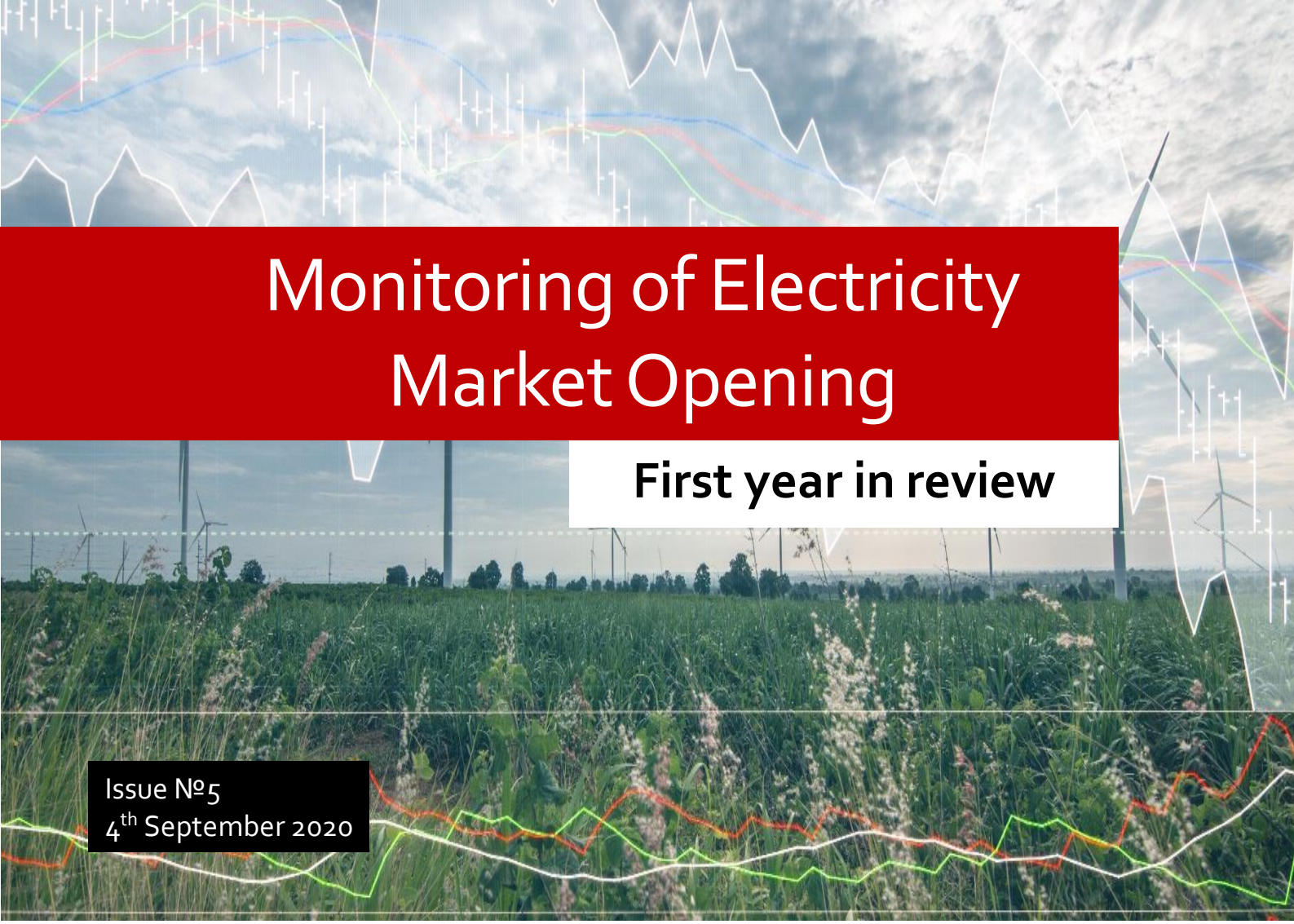

Monitoring of Electricity Market Opening

First year in review

Issue №5
4th September 2020

Ukraine opened its electricity wholesale market on July 1st, 2019.

The Monitor of Electricity Market Opening (MEMO) is an analytical publication series that aims to present key developments in an emerging market.

It is designed to provide professional and independent in-depth analysis of the Ukrainian electricity market.

This independent report was prepared to support the work of the Ministry of Energy of Ukraine.

Low Carbon Ukraine

Implemented by:
Berlin Economics

Supported by:
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

based on a decision of the German Bundestag

Low Carbon Ukraine

Policy advice on low-carbon policies for Ukraine

Low Carbon Ukraine is part of the International Climate Initiative (IKI). The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) supports this initiative on the basis of a decision adopted by the German Bundestag.

All results of the project are available online at www.LowCarbonUkraine.com.

We will be grateful for your feedback on the Monitor of Electricity Market Opening, in particular, comments how to make it even more useful for parties interested in understanding processes and outcomes in the emerging electricity market in Ukraine.

Please get in touch via info@LowCarbonUkraine.com.

This report was prepared in English and Ukrainian languages. In the event of discrepancy between the texts, the English text shall prevail.

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Contents

Glossary

Abbr.	Full name	Details
AS	Ancillary services	Part of the balancing market in the form of reserve services provided to system operator by market participants
BAM	Bilateral agreements market	Non-regulated market segment
BEI	Burshtyn energy island	A trading zone synchronized with the ENTSO-e
BESS	Battery energy storage system	
BM	Balancing market	Last sequence of electricity markets after day-ahead and intraday market
BRP	Balancing responsible party	Every market participant who is responsible for settling imbalances
BSP	Balancing service provider	Market participants providing up/down balancing energy to the TSO
CE	Centrenergo	State-owned generation company that operates coal-and gas-fired TPPs
CHP	Combined heat and power plant	
CMU	The Cabinet of Ministers of Ukraine	
DAM	Day-ahead market	An organized market segment where electricity for the next day is traded
DE	Donbasenergo	Privately-owned generation company that operates Slovianska TPP
DTEK		Largest privately-owned vertically integrated group of companies
DSO	Distribution system operator	
EA	Energoatom	The state-owned single operator of nuclear power plants
EML	Electricity market law	
ESS	Energy storage system	
FCR	Frequency containment reserve	Ancillary service type, primary reserve, normally with activation time of up to 30 seconds
FIT	Feed-in Tariff	Policy mechanism to guarantee fixed remuneration for RES generation to investors
FRR	Frequency restoration reserve	Ancillary service type, secondary reserve (both automatic (aFRR) and manual (mFRR)), normally with activation time of up to 5 minutes
GB	The Guaranteed Buyer	A state-owned enterprise, off-taker of renewable energy and part of PSO
HPP	Hydropower plant	
IDM	Intraday market	An organized market segment where electricity is traded for the current day
IPS	Integrated power system	Ukrainian mainland trading zone, synchronized with Russia
LCU	Low Carbon Ukraine project	
MEU	The Ministry of Energy of Ukraine	
MMS	Market Management System	Software used by UE to operate and manage the balancing market
MO	Market Operator	A state-owned enterprise, operator of day-ahead and intraday market
NEURC	National Commission for State Regulation of Energy and Public Utilities	Energy market regulator
NPP	Nuclear power plant	
OTC	Over-the-counter market	Trading between two parties without the supervision of an exchange
PHES	Pumped hydro energy storage	
PSO	Public service obligations	Obligation imposed on an organization to provide a service of general interest
REMIT	Regulation on wholesale energy market integrity and transparency	
RES	Renewable energy sources	
RR	Replacement reserve	Ancillary service type, tertiary reserve, normally with activation time of up to 15 minutes
SOE	State-owned enterprise	
SOLR	Supplier of Last Resort	
TPP	Thermal power plant	
TSO	Transmission system operator	
UE	Ukrenergo	Ukrainian transmission system operator and operator of a balancing market
UEEX	Ukrainian Energy Exchange	A private company, independent energy commodities exchange
UHE	Ukrhydroenergo	State-owned enterprise, operator of large hydro power plants
USS	Universal Services Supplier	Supplier at regulated prices
WEM	Wholesale electricity market	Comprises BAM, DAM, IDM, BM

Intro

On July 1st, 2019, Ukraine opened its electricity market, shifting from a regulated single-buyer model to competitive liberalised model in line with EU directives. The reform was implemented in the tight timeframe of only 2.5 years – very quick by European standards.

Due to the haste, Ukraine launched its market in a half-baked state, without a comprehensive testing period and without having addressed important pre-requisites for a successful open market, such as:

- the elimination of cross-subsidies on the market,
- the elimination of reasons for debt accumulation,
- the re-financing of old market debt, which is still on the balance sheets of the SOE Energorynok, the single buyer in the previous market model,
- legal unbundling between suppliers and DSOs,
- thoroughly tested market software,
- introduction of an efficient commercial metering system, as well as
- testing and certifying providers of ancillary services.

All IFIs operating in Ukraine, as well as several experts, including the Low Carbon Ukraine project, voiced their concerns about the risks of opening the market prematurely. Nevertheless, the authorities emphasized the market's readiness and opened it as scheduled.

The wholesale market started in a so-called 'safe mode', with many regulations in place to prevent rapid price rises, and to address incumbent actors' market power. However, these regulations were not effective in promoting competition and treated dominant players differently. Key regulations active after the market opening:

- Price caps in the DAM/IDM.
- Price caps in the balancing market and for ancillary services.
- A PSO to supply households with electricity below-market prices, via a state-owned trader, the Guaranteed Buyer.
- DSOs temporarily act as commercial metering operators.
- All state-owned companies, willing to sell power via bilateral agreements, must do so via regulated auctions on a designated exchange.

Participants with market power on both the buyers' and sellers' side had opportunities to exercise market power and occupy bigger shares of the market under effective market rules with existing bid caps and unregulated intra-group activities.

In a functioning market, the key goal of the market design is to provide optimal dispatch levels at minimal cost, while also incentivising sufficient investments and efficient consumption decisions. Competition levels and cost-reflective prices should be indicators of how the market performs. In Ukraine, this is not the case. The regulations revolve around control over prices, thereby merely changing the outcome of the system, but not influencing the market structure itself.

Judging from EU experience electricity market reforms take years to finalise. Ukraine has just started its long way towards a truly liberalised competitive market. The first year after the start of the reform highlighted the main problems and barriers on the way towards an effective competitive structure. Now it is important to develop a long-term strategy on how to make the market work properly and to the benefit of Ukrainian consumers.

This monitoring report covers 12 months after the opening of the wholesale electricity market. We focus on the wholesale market segments; retail is not analysed. The report is based on a comprehensive analysis of the available data and thus contains 66 figures, tables, and charts in total. For readers' convenience, we structured the report in the following way:

- The first part gives a general overview of the market, with an analysis of key metrics and a timeline of legislative framework changes.
- The second part provides a comprehensive review of the main events that occurred during 12 months and key problems remaining in the market.
- The third part focuses on recommendations for improvements and a to-do list for the next twelve months.
- The fourth part comprises an extensive in-depth data analysis, with graphical representation and short narratives about the market performance.

Overview

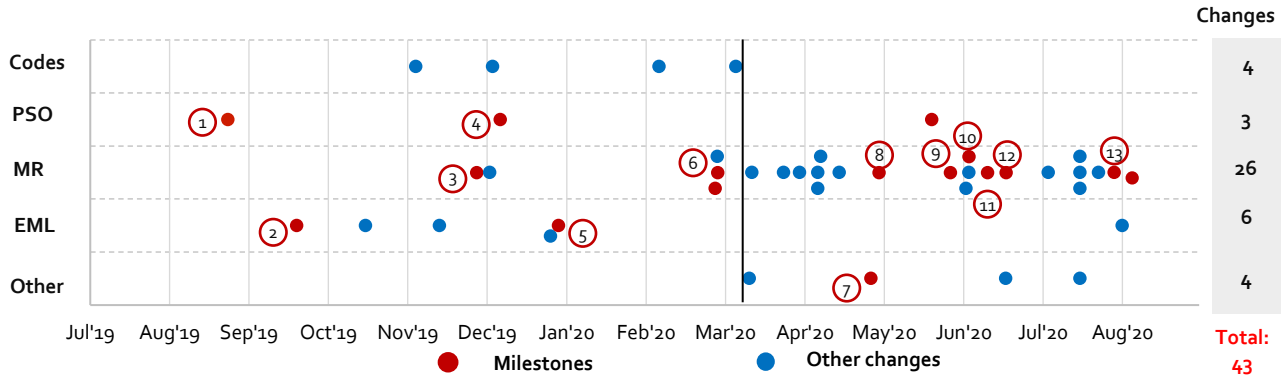
Legal framework development

We highlight significant and minor legislative changes, both primary and secondary, and sort them into five groups (Figure 1):

1. The Law of Ukraine "On the electricity market" (Electricity market law, EML)
2. DAM/IDM, BM and ASM rules (Market rules, MR)
3. Grid Codes (Codes)
4. Public service obligations, households' supply (PSO)
5. Other legislative documents.

