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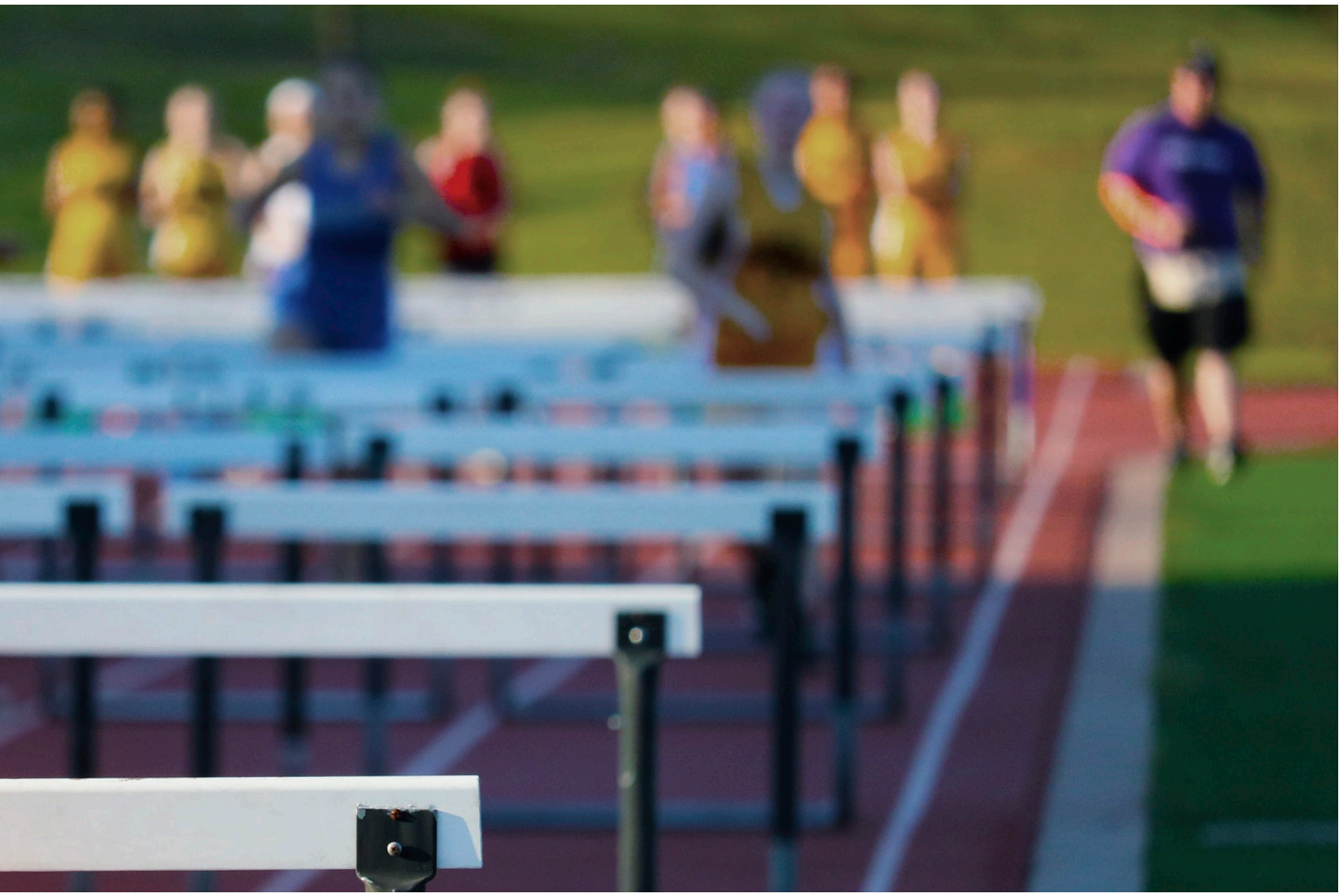
Analizy i dialog



How do we cope with summer peaks?

Review of changes after the 2015 crisis

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Forum Energii is a Polish think tank forging the foundations of an effective, secure, clean and innovative energy system.

