

Analysis of cross-zonal risk hedging opportunities as referred to in Article 30(4) of European Commission Regulation (EU) 2016/1719 of 26.09.2016 establishing a guideline on forward capacity allocation

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EXECUTIVE SUMMARY - CONCLUSIONS

1. In an analysis dated 3 April 2017 the President of ERO indicated that products available on the Polish energy market can be used to hedge risks on spot markets, in particular to hedge on the market dedicated to cross-border electricity exchange with Sweden and Lithuania under the day-ahead market coupling procedure.
2. In the last four years since 2017, there have been major changes in the electricity market in the European Union, including the Polish market, which have led to a material increase in the importance of energy spot markets and a fundamental revaluation of price drivers.
3. With the dramatic increase in the importance of renewable sources, weather (wind, sunshine) has become the determining factor for the price level on the SPOT market. Legal solutions (auctions) and good forecasting tools have turned the day-ahead market into a basic market for energy from RES, with almost zero variable cost.
4. In the case of forward markets with physical delivery, the basic price-determining factor has become the price of emission allowances, as well as revenues from the capacity market, which is a new element of the Polish market.
5. On the Commodity Forward Instruments Market (CFIM) of the Polish Power Exchange the same forward instruments are invariably traded, i.e. standard BASE, PEAK, OFFPEAK contracts for yearly, monthly and weekly periods. Due to the aforementioned differences in the formation of prices on these markets, in principle, there is no short-term correlation between SPOT and CFIM, so delivery contracts are currently not a price hedging mechanism on the SPOT market, but only an element of portfolio building, and the risk appetite of Polish market participants is realized through its differentiation and proportions between open positions on these markets. Therefore, it is not possible to hedge price volatility in the SPOT market regardless of whether or not a market coupling mechanism exists.
6. In European markets with which Poland has non-synchronous connections (Lithuania, Sweden), there is a uniform energy price determined by the day-ahead market, and hedging against its volatility is ensured by financial markets (Nasdaq, EEX) and a combination of a financial contract with the system price as an underlying instrument and a contract for differences between the system price and the area price (Electricity Price Area Differentials - EPAD).
7. After the launch of the Single Intraday Coupling Market (XBID) on the Polish Power Exchange as a market coupling Poland with the synchronous area, there is a visible search for flexibility in the Polish market, mainly by the German and Austrian markets. In this situation, market coupling for non-synchronous connections offers the opportunity to reach for flexibility from the Nordic area, where it is provided by controllable RES.
8. Launch of the multi-NEMO mechanism has provided the Polish market with a mechanism for hedging volatility on the DAM market through financial contracts for the Polish market, quoted on EEX, for which the underlying instrument are the "Polish" DAM prices on the EPEX SPOT exchange, which are identical to the prices in the second fixing of TGE, but the liquidity of this market is still insufficient.
9. The new structure of electricity production in Poland and the above-mentioned problems with hedging prices on SPOT markets should lead, in the short term, to changes in market behaviour and a reform of the electricity forward market on TGE towards uniformity of energy prices (one fixing on the DAM, introduction of hedging market-to-market financial contracts). Otherwise, liquidity will continue to decrease on all forward contracts except possibly the underlying ones for the main trading periods. An opportunity to hedge against price volatility for entities not trading physical energy must also be introduced.
10. Despite the currently very limited opportunities of hedging price volatility on the DAM, it cannot be considered that a possible allocation of some capacity on non-synchronous connections would bring about a reduction of risk. The explicit auction mechanism would mean that, in fact, the costs of these contracts (price plus capacity from the auction) would not deviate from the commodity market, and the limited capacity would not increase the liquidity of this market.

LEGAL BASIS

Pursuant to Article 30(1) of Commission Regulation (EU) 2016/1719 of 26 September 2016 establishing a guideline on forward capacity allocation (EU OJ L 259 of 27.09.2016 p. 42), hereinafter referred to as "Commission Regulation 2016/1719", transmission system operators (TSOs) on a bidding zone border shall issue long-term transmission rights unless the competent regulatory authorities of the bidding zone border have adopted coordinated decisions not to issue long-term transmission rights on the bidding zone border. When adopting their decisions, the competent regulatory authorities of the bidding zone border shall consult the regulatory authorities of the relevant capacity calculation region and take due account of their opinions.

Article 30(2) of Commission Regulation 2016/1719 stipulates that where long-term transmission rights do not exist on a bidding zone border at the entry into force of this Regulation, the competent regulatory authorities of the bidding zone border shall adopt coordinated decisions on the introduction of long-term transmission rights no later than six months after the entry into force of this Regulation.

Pursuant to Article 30(3) of Commission Regulation 2016/1719, these decisions shall be based on an assessment, which shall identify whether the electricity forward market provides sufficient hedging opportunities in the concerned bidding zones. The assessment shall be carried out in a coordinated manner by the competent regulatory authorities of the bidding zone border and shall include at least:

- a) a consultation with market participants about their needs for cross-zonal risk hedging opportunities on the concerned bidding zone borders;
- b) an evaluation.

The first consultations with market participants were conducted from 16 January to 16 February 2017 and on the basis of these consultations and the Analysis of 3 April 2017, the President of ERO released on 17 May the decision on not issuing long-term transmission rights by Polskie Sieci Elektroenergetyczne S.A. with its registered office in Konstancin-Jeziorna for the Poland-Lithuania market zone, i.e. on the Polish-Lithuanian cross-border interconnection (LitPol Link).

As Commission Regulation 2016/1719 requires the ERO President to reassess and analyze whether sufficient hedging opportunities are provided in the electricity forward market for the market zones in Sweden and Lithuania, further consultations with market participants were conducted from 25.02.2021 to 17.03.2021.

The questions asked during both consultation rounds were as follows:

1. Is there a need for cross-zonal risk hedging in the transmission between the Polish market zone and the market zones in Sweden and Lithuania?
2. Are there sufficient risk hedging opportunities in the Polish electricity forward market? Please justify your answer.
3. Are there any products or combinations of products in the Polish bidding zone on forward markets that represent a hedge against price volatility on the day-ahead market?

If the answer to Question 3 is positive:

4. Do existing products or combinations of products represent a sufficient hedge against price volatility in the day-ahead market? Please justify your answer.
5. Are existing products or combinations of products efficient in terms of:
 - i. trading horizon;
 - ii. bid-ask spread;
 - iii. traded volumes in relation to physical consumption;
 - iv. open interest in relation to physical consumption.

In the second round of consultations, no market participant chose to submit its answers to the ERO President's questions. In these circumstances, this analysis provides the basis for the assessment of the opportunity to hedge the risks in cross-zonal transmission referred to in Article 30(3) of the EC Regulation 2016/2019. Given that, as mentioned, the ERO Market and Consumer Affairs Department prepared such an analysis for the previous decision (published in the ERO Bulletin No. 64(2287) of