Further on, we describe the most significant milestones, listed in chronological order, which per our analysis had the most impact on the market's development.

Figure 1. Changes to the electricity market's legal framework



(1) 29/8/2019 Changes to the PSO

The GB was allowed to bid on the DAM/IDM only at purchasing prices, at 567 and 678 UAH/MWh for nuclear and hydro respectively. This was supposed to limit the GB's market power on the DAM/IDM segments and keep its revenues in check.

Result: The GB's bidding strategy and volumes were disclosed and known to all market participants, who adjusted their bidding strategies accordingly. DAM prices were hardly affected and remained close to price caps.

(2) 24/09/2019 Imports from the East on the BAM

Imports from Russia and Belarus, previously allowed to be sold only on the DAM and BM, were from then on also allowed to be sold via bilateral agreements.

Result: Imports from the East increased only in Nov'19, to 2.4% of the total load. In all other months, they remained below 1%, not affecting the security of supply. A drop of DAM prices in Nov'19 resulted from the increase of supply from nuclear power and a respective increase in the number of low-price bids.

(3) 1/12/2019 Changes to balancing market rules

Initially, BM caps were set as constants. When DAM prices started to drop due to increasing supply from NPPs, BM prices were not viable for BSPs anymore. In response, the minimum price cap on the BM was made dynamic and set at 70% of DAM prices.

Result: DAM prices bounced back up. Total volumes of low-price supply bids on the DAM started to increase. Meanwhile, balancing market activations for downward regulation rose.

(4) 10/12/2019 Changes to the PSO

The GB-specific price cap was set at 75% of the DAM's price cap to lower peak and off-peak prices. A reconciliation procedure over volumes sold to USSs was introduced.

Result: The GB's bidding strategy and volumes remained known to the market. The total volume of mid-price bids during peak hours increased as the GB started to bid at a maximum level of 1,536 UAH/MWh. The off-peak price bounced back to price caps level. Around UAH 3 bln were returned by the USSs to the GB, based on 2019 recalculations of households' declared volumes.

(5) 1/1/2020 Changes to the PSO and EML

The obligation for all generators to sell on the DAM increased from 10 to 15%. Grid operators were obliged to buy power to cover technical losses on the market, not under PSO prices. Also, the PSO for households could now de-facto be financed via the transmission tariff. PSO volumes sold to the GB were linked to the electricity balance forecast, approved by the Ministry of Energy. Imported electricity from Russia was prohibited from being sold via bilaterals and on the IDM.

Result: DAM turnover grew thanks to increased grid operators' and USSs' demand. Linking PSO volumes to the electricity balance forecast again gave away the information about EA's and the GB's volumes on the market, and also pushed them into growing imbalances.

Meanwhile, on the DAM, supply continued to rise and outpaced demand. Therefore, the total volume of low-price bids from traders rapidly increased, especially during off-peak hours, pushing DAM and the resulting imbalance prices down.

(6) 1/3/2020 Changes to BM rules, peak/off-peak hours

DAM/IDM trading during the 8th hour was now capped by the peak-hour price cap. Two imbalance prices were introduced, one for positive and one for negative imbalances. NPPs were now allowed to participate in the BM. All BSPs > 1MW were obliged to bid on the BM. The minimum price cap was set at 55% of the DAM result, and the maximum price cap at 115% of the DAM's price cap. Pricing on the BM was linked to the market's surplus or deficit status.

Result: The regulation loophole which allowed traders to arbitrage between DAM and imbalance prices was closed. Off-peak low-price bids decreased. However, the number of low-price bids increased during peak hours. While the GB was the price-maker on the DAM, it struggled to sell on the DAM, as demand started to drop even before the COVID-19 lockdown. The imbalances volume thus grew. The market design allowed generators to adjust to constant commercial surplus on the market and incentivised them to sell as much as possible via bilateral agreements. We analyse the inefficiencies of the balancing market design further on page 19.

(7) 28/4/2020 Updated electricity balance forecast

The electricity balance forecast was reviewed. EA's output was adjusted to a lower level.

Result: Slight decrease in the total imbalance of the GB, but not for long as DAM demand dropped further. The GB was still unable to pay in full for EA's supply under the PSO, as prices on the DAM went below 1,300 UAH/MWh.

Further changes to the MR are labelled as temporary, only for the duration of the COVID-19 quarantine.

(8) 1/5/2020 Changes to RES bids price (MR)

Before 16/4/20, the GB was obliged to bid all RES on the DAM at the lowest possible price. To keep DAM prices from plummeting, NEURC then allowed the GB to bid RES at 567 UAH/MWh. Later, on 1/5/20 this RES-specific cap was increased to 75% of the DAM price cap (1,536 UAH/MWh during peak hours).

Result: DAM prices bounced back, but only for a couple of weeks. As the GB's bidding strategy was still known to market participants, the volume of low-price bids started to increase in mid-May'20, pushing DAM prices down again.

(9) 28/5/2020 Changes to the PSO and MR

The GB was allowed to sell power under bilateral agreements via auctions. The GB-specific price cap was dropped, and bids at any price were allowed on the organised market segments. Special sessions for EA auctions were introduced, covering 5% of NPP output, only for energy-intensive industries. An increase in the down-regulation BM price cap from 55% to 65% of the DAM price was introduced.

Result: No significant impact on balancing market prices. The GB now entered the OTC segment and could decrease its imbalance. EA could sell to buyers who could pay. The total effect on competition in bilaterals was insignificant.

(10) 4/6/2020 Control over volumes introduced

Generators were restricted from selling more energy on the market than they can produce, based on their available capacity and fuel stock. Similarly, traders now cannot sell on the DAM more than they have bought previously via bilateral agreements.

Result: TPP operators now maintain high stocks of coal. Blocks in cold reserve are not excluded from restrictions. The total amount of bilateral trading and BM arbitrage has not changed. IDM turnover started to grow as it is not accounted for in the methodology.

(11) 11/6/2020 Changes to balancing market rules

The minimum price cap on the BM was increased from 65% to 80% of the DAM price

Result: Balancing market prices rose, leaving less room for BM arbitrage. The volume of low-price bids on the DAM dropped, as BM down-regulation prices were less attractive for TPP's arbitrage.

(12) 18/6/2020 Coal priority dispatch

The CMU recommended the TSO to prioritise coal-fired blocks' dispatch over gas-fired. This is an act of administrative intervention into the market and economic activities of companies.

(13) 29/7/2020 Off-peak price cap increased

Off-peak price cap in the IPS trading zone increased to 60% of the peak-hour price cap, to 1,229 UAH/MWh.

Result: Off-peak prices rose slightly but have remained below the capped level for now.

Conclusions

- Volatile legislation signals that regulations are far from perfect and the market is not ready for new players.
- Changes to the PSO and the balancing market rules had the most impact on the market.
- Changes increased administrative control and offered small patches rather than addressing structural problems.
- Changes were aimed to redistribute financial flows rather than promote competition and decrease barriers for new entrants and smaller players.
- Most changes were introduced as temporary for the time of the COVID-19 quarantine. In fact, most of these changes have little to do with COVID-19 effects and risk to become permanent.

Key market data – IPS and BEI trading zones

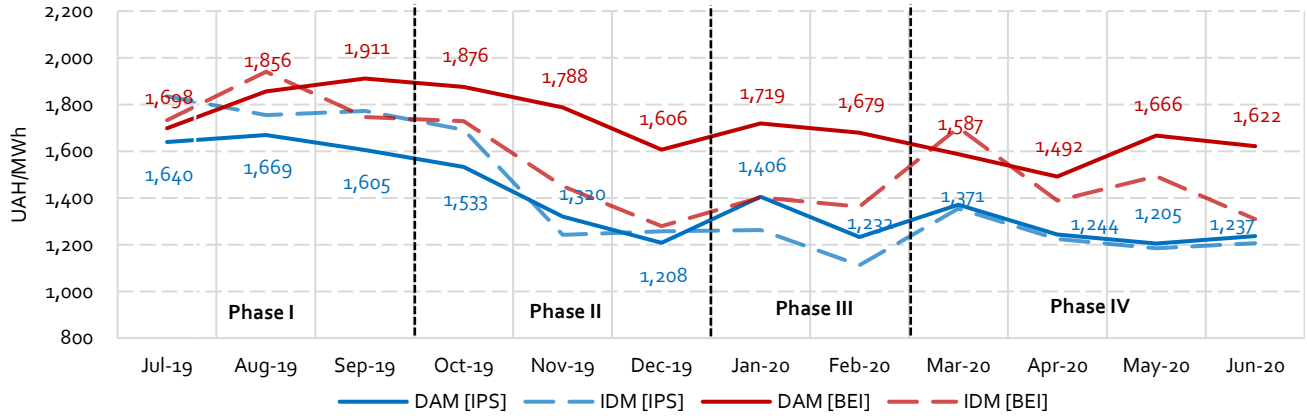
The wholesale electricity market experienced a certain period of stability after the market opening and then went into ongoing turbulence.

For the period covered, our analysis identifies four phases in the wholesale market. Each is described by a set of metrics across organised market segments, giving a comprehensive picture of market reactions.

Key highlights of the market prices development are:

- Prices have been decreasing since the market opening
- The change in DAM prices for 12 months (highest to lowest): -22% in IPS, -15% in BEI.
- BEI price is higher (~25-35%) than in the IPS zone.
- This is due to the market power of a company DTEK, which controls ~90% of generation in the BEI zone.

Figure 2. Average prices dynamics



Source: Market Operator data, LCU calculations

We identify four phases of market development, mostly driven by changes to the PSO and balancing market rules.

	IPS	BEI
Phase I: **Jul-Sep'19**	▪ Stable consumption and NPP load (57%). ▪ Demand and supply on the DAM are closely matched. ▪ Stable high DAM price, IDM price higher than DAM. ▪ Lack of supply on balancing market.	▪ DAM price gradually rises, does not deviate far from bid caps. Stable exercise of market power by DTEK. ▪ DAM trade volumes are dropping. TPP shifts capacities to balancing market, upward regulation volume rises. Import is ~1/3 of total load, does not affect prices.
Phase II: **Oct-Dec'19**	▪ Nuclear load increases to 60% average, most of it goes to the DAM. TPPs do not impact pricing on DAM. ▪ DAM price drops due to NPP supply surplus, IDM price close to DAM. ▪ Changes to balancing market rules. TPPs adjust to surplus on the market – an increase of down activations on balancing market.	▪ Peak DAM price drops, off-peak remains stable. ▪ Import increases to 70% of total load, mostly during peak hours, and contributes to a slight price drop. ▪ DAM demand and supply sometimes exceed total consumption in BEI zone – possibly due to re-sale of imported electricity. ▪ Balancing market activations shrink.
Phase III: **Jan-Feb'20**	▪ DAM price recovers back to levels slightly below Phase I, and then drops and remains volatile. IDM price drops to DAM level. ▪ BM rules' loophole creates arbitrage possibilities and syphons money from the market. Supply bids start outpacing demand bids on DAM, driven by speculative bidding. ▪ EA and GB start selling significant surplus as imbalance at lower prices, debt begins to accumulate.	▪ DAM price rises again, supply exceeds demand during off-peak hours. DAM volumes are rising, while IDM volumes drop to insignificant levels. ▪ Import and export are at the highest levels – possible re-export operations. DTEK secures half of cross-border capacity. Most of the import comes during peak hours when the price differential is the highest. ▪ Burshtyn TPP gradually leaves DAM, selling most of the output via intragroup transactions.
Phase IV: **Mar'20-now**	▪ Introduction of two imbalance prices eliminates arbitrage possibility for traders. Changes to BM rules allow generators to exploit a new arbitrage via downward regulation. ▪ Drop of demand on DAM, partially due to pandemic and due to volumes shifting to other segments. ▪ Prices remain relatively stable, as GB is de-facto a market-maker. Prices deviate from caps 25-30% ▪ EA and GB enter bilateral agreements segment. Significant increase of IDM volumes, IDM price closely follows DAM results.	▪ DAM price drops due to a surplus of supply and stabilizes starting from May. Supply and demand are closely matched in May-June. ▪ Off-peak prices bounce back to price caps. ▪ Downward regulations increase in Mar-Apr, then decrease back following a rise in prices. Upward activations decrease. Imbalance volumes decrease. ▪ Import shrink as demand drops and prices go down. Exports completely stop in May. ▪ IDM trading almost stops. DAM share of the total load is lowest in 12 months.