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Introduction

What matters to electricity consumers is its price and reliability of supply. In recent months the price of electricity on the wholesale market in Poland has increased by 70%. Even if the correction of these increased prices is taken into account, it is hard to imagine a clearer signal that the time of cheap electricity is coming to an end. Those whose electricity suppliers went bankrupt last summer learned about it the hard way. New contracts offered by reserve suppliers appear to be significantly more expensive, sometimes at double or triple the cost.

Does the higher price mean more stability and reliability? The greatest challenge we face in Poland is to meet the peak demand in summer. We learned about it in August 2015 when PSE (transmission system operator) introduced the highest level of load curtailment, a temporary rationing of energy consumption by industrial customers of above 300 kW. In reaction to the situation, experts recommended the steps to be taken to avoid similar incidents in the future. Forum Energii offered their own analysis of the situation in September 2015. Three years have passed since then. We are reviewing what measures have been taken since 2015 to ensure that energy consumers have a peaceful nights' rest even in summer time.

Joanna Maćkowiak Pandera, PhD
President of Forum Energii

Key conclusions

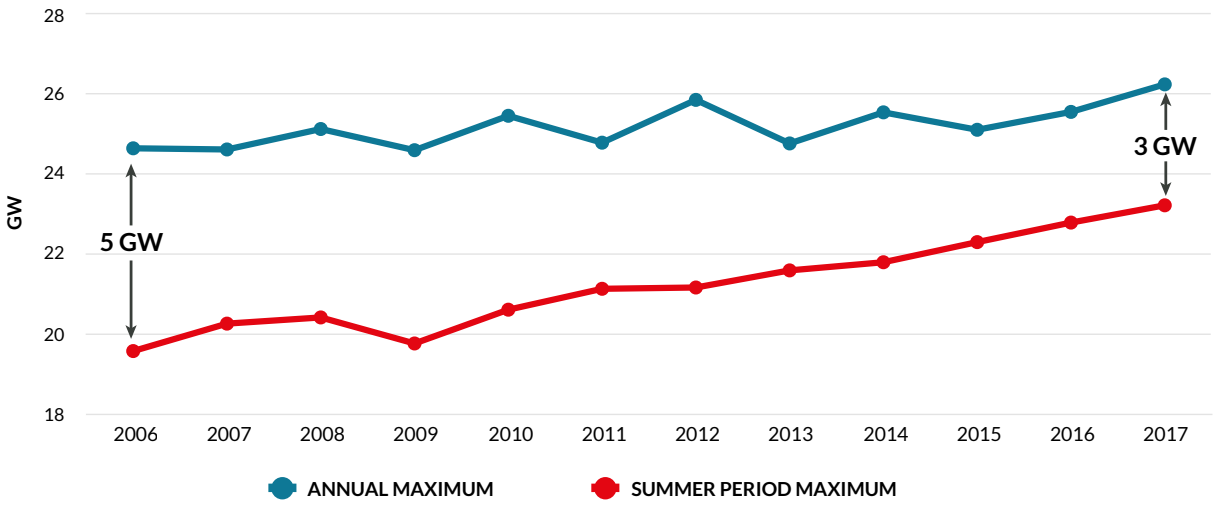
- Meeting the electricity demand in summer remains the most serious challenge to the reliability of the Polish energy sector.
- The condition of KSE (Polish Power System) has improved since 2015. The DSR scheme has been introduced. Cross-border trade in electricity has been unblocked. The capacity balance has improved - following the commissioning of Kozienice power plant and a number of gas units.
- Inadequate steps have been taken to diversify power generation sources. A high share of thermal power plants (both gas and coal) together with rising summer temperatures will cause the problem of summer capacity to reoccur.
- Electricity supply during the summertime could be further secured with photo-voltaic installations of 3-4 GW. However, the solar energy sector has fallen into stagnation due to the lack of a government energy strategy.
- Reform of the power market has begun. For the supplies to be reliable in the coming years it is critical that the market's price flexibility increases.