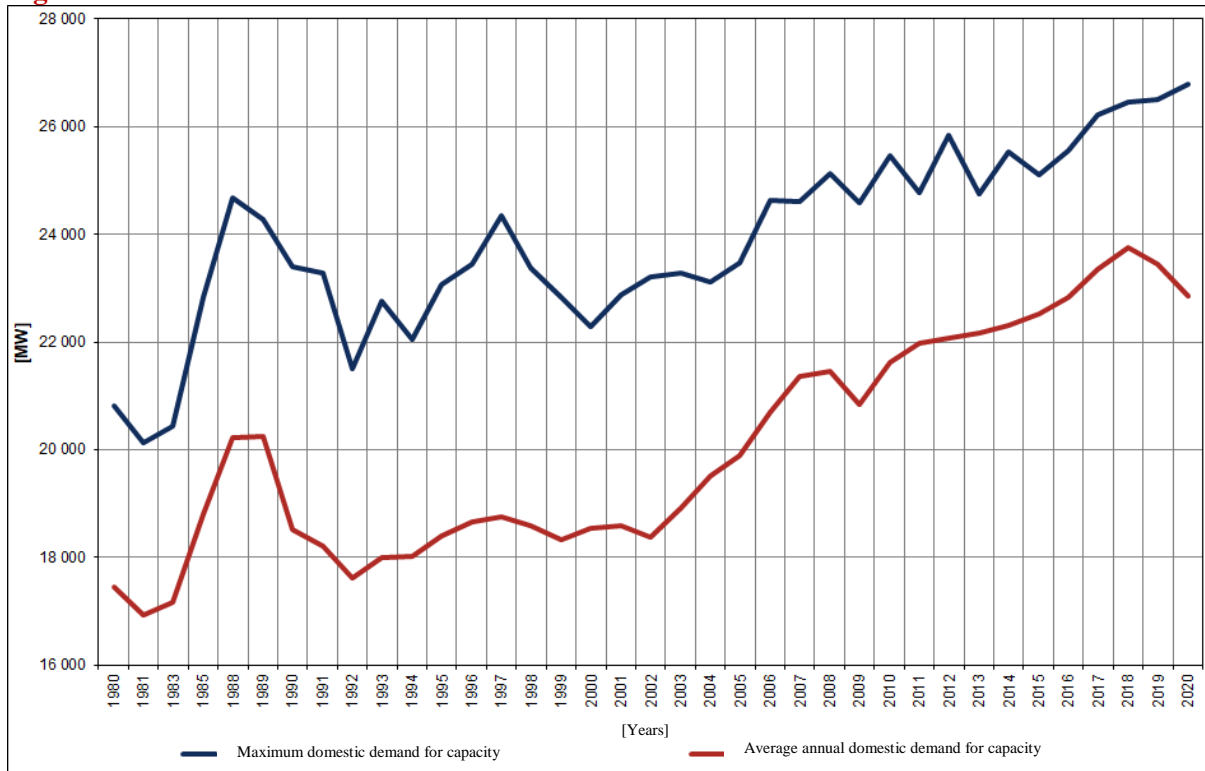
18 May 2017) this document focuses on the changes in circumstances that could affect the change in the ERO President's decision of 2017.

ELECTRICITY MARKET IN POLAND

TRADING IN ELECTRICITY AND KEY MARKET CHANGES IN THE YEARS 2017-2021

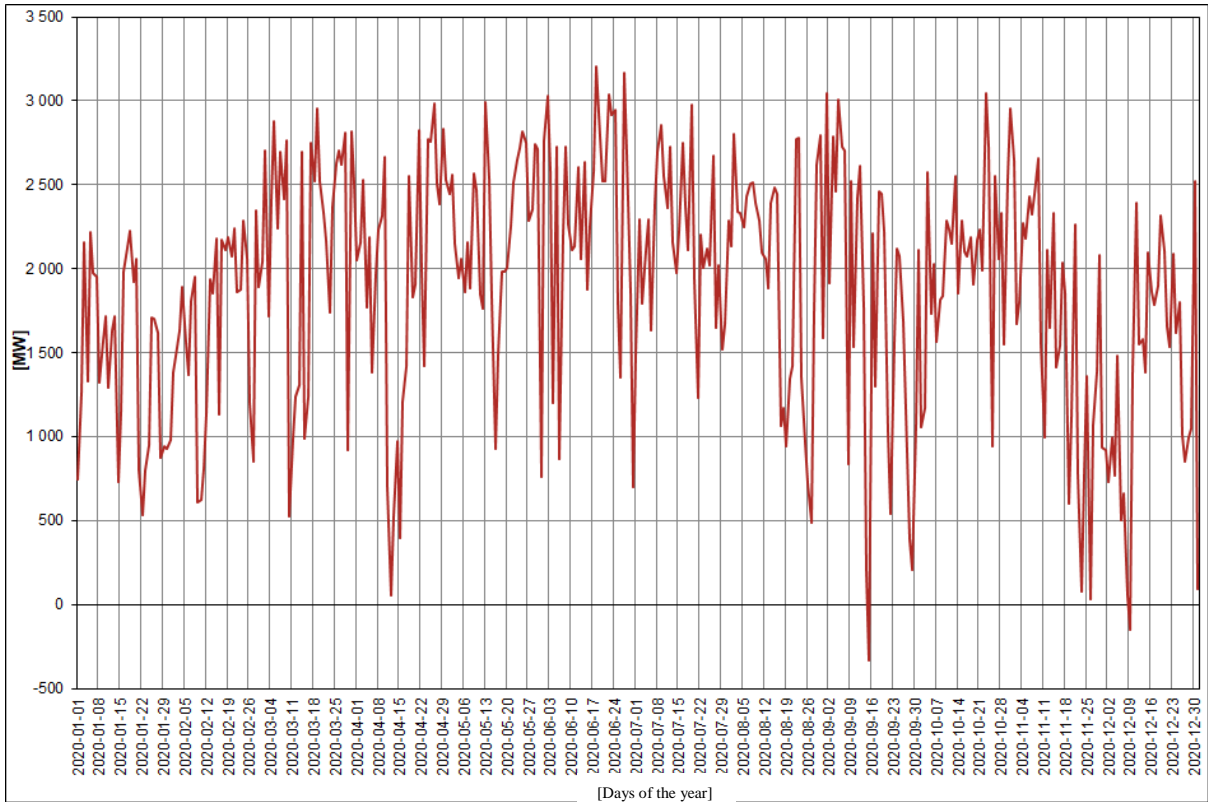
According to PSE, the average annual domestic capacity demand and the maximum demand in daily peaks on working days in the years 1980-2020 were as follows:

Fig. 1.



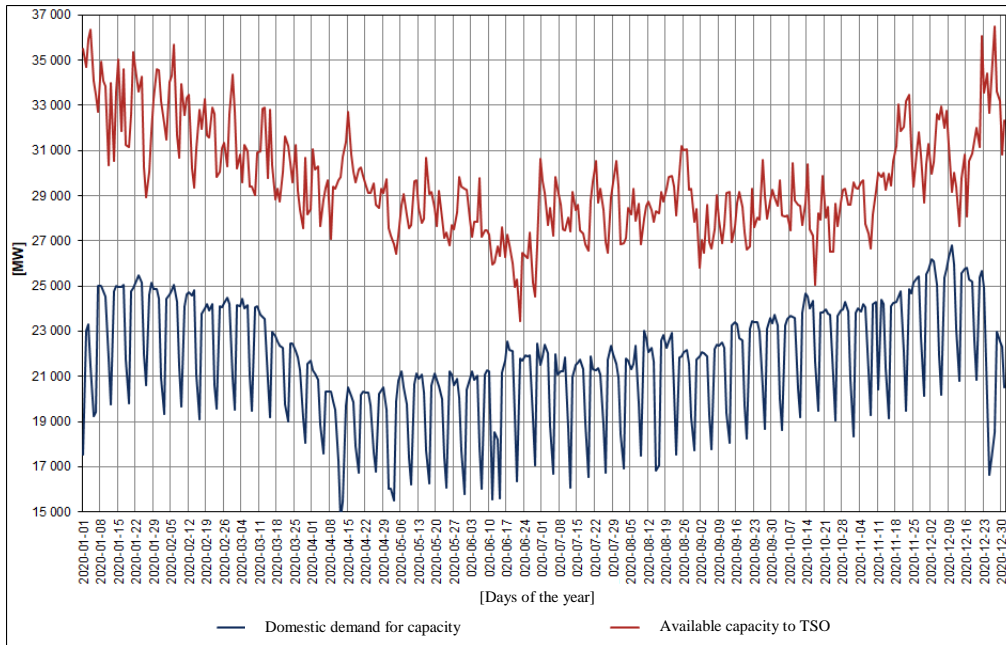
The overall balance of cross-border exchange in the daily peak of domestic capacity demand on particular days in 2020 was as follows (source: PSE S.A.):

Fig. 2.