Data on trading volumes on all market segments are available starting from Jan'20 only.

Highlights in the IPS trading zone:

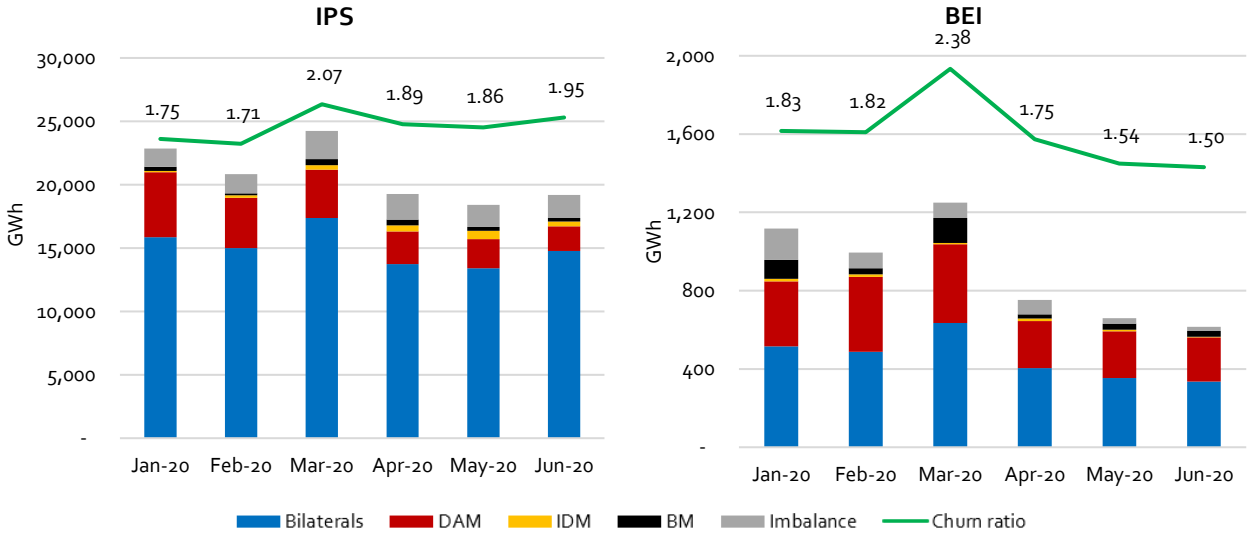
- The DAM decreasing each month, volumes shift to OTC and the IDM.
- The OTC segment, represented by bilateral agreements, dominates in volumes traded.
- IDM turnover increases starting from Mar'20 – possibly due to the GB's growing imbalance.
- A stable high share of positive imbalances starting from Mar'20 – an excess of power that the GB struggles to sell on DAM and IDM, without access to bilateral agreements.
- DAM share is now comparable to positive imbalance volumes – since market players adapt their strategies to constant predictable excess from the GB.
- Churn ratio (traded volumes/total consumption) has jumped since Mar'20, due to a relative increase of the bilateral segment.

Highlights in the BEI trading zone:

- DAM share is relatively stable and comprises around 1/3 of all traded volumes.
- A higher share of the balancing market – as DTEK can shift volumes to this segment and get higher prices.
- OTC share is growing and now comprises more than half of the market.
- IDM volumes are insignificant, no liquidity in this segment. IDM trading occurs mostly during off-peak hours.
- Positive imbalances are decreasing.
- Churn ratio has also jumped since Mar'20, due to a relative increase of the bilateral segment. But later dropped in May'20.

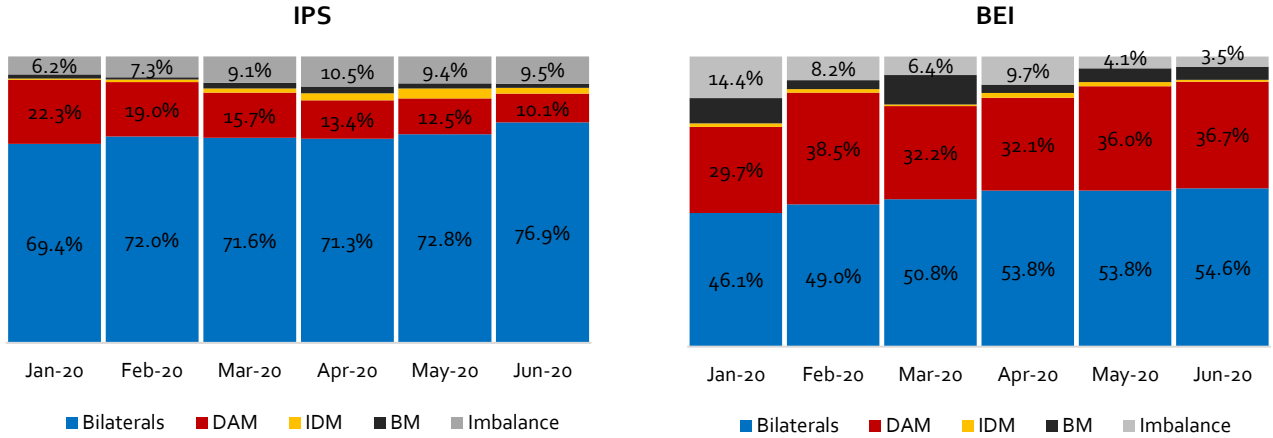
After the first 12 months of the market, the liquidity of the organised wholesale segments is the lowest on record in both IPS and BEI trading zones.

Figure 3. Electricity sold per market segments



Source: Ukrenergo, Market Operator data, LCU calculations

Figure 4. Distribution of electricity sold between market segments



Source: Ukrenergo, Market Operator data, LCU calculations

Final electricity prices increased right after the market opening – due to a rise in energy prices. +15% for 1 class DSO connections, +9% for 2 class in the IPS, and +22% for 1 class, +14% for 2 class in the BEI.

The increased energy prices in Q3 2020 were caused by two main reasons:

- Relatively high peak price caps, above marginal costs of thermal coal-fired power plants.
- The exercise of market power by dominant players by bidding at the maximum price cap and closely matching supply and demand levels on the DAM.

In Q4 2019, the final prices decreased slightly but were still higher than pre-reform levels. This was due to decreasing RES support, resulting from a recalculation of the TSO tariff. The initial calculation contained an error in transmission volumes.

In Jan'20, grid charges, mostly from DSOs, increased significantly, and the NEURC adopted a dispatch tariff with a deficit of RES support financing. Wholesale prices continued to decline, yet the price decrease in the IPS was larger than in the BEI.

The resulting final electricity price in the IPS in Q1-Q2 2020 was kept comparable to pre-reform levels, and even lower for 1-class consumers – mostly thanks to a deficit in RES support financing. In the BEI, electricity prices were higher due to higher energy component prices, because of monopolistic market structures, and higher average DSO tariffs.

The estimated final prices including the missing RES support, which would be sufficient to finance RES without accumulating debt, would have been comparable to pre-market-opening prices in the IPS and 17% higher in the BEI. The decreased energy component in IPS (2-10%) has been 'balanced' by the increase of DSO tariffs (50-80%).

Figure 5. Estimated final electricity price (w/o taxes), 1-class consumers (at DSO connection >27.5kV)

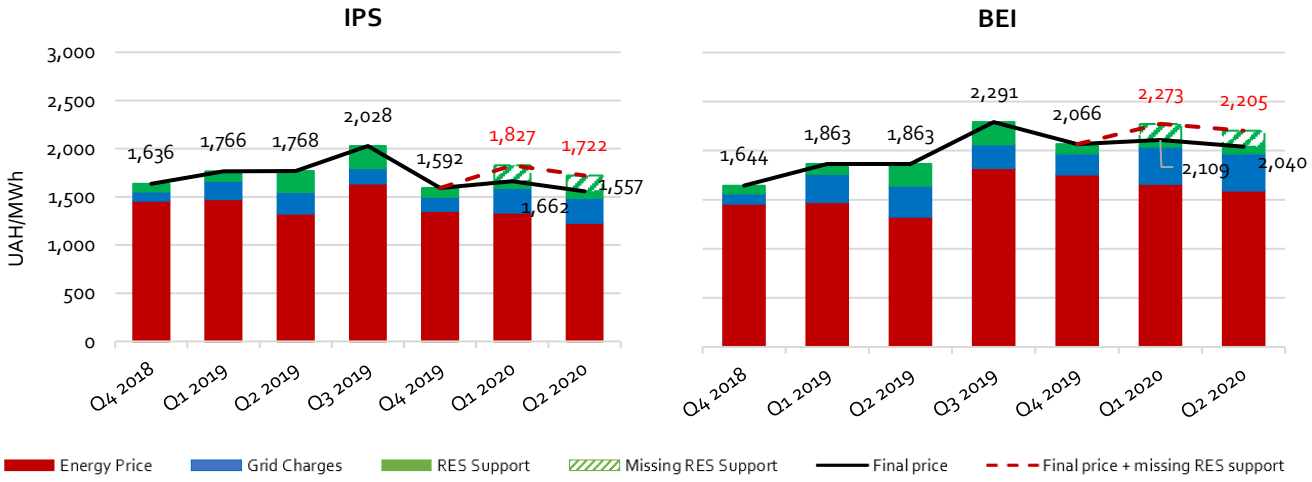
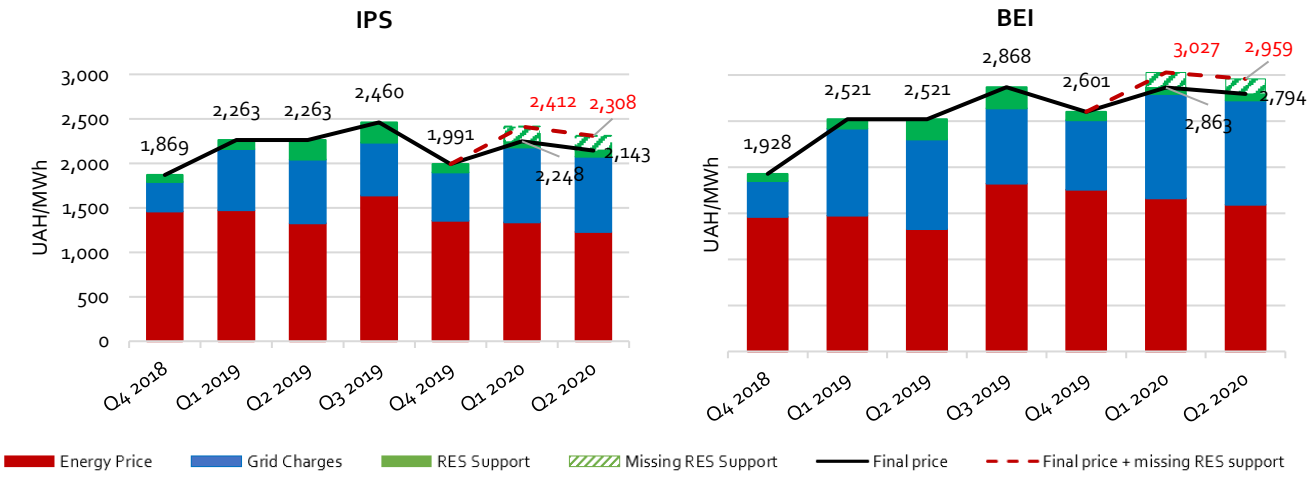


Figure 6. Estimated final electricity price (w/o taxes), 2-class consumers (at DSO connection <27.5kV)



Source: Market Operator, NEURC data, LCU calculations

- The final price increased after the market opening and decreased back to pre-market opening levels in Q2 2020.
- BEI final electricity prices are 30-31% higher than in the IPS (+28% if missing RES support is accounted for).
- DSO tariffs contributed the most to price increases.