1. Challenge

From a short-term perspective the greatest challenge to the reliable supply of electricity are summer peaks. The cumulative annual rate of increased capacity demand for the last ten years amounts to 1.4%. The demand in summer grows more dynamically than in other seasons. In winter it grew by 1 GW and in summer by as much as 2.5 GW. The trend continued in 2018 as well. A few historical records were broken in summer: for example, on 1st July at 13:15 the highest summer peak load of 23.5 GW was recorded.

12 years ago the difference between the winter peak and the summer peak equaled 5 GW. In 2017 it was only 3 GW. The gap keeps narrowing.

Fig. 1. Demand for peak capacity grew faster in summer

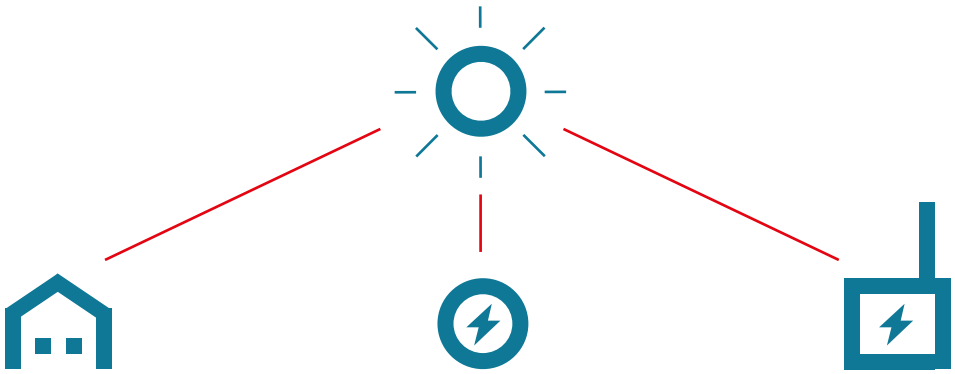


There are a number of causes behind the capacity problems in summer, which we described in detail in a Forum Energii report in 2015. These could be divided into challenges resulting from:

- supply (generation),
- demand (mostly industrial consumers),
- transmission.

The figure below illustrates factors affecting summer peak problems.

Fig. 2. Factors causing summer peaks.



DEMAND

Higher demand - growing number of cooling devices

Tariff structure which promotes electricity consumption during the peak

No economic mechanism in place to push consumption outside the peak

TRANSMISSION

Limited available transfer capacity of interconnections

Limited grid transmission capabilities in high temperatures

SUPPLY

Dominant role of thermal power plants at 90% - cooling problems

Limited power supply from combined heat and power

Capacity unavailable due to planned maintenance works

Reduced capacity due to unexpected failures

Reduced supply from wind plants in summer

The primary reason for the phenomenon of summer peak problems is higher temperatures and in some cases also the very low level of water in rivers. Air temperatures are increasing and have a significant impact on the overall electricity system. What can be expected is that the number of cooling devices will continue to grow in the coming years.[1] For this reason it is necessary to employ remedial measures to reduce the risks related to summer peak load problems.

The factors contributing to the summer peak load differ in nature. Some can be eliminated others mitigated and some will need to be accepted. Some remedial measures can be easily introduced whilst some will require more time and call for complex coordination, for example at an international level.

1 Increase in the number of cooling devices is related to a higher level of income of Polish people, technological advances and growth in modern office developments.

2. Impact of measures

Below is our analysis of factors in the supply, demand and transmission areas responsible for the summer peak problem, which can be resolved through regulatory decisions. We recommend a preferred direction of change and define what measures will help achieve the goal. Moreover, we specify which institutions and bodies are responsible for particular tasks. We also review progress in change management since 2015.

Table 1. Remedial measures reducing the problem of summer peak loads and a rough review of their progress.