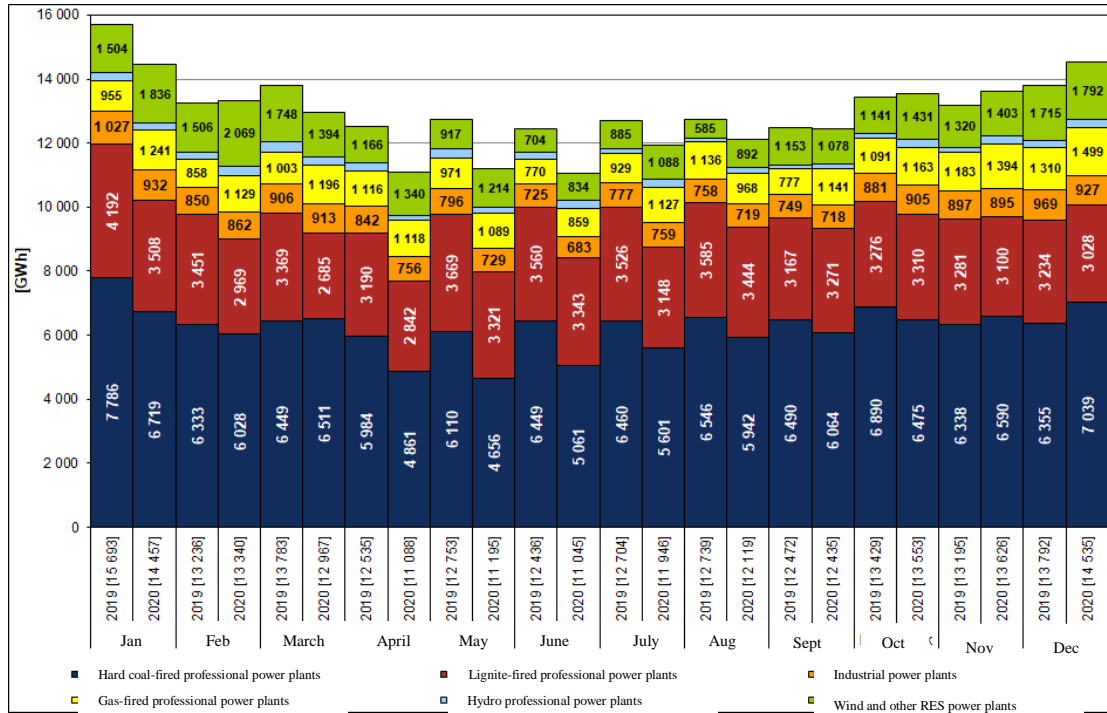
Domestic capacity demand and available capacity to TSOs at daily peaks of domestic capacity demand in 2020 was as follows:

Fig. 3.



By generation technology, energy production in the years 2019-2020 was as follows (source: PSE):

Fig. 4.



By contrast, the percentage share in domestic electricity production of particular groups of power plants by fuel type in 2020 was as follows:

Fig. 5.

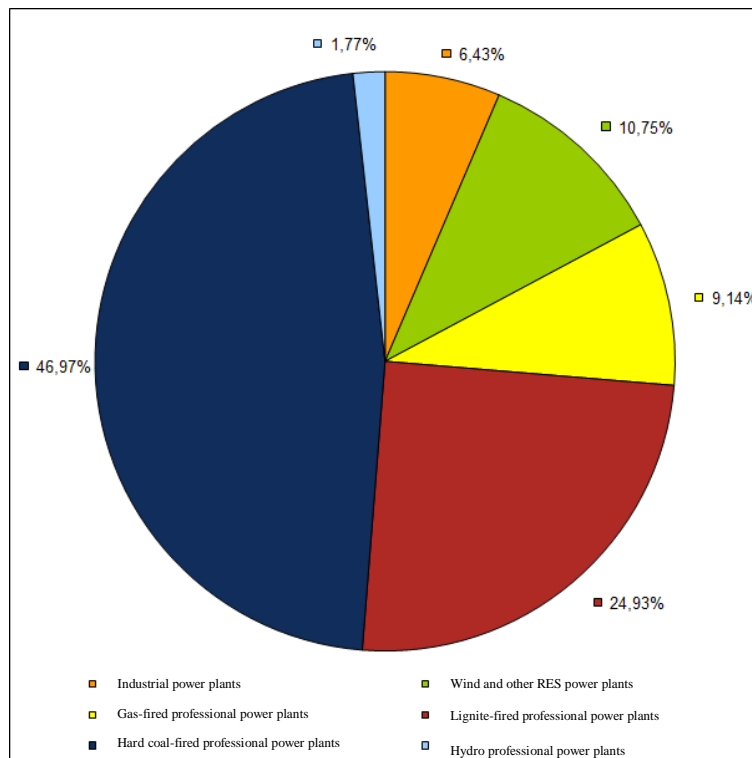


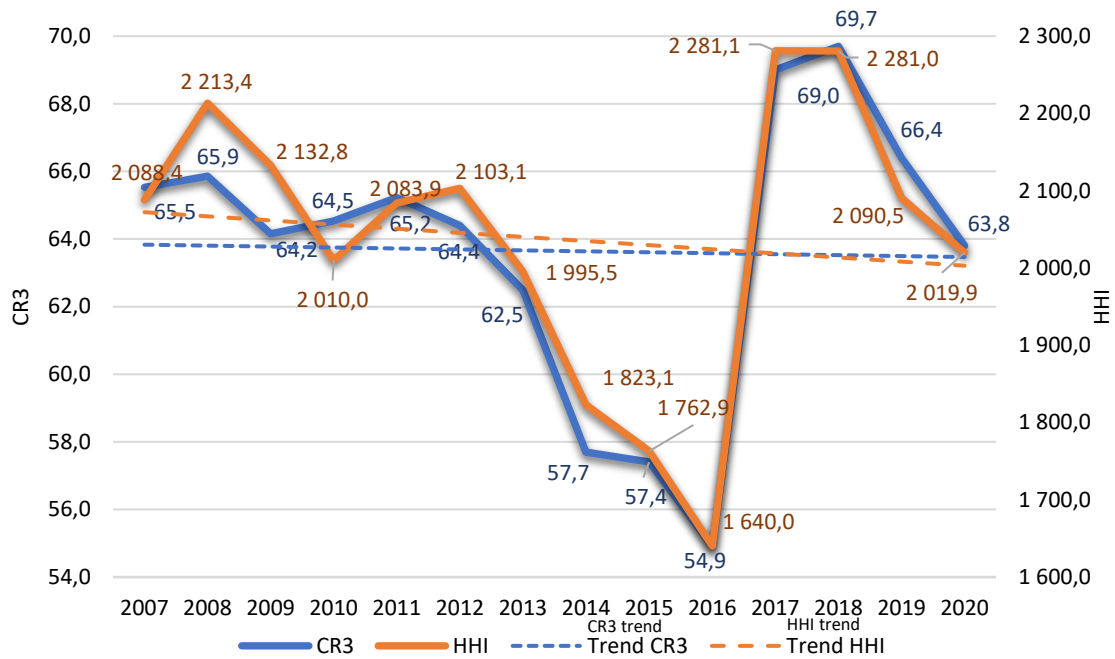
Table 1. Structure of electricity production in domestic power plants, volumes of electricity exchange with foreign countries and domestic electricity consumption in the years 2018÷2020 [GWh].

item	specification	2018	2019	Dynamics [(b-a)/a*100] [%]	2020	Dynamics [(d-b)/b*100] [%]
		[a]	[b]	[c]	[d]	[e]
1.	Total production (1.1+1.2+1.3+1.4)	165,214	158,767	-3.9	152,308	-4.07
1.1	Professional power plants	143,234	134,245	-6.28	126,137	-6.04
1.1.1	Professional hydro power plants	2,197	2,454	11.7	2,698	9.96
1.1.2	Professional heat power plants	141,037	131,791	-6.56	123,439	-6.34
1.1.2.1	Hard coal-fired	82,375	78,190	-5.08	71,546	-8.5
1.1.2.2	Lignite-fired	49,072	41,502	-15.43	37,969	-8.51
1.1.2.3	gas	9,590	12,099	26.16	13,924	15.09
1.2	Wind and other RES power plants	11,958	14,344	19.96	16,372	14.14
1.3	Industrial power plants	10,022	10,178	1.56	9,799	-3.73
2.	Cross border exchange balance	5,718	10,624	85.8	13,224	24.48

As it can be seen, the share of renewable sources in the production structure is growing dynamically, while the share of lignite and hard coal power plants is decreasing. Among renewable sources, photovoltaic deserves special attention, the capacity of which increased from 1,500 MW at the end of 2019 to 4,000 MW in December 2020. The coming years will see further dynamic growth of offshore and onshore renewable energy. For the purposes of this analysis, it is primarily significant because it translates into increased liquidity in short-term electricity markets through the CFD auction mechanism discussed below and the general nature of short-term predictability of generation volumes from these sources.