Market Transparency

Transparency is important for all stakeholders on the market. For authorities – to closely monitor market development and safeguard competition. For market players – to evaluate competitor's behaviour and to adjust their strategies. For potential newcomers – to access whether the new market is worth investing into. The more transparent a market, the more effective competition is, and consumers get the best value in the services provided.

In this section, LCU focuses on the assessment of data disclosure according to the Ukrainian legislation. We do not assess gaps in data compared to the best market practices.

Disclosure of information on the Ukrainian electricity market is regulated by several documents, such as the electricity market law and respective market rules. Other regulatory documents include:

- The CMU decree #768-p of 27/09/2017 on implementation of EU Regulation No 543/2013 of 14 June 2013 on submission and publication of data in the electricity market.
- NEURC decree #459 on 19.06.2018 to meet the EU Regulation on market transparency using the ENTSO-E transparency platform.

Figure 7. Transparency of market data

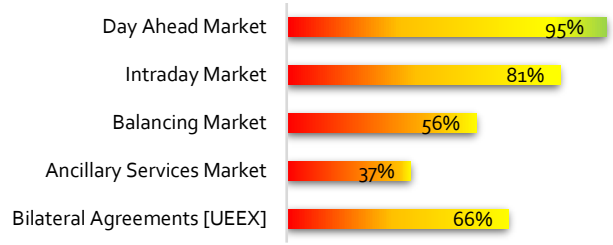
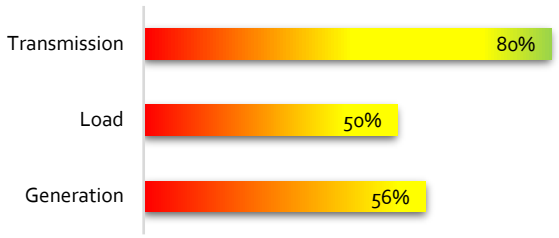


Figure 8. Transparency of system data



Source: LCU methodology and assessment

The DAM is Ukraine´s most transparent market segment. Data is published regularly, and regular reporting is in place. "Black boxes" are non-accepted block bids on the DAM, which are not published on supply-demand curves.

The BM market segment is less transparent. Data is published with a significant time lag and seems to be prepared and published manually. Imbalance volumes are published only starting from Jan'20. UE recalculated and re-published balancing market results starting from Jun'19 retrospectively in Jun'20, without notification.

The AS segment is the least transparent one. Market prices are not publicly available, aggregated contracted volumes are published with daily granularity only and without further details.

The BM´s and AS market´s lack of transparency is partially caused by delayed implementation of the Market Management System software. The MMS v.2 was implemented almost a year after market opening but still is not fully operational though. The NEURC calls for a software audit.

The data on OTC trading is available only from the UEEX platform, a designated exchange for SOE bilateral contracts trading. The data published there is regulated by the Ministry of Energy. It does provide sufficient information on prices and trades, yet it is hard to navigate and searching for data is painstaking. The historical data on volumes on the bilateral agreements segment is still not made available to the public by UE.

Furthermore, the system data quality is lagging. Transmission data is sufficient on cross-border trading, but not much is known for internal grid operation. Generation and load data are highly aggregated and sometimes are not presented correctly. In July 2020 NEURC approved a manual on data publication on ENTSO-E´s transparency platform. Starting from Sep'20 all market participants will be obliged to upload data on ENTSO-E´s platform. The control over the quality of this data is yet to be implemented.

In Mar'20, a EU4Energy Governance project was launched to assist Ukraine in the transposition of Regulation (EU) 1227/2011 on wholesale energy market integrity and transparency (REMIT) into Ukrainian legislation. REMIT regulation is still not implemented in Ukraine.

Conclusions

- There is a substantial improvement in data disclosure compared to the previous market model.
- Market data transparency significantly increased, but some segments are still obscure after 12 months of market operation.
- Ukrenergo is struggling, most likely due to a lag with MMS development and implementation.
- System data is less transparent and harder to use compared to market data.
- Important data disclosure standards and regulations are still not adopted, after all deadlines were missed.

Main problems of the market design

The inefficiency of the price caps design

The system of price caps was established across different market segments at the beginning of the market opening to keep prices from skyrocketing. Besides market-wide price caps, applicable to all participants on organised market segments, the authorities imposed some specific caps for individual market actors as well (see Table A).

The min-max price caps for DAM/IDM were derived from 1H 2020 market results under the single-buyer model. They do not represent an economics-based estimation of marginal costs but rather reflect the administration's historic cost-plus pricing approach from the previous market.

Specific bid caps for the GB, and renewable energy marketed by the GB as a single off-taker, distort the market even more. Combined with the GB dilemma which we describe on page 15, they provide information about the bidding behaviour of the biggest player. This allows other participants to adjust and bid close to price caps.

The regulations in place are focused on controlling prices across market segments reminiscent of the single-buyer market model. Since state-owned companies are the ones under strict administrative regulations, they are affected the most.

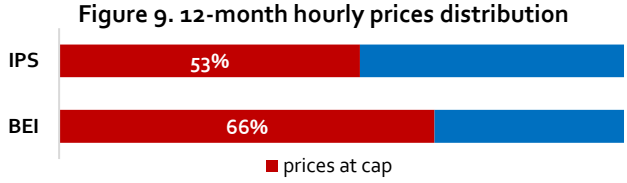
Table A. Price caps effective in the Ukrainian electricity market

	in UAH/MWh	From Aug'19	From Dec'19	From Mar'20	From Aug'20
DAM/IDM	Peak	2,048	2,048	2,048	2,048
	Off-peak	959	959	959	IPS: 1,229; BEI: 959
BM	Min	815	70% DAM price	55% DAM price	80% DAM price
	Max	2,355	115% DAM price	2,355	2,150
Ancillary services (UAH/MW)	Up	1143	1143	499	512
	Down	258	258	282	289
GB on DAM/IDM	power from EA/UHE (max)	567 nuclear/674 hydro	1,536	1,536	2,048
	RES (max)	10	10	10	2,048
PSO households: sale to the GB	EA	567, 90% of output	567, 90% of output	567, 85% of output	10, ≈ 40-50% of output
	UHE	674, 35% of output	674, 35% of output	674, 35% of output	10, 30% of output

LCU analysis shows that the price caps were efficient in keeping the prices from increasing rapidly. However, they also distorted the market as they affected the market participants' behaviour.

More specifically, the imposed caps dictated most market prices (Figure 9). This stems from the fact that in contrast to other EU markets, the Ukrainian electricity prices are products of market power exercise, only limited by price caps (Figure 25, page 29 and Figure 43, page 35 in Annex).

Figure 9. 12-month hourly prices distribution



Source: Market Operator data, LCU calculations

The market power in Ukraine arises from two main factors:

- In a highly concentrated market, the few existing players can easily exercise their market power.
- Less regulated players have an advantage over the biggest market players (EA and the GB) since the latter must disclose information about their strategies, due to imposed regulations such as the PSO for households.

On the BM, the minimum price cap is linked to the DAM result. This interlinked system of caps allowed market players to manipulate DAM prices to exploit regulatory deficiencies. We discuss this on page 19.

Deviations of DAM prices from the capped level had two main reasons. First, since the BM's price caps hinges on the DAM price, market players placed their bids strategically to drive up the DAM price and thus the BM price, instead of applying an economic or competitive rationale. The second reason for price changes on the DAM was the increased generation of renewables in Apr'20.

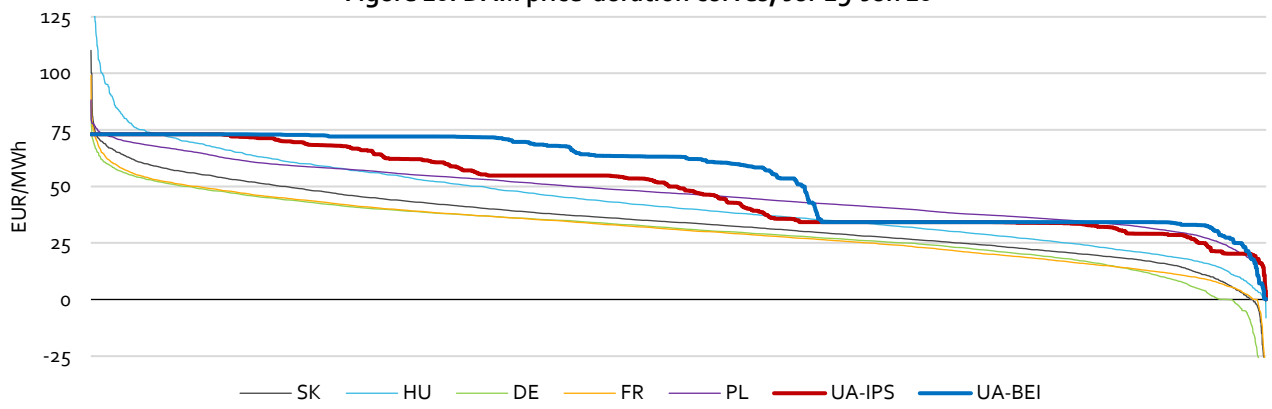
Dropping DAM prices hit the GB hard, due to the GB dilemma, which we describe on page 15. The regulator thus took a drastic measure and allowed the GB, who markets all the renewable energy on the market, to bid renewable energy at any price, cancelling the 10 UAH/MWh cap.

This change has effectively cancelled the potential of RES to decrease market prices. Currently, the GB is still a price-maker on the DAM and bids at the highest prices. Therefore, daytime prices in most cases remain high and do not follow the increase of renewable energy supply. This undermines the market logic and is an illustration of the artificial market power of the Guaranteed Buyer.

Figure 10 shows price-duration curves – hourly prices sorted in descending order. Price-duration curves give a visual representation of market performance. In contrast to European markets, the Ukrainian day-ahead market shows the following inefficiencies:

1. Flat horizontal parts of the curves represent prices close or equal to price caps – they dominate Ukrainian market results.
2. For most of the time, prices in Ukraine are significantly higher than in EU markets, both with and without capacity markets in place.
3. Prices close to caps show there is hardly a competition in the market. Market players adjust behaviour and bid close to caps.
4. There are no scarcity prices in Ukraine. EU markets allow scarcity pricing to occur and send a signal to investors.

Figure 10. DAM price-duration curves, Jul-19-Jun'20



Source: ENTSO-e transparency platform, Market Operator, LCU calculations

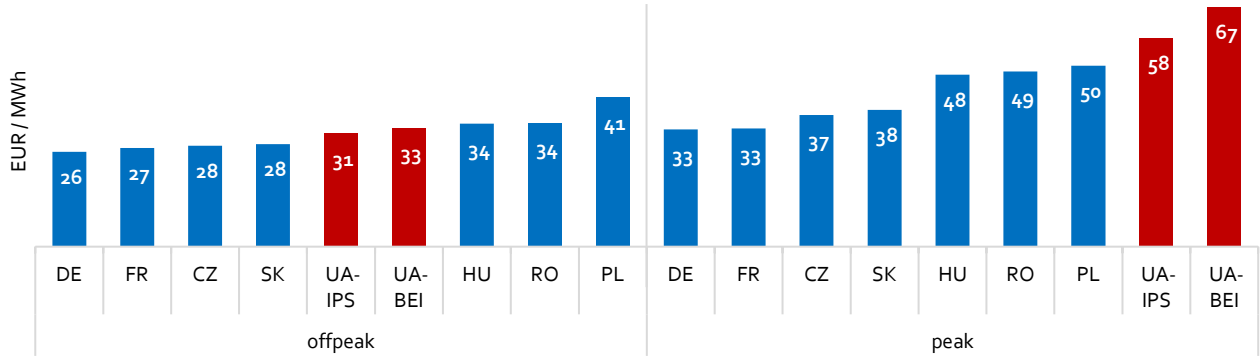
Scarcity prices are the ones significantly higher than average and occurring for a limited number of hours throughout the year, up to 3-5%. They represent hours where demand is the highest and inform about potential room for investment.

