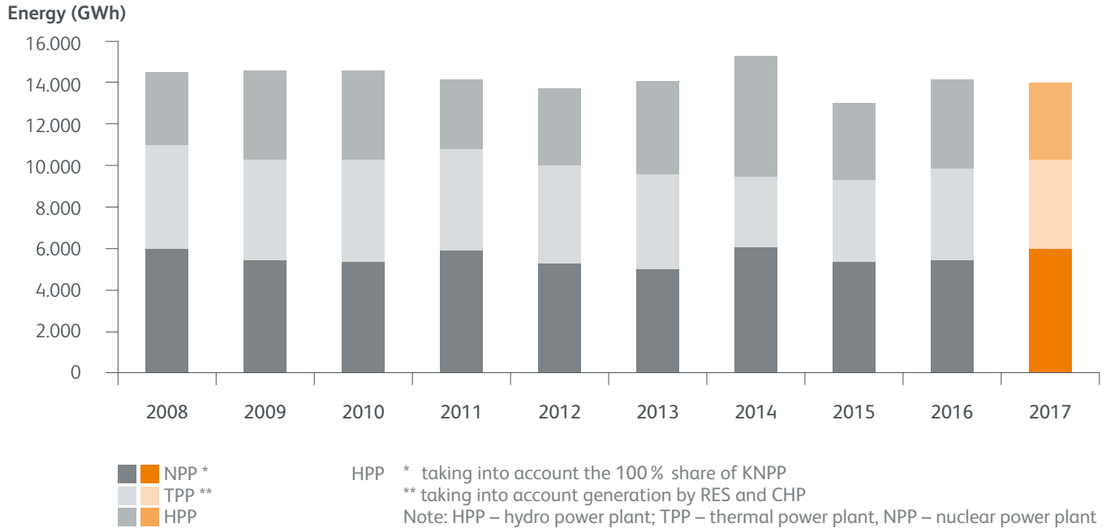
In 2017, no short disconnections due to own causes were recorded, while **15 long disconnections were recorded at 13 delivery points.** The diagram below shows the total and permitted time of long disconnections per change of title point. The disconnection values below show that these were within the limits laid down by the law.

Chart 4: Duration of long disconnections at each change of title point



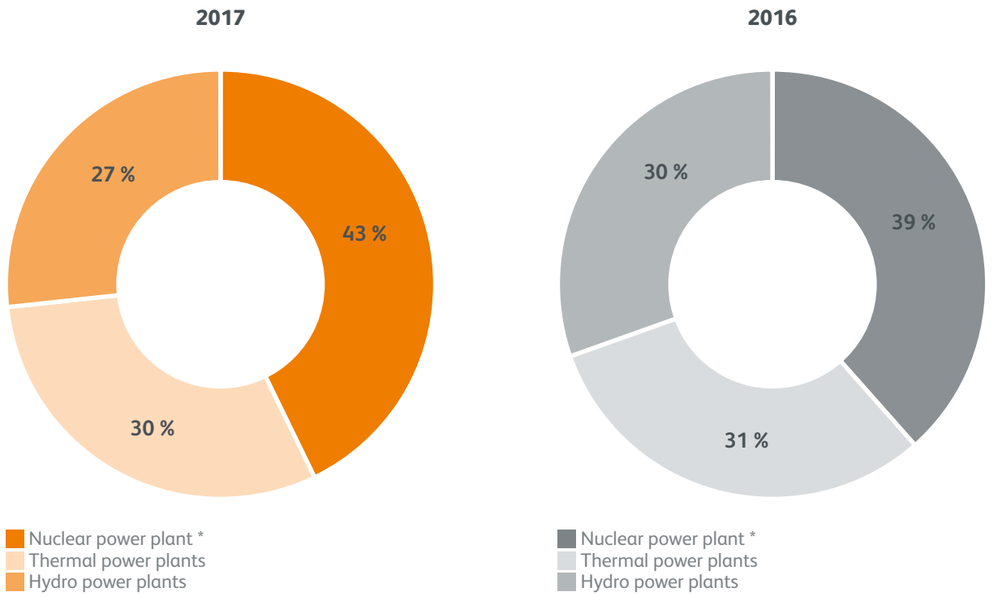
Electricity offtake and input: The total electricity fed by producers to the transmission network in 2017 amounted to 13,952GWh, which is 164GWh less than in 2016. Hydro power plants fed in less electricity than the previous year, when hydrology characteristics were better. Hydro power plants fed 3,725GWh of electricity to the transmission network, which is 569GWh less than in 2016. Thermal power plants fed in 4,262GWh, or 139GWh less than in 2016, while the nuclear power plant fed 5,966GWh of electricity to the transmission network, which is 543GWh more than in 2016.