Concentration ratios in the generation sub-sector, in the electricity market in 2020, decreased, but still remain high compared to the status in 2016. This is related to the acquisition of generation assets of EDF and ENGIE by the PGE and Enea groups. On the other hand, the decrease recorded in 2020 is related to the development of the renewable energy sector and the activity of private investors in this market area.

Fig. 6. Concentration of the generation sub-sector and market shares of the largest entities by energy fed into the grid in the years 2007-2020.



The structure and operation mechanisms of the electricity market in Poland deviate, in detail, from analogous structures and mechanisms that have evolved in recent years in most other EU countries recognized as competitive markets, despite the fact that EU directives in this respect are not implemented with greater delays than in many other countries. Electricity is traded in Poland on the organized market operated by TGE and other platforms admitted to operate under the multi-NEMO mechanism (EPEX SPOT, Nord Pool), as well as under bilateral contracts and brokerage platforms. In this sense, as in neighbouring markets, participants have broad access to various forms of electricity sales and access to market information on volumes and prices at which energy is contracted and sold on the wholesale market.

Table 2. Forms of electricity sales by producers in the years 2019-2020 [TWh].

Year	Trading companies	Regulated markets, including power exchange	Balancing market	Export	Final customers	Other sales*
2019**	55.0	82.9	10.7	0.0	2.0	1.8
2020	30.7	106.3	9.9	0.4	1.8	2.6

* Other sales include the volume of electricity sold to the TSO and DSO and sales to small local distributors.

** The data have been revised compared to the data in the ERO President's Report for 2019 due to the correction of data by the surveyed entities.

Source: Data from the Ministry of Climate and Environment and ERO.

Table 3. Forms of electricity sales by trading companies in the years 2019-2020 [TWh].

Year	Trading companies	Regulated markets, including power exchange	Balancing market	Export	Final customers	Other sales *
2019**	122.71	103.5	7.4	2.4	127.2	17.8
2020	110.51	96.5	7.4	1.5	127.0	28.0

* Other sales include the volume of electricity sold to the TSO and DSO and sales to small local distributors.

** The data have been revised compared to the data in the ERO President's Report for 2019 due to the correction of data by the surveyed entities.

Source: Data from the Ministry of Climate and Environment and ERO.

As compared to the years 2013-2016, producers' sales through regulated markets increased, reaching 70% in the total sales of producers. On the other hand, trading companies directed their sales mainly to other trading companies, to final customers and to the exchange.

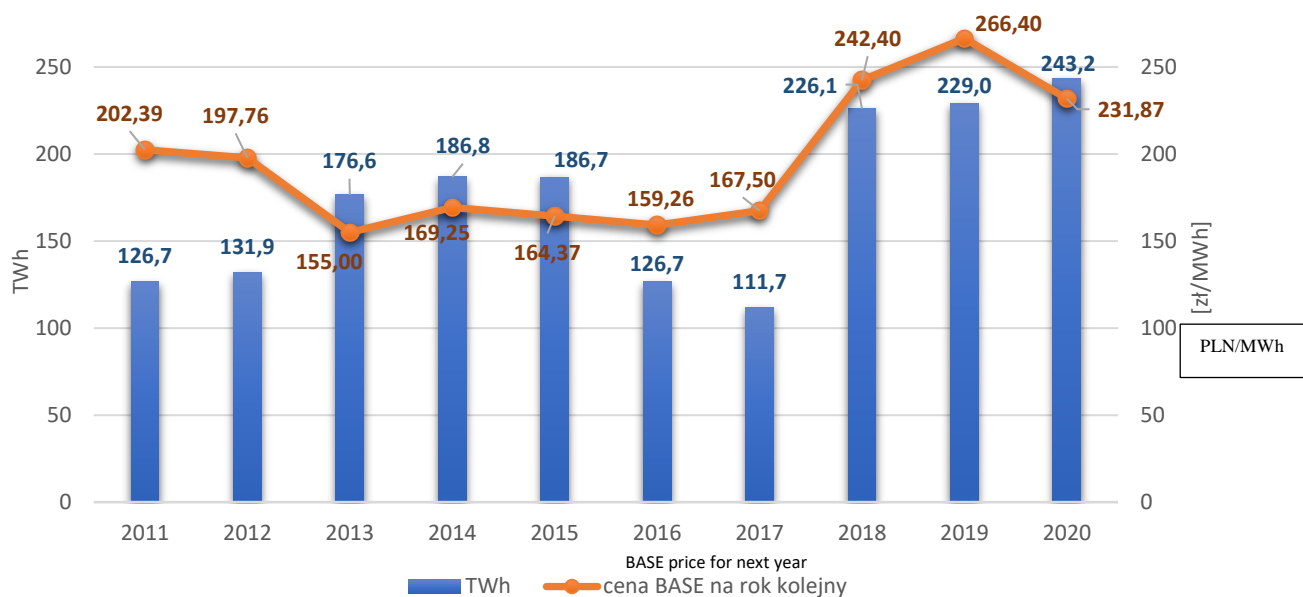
ELECTRICITY EXCHANGE MARKET

Among the regulated electricity markets in Poland, the central role is still played by the Polish Power Exchange (Towarowa Giełda Energii S.A.), but since 9.02.2021 two other exchanges nominated in the Multi-NEMO mechanism - EPEX SPOT and Nord Pool - have also started their activity in Poland.

Trading on the energy exchange is conducted 24 hours a day, 365 (or 366) days a year. The participants of the exchange market run by TGE S.A. (Commodity Market - CM and from 1 May 2020 - Organized Trading Facility (OTF)) may be trading and generating companies as well as large final customers, which may act on their own after becoming a member of respectively the CM and the OTF (by entering into an appropriate agreement with TGE S.A.) or through brokerage houses or other entities, which have the status of members of the CM and the OTF from their own group and which may enter into transactions on behalf of other entities belonging to the same group.

The chart below shows the trading volume and the weighted average electricity prices for a yearly contract in a block delivery (BASE-type contract) in the years 2011-2020.

Fig. 7. The volume-weighted average price of electricity for the BASE year contract for the following year and the total volume of electricity trading in the given year on all electricity markets of TGE.



Source: ERO based on TGE data.

The total volume of transactions concluded in 2020 on all electricity markets on TGE amounted to 243.2 TWh, an increase of 6.2% compared to 2019, when the total volume of transactions concluded amounted to 229 TWh. On the other hand, electricity sales in the entire quotation period of all contracts with physical delivery of electricity in 2020 amounted to 224.4 TWh, which accounted for 147.3%¹⁾ of gross electricity production in 2020.