Sector	Factor	Action	Who	Progress
Supply	Dominant role of thermal power plants	**Goal:** Diversification of generation sources. Reducing the share of thermal power plants. **Action:** - achieving the level of minimum 4 GW in PV, - taking advantage of the correlation of summer peak load and solar energy, - development of offshore wind farms.	Ministry of Energy - act on renewable energy and auctions	0
	Limited availability of combined heat and power in summer	**Goal:** increase the utilization of combined heat and power units in summer. **Action:** - building heat storages, - refurbishment of heat distribution grids, - increase in the use of hot utility water in summer, - increase in the use of district cooling, - support scheme for combined heat and power systems.	Ministry of Energy - strategy for the heating sector and support scheme for combined heat and power systems	0
	Capacity unavailable due to maintenance works	**Goal:** Higher availability of units in key moments for KSE. **Action:** - further improvement in coordinating, - planning maintenance works outside the summer peak period.	PSE, URE (Energy Regulatory Office) and generators - cooperation	+
Demand	Higher demand of energy in summer peak	**Goal:** Pushing the demand outside the summer peak. Energy price should reflect real demand. **Action:** - reform of the electricity market, - implementation of DSR, - reform of the balancing market, - new tariffs for households - flexible tariffs to be aimed for.	Ministry of Energy - reform of the electricity market PSE - system services	+++
Transmission	Limited options of interconnections	**Goal:** Unblocking transmission capabilities **Action:** - coordination of uncontrolled cross-border flows, - introducing a mechanism of re-dispatching cost distribution, - change of the region-based energy market in the EU, - phase-shifting transformers on inter-connectors, - regional cooperation among operators.	Ministry of Energy - EU level engagement PSE - cooperation among operators EU[2]- better coordination among operators.	++

+++ HIGH PROGRESS ++ MEDIUM PROGRESS + LOW PROGRESS 0 NO PROGRESS

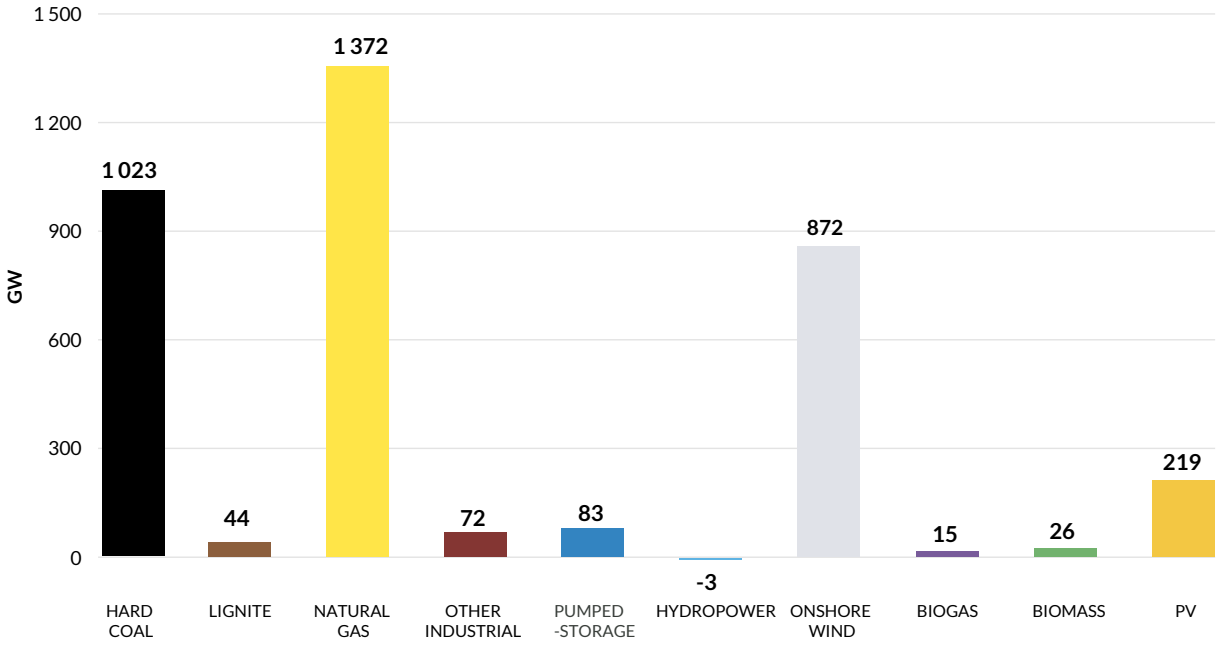
Below is our analysis of measures in the area of balancing national capacity and quality of resources.