Chart 5: Electricity input to the transmission network between 2008 and 2017 (in GWh)



In the last 10 years, the electricity input structure in the transmission network somewhat changed. Due to the construction of additional power plants on the lower Sava river and favourable hydrology characteristics, **the electricity fed in by hydro power plants increased, while that fed in by thermal power plants has somewhat reduced in recent years.**

Chart 6: Structure of electricity input in the transmission network between 2017 and 2016 (in %)

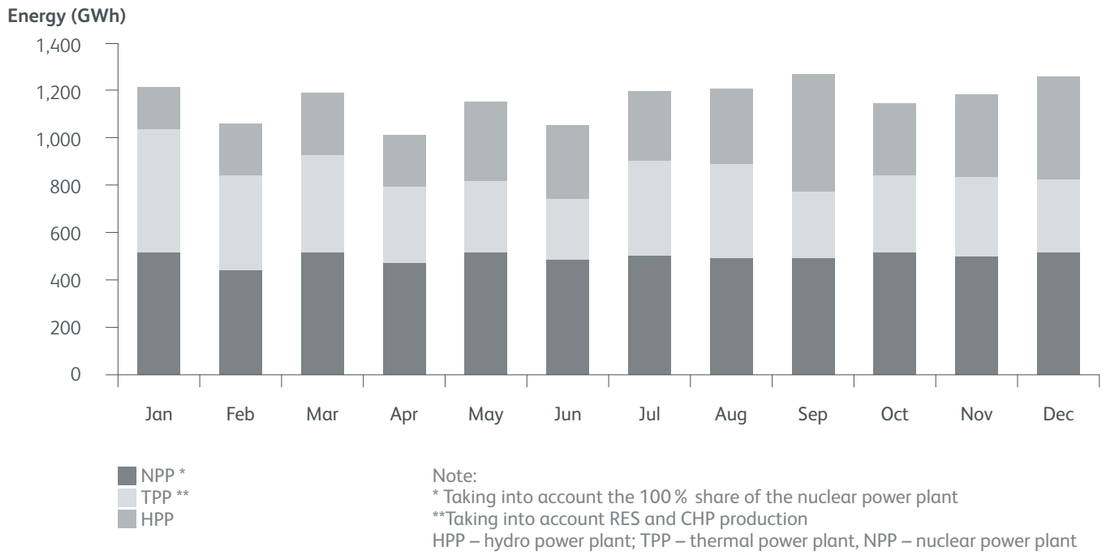


Note:
* Taking into account the 100 % share of the nuclear power plant

As usual, the **Krško Nuclear Power Plant (NPP) again contributed the largest share to the total electricity input** in 2017, approximately 43 %. This is followed by thermal power plants, which contributed some 30 % and hydro power plants, which contributed 27 % to the total electricity fed in.

The electricity fed in by the Nuclear Power Plant is constant throughout the year, while that fed in by hydro power plants depends heavily on hydrology characteristics and that fed in by thermal power plants depends primarily on system needs and market factors.

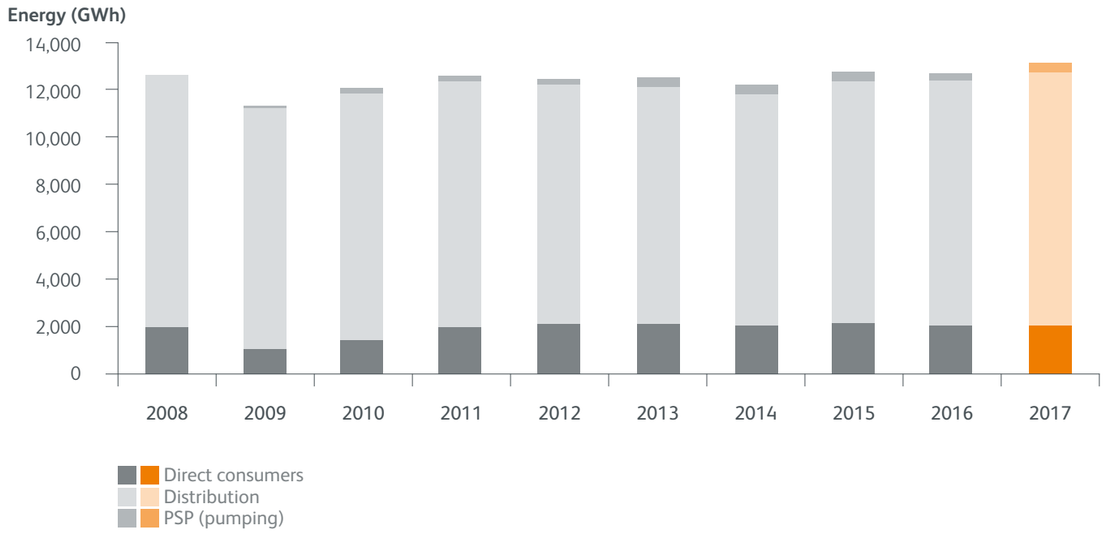
Chart 7: Electricity input to the transmission network in 2017 by month