In the reporting year, TGE operated the following electricity sales markets: Intraday Market (IDM) - in the XBID model, Day-Ahead Market (DAM) and, with regard to the forward instruments market, Commodity Forward Instruments Market (CFIM), including in the auction system) as of 1.05.2020 transformed into the Forward Products Market with Electricity Supply (FPMES) of the Organized Trading Facility (OTF). At the end of 2020, 76 entities held the status of the TGE's CM member, of

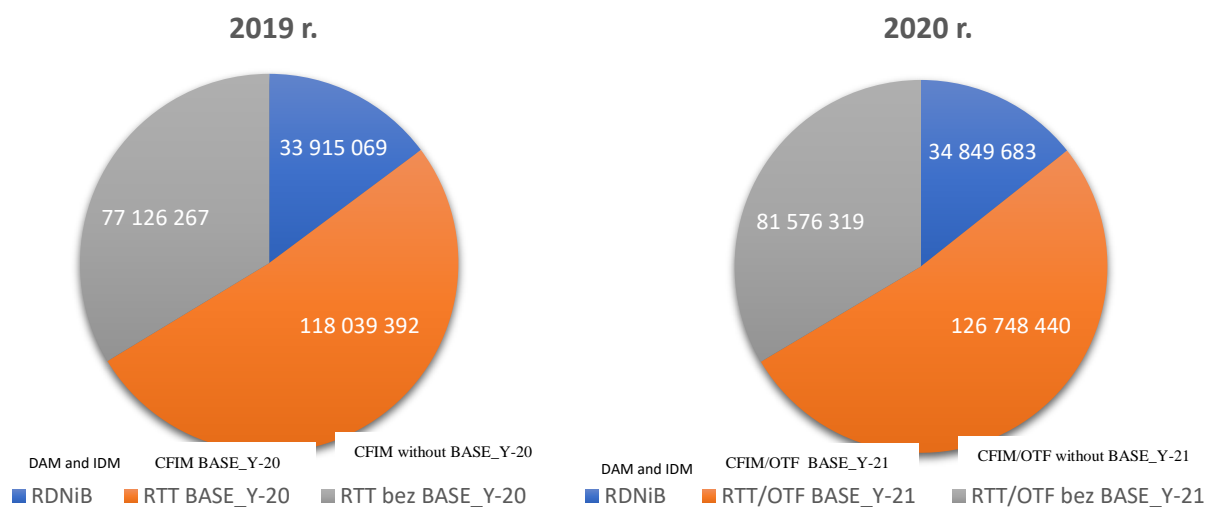
¹⁾ With regard to electricity production in 2020, according to PSE S.A.

which 46 entities simultaneously held the status of the OTF member, while 45 of them actively participated in trading on the electricity markets operated by TGE.

The highest trading volume was carried out on the CFIM/ FPMES OTF. In 2020, 44,855 transactions were concluded on this market (including auctions), and the total trading volume amounted to 208.3 TWh. The most liquid contract in 2020 was the annual contract in block delivery for 2021 (BASE_Y-21). The trading volume for this contract in 2020 was 126.7 TWh, which represents 60.8% of the total trading volume recorded on the CFIM in 2020.

In 2020, 1,258,324 transactions were entered into on the DAM. At the same time, the exchange members carried out electricity purchase/sale transactions with a total volume of approximately 32.7 TWh, a decrease of approximately 3% compared to the previous year. On the IDM, 417,356 transactions were made, and the total volume of trading on this market amounted to 2.1 TWh.

Fig. 8. Electricity trading structure in the years 2019-2020 on markets operated by TGE S.A. [MWh].

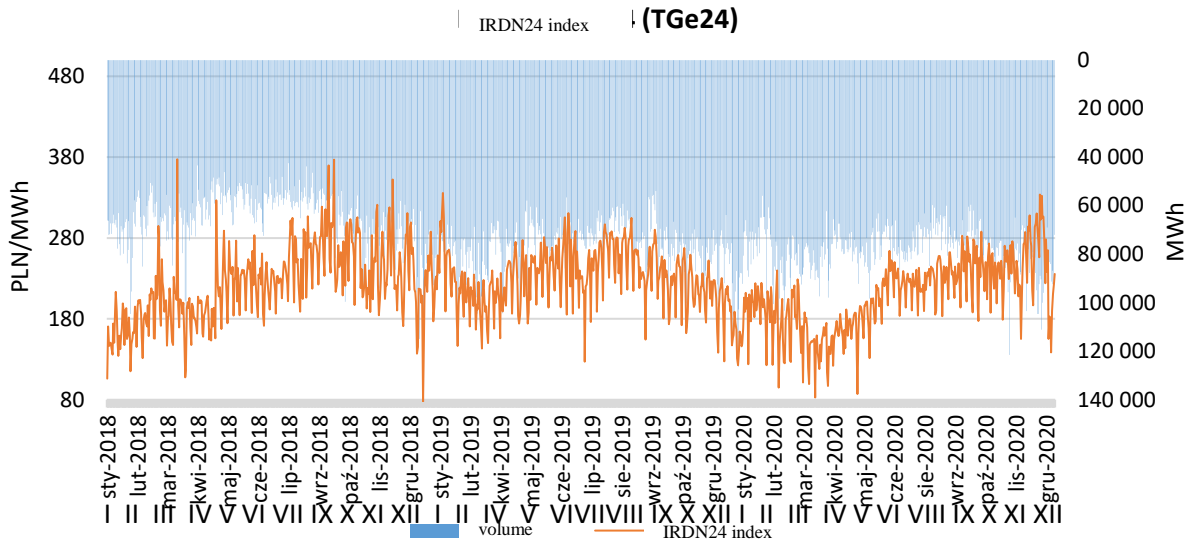


Source: ERO based on TGE data

PRICES ON THE EXCHANGE MARKET

The chart below presents electricity prices on the Day-Ahead Market DAM (SPOT market) run by TGE, measured by the IRDN24 (TGe24) index. The index represents the arithmetic average price from all transactions, except for block contracts, on the DAM exchange session, calculated after the delivery date for the whole day.

Chart 1. Average daily prices of electricity in SPOT transactions measured by the IRDN24 index [PLN/MWh] and electricity trading volume on the DAM market (without block contracts) [MWh] in particular months of the years 2018-2020



Source: ERO based on TGE data

The volume-weighted average electricity price on the DAM market in 2020 was 210.11 PLN/MWh and was lower than in 2019 by 19.51 PLN/MWh, when the price was 229.62 PLN/MWh.

PRICES OF ELECTRICITY SOLD IN 2020 ON TGE S.A.

The year 2020 saw a decline in electricity prices on the CFIM market operated by TGE S.A., which is reflected in the year-on-year decrease in prices of BASE_Y forward contracts (annual contract in a block delivery for the following year). The volume-weighted average transaction price of the BASE_Y-21 contract throughout 2020 was at 231.87 PLN/MWh, while in 2019 the volume-weighted average transaction price of the corresponding BASE_Y-20 forward contract was 266.40 PLN/MWh.

At the same time, the average monthly price of BASE_Y-21 contracts concluded in December 2020 was 235.30 PLN/MWh, while the average monthly price of the corresponding BASE_Y-20 contracts concluded in December 2019 was 242.14 PLN/MWh. This means a decrease in the price of these contracts by approximately 3%.

CHARACTERISTICS OF THE POLISH EXCHANGE MARKET

The products quoted on the TGE markets are quite substantially different from the products on European exchanges, both spot (EPEX SPOT, Nord Pool) and forward (Nasdaq, EEX). First of all, on the Day-Ahead Market (DAM) we deal with two fixings, where the first one (at 10.30 a.m.) involves only orders from the Polish market, and the second one is carried out under the market coupling procedure, i.e. it is a common price fixing mechanism through multi-NEMO and the price on this fixing is influenced by orders from the price zones covered by the analysis, i.e. Sweden and Lithuania (and indirectly also from other markets). A similar phenomenon occurs only in the case of the Austrian EXAA exchange. As part of the analysis, we will compare the average prices at these fixings.

The forward market, on the other hand, in the case of TGE is a market for delivery contracts (with physical delivery), whose value does not change during the settlement period, therefore they are not a hedging mechanism for the SPOT price.

On the other hand, a new element of the market is the SIDC Intraday Market launched by TGE. On 19.11.2019 TGE launched the SIDC European Intraday Electricity Market in the XBID model. It operates within the European Union (currently connecting 21 countries) and enables cross-border electricity trading between entities in most EU countries.

Trading on SIDC is conducted in a 24-hour continuous quotation formula. The instruments traded are those with next-day delivery, whose quotations begin at 2:00 p.m. on the day before delivery and gradually expire from the market one hour before delivery. Transactions on this market are entered into in EUR, while settlements between the Exchange and Polish market participants will be carried out by the IRGiT in PLN. The model of clearing and settlement for the Intraday Market, developed by the IRGiT and adjusted accordingly to the requirements of the XBID model, allowed optimizing the costs of hedging lodged by the House's Members. The XBID (Cross Border Intraday Coupling) model of the Intraday Market was launched in 2018 as a joint initiative of energy exchanges and transmission system operators (TSOs) from 14 countries to create an integrated cross-border Intraday Market. Trading is possible through a platform developed by Deutsche Boerse AG. The SIDC-XBID solution is based on a common IT system with a single Shared Order Book (SOB), Capacity Management Module (CMM) and Technical and Financial Settlement Module (Shipping Module - SM), which is centrally managed by Deutsche Boerse AG.