2 EU – what we mean here is European institutions engaged in the process of creating European regulations, directives, resolutions, grid codes and recommendations – primarily the European Commission, European Parliament, ACER, ENTSO-E.

2.1 Balance of national generation capacities – supply

Summer peak load has increased by 0.6 GW over the last 3 years. In the same period of time electricity capacity in the system has also increased. Kozienice Power Plant (1 GW) and gas power plants (over 1 GW) have been commissioned. Wind farm capacity has also grown. Capacity of PV installations has increased by 0.2 GW to reach a total of approximately 0.32 GW.

Fig. 3 Balance of new generation capacity in Poland in the years 2015 - 2018 (August) based on data from ARE (Energy Market Agency).



Cogeneration is utilized to a small extent in Poland. It could be used more to balance the system in summer by refurbishing heat systems and using them to heat household water in summertime. There are also heat storage methods that have not been fully utilized.

2.2 Quality of capacity

What is crucial for the reliability of electricity supply is not only total capacity but also the ability to provide capacity at critical moments. What matters, then, is not only quantity but also quality.

Quality of capacity could be described with at least two parameters:

- performance characteristic (such as variability or resilience to weather parameters)
- failure rate of generation units.

These elements of the energy system are addressed below.

2.2.1 Characteristics of unit performance – low diversification of sources

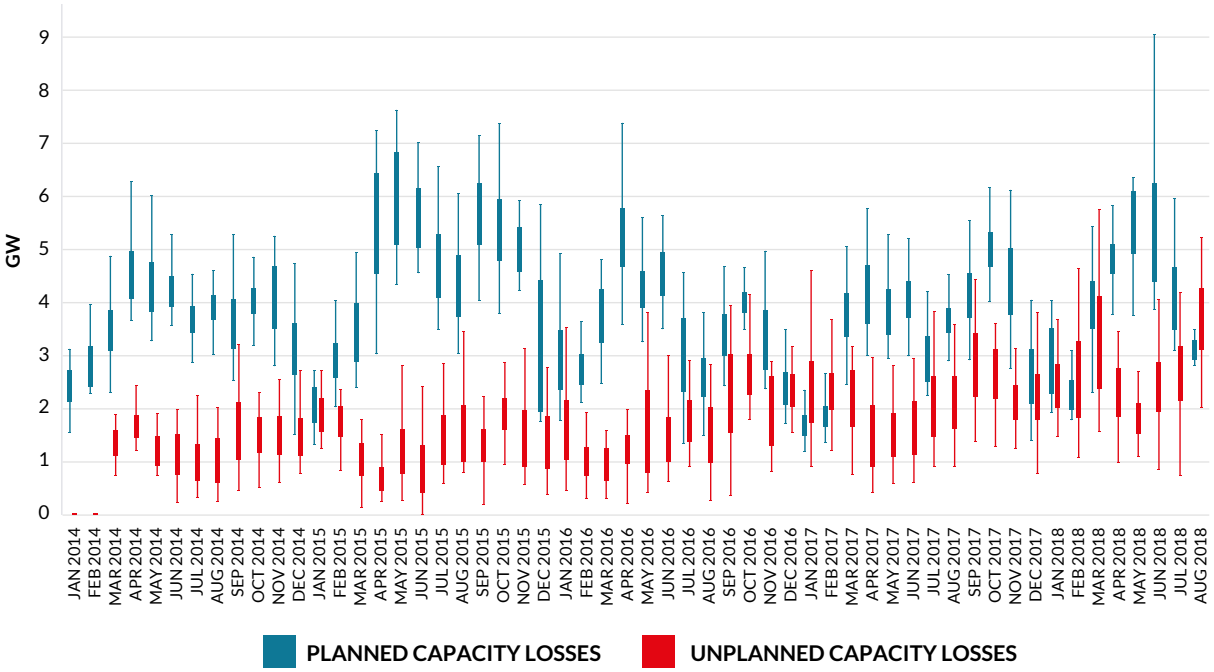
In recent years capacity in conventional power plants has increased by 2 GW. These thermal units, however, have their limitations, especially in summer. Considering the high correlation between the generation of solar energy and the timing of the summer peak load, PV could improve the capacity balance in summertime and contribute to lower wholesale electricity prices. Despite recommendations from both the system operator and experts in regard to increasing installed PV capacity to a minimum of 2 GW, we are still seeing stagnation - as little as 0.2 GW has been added to the system. Work on the Renewable Energy Act and organization of auctions for renewable energy sources are moving slowly. We have not seen the government strategy for energy development.
At this moment no decision has been made in regard to the development of offshore wind farms. Their capacity could be used for 4000 hours annually - meaning the figure is similar to the performance time of conventional units in recent years. The failure rate of wind farms is low though their performance depends on weather conditions.