Note:
* Taking into account the 100 % share of the nuclear power plant
**Taking into account RES and CHP production
HPP – hydro power plant; TPP – thermal power plant, NPP – nuclear power plant

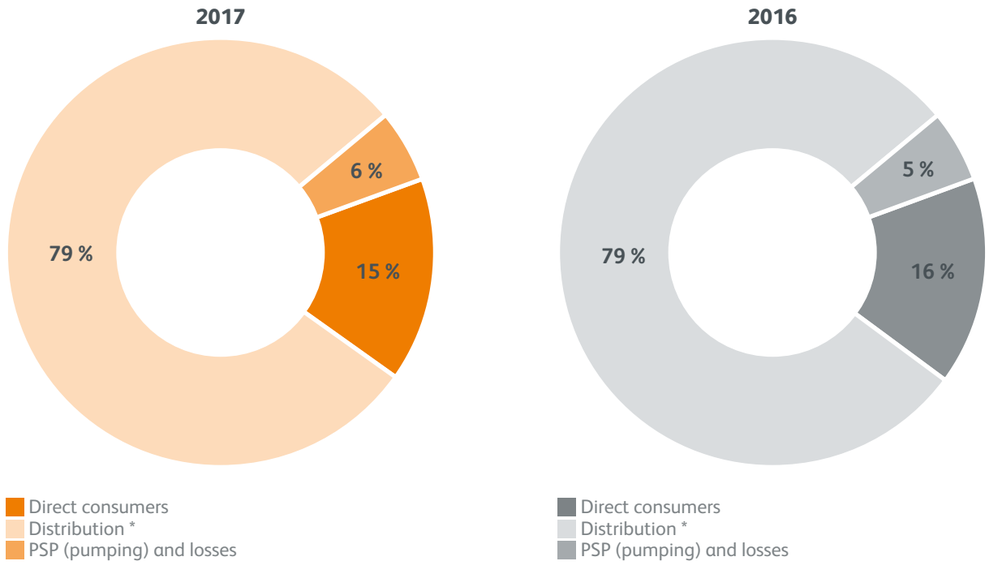
In 2017, the **total energy offtake from the transmission network excluding losses amounted to 13,149GWh,** 2,082GWh of which was taken off by direct customers, 10,702GWh was distributed and 365GWh was taken off by a pumped storage plant for the purposes of pumping. With respect to 2016, offtake **increased by some 3%.**

Chart 8: Electricity offtake from the transmission network between 2008 and 2017 (in GWh)