These high peak prices are perfect for flexibility services providers, like storage centres and gas peakers. They would be able to recover their capital costs during scarcity events, although operating only during a limited number of hours.

Ukraine's price caps, therefore, do not provide an incentive for new flexibility service providers to invest. At the same time, they allow incumbent players to exercise their market power and achieve higher revenues than they would get in a competitive market.

Resulting off-peak prices in Ukraine are on par with European prices only due to negative prices occurring in the EU. Peak prices in UA are the highest in Europe: UA-BEI price levels are twice as high as German day-ahead ones.

Figure 11. Average DAM prices in European countries, Jul-19-Jun'20



Source: ENTSO-e transparency platform, Market Operator, LCU calculations

Conclusions

- Price caps are designed to limit the revenue of dominant players, not to limit their market power.
- Price caps are efficient in limiting the prices at certain level; however, resulting average prices are higher than on EU markets.
- There is no real competition on the market. High market concentration allowed all market players to adjust.
- Price caps do not reflect scarcity – and therefore inefficiently shape demand patterns.
- Existing market-wide bid caps hamper long-term investment signals.
- An increase of price caps without addressing the market power beforehand would likely cause prices to increase.

Design of the PSO for households

Since the market opening, two PSOs permeate Ukraine's electricity market: (1) electricity supply to households at a regulated price below market levels, and (2) a support scheme for RES.

The GB acts as a manager for both these public service obligations on the market. According to the Law, GB activities are financed its activities via the TSO transmission tariff.

Since the market opening, the PSO for households forced EA and UHE to supply part of their output to the GB at a regulated price, close to the cost of production. Then the GB sells this power to USSs, which deliver the power to households, at even lower cost.

The current final price for households comprises two components: firstly, households buy the first 100 kWh per month at a price that does not cover the full cost. Secondly, they receive any amount beyond these 100 kWh at a price that hardly covers the cost of power under the PSO. This pricing is uniform for all households, regardless of income levels and consumption volumes.

Such a PSO design is not compatible with the Law of Ukraine "On the electricity market" and creates significant distortions on the market.

Ukraine's unjust subsidy system violates the Law

Prices for households, therefore, do not cover the full cost of generation and delivery of power to households. Since industrial customers pay higher prices, the current PSO design also de-facto keeps cross-subsidisation in place. The EML proposed as a solution for this problem that losses generated under PSOs for both RES support and for households' supply could be financed via higher transmission tariffs.

The Law requires the definition of vulnerable consumers to be set by the CMU. De-facto vulnerable consumers are identified in the current legislation as households and consumers with a connection point <150 kW. However, the legislation does not clearly define the meaning of 'vulnerability'. De-facto declaring everyone as vulnerable whose connection to the grid is below 150 kW is at least. questionable. A thorough definition would be guided by electricity consumption profiles per income and already existing other poverty indicators.

Electricity expenses are for example already part of the established state welfare system, along with other utility expenses. This welfare system design is linked to households' income and provides a direct monetary subsidy. An increase of the electricity bill beyond a defined income share will be covered by the state, addressing the energy poverty concerns related to an increase in tariffs to a cost-recovering level.

The design allows volume manipulations from USS-DSOs

USSs without complete ownership unbundling from DSOs and who are designated suppliers to households under the PSO have exclusive access to electricity below market prices. They may use this privilege to gain windfall profits by reporting higher consumption than actually occurs. The control over volumes declared by the USS and reported by commercial metering operators, therefore, remains an issue, as DSOs are performing this role temporarily.

Without a strict audit over the volumes consumed, hourly or at least regular metering, or until an independent metering administrator is in place, the DSOs always can manipulate and overestimate its volumes to gain an advantage in the form of access to cheap electricity bought under the PSO.

Artificial limits to competition (effects on BAM, DAM)

The initial design of the PSO envisaged that EA supplies to the GB more than households consume, and the GB markets the excess on organised market segments. EA was thus de-facto blocked from the bilateral agreements segment. Thermal generators, not constrained by any limitation and facing no competition from the country´s biggest generator, therefore now dominate the bilaterals segment.

EA then unilaterally decided to violate its obligations in Mar-Apr'20 and started to sell less power to the GB due to accumulating debt. A special auctions' sessions were introduced for EA for up to 5% of its output in Jun'20. However, this translates into only roughly 2.5% of overall output in the country vs 25% for thermal generation. This is not enough to shake up the market power of private thermal producers on the OTC market. We review market power in different segments in detail on page 16.

Financially non-sustainable design

The initial PSO design allowed the GB to profit from the sale of excess power on the market. This was possible only under conditions when the wholesale market price was relatively high. Starting from 2020, and due to market conditions partly induced by the PSO design itself, the GB was incurring losses by supplying power for households. It now owes both EA and UHE large amounts of money.

To stop this debt accumulation, a so-called transitional PSO was adopted on 5/08/20. Now EA sells to the GB only volumes required for household consumption, at 10 UAH/MWh. This design may stop debt from piling up further, yet the GB still needs to find a way to finance its old debt.

LCU estimations show that the PSO for households in 2020 requires around UAH 7 bln to cover the GB's losses. These expenses were not foreseen in the TSO tariff for 2020, and are in addition to a total of UAH 27 bln required to finance the support for RES. We estimate the total financing deficit of the GB at UAH 23.3 bln for 2020, accounting for all recent legislative changes.

On the other side, the GB is also obliged to supply power to USS in the BEI, which is a separate trading zone, where EA and UHE have no generation capacities. The GB is forced to buy power at higher prices in BEI markets, where DTEK's generation monopoly keeps them high. At the same time, DTEK is not part of the PSO in BEI. The current design therefore effectively allows subsidisation of a monopolist by consumers.

Households' tariffs are not cost-reflective

Current households' tariffs, which are a product of a previous market model, do not cover the total cost, which should comprise the cost of both power and its delivery to customers. In 12 out of 25 regions the cost of delivery (distribution and transmission) already exceeds the average regulated price for households.

In an updated PSO design, the pricing methodology between the GB and USSs remains unchanged. Losses, incurred by USSs while supplying power to households, will still be covered by the GB. This is possible if the TSO transmission tariff remains unchanged.

If the transmission tariff surpasses 290 UAH/MWh, even under the updated PSO the GB will start making losses on supply to households and will require additional financing. Additionally, according to LCU estimations, stable financing of the renewable energy support would have required a transmission tariff of 320 UAH/MWh starting from Jan'20, or 410 UAH/MWh from Aug'20 to finance 2H 2020 of RES support, without addressing accumulated debt. The effective PSO design is not financially sustainable at the current level of households' tariffs.

"Transitional PSO" adopted in Aug'20

As stated above, EA and UHE are now selling their power to GB for households' supply at 10 UAH/MWh. The PSO has also introduced a "safety measure" against state generators making losses. EA and UHE now must ensure that the average selling price of all their electricity portfolio must be not less than their operational cost of production. This is de-facto a minimum price cap for state-owned generators. Based on available data for 2020, this equals to 950-1000 UAH/MWh for EA and 725-750 UAH/MWh for UHE. Additionally, this threshold will depend on the following factors:

- For EA, the higher the households' consumption – the higher the minimum cap.
- For both EA and UHE, the higher the overall consumption, the lower the minimum cap.

The problems with such design are:

- The minimum price cap limits EA' and UHE's competitive advantage on bilateral agreements segment and provides information to competitors.
- Puts UHE in a better competitive position against EA.
- May lead to a higher average price on the market.

The Guaranteed Buyer's dilemma

The effective PSO mechanism in place further distorts decision-making processes and forces policymakers into manual regulation and balancing. By design of the PSO for households, if TSO transmission tariffs are increased, the GB incurs additional losses. Similarly, if the market price goes down, GB revenues are falling.

While in 2H 2019 GB was making a profit on the PSO for households' activities, due to the market conditions in 2020 it is now making a stable loss.

Nonetheless, the Regulator is reluctant to increase TSO transmission tariffs further since this would raise the market prices and final prices for consumers consequently. This imposes limitations on the financing of GB activities as GB may get sufficient funding for all PSO activities in case of TSO tariff increase.

The GB dilemma is that the consumers' and the regulator's goals are contrary to the requirements of the PSO design. This dilemma forces the policymakers to manually balance the financial flows in the market. It also incentivises manual price regulation via the system of price caps. This undermines the whole purpose of the free market and violates its principles.

The manual control over electricity volumes and flows proved to be ineffective and distorted the market.

Conclusions

The current PSO design is not compatible with a liberalised market model, violates the EU acquis and is a large source of distortions:

- It creates room for manipulations for DSOs and USSs within one vertically integrated group, granting them limited exclusive access to cheap electricity and a competitive advantage over other suppliers.
- It distorts policy decision-making, pushing the administration towards price regulations.
- It limits competition across different market segments.
- It gives an advantage to market players not under PSO and allows for strategic bidding and arbitrage across market segments.

Market power goes unchecked

Market power is the ability of a company or group of companies to affect market prices consistently for many hours. It refers not only to the market in general but can also be exercised across several market segments, e.g. on both the demand and supply side.

The exercise of market power typically entails economically or physically withholding some supply from the market to raise the price at which the remaining supply is sold.

- Economic withholding: to offer a portion of or all available capacity at a high price so that it is not scheduled.
- Physical withholding: to withhold a portion of or all available capacity instead of offering it on the market.

The exercise of market power can also impact the market price through the submission of:

- high offer prices and/or restrictive operating parameters intended to raise the price of energy or reserves,
- low offer prices and/or operating parameters intended to lower the price of energy.

The exercise of significant market power reduces economic efficiency because prices under market power do not reflect marginal costs, resulting in inefficient outcomes in both the short and long-run. Furthermore, wealth transfers from the exercise of market power would contradict the premise of introducing competition into Ukraine's electricity market.

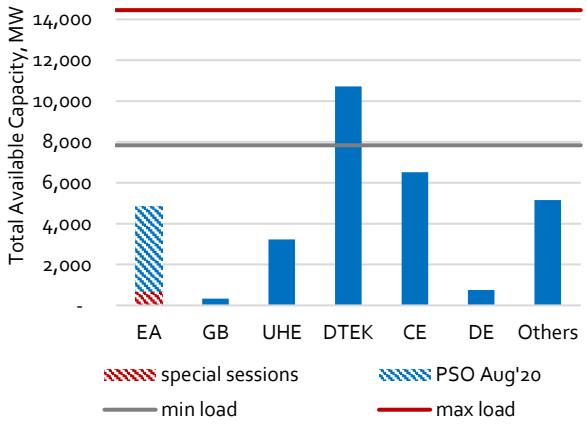
Ukraine's electricity market is highly concentrated, with the four biggest generators, EA, UHE, DTEK and CE covering around 85% of the country's electricity output. However, existing anti-monopoly measures to protect consumers from these incumbents' market power lack stringency.

As already discussed in the PSO chapter on page 14, the initial PSO design significantly limited competition on the bilateral agreements segment and enhanced private companies' power. For instance, Energoatom's power on this segment was limited by the PSO, but the power of DTEK remained unaddressed (Figure 12).

DTEK controls large shares in most IPS market segments:

- it dominates the bilaterals market,
- controls around 40% of retail (estimate based on NEURC reports),
- and can influence market price in the DAM by shifting away demand volumes via intragroup trading (see page 20).
- controls 43% of distribution via the 7 of 32 DSOs in Ukraine.

Figure 12. Market concentration on the bilateral agreements segment



Source: Ukrenergo data, LCU calculations

After the changes to the PSO in Aug'20, EA was allowed to increase its supply to bilateral agreements segment. However, the implemented cost safeguard imposes a minimum price the EA can sell power at thus limiting their competitive position.

Market structure in the BEI trading zone represents a case of a classical monopoly, where a single generator, the Burshtyn power plant owned by DTEK, can cover the whole demand, only contested by the priority dispatch of RES and CHP. Besides, DTEK can exercise market power on cross-border allocation auctions and influence the import-export volumes. We discuss this in detail on page 18.