Although capacity is growing in terms of absolute numbers, its quality still fails to meet the requirements of the Polish electricity system.

2.2.2. Failure rate of conventional units

The number of failures in conventional units has grown in recent years - despite reduction in the scope of planned outages. What is worrying is not only the total of capacity losses, but also their amplitude, that is value of a single loss (Fig. 4).

Fig. 4. Comparison of planned and unplanned capacity losses in KSE in recent years based on data from GPI TGE (Power Market Data).

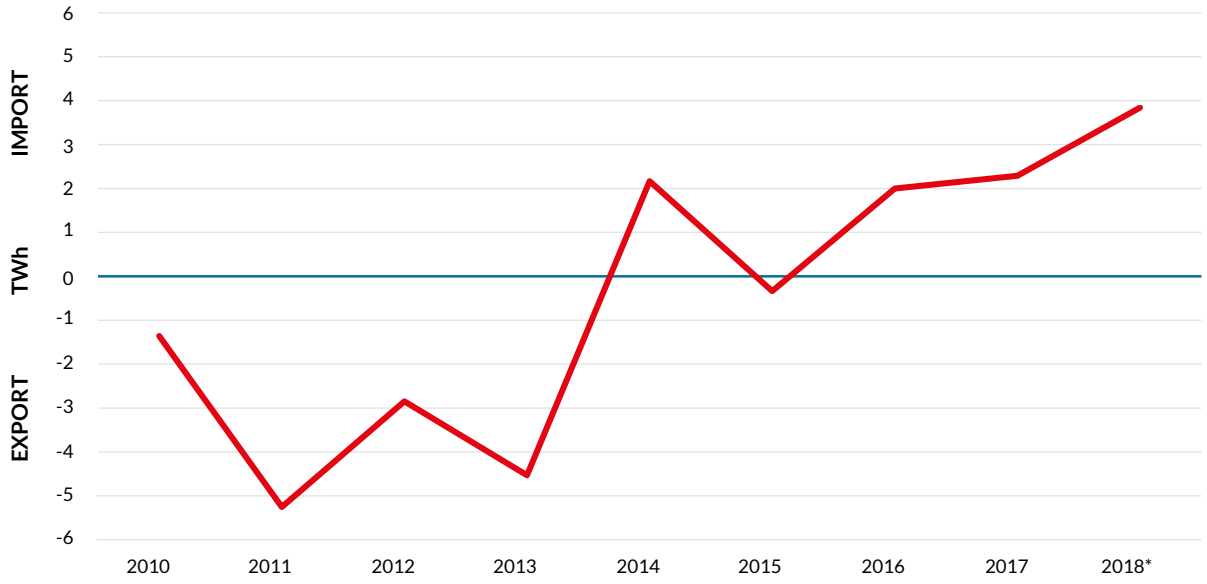


The situation may improve in 2021 when a capacity market is launched, which will mean that capacity generators will be required to guarantee full availability for the pledged capacity. Should an uncontrolled failure occur, generators will be liable to penalties. Capacity market should encourage generators to cooperate in terms of sharing capacity and maintaining reserves.