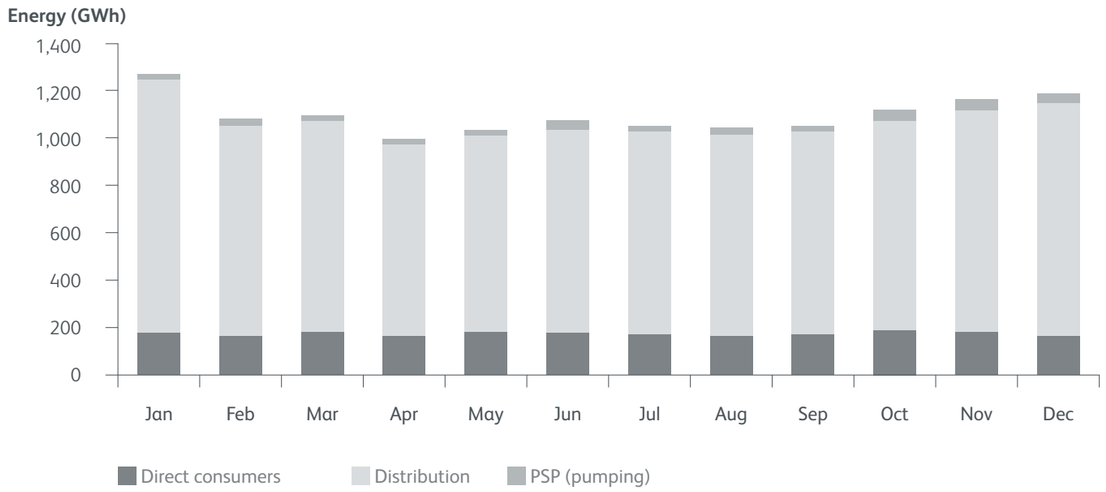
The 10-year average shows that the electricity offtake values fluctuated without a specific trend, and increased by some 4 % in 2017 compared to 2008, i.e. from 12,604GWh to 13,149GWh.

Chart 9: Structure of electricity offtake from the transmission network between 2017 and 2016 (in %)



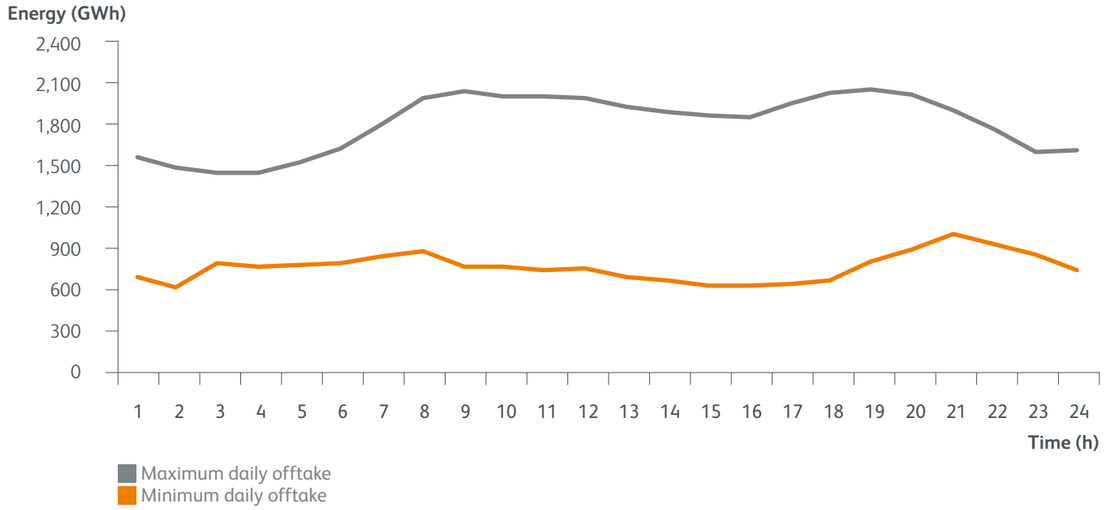
In the last 5 years, the trend of electricity offtake from the transmission network did not change much.

Chart 10: Electricity offtake from the transmission network in 2017 by month



The figure above shows the monthly electricity offtake from the transmission network, broken down to offtake by direct customers, distribution companies and pumped storage plant. **Distribution companies account for the largest share,** i.e. 81 % on average. In 2017, **the average monthly electricity offtake from the transmission network accounted to some 1100MWh.**