NEW ELEMENTS OF THE ENERGY MARKET - CAPACITY MARKET AND CFD AUCTIONS

When analyzing the opportunities created by the Polish electricity market, it is impossible not to mention two markets that emerged, similarly to XBID, after 2017 and currently have a significant impact on the opportunities of hedging energy prices - these are the capacity market and auctions for electricity producers based on the CFD structure, i.e. a contract for difference.

CAPACITY MARKET SCHEME

The Capacity Market Act was passed in the Sejm (Polish Parliament) on 8 December 2017 and came into force after notification to the European Commission.

The purpose of introducing the capacity market is to ensure medium- and long-term security of energy supply to electricity consumers in a cost-effective, non-discriminatory and sustainable manner. The system defined in the Capacity Market Act adopted by the Sejm ensures sufficient available capacity mainly in a 5-year perspective and only partially encourages investments in new generation units. The Capacity Market Act introduces charges for making available electric capacity or reducing its consumption during risk periods forecasted by the TSO in order to maintain energy security. Generation units and demand reduction units compete for capacity payments in a Dutch-type auction system (one, settlement price for all auction winners).

The following domestic and foreign units may participate in the capacity market:

- Existing and planned physical generating units with an available capacity of not less than 2 MWe,
- Existing and planned demand reduction units with available capacity demand reduction of not less than 2 MWe.

Generating and demand reduction units on the capacity market may consist of one unit or a set of units with a total available capacity greater than 2 MWe and smaller than 50 MWe.

Main principles of the Polish capacity market:

1. Single buyer market
2. TSO certification of participating entities
3. Foreign entities may participate
4. Payments are adjusted for other public support (both operational and investment)
5. Strict rules on obligation fulfilment
6. Secondary market without TSO intervention (if transactions take place between certified entities)
7. Capacity payments granted from money collected from final customers through a dedicated payment

8. Bonuses and penalties for exceeding / not delivering capacity in certain periods
9. Dutch auctions with uniform closing price. First auctions held in 2018, with delivery in 2021-2023. Further auctions scheduled 5 years before delivery.

Capacity contracts for a period of 1 year up to a maximum period of 5 or 15 years for upgraded generation and/or new units. Demand reduction units certified by the TSO. Full or partial exclusion of units receiving support from other sources. Four annual auctions have already taken place. The last Capacity Market auction was for 2023 with a closing price of 202 PLN/ kW/year. Approximately 50% of the winning bids were one year supply and the remaining 50% between 5 and 15 years. Starting from 2025, it will no longer be possible for units with an emission factor of more than 550 kg CO₂ per MWh of production, i.e. coal-fired units, to participate in the capacity market. Until 2035, only 4 GW of power from the newest units in coal-fired power plants will remain covered by the capacity market support.

RES AUCTIONS

RES auctions are conducted by the Energy Regulatory Office, and the Settlement Manager is responsible for the settlement of the results. Auctions are conducted in several categories for different volumes and technologies, and their winners (offering the lowest settlement prices) are guaranteed to match the price bid in the auction, while the price to which they are settled is the price of the DAM market on TGE (differential contract). Such settlement construction results in the fact that, indeed, just those auctions offer the only instrument on the market hedging against price volatility on the DAM and it reinforces the DAM liquidity.

INTERCONNECTION (CROSS-BORDER) EXCHANGE

The cross-zonal exchange of electricity on the synchronous section (borders with Slovakia, the Czech Republic, Germany) takes place in explicit auctions, but, due to the presence of large unscheduled flows, no LTTRs have been allocated recently, so most of this exchange takes place through the granting of short-term rights and on XBID. All indications are that as of June 2021 an agreement between TSOs and NEMOs covering 7 countries (Poland, Germany, Austria, Czech Republic, Slovakia, Hungary, Romania) and 6 borders (PL-DE, PL-CZ, PL-SK, CZ-DE, CZ-AT, HU-AT) will be implemented, which provides for the introduction of market coupling mechanism (Interim Market Coupling) also on these borders as a prelude to Flow BASEd Market Coupling, for the Core (1) region, which is the target model.

On non-synchronous connections with Sweden and Lithuania exchange is carried out under market coupling and long-term transmission rights are not allocated (according to the mentioned PURE decision).

Table 4. Actual flows with particular countries in 2020 [GWh] (source PSE).

item	specification	input	output	balance
1.	Belarus	0.0	0.0	0.0
2.	Czech Republic	1,674.1	3,649.7	-1,975.6
3.	Lithuania	2,158.7	380.7	1,778.0
4.	Germany	11,235.2	12.1	11,223.1
5.	Slovakia	92.5	3,154.6	-3,062.1
6.	Sweden	3,788.9	12.6	3,776.3
7.	Ukraine	1,484.1	0.0	1,484.1
8.	Total	20,433.7	7,209.7	13,224.0

As it can be seen, electricity imports accounted for an important part of energy supply for Polish consumers in 2020.

ANALYSIS AND RESULTS

ASSUMPTIONS FOR THE ANALYSIS

Pursuant to Article 30(4)(A0) the analysis shall examine the functioning of wholesale electricity markets and shall be based on transparent criteria which shall include, inter alia, an analysis of whether the products or combinations of products offered on forward markets provide a hedge against price volatility in the day-ahead market of the market zone concerned, where the day-ahead price is sufficiently correlated with the base price on which settlement for the product or combination of products is based.

Markets and products offered by TGE, other multi-NEMO markets may be adequate for volatility hedging on the DAM, however the way of achieving this "hedging" is different than in case of markets connected with the Polish one.

The following markets were analyzed:

1. the Day-Ahead Market (DAM) operated by TGE with two fixings and double price determination
2. the DAM operated by the other multi-NEMO which is identical, in terms of prices, with the second fixing on TGE
3. the Commodity Forward Instruments Market transformed into the Products Forward Market with Electricity Supply (PFMES) of the Organized Trading Facility (OTF) on TGE.
4. Forward Markets offered by other forward exchanges (Nasdaq, EEX), one of which maintains quotations for the Swedish and Lithuanian markets (Markt to Market products hedging the system price and products hedging the differences between the Nord Pool system price and prices of individual price areas of Sweden and Lithuania (EPAD) - Nasdaq), and the other one - financial contracts for energy of the Polish price area hedging price risk of multi-NEMO market or fixing II on TGE - EEX.

The analysis took into account data from the period not covered by the previous analysis - i.e. 2017-2020.

DATA FOR ANALYSIS

In the analysis, data published on the websites of PSE S.A. and TGE S.A. as well as data obtained from TGE S.A. through ERO were used.