2.3 Transmission

Over the past 3 years the new connection opened with Lithuania and the increased availability of capacity in the connection with Germany have both increased Poland's ability to import electricity. Installation of phase shifters and a temporary shutdown of one of the inter-connectors increased options of importing electricity to Poland. The figure below shows the balance of trade for Poland.

Fig. 5 Balance of cross-border transmission of electricity (based on data from ARE - as of 31.06.2018).



In terms of international cooperation, we still need to develop the transmission connections and modernize the distribution grid to improve electricity supply reliability. What is also important is intensive cooperation with neighboring TSO's to improve the coordination of physical flows and increase trading capabilities among the systems.

2.4 Demand – DSR model

In August 2015 PSE held only 200 MW in the demand side response model. The mechanism failed at the critical moment three years ago. One of the main reasons was the voluntary nature of the DSR pledge and no diversification of participants willing to offer load rationing. In 2016 PSE offered a new demand reduction scheme based on payments for readiness with bids from various industrial units selected during auctions. The new scheme was launched in 2017. In 2018 more than 500 MW was secured in the guarantee program (with remuneration for readiness) and the same capacity in the current program. The DSR

scheme is developing slowly and it should be part of a capacity market and balancing market. Continual utilization of the DSR scheme will result in the increased scope of its application and number of participants as well as cost reduction.

In August 2018 PSE ran mock calls for DSR action, which proved the functionality of the mechanism.

2.5 Market flexibility

The basis of a modern energy market and security of supply is electricity prices that reflect the correlation between supply and demand.

Building new generation units to cover peak load demand in short periods of a year leads to an oversupply of electricity and, consequently, too low wholesale prices. This again raises questions as to whether it will be possible to restore the generation assets. There are propositions to introduce remuneration for capacity. An alternative would be improved market flexibility. On the basis of such a model, electricity should be priced high when there are shortages and low when there is surplus.

The balancing market, currently undergoing reform, could serve that purpose. One of the elements of the system would be the removal of price limits. As a result, electricity prices can reach +/- 10,000 EUR on this market. A balancing market acts as a safety valve for the electricity system as it enables the market to verify demand for electricity through prices.

Reform of the balancing market should be the first step towards a change in the design of tariffs. Currently, the G12 tariff for households still encourages consumption of electricity between 1:00 and 3:00 in the afternoon, which is precisely when summer peak load occurs.

Conclusion

The discussion on energy security cannot be confined to the context of security of resources and sources of fuel import. What is indispensable is the stability of the electricity supply and reassurance of consumers, who can place full trust in the reliability of the national electricity system.

The level of reserves remains at a safe level for most of the year and the Polish electricity system operates without any failures. However, the reliability of an electricity system is defined by its ability to deal with peak loads - in summer and winter.

The situation has improved since 2015 - mainly in the area of a balancing market, changes on the electricity market and transmission. What can, however, be viewed in a negative light is progress in terms of diversification of capacity - mostly in regard to development of PV market and cogeneration for balancing the system.

Notes

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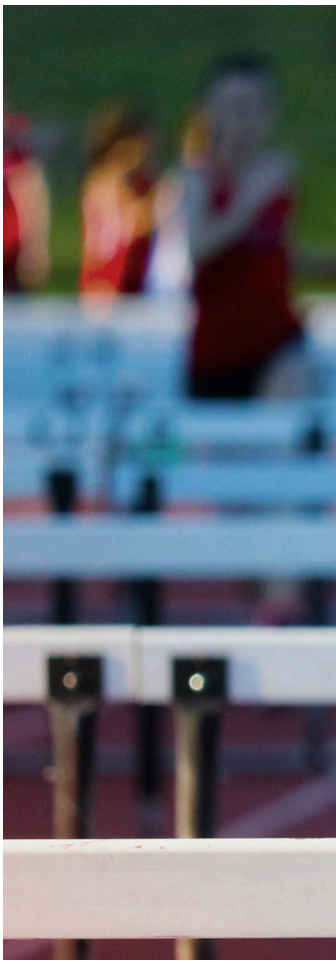

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