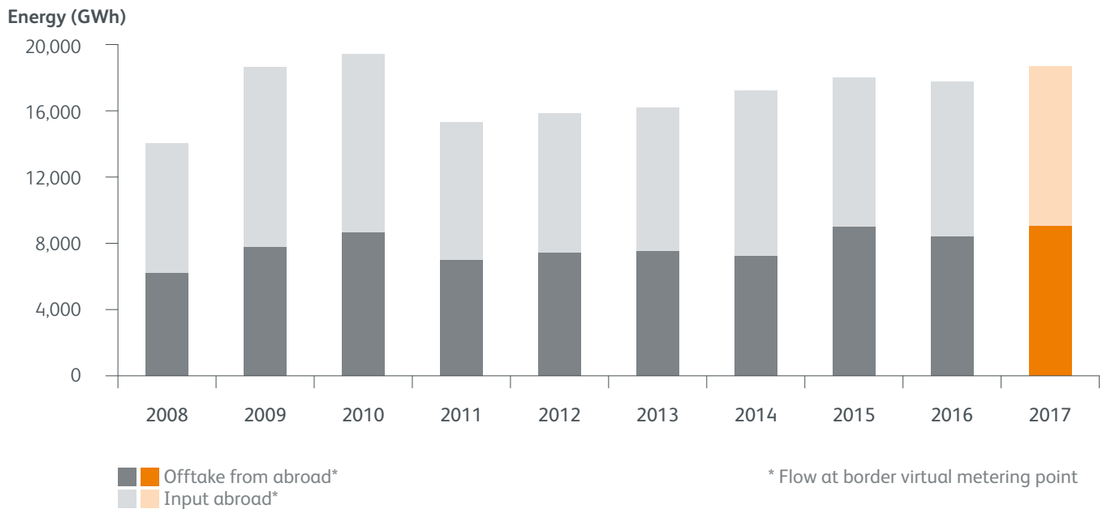
Chart 11: Maximum and minimum electricity offtake from the transmission network in 2017



The maximum daily electricity offtake from the transmission network (45,168MWh) took place on 11 January, which coincides with the extremely cold period that took Slovenia at the start of 2017. The lowest daily offtake took place on 1 May and amounted to 23,126MWh. The lowest offtake coincides with May Day holidays, when a part of the industry has a closure period.

In January, some 16 % higher than average monthly electri

Chart 12: Electricity input and offtake from abroad between 2008 and 2017 (in GWh)



The diagram shows the dynamics of electricity input and offtake from abroad in the period between 2008 and 2017. In 2009, the cumulative electricity input and offtake from abroad increased heavily. After a phase-shifting transformer started operating in 2010, flows somewhat reduced. In 2017, 9,558GWh of electricity was input abroad and **9,133GWh was taken from abroad.**

Chart 13: Structure of electricity input and offtake from abroad in 2017 and 2016 (in %)

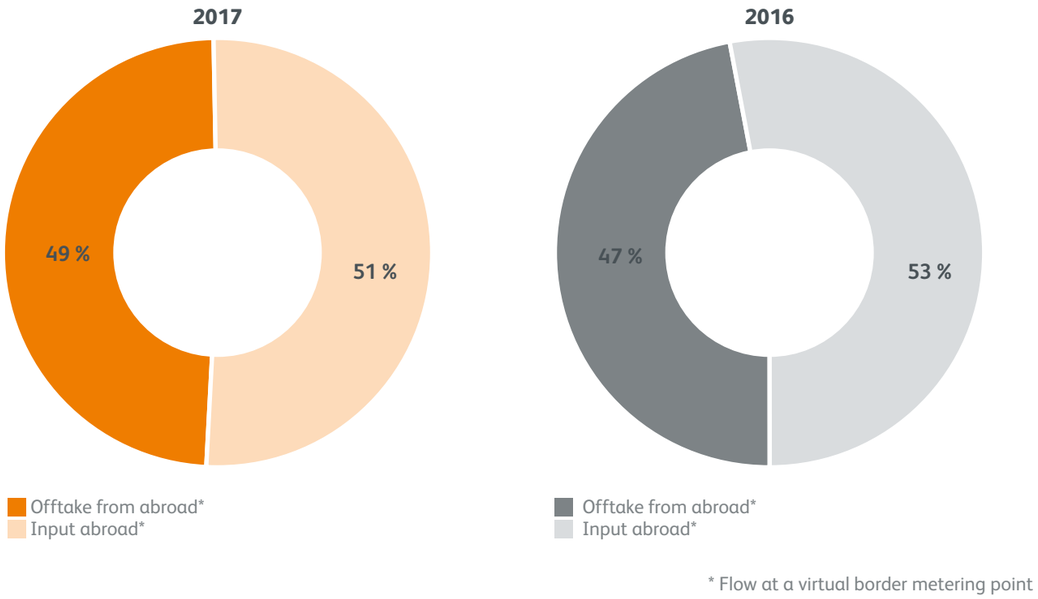
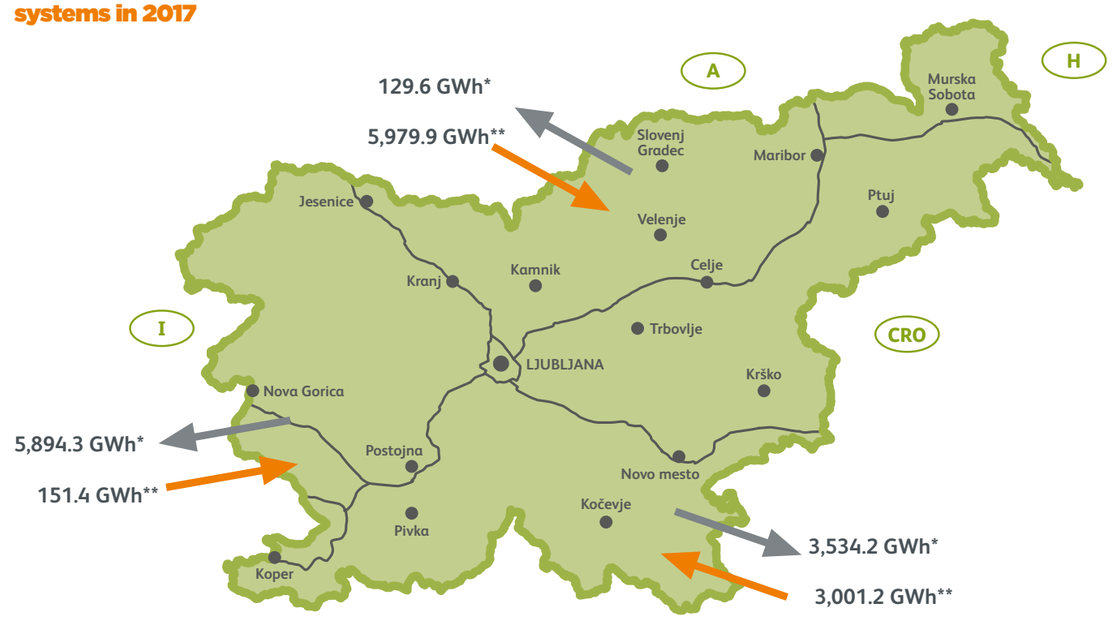