No specific regulations were imposed on DTEK in the BEI trading zone since the market opening, besides market-wide price caps, which are above its marginal costs of production. DTEK exercises its power via:

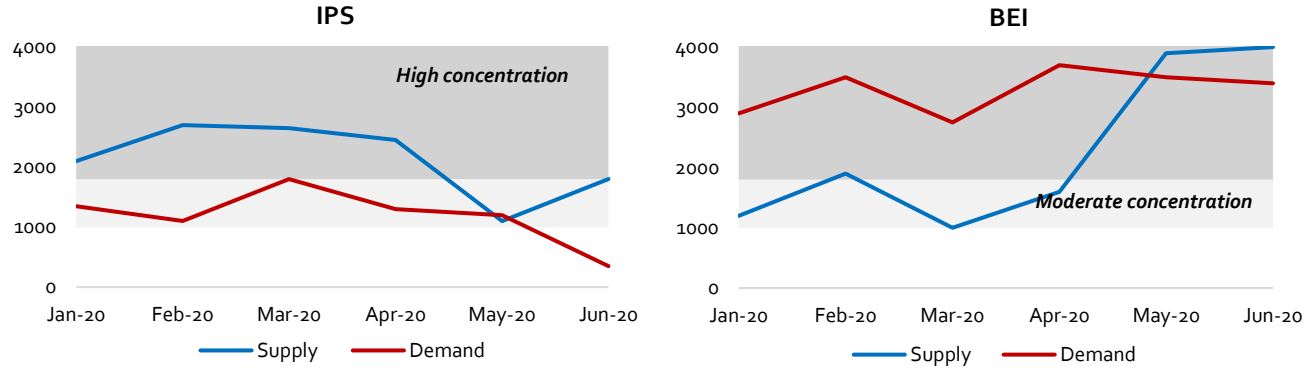
- control over cross-border allocations,
- limitations to import volumes due to reserves requirements,
- intragroup trading to related suppliers,
- bidding at highest possible prices, and
- withholding volumes from the DAM and shifting to the BM (which features higher price caps).

Regulations dictate DAM supply. All generators are obliged to bid 15% (10% before Jan'20) of their output on the DAM. Additionally, during the first 12 months of the liberalised market GB was allowed to sell only on organised segments and excluded from the bilaterals market. Artificial limits to the competition on the DAM thus encouraged non-regulated players to shift their sales to bilaterals, where they faced no competition from EA.

As a result of these regulations, the GB has been granted market power on DAM. Combined with the effects of the GB dilemma and specific price caps, the information on GB's volumes and bidding strategy became transparent. Due to the balancing market loopholes (see page 19), this allowed other market participants to manipulate DAM and BM prices via strategic bidding.

Herfindahl-Hirschman Index (HHI) on DAM, reported by the Market Operator, show a high concentration of supply and moderate concentration on the demand side in IPS. In contrast, the BEI concentration of supply was lower than in IPS until import stopped. Demand in BEI remains highly concentrated (Figure 13).

Figure 13. HHI market concentration index on DAM



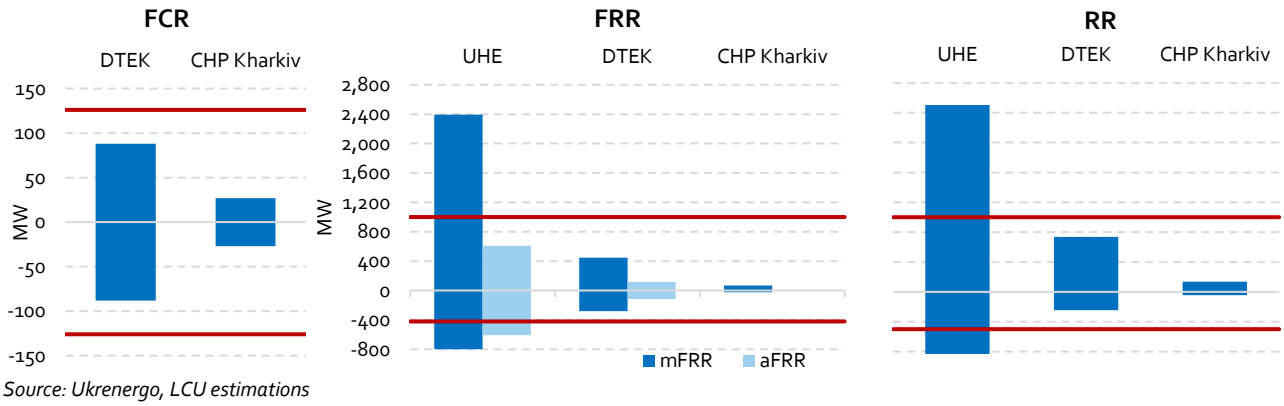
Source: Market Operator

The ancillary services market has effectively started in Apr'20. Meanwhile, the certification of service providers is still ongoing. At the date of this report, the total supply of services is sufficient for FRR and RR, while FCR supply is not yet sufficient to cover the demand in the IPS trading zone. Further certification is expected to add to the total supply. FCR supply will remain mostly in DTEK's hands, as Ukraine's large hydro plants are not capable of providing FCR services at the moment.

The ancillary services segment is now dominated by two players only: UHE and DTEK. Due to the lack of competition, the regulator has thus capped prices in the ASM. These caps might deter new suppliers from entering the market.

Unfortunately, we were not able to analyse the concentration on the balancing market due to a lack of data.

Figure 14. Market concentration in separate ancillary services products [IPS]



Source: Ukrenergo, LCU estimations

Conclusions

- The Ukrainian electricity market is highly concentrated and resembles an oligopoly structure.
- Market power is not evenly addressed by regulations, affecting only state-owned enterprises.
- Information disclosed because of regulations allowed unburdened market participants to adjust their strategy.
- RES do not increase the competition level as they are exclusively marketed by a single state-owned off-taker.
- Vertically integrated DTEK is able to exercise market power across different market segments, with the possibility to influence both demand and supply.
- In the BEI trading zone, the market power is obvious yet not addressed by regulations.

Cross-border trading limitations

The IPS trading zone is big enough to sustain competition from Russia and Belarus. However, the matter of imports from Russia and Belarus lies in the political realm. Imports from Russia is not allowed via bilateral agreements. Starting from Apr'20, any imports from the eastern neighbours are banned.

From an economic standpoint, a limited share of import would introduce welcomed competitive pressure on the market. This is strongly opposed by dominant players. As data analysis shows, the active criticism of import from Russia began in Nov'19, after DTEK failed to secure a significant share of cross-border allocation (Figure 38 in Annex, page 33).

Historical data shows that import from Russia and Belarus had no impact on Ukraine's security of supply (Figure 37 in Annex, page 33).

Meanwhile, in the **BEI trading zone,** the import did have an impact on prices. The prices started to decrease in Oct'19 when imports rose. During this period, the importers' structure was diverse enough to decrease market concentration and push down prices.

Our analysis identified some irregularities in BEI trading:

- Supply and demand on the DAM exceed the total demand in the zone (Figure 44 in Annex, page 35).
- Increasing imports from Slovakia coincide with increasing exports to Romania (Figures 55, 56 in Annex, page 39).

We believe that the DAM in BEI might be used to trade electricity for re-export. However, the resulting DAM price is higher than in any neighbouring market. Potential explanations could be tax optimisation schemes or shifting and registering profits in other jurisdictions.

Starting from Jan'20, the monthly auctions for capacities with Slovakia and Romania were opened. Yearly auctions were conducted neither in 2019 nor in 2020. DTEK managed to secure >50% of cross-border capacities (Figure 57, 58 in Annex, page 40). It allowed exercising its market power and block import by not using the allocated capacities. Therefore, in contrast to a stable decrease from Oct'19, DAM price bounced back in Jan'20.

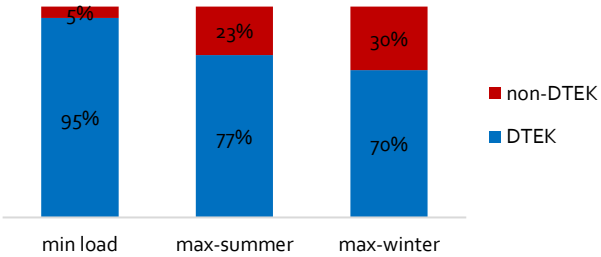
In Apr'20 NEURC updated the rules for cross-border capacity allocation. A "use it or lose it" principle for daily cross-border allocations, and "use it or sell it" – for longer-term auctions was introduced effective from Oct'20. The maximum allocated capacity to one company or a group of affiliated companies was set at 50% of the maximum volume starting from Apr'20. However, LCU identified a potentially DTEK related company, PeakUkrResource, that transfers allocated capacities to DTEK, which is seen on UE's auction platform. The resulting the joint share of DTEK in May'20 reached 68%. As exports from the BEI stopped in May'20, the DAM price increased because of an almost complete halt of imports.

BEI cross-border trading is limited by the following restrictions:

- The amount of import directly depends on the amount of export: Imp - Exp <= 650 MW. In most cases, exports from BEI is controlled by DTEK, which owns the biggest TPP there.
- Security of supply reserve requirements, which result in 2-3 blocks of Bursthyn TPP (depending on load) being always online. UE always requires a minimum of 3 blocks with 410 MW load to meet reserve requirements.
- Given the reserve requirements, the allowed import may be up to 50 MW at off-peak, zero during daytime minimum and up to 260 MW during peaks.
- The allowed import, after cross-border capacities are allocated on auctions, is then adjusted proportionally for all importers according to residual demand (total demand minus reserve requirements).

LCU estimated the potential DTEK share in BEI demand coverage given the limitation above and if the export is zero. In the case of DTEK buying 50% of import capacities, whether used or covered by TPP generation, the total share of DTEK in BEI varies from 70% during max demand to 95% during min demand (Figure 15). If related parties' capacity transfers are included, these shares may increase even more.

Figure 15. Potential coverage of BEI demand



Source: LCU calculations

Conclusions

- In the IPS, imports from Russia are political matter and are now banned. From an economic standpoint, the competition from Russian and Belarus imports can be effective reduce incumbents' market power provided Ukraine's security of supply is not threatened.
- In the BEI, due to the small size of the trading zone, imposed balancing restrictions and still developing cross-border auctions rules, DTEK manages to exercise its market power and covers more than 70% of demand.
- For some time, demand and supply in the DAM exceeded the BEI's total load. This may be connected to re-export activities and may indicate tax optimisation schemes or profits being shifted to other jurisdictions.

Market design encourages gaming/strategic bidding

The role of the balancing market is to balance as closely as possible production and consumption before energy delivery and to minimize the balancing cost. LCU analysis shows that the BM in Ukraine deviates from this function and is used in a ploy of strategic bidding.

At the time of market opening, the Ukrainian BM design was based on a single imbalance price and fixed price caps (as % from DAM caps). The supply was scarce, yet prices were stable. However, the downward regulation price, which BSPs pay to reduce their output, was not economically attractive (see Figure 28, page 30).

In Nov'19, the DAM price dropped below the minimum BM cap. Several changes to the BM rules followed, effective from Dec'19. New provisions aimed at:

- increase of supply on the market via compulsory participation for generators >20 MW (except for CHP) and minimum supply requirements for BSPs,
- changes to price caps, linking them to DAM prices, instead of fixed DAM caps.

These changes resulted in increased supply on the BM, mostly in upward regulation, and a drop in BM prices. Meanwhile, on the DAM, prices went down. BM downward-regulation prices plummeted below marginal costs of thermal generators. As a result, the imbalance price dropped below the DAM price.

This has opened the first BM loophole. Market participants could bid low on DAM, force the price down and sell power cheap. Their resulting negative imbalance (power sold minus power bought) is then cleared at a single imbalance price up to 30% lower than the DAM.

This was only possible due to a stable commercial surplus on the wholesale market (not to be confused with excess generation in the power system). As EA and GB were allowed on regulated segments only and could not reduce their positive imbalance via bilaterals, other market participants could force them into imbalances by further increasing their number of low-price bids on the DAM. LCU identified this trend in Jan-Feb'20 (see Figures 62-65 in Annex, pages 42-45), especially during off-peak hours.