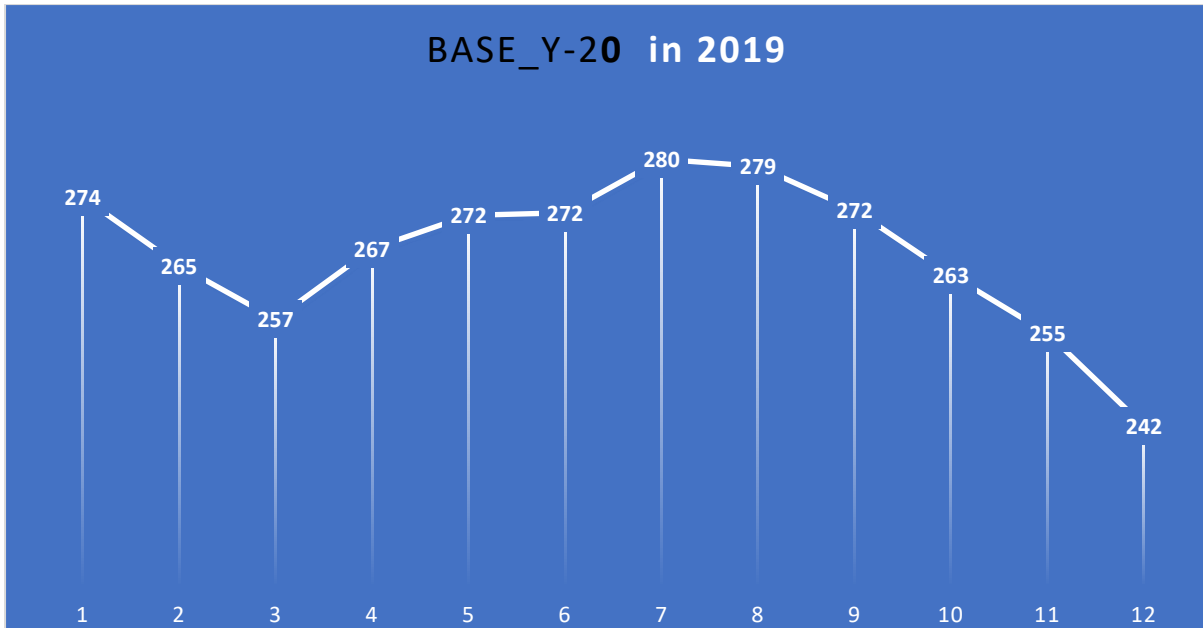
ANALYSIS RESULTS

Trading on the forward market organized by TGE takes place in advance depending on the products offered in given time periods, i.e. up to 3 years for an annual contract, 9 months for a monthly contract, 6 weeks for a weekly contract, etc. There are basic contracts (BASE), peak and off-peak products available.

Due to the nature of contracts (delivery with a fixed price), they can only be entered into by energy market participants who own a schedule unit and, in principle, there is no concept of closing a position. The sale of a contract bought earlier results in its "closing" in respect of delivery obligations, but the clearing house keeps the settlement of both transactions - purchase and sale. The contract is also not, in a classical sense, a volatility hedge on the DAM, but it is simply an avoidance of the DAM risk through the purchase of a fixed-price contract for the entire volume covered. Such market construction implies that there is no single reference price for physical energy delivered at a given moment. It may be taken as the price of the most liquid annual BASE contract, the price established at the fixing I, fixing II or a combination of these products related to the demand profile of a given market participant.

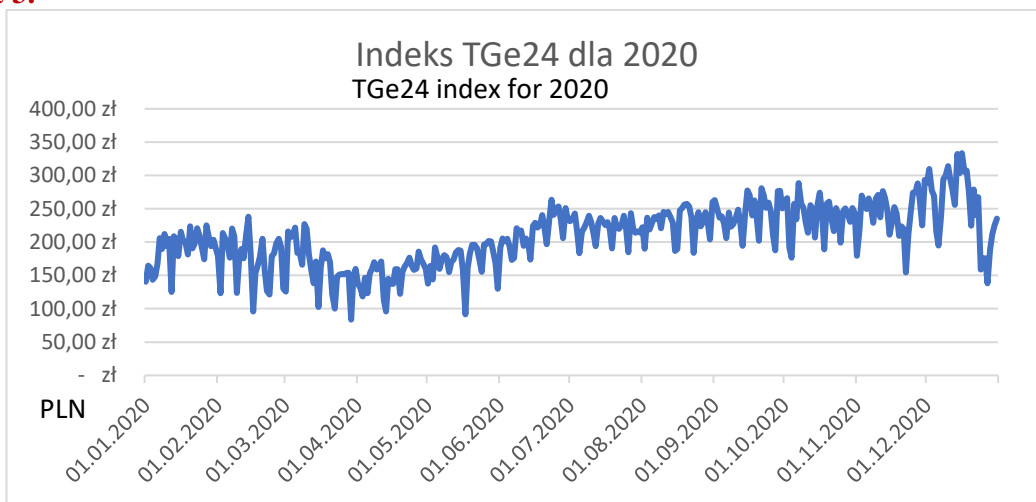
It is worth tracing the quotations for the 2020 BASE contract in 2019 (average monthly prices of the contract)

Chart 2.



and compare them with the day-ahead market prices for 2020.

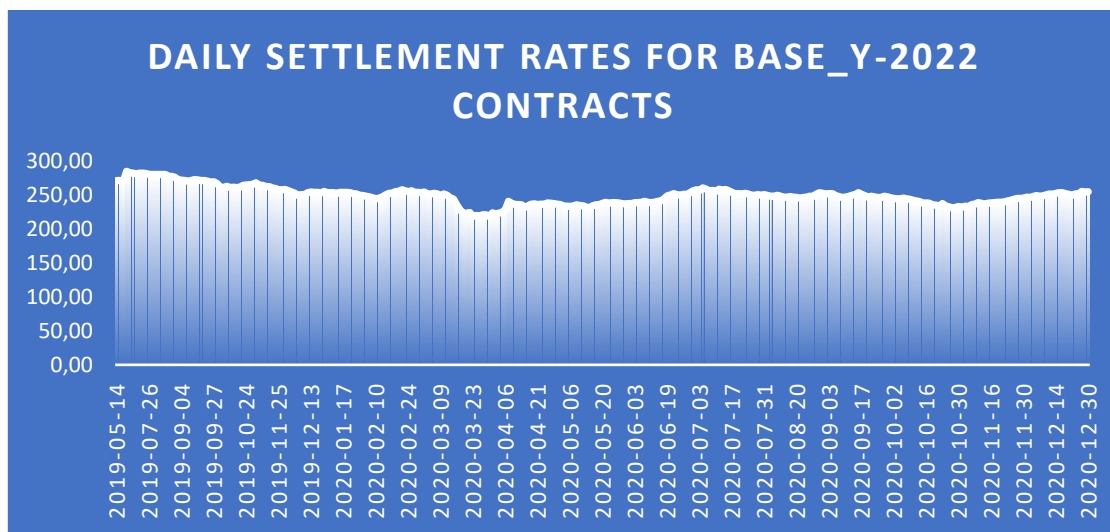
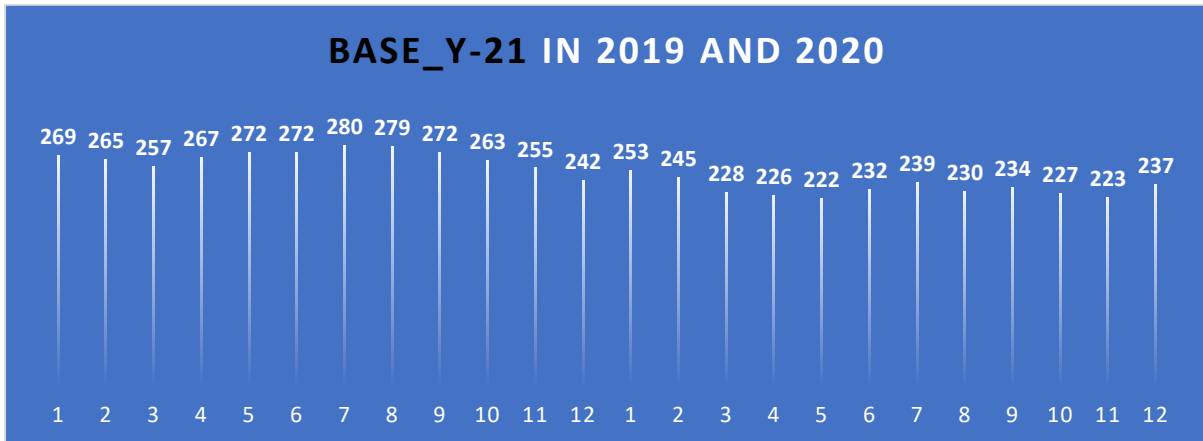
Chart 3.



As can be seen, the BASE 2020 price was characterized by high volatility, which was influenced by, among others, the demand forecasts for 2020, the EU ETS emission allowance prices as well as the capacity market. The DAM price, on the other hand, is dictated by slightly different factors such as the weather (and the resulting volume of RES energy offered on the DAM), short-term demand forecast, failures, outages and shutdowns. It is also influenced by the anticipated direction of the XBID, through which, recently, the German market as well as other neighbouring markets have been searching for short-term flexibility in order to balance the surplus or shortage of RES energy.