Diagram 4: Physical cross-border electricity flows to and from the neighbouring electricity systems in 2017

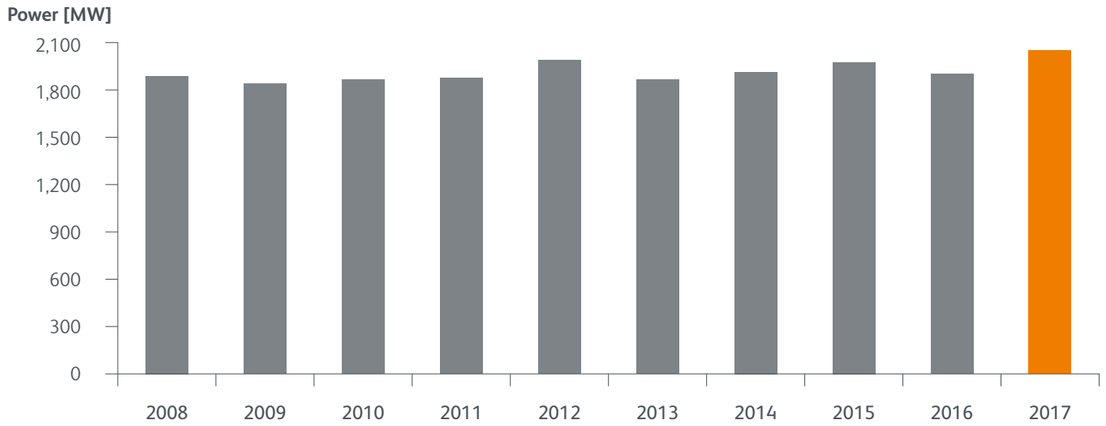


* Input abroad: 9,558.2 GWh
**Offtake from abroad: 9,132.5 GWh
Note: Taking into account the calculated border virtual points.

Based on the data shown, one may conclude that Slovenia has excess electricity, since feed-in exceeded acceptance by 426GWh. That is, however, not the case, since only 50 % of the electricity produced by NPP belongs to Slovenia. Taking into account that fact, one may conclude that **Slovenia took off some 2,560GWh more energy than it fed in, which is also the share of Slovenian import dependency.**

Transmission network loads: Peak load is the maximum hourly load average (not taking into account losses) that takes place in the relevant year. **In the last ten years, the peak load value did not change much.** From 2008 to 2009 and in 2013 and 2016, a negative trend in peak loads was recorded, while a positive one was recorded from 2010 to 2012 and in 2014, 2015 and 2017.
Peak loads take place in winter months, while peak hours have shifted from afternoon to evening hours since 1997.