This loophole played a decisive role in EA-GB debt accumulation within the PSO for households. It syphoned millions from GB and EA and redirected them to speculative suppliers. However, this was in line with market rules. The NEURC identified the loophole, albeit the damage was already done, and introduced the following changes to BM rules in Mar'20 to address it:

- a dual price imbalance system,
- a BM price-setting mechanism, depending on deficit/surplus in the system,
- accepted downward activations were treated as power purchases from the system by the BSPs,
- a wider range of price caps, keeping the link to the DAM result for the BM minimum price and a hard link to the DAM price cap for the BM maximum cap.

As a result, upward regulations volumes remained in line with the physical balancing of the grid, and resulting activated energy was in the range of 1-5% of total consumption (hourly-average range: 100-500MW). At the same time, downward-regulation volumes almost quadrupled to 18-22% of total consumption (hourly-average range: 2,000-3,000MW) starting from Mar'20 (Figures 29, 30 in the Annex, page 30). The price of upward regulation jumped to pre-Dec'19 values, while downward regulation prices fell below marginal costs of thermal generators, benefitting them.

This indicates that the balancing market does not perform as designed. The volumes of activated downward regulations are not representative of the physical balancing of the grid. Our analysis shows that the current market rules allow arbitrage opportunities for BSPs and incentivise strategic bidding, that distorts market signals.

The gaming strategy uses the DAM to manipulate the outcome of BM prices. The balancing market part works the following way:

1) Generators submit their scheduled output, and consumers their scheduled load, to UE.

2) UE uses these schedules to build forecasts and project the physical imbalance in the system. From this projection, UE calculates the demand for balancing services.

3) Generators can submit inflated generation schedules, as generation blocks in cold reserve are accounted for.

4) Higher generation forecast leads to higher demand from UE for downward regulation.

5) Downward regulation bids are submitted at the lowest possible price, which is linked to DAM results. The lower the DAM price, the lower the price the generator would pay to UE for downward regulation.

The DAM side works the following way:

1) Generators sell more power on the bilateral agreements segment than they plan to produce.

2) This decreases demand on other market segments, mostly on the DAM.

3) Decreased DAM demand pushes DAM price down and forces EA and GB into more imbalances.

4) Lower DAM prices result in lower BM downward prices, which is profitable for generators.

5) Positive imbalance in the system is sold to generators at low prices as part of market clearing.

6) The downward activations reduce generators' imbalance, which could occur due to their higher sales (1).

The lower the minimum cap on the balancing market, the more profitable the strategic bidding. The profitability for thermal generation remains as long as the minimum BM price <= marginal cost. LCU estimates the marginal cost of coal-fired thermal plants in Ukraine in the range of 900-1,100 UAH/MWH at current market prices for coal in Europe.

Players with market power who can affect DAM pricing and demand&supply can also ensure the continuity of the positive imbalance/surplus on the market.

Thereby the generators can benefit from lower DAM prices that maintain the comfortable downward regulation price on the BM below their marginal costs – by selling more on bilaterals. Our data analysis shows the increase of low-price bids on DAM in Apr-May'20, proving the generators make use of this (see Figures 62-65 in Annex, pages 42-45).

One specific case which occurred at the end of May'20 shows additional risks that the market regulation inefficiency may pose to the system.

The DAM price was steadily dropping from 21/05 on, reached 801 UAH/MWh on 25/05 and hit low of 660 UAH/MWh on 29/05. The EA voluntarily decreased its output on 27/05 until 31/05 and then increased it back. Simultaneously, the thermal generators increased their output.

LCU analysis showed that this case was not driven by system restrictions or increased RES supply but was a result of strategic bidding by the dominant player on the market. The increased supply of bilateral agreements by DTEK drew demand away from DAM and lowered prices (Figure 16, 17). The resulting low DAM price also pushed BM and imbalance price below EA's marginal cost, forcing them to ramp down the production for 5 days to avoid losses.

This case of suboptimal system dispatch resulted in:

1. Increased CO_2 emissions of 250 ths tonnes in one week only.
2. additional operational costs of about UAH 150 mln, i.e., 10% of operation cost.

The NEURC tried to address this loophole in Jun'20 by increasing a minimum price cap on the BM and introducing control over how much electricity could be sold by generators and traders.

The subsequent market data shows that these changes were not sufficient and that the strategic bidding persists. The system remained in surplus during most hours, the supply and activations of downward regulation remained stable, and the downward BM price is still on par with marginal costs of thermal generators.

The demand on the DAM decreased even more in Jun'20, while DAM supply partially shifted to the IDM since the IDM was not included in the control methodology mentioned above.

Based on market data (Figures 22-24 in Annex, page 28), LCU suspects that the IDM can now potentially be used by market players to collude and force sellers like GB and EA to sell on the IDM at lower prices. This is possible due to the different price-setting design:

- The DAM uses a clearing price, bidding information is not disclosed to participants,
- The IDM uses pay-as-bid pricing and discloses more information about the bids than the DAM.

Figure 16. Registered bilateral agreements volumes

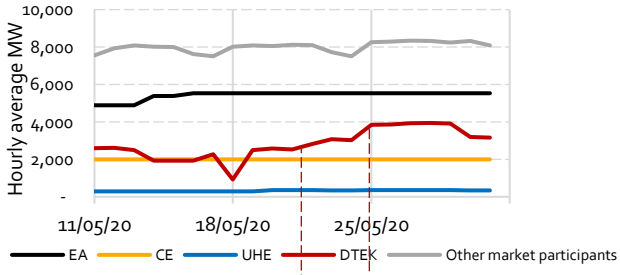
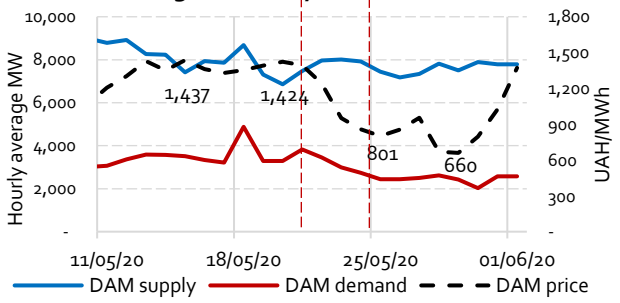


Figure 17. Day-ahead market



Source: Market Operator, Ukrenergo, UEEX data, LCU estimations

Conclusions

- Balancing market loopholes were created by imperfect and reactive regulatory changes.
- While the first loophole was closed in Mar'20, inefficiency persists,
- Regulations in place were not sufficient to prevent strategic bidding.
- Supply and activation of downward regulations on the balancing market is not representative of an actual physical regulation, i.e. turning generating units off.
- Balancing market rules, together with the price caps design, create room for manipulations and distort the DAM.
- The DAM may be used by market players to achieve a comfortable BM price below their marginal costs.
- Strategic bidding is possible due to limitations imposed on EA and GB, compared to other market players.
- The existing market regulations have drawbacks and may lead to increased CO_2 and system costs.

Debts accumulation

The UAH 30 bln debt accumulated in the previous market system should have been addressed before the market opening. The process has only started in Jul'20 with the adoption of the relevant law. However, this law envisages only how debt is to be cleared off, not to close its source. And the same problem now affects the new market design as well. The debt in the market has grown dramatically during Jan-Jun'20 (Figure 18). As of 1/7/20, the focal points are:

- GB-to-EA debt, within the PSO for households (UAH 7.7 bln)
- Consumers-to-UE debt for transmission tariff (1.2 bln)
- GB-to-RES debt, financed via the transmission tariff (15.9 bln)
- Balancing market debts, which has two distinctive problems:
  - SOLR and Voda Donbasu debt within BRPs (2 bln)
  - Difference between BRPs and BSPs (1 bln).

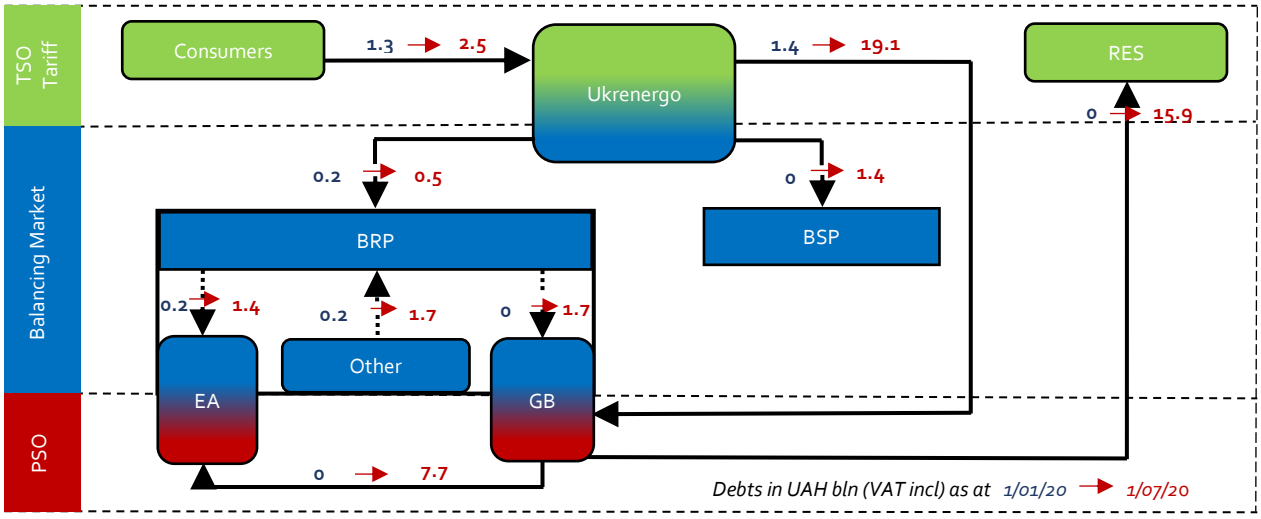
GB-to-EA debt has accumulated due to limitations of the PSO design and decreased market prices resulting from balancing market loopholes and decreased DAM demand. The debt accumulation has stopped with the adoption of the 'transitional' PSO. However, a source to finance this debt has not yet been identified. The EML allows financing GB via the transmission tariff, but this decision will hardly be accepted by the NEURC due to the GB dilemma.

The GB-to-RES debt chain has a different source, as by design RES support should have been covered via transmission tariff in full. Due to inflexibility and vulnerability of PSO design and political decisions of NEURC, the debt has accumulated. Per LCU assessment, even with the decrease in FITs effective from Aug'20, the increased TSO tariff is still not sufficient to cover RES support costs, disregard the accumulated debt.

The supplier of the last resort is now close to bankruptcy, as it supplies power to state-owned mines. Voda Donbasu, a water utility supplying both controlled and non-controlled territories in eastern Ukraine, also accumulates the debt. This is the same source that contributed to debts in the old market – and now threatens the stability of the balancing market. SOLR is buying the power as imbalances and unable to pay for it since its consumers do not pay in the first place and are not disconnected from the grid due to security reasons.

The growing gap between payables from BRPs and receivables of BSPs indicate that there might be an inefficiency in the pricing on the BM. The uplift to cover this gap will be borne by all market participants. Judging from volumes of recalculated BM results, the uplift can surpass UAH 2 bln and may be too hard to absorb by the market. NEURC is considering socialising part of this debt via TSO tariffs. However, the source of this debt should also be addressed in the first place, and it lies with BM caps and imbalances pricing.

Figure 18. Debts accumulation scheme



Source: Ukrenergo, LCU estimations

Conclusions

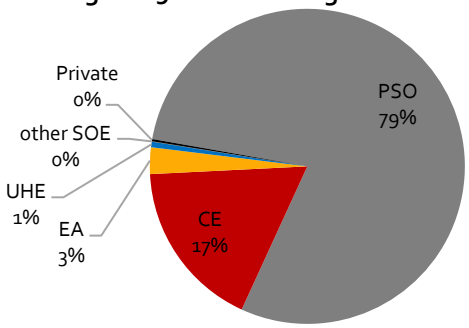
- The source of some of the old debt is still unaddressed and affects the new market model as well.
- The new debt has accumulated too fast due to short-sighted political decisions and inefficient market regulations.
- The PSO for households' debt and RES debts are hard to finance via established mechanisms, due to the GB dilemma and political reluctance to pass the costs onto consumers.
- Balancing market debt is likely the result of bad market design, price caps and delays in MMS software implementation.
- If the debts' sources are not addressed and financed, the market may collapse with small players hurt the hardest.