The analysis of prices for the BASE contract for 2021, which is worth showing from the perspective of quotations of two years - 2019 and 2020, may also lead to interesting conclusions. In this case, we have also seen high volatility, where it can be assumed that the price was influenced, among other factors, by the two waves of the covid19 pandemic, while it is quite interesting that the rapidly increasing EU ETS allowance prices did not contribute to the increase in the BASE_y-21 price in the last weeks of 2020. Current DAM quotations are much higher, (TGE24 of 14.04 2021 was, for example, PLN 299). In this case, it may be assumed that the bids to sell this contract were secured by the low price of EU ETS allowances in spring 2020.

Chart 4 and 5.



The analysis of volatility of DAM prices and prices of the most liquid BASE_Y and PEAK5 contracts does not show a far-reaching correlation between them due to the fact that fundamental factors influencing DAM and forward market prices are, to a large extent, different. However, contracting on the forward market makes it possible to relieve from the volatility risk on the DAM and in this sense the Polish market exhausts the criterion of opportunity to hedge against price volatility on SPOT markets. In the near future, it should be assumed that the increasing volume of transactions on the DAM, resulting from, for example, the availability of market coupling also on synchronous connections and from the increase of volumes of RES energy under CFDs (also offshore) may also be subject to hedging both by market participants and financial institutions financing e.g. RES investments, through the popularization of market-to-market financial instruments on EEX (for the time being, their low liquidity does not allow to consider them in the analysis).

CROSS-ZONAL TRADING VOLUME AS A PROPORTION OF TOTAL ENERGY TRADING VOLUME

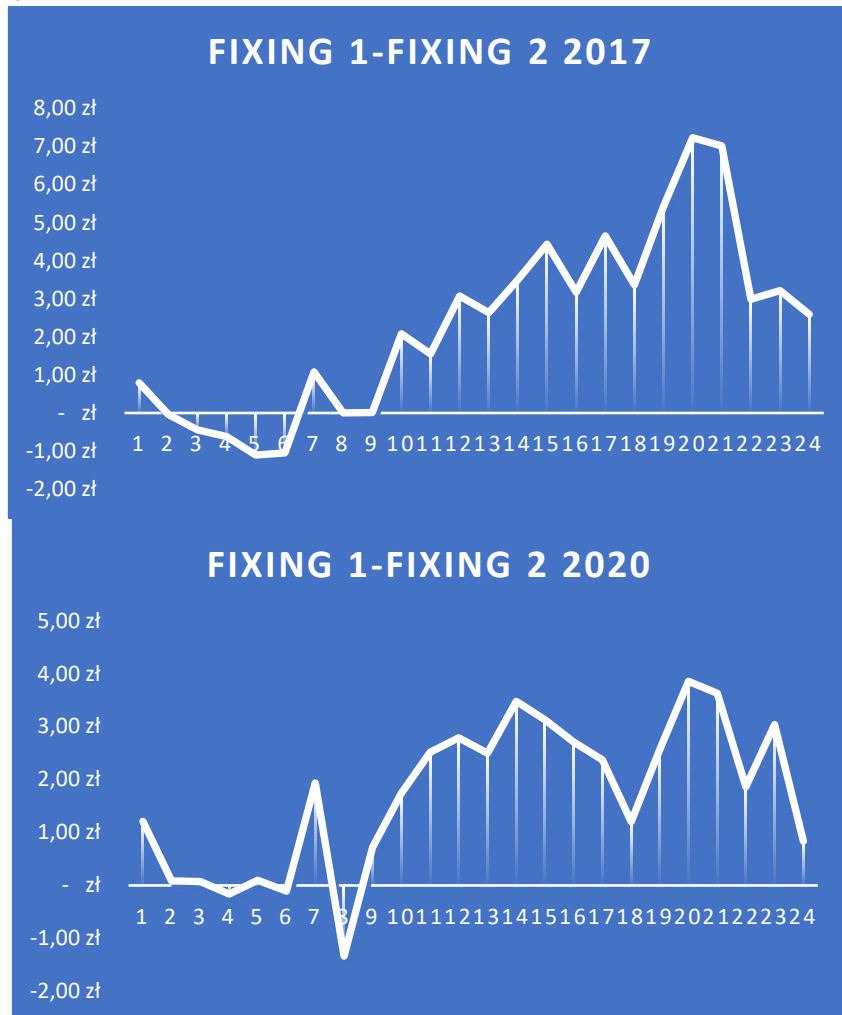
This analysis addresses the risk hedging opportunities in the cross-zonal transmission carried out in the cross-border interconnections with Sweden and Lithuania. As shown in the chapter on international exchanges, in 2020 imports of about 3800 GWh and exports of 12 GWh are recorded for Sweden, respectively 2100 GWh imports and 380 exports for Lithuania, i.e. a total of 5900 GWh imports and 392 GWh exports.

Meanwhile, energy volumes in TGE Fixing I and Fixing II in 2020 amounted to 14,436 GWh and 6685 GWh, respectively (according to TGE data), i.e. the impact of imports on prices in TGE Fixing II was very significant (even assuming that part of the imports was not realized through MC but within the framework of inter-operator exchange, and part of energy from Sweden could be exported to Lithuania

within MC). This impact could only be mitigated by integrating the entire DAM into one fixing, as is the case in almost all EU energy markets.

The impact of imported energy and its export can also be seen in the price differences between Fixing 1 and Fixing 2 averaged over individual trading hours. Here is how these differences looked in 2017 and in 2020:

Charts 6 and 7.



As can be seen, energy imports were important for the reduction of the price during peak hours and for the possibility of selling it during off-peak hours, assuming arbitrage between the two fixings. Of course, these proportions looked different from day to day and from season to season, but the trend of 2017 was, in principle, maintained also in 2020. One may wonder to what extent this trend would have deepened if, along with the introduction of the MC mechanism on synchronous connections, one fixing on the DAM had been introduced at the same time. Otherwise, in fact, the situation on the neighbouring markets and the correlation of Core 1 and Scandinavian zone prices would have a greater impact on the price on the Polish DAM than the domestic generation and demand. Such a tendency could also deepen after abolishing the so-called exchange obligation and transferring the majority of forward contracts to the OTC area. This would also limit the possibility of mitigating the spot price risk through FPMES.

Table 5 and 6. Relationship between forward contracts and SPOT contracts for the years 2019 and 2020.

Relationship between trading volume in BASE contracts with delivery in 2019-2020 concluded on CFIM/OTF and trading volume on DAM					
Delivery year	Contract length	DAM/Fixing1 2019	DAM/Fixing2 2019	DAM/Fixing1 2020	DAM/Fixing2 2020
2019	BASE_Y	773%	1657%	787%	1574%
2019	BASE_Q	112%	240%	101%	201%
2019	BASE_M	67%	143%	39%	77%
2019	BASE_W	13%	28%	6%	12%

Relationship between trading volume in PEAK contracts with delivery in 2019-2020 concluded on CFIM/OTF and trading volume on DAM					
Delivery year	Contract length	DAM/Fixing1 2019	DAM/Fixing2 2019	DAM/Fixing1 2020	DAM/Fixing2 2020
2019	PEAK5_Y	100%	214%	109%	219%
2019	PEAK5_Q	14%	29%	9%	19%
2019	PEAK5_M	7%	15%	3%	5%
2019	PEAK5_W	1%	3%	0.3%	0.7%

CONCLUSIONS

Detailed results of the analysis are presented in the introduction (EXECUTIVE SUMMARY - CONCLUSIONS). Although there are no products on the Polish market (except for CFDs in auctions), which can serve as an ideal hedge against price fluctuations on the market dedicated to cross-border electricity exchange, the liquidity and volume of transactions on the OTF market is sufficient to mitigate this risk and adequate to the volume of exchanged energy. However, as the market coupling mechanism expands, it would be advisable to include market to market contracts based on the DAM exchange rate standardized at a single fixing into the catalogue of market products available in Poland.