Chart 14: Peak loads on the transmission network between 2008 and 2017 (in MW)



The peak load **in 2017 achieved a record value (2,131MW)** and increased by some 8 % compared to 2016, which can mostly be attributed to extremely low temperatures in January.

Congestion analysis (right to use cross-border transmission capacities): In cross-border trading, a major challenge continues to be the **integration of production from renewable energy sources (RES) in electricity systems throughout Europe.** If the neighbouring system operators deal with that issue directly, the impact on ELES and the Slovenian electricity market is somewhat more indirect and **shown in reduced transmission paths primarily in the direction from Austria to Slovenia.**

In 2017, net transmission capacities (NTC) in the direction of Austria-Slovenia on average amounted to 747MW, which is 13 % more than in 2016, but 24 % less than planned. In the direction from Slovenia to Italy, the average NTC value decreased compared to 2016 by some 0.4 % and amounted to 549MW. A decrease, with respect to 2016, has also been recorded on the Croatian border, where the average NTC value amounted to 1,456MW in the direction Croatia-Slovenia and 1,459MW in the direction Slovenia-Croatia.

In terms of allocating cross-border transmission capacities, the Company finds the fact that **2017 passed without noteworthy incidents** to be the key achievement. Considering the fact that the process has become increasingly complicated due to market integration, while any local problems substantially surpass national borders, the robustness of the process demonstrated is all the more important.

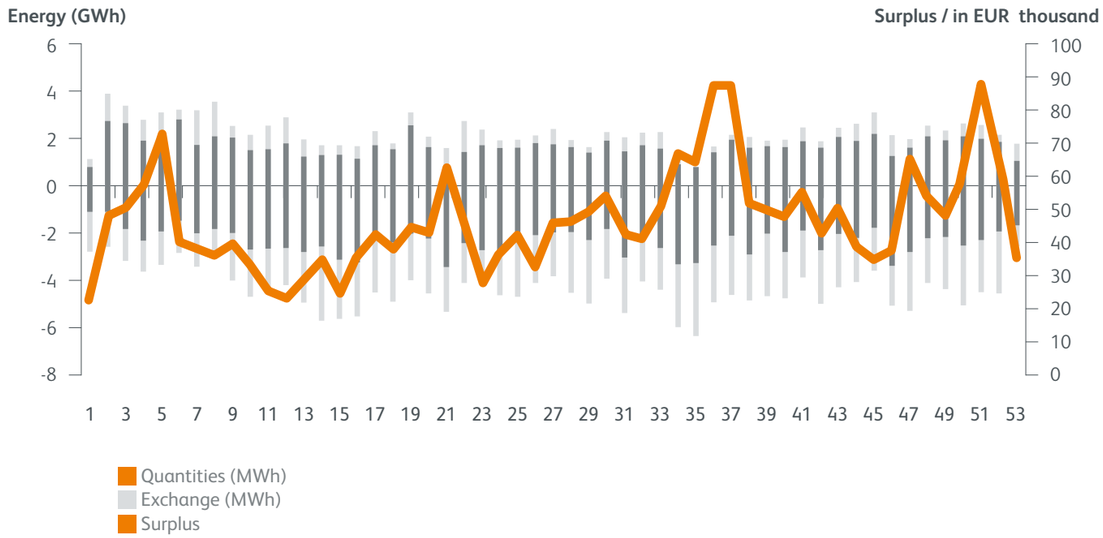
Analysis of system services: For the purposes of rendering secondary frequency control, ELES **again leased active power reserves in 2017 in the amount of ±60MW.** That lease was realised by ELES in 2013, i.e. for the period from 2014 to 2018.

ELES **is required to provide +553MW of positive and -185MW of negative reserve for tertiary frequency control.** In 2017, **a revised agreement was signed by the members of the Slovenia, Croatia, and Bosnia and Herzegovina (SCBH) block,** which regulates common dimensioning and provision of a tertiary reserve. According to that Agreement, **ELES is required to provide 250MW of tertiary reserve, while the revised agreement permits it to utilise 114MW of negative reserve.** In 2017, ELES **also signed a new contract on mutual assistance in the form of a division of tertiary reserve of +250MW with the Italian operator TERNA.**

Despite a lower amount of the necessary reserve with respect to the agreement made with members of the SCBH block, ELES adopted a decision based on a risk analysis to dimension its need for tertiary reserve to 348MW. Most of the reserve (+194MW) was already leased by ELES in 2013 and 2014, i.e. in the long term until 2019. In 2017, ELES **started conducting monthly and annual public auctions for the lease of active power reserves to render tertiary frequency control for 2018.** At the annual level, it managed to lease +118MW of positive and -185MW of negative reserve, while the remainder of +36MW reserve will be leased, if necessary, at monthly auctions in respect of expected conditions and risks.

In 2017, **136GWh of energy was exchanged in both directions through a mechanism for the balance of unintentional deviations (INC).** Savings on account of a cheaper source of balancing energy at annual level amount to €2.5 million. The INC mechanism allowed the Company to ease the amount of activated secondary control in Slovenia, since the amount of exchanged energy through that mechanism amounted to 29 % in positive and 44 % in negative direction. Due to direct benefits, ELES continued activities in 2017 that will **speed up connection to the trans-European exchange mechanism for unintentional deviations (IGCC)** at accelerated pace. It is expected that it may take place in 2019.

Chart 15: Course of financial benefits and system balancing amountsounts



The chart shows financial benefits and system balancing amounts that were achieved using the INC mechanism and secondary regulation, i.e. by week for 2017. As is evident, the INC mechanism largely complemented system balancing and reduced the need for activating secondary regulation, which was more negatively pronounced due to long positions of balance-sheet groups for the most part of the year, while transmission capacities for export from Slovenia to Austria and Croatia were more rarely occupied at that time.

Imbalance settlement: In addition to traditional tools (such as primary, secondary and tertiary frequency control) and use of a mechanism for imbalance netting, **the system operator uses market purchases and sales to balance the system.** It distinguishes between the balancing of announced imbalances set a few days ahead in the form of compensating energy and take place as a result of unintentional imbalances between regulation areas in the previous period and the settlement of unintentional imbalances that take place in real time, due to differences between the realisation of production and consumption in Slovenia or as a result of imbalances between commercial exchange and physical flows at borders with neighbouring countries. The system operator **typically settles all announced imbalances with the sale or purchase of energy on the daily market,** while all other imbalances taking place in real are eliminated with prompt purchases or sales of energy on the balancing market, thus relieving the reserve intended for secondary and tertiary frequency control.

In 2017, ELES **bought 106GWh on the daily market for the purposes of covering the announced negative imbalances that would result from the return of announced imbalances (compensations),** while almost no sale was made due to positive imbalances. The situation on the balancing market was different, since **operators bought 71GWh during shortage periods and sold 147GWh during excess periods.** Due to an increasing share of unpredictable production from RES, the Company **recorded a 15% growth in 2017 in the need to settle imbalances in real time compared to the previous year.**

Control block operation: ELES as the manager of the SCBH control block is directly responsible for settling imbalances that occur within the control areas of Slovenia, Croatia and Bosnia and Herzegovina. Due to enhanced settlement of imbalances by all members of the block, the quality of SCBH control block operation improved in 2017 SHB, since the standard deviation of unintentional imbalances fell by 14 % from 19.2MW to 16.6MW, which accounts for merely 0.24 % of peak power. The largest credit goes to **efficient operation of the netting mechanism or current imbalances between Slovenia, Austria and Croatia** while Bosnia and Herzegovina also attributed a great deal to improved indicators by amending market rules in past years, thus significantly decreasing imbalances in its control area.

Considering individual control areas, standard deviation of unintentional imbalances in Croatia fell from 12.9MW to 11.5MW, which accounts for 0.37 % of peak power of that area, and in Bosnia from 19.6MW to 14.7MW, which accounts for 0.68 % of peak power. The quality of the Slovenian control area cannot be compared to the remaining block members, since ELES as the block manager provides for the settlement of all unintentional imbalances within the block (including in Croatia and Bosnia and Herzegovina), which is most often the reason for poor quality. If account is taken only of the share of control intended merely for covering imbalances of Slovenian balance sheet groups, standard deviation of such imbalances would amount to 11.5MW, which is an improvement by 18 % compared to the previous year.