Potential abuse in auctions rules for state-owned enterprises

All companies with more than 50% of state ownership are obliged to sell the power via bilateral contracts via a designated auction platform and under a predefined set of rules, adopted by the Ministry of Energy. The Ministry also decides on when to conduct a tender to choose a designated platform.

Since the market opening, UEEX has been the sole designated auctioning platform. An analysis of the trade results for Jul'19-Jun'20 shows that, apart from PSO volumes, most of the trades were conducted by Centrenergo (Figure 19). EA started trading outside of the PSO starting in Apr'20, and UHE in from Jan'20.

Figure 19. UEEX trading distribution [IPS]



Source: UEEX, LCU calculations

LCU identified the following strange patterns in SOE auction sessions:

- Starting prices are always higher than strike prices.
- Strike prices for CE were considerably lower than on the DAM.
- Sellers tend to increase the financial guarantee requirement.
- The variability of buyers is low. Only a limited set of companies has enjoyed access to long-term contracts with state-owned generation on most of the trade sessions observed.

The analysis of prices showed that on average, CE sold at 10% less than it could on the DAM. For comparison, UHE sold at 1% less than DAM prices and EA managed to sell at 5% more, due to higher prices during off-peak hours than DAM caps (Figures 61, 62, page 41). The 10% price difference may allow the buyers to re-sell power further on the market. Compared to an average 0.5-1.5% margin for traders in electricity markets, 10% is significant.

If we assume that CE is not a pivotal supplier on the DAM, and if the whole demand covered by CE-UEEX contracts shifted to the DAM without influencing prices, CE would have gained additional UAH 1.3 bln in revenues if it had sold on the DAM during Jul'19-Jun'20. We also identified that starting from Mar'20 CE sold on the UEEX significantly more power than it actually produced. This behaviour also confirms the balancing market loophole described on the pages 19-20.

At the same time, EA managed to gain UAH 67 mln more than it would get by selling on DAM, and UHE foregone only UAH 8 mln.

LCU analysis identified the following weak points of the auction rules set by the Ministry of Energy:

- The starting price, set by the seller, is used to determine the financial guarantee, which is calculated as a percentage from the starting price.
- The seller has the power to group 1-MW lots into bigger batches during the auction, creating an artificial barrier for smaller buyers.
- The buyer is unable to bid for a batch bigger than his submitted guarantee.
- The sellers tend to overstate the starting price and no buyer accept such offers. At this point, the auction allows the buyers to present their counter-offers, consisting of their price and desired number of lots, giving the seller anonymous information.
- It's up to the seller's discretion to either ignore the counter-offers or offer them for the trade during the auction. The bigger volume of the offer the seller decides to put up for the bidding, the less the competition.

These factors combined create the following risks:

- The state-owned sellers can create barriers for entry by inflating financial guarantee requirement and starting prices.
- The competition is further decreased by the seller's ability to group lots into batches during the auction.
- The counter-offer mechanism allows conveying information if collusion takes place and allows the seller to choose buyers.

Conclusions

- The existing regulated auction rules for state-owned enterprises contain significant flows that may lead to collusion or/and corruption, resulting in missing revenue or even losses for state-owned companies.
- The auction design allows to create artificial entry barriers, limit access to electricity for smaller players, benefit bigger players and dramatically reduce competition, which leads to lower selling prices and distorted market signals.
- The average selling price of state-owned Centrenergo was 10% lower than the DAM price, which may indicate a potential abuse of auction design.
- Such a big spread may have allowed benefiting buyers to re-sell power further at significant margin.

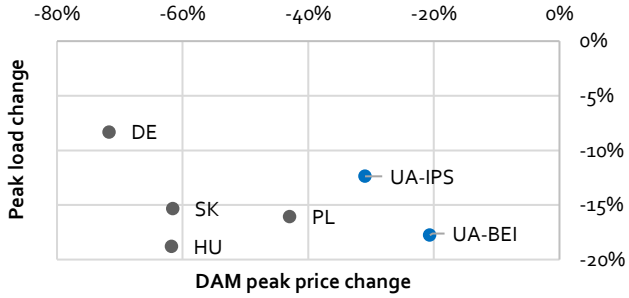
COVID-19 impact

The COVID-19 strict nationwide lockdown was enacted from 12/03 till 11/05. During this time, the electricity consumption (temperature-adjusted) has decreased 5% compared to the previous year. At the same time, the DAM price dropped following a decrease in DAM demand. LCU analysis identified that DAM demand decrease was faster than overall consumption decrease. The relative share of DAM demand from total consumption in IPS has dropped from 33% in Mar'20 to 18% in Jun'20 (Figure 23 in Annex, page 28).

Covid-19 lockdown did contribute to a drop in demand and DAM price. However, the changes to the balancing market rules from 1/03/20, which we discussed on pages 19-20, had a decisive role in shifting DAM demand to other market segments (Figure 4, page 9).

The DAM price decrease in Ukraine was also lower if compared to other EU countries (Figure 20). This confirms that Ukraine's wholesale market price is not a product of and effective competition but rather a product of administrative regulation in a highly concentrated market.

Figure 20. Peak load and DAM peak prices, 6-months relative change (Apr '20 vs Oct '19)



Source: ENTSO-e transparency platform, Market Operator data, LCU

The lockdown has also contributed to the GB's growing debt within the PSO mechanism. During Apr-Jun'20 households' consumptions has increased 6.3% compared to the same period in 2019. At the same time, nuclear generation has also decreased, due to lower total demand and UE's balancing restrictions. This resulted in less power available for sale on the market in GB's portfolio and, respectively, less revenues.

In BEI, the DAM price has been decreasing since Jan'20 but kicked back in May'20. This is due to half of the export from Burshtyn TPP as prices in the EU markets were not attractive for coal-fired generation. This led to a decrease in imports as well, which resulted in significantly less competition in the market.

In response to the lockdown consequences, the NEURC has adopted on 8/04/20 and further expanded a resolution containing measures to address the market's problems. Notably, this "COVID-19" regulations are stated to be temporary, and their duration is linked to the CMU resolution on quarantine measures, which is now being prolonged. Some of these measures include the following:

- Fines are not applied for delays in payments on the market.
- Imports from Russia and Belarus is banned, yearly cross-border allocations are cancelled.
- GB bids RES at any price, without special min/max cap
- TPP operators cannot sell on bilaterals, DAM and IDM more than their estimated output based on their fuel stock, contracted gas volumes and generation blocks' status.
- Traders in IPS cannot sell on bilaterals, DAM and for export more than they have bought on bilaterals, DAM and imported. The negative balance is to be settled via the BM market only, not IDM.
- The off-peak price cap is increased.
- Three changes to BM minimum price cap, finally resulting in 80% of the DAM price cap.

Per our assessment, these measures do not directly address the falling DAM demand, and partly contribute to the DAM price increase. The limitations imposed on generators' sales volumes so far proved to be not effective, as blocks in cold reserve are accounted for in the approach, and coal stocks have been stable during the analysed period.

Linking the measures targeted at the electricity market and the epidemiological situation in Ukraine seems to be irrational, as the situation after the lockdown being gradually lifted did not affect the market performance, and DAM demand continued to decrease. Per LCU assessment, the market situation was mostly driven by problems in the PSO design and balancing market rules, not the quarantine measures.

Conclusions

- Decrease of DAM demand and DAM price during Mar-Jun'20 was mostly driven by changes to the market rules in Mar'20. The covid-19 lockdown effects did contribute as well but did not have a decisive role.
- DAM price drop, increased households' consumption and decreased nuclear generation during the quarantine has negatively affected Guaranteed Buyer's financials and contributed to its growing debt.
- In BEI, export stopped following the drop of electricity prices in the EU. This led to almost complete halt of import and increased DAM prices in BEI.
- Regulations claimed to address covid-19 consequences tend to regulate prices rather than address the core problems and will not help in the long-term.

First 12 months of the new market were an expensive test period, which Ukraine desperately required before the reform implementation. Started under so-called 'safe mode', with lots of restrictions, gaps and distortions, an unprepared market management software, the wholesale market performance is still far from perfect. LCU identifies the list of core problems that hinder healthy market development and competition in the Ukrainian electricity market.

- **Design of the PSO for households**

This is the biggest single reason for market distortions. The mechanisms limited the competition, imposed unfair limitations on the state-owned generators and allowed private companies to exploit the loopholes market rules.

The household consumers, disregarding their income, are not paying the full cost of electricity. Furthermore, this price difference between market price and households' tariffs creates room for a potential to misappropriate of volumes claimed for households' consumption and obtained at below-market prices.

- **Restricted competition**

PSO design cemented domination of privately-owned generation on bilateral agreements segment. GB is a player with artificial market power. Cross-border limitations do not allow Ukrainian consumers to benefit from competition and lower prices on the market.

- **Market power not fully addressed**

Even with PSO-related issues address, both EA and DTEK will have significant market power on the wholesale supply side. Additionally, DTEK already has significant control over retail supply. DTEK also dominates Burshtyn island. A special regulation should be applied to this trading zone.

- **The inefficiency of the price caps design**

Current price caps system does not limit the market power but only limit the revenues of dominant players. Caps significantly distort the bidding behaviour and lead to higher average prices. At the same time, the market prices do not represent actual surplus or deficit of energy in each hour and thus do not provide a reliable investment signal for investors.

- **Growing debts**

Some of the debt sources were inherited from the previous market, some are new. The total debts accumulated in 1 year only is already comparable with the old debt which has been forming 5 years. If not addressed and served in time, the debts risk to overrun the market and lead to a chain of defaults.

- **Gaps in the regulations**

Problems in the balancing market, performance of the auctions for bilateral agreements, lack of transparency – these issues are mostly products of imperfect market rules and regulations and can be relatively easily addressed.

Ukraine's market is big enough to sustain competition. Existing distortions are not a fault of an inherent market structure. All abovementioned problems can be addressed provided there is a strong political will for substantial reforms, a clear vision of the target market model for Ukraine and a long-term implementation plan in place.

Based on the identified issues we recommendations on measures to be implemented in the next 6-24 months. These mainly short-term fixes would drastically improve market performance and give time for deeper reform, including ENTSO-E integration, higher shares of RES and a better targeted social support system.

1. Redesign the PSO mechanism as soon as possible

Review the eligibility criteria for subsidised electricity. Redesign the outdated existing complex system of household consumers' types. Introduce a more straightforward definition of 'vulnerable consumers' in secondary legislation, along with vulnerability criteria. Design a long-term roadmap to eliminate cross-subsidisation through the electricity market.

Redesign tariffs methodology. The following recommendations are short-term fixes that aim to improve the system's efficiency but do not represent the target model of PSO our project would recommend in the long run.

Link EIC-codes of households to their respective tax ID numbers and their status at the state subsidy/welfare system. Link the low-priced electricity volume to the number of registered persons in households. E.g., allocate 50kWh per month per person.

The tariff for consumption above low-priced volume should be cost-reflective: nuclear regulated price + TSO + DSO + USS margin.

Link tariffs to consumption volumes, to stimulate energy efficiency and to eliminate the subsidisation of non-vulnerable consumers.

The tariff should also be linked to hourly fluctuations on the market (time-of-use tariffs), to stimulate households to follow the general demand and behave economically, in line with the market.

Ensure that Universal Service Suppliers procure adequate volumes for vulnerable customers. Ideally, Ukraine should speed up the full ownership unbundling of DSOs and suppliers. A short-term option would be to allow only USSs that are not a related party to any DSO to supply power to households in any region. Another solution could be to introduce households' load profiles, measured by a third-party independent contractor.

Increase data transparency for household consumers. Introduce full price components disclosure in the electricity bills, showing the market price households would have paid (e.g. universal service tariff) and the provided subsidy.

Increase competition on the market. The volume-based PSO with regulated price must be abandoned. EA and UHE should freely trade on the market, without additionally imposed price controls or volume regulations. EA's windfall profits can be captured and redistributed to cover costs of the PSO design:

- Either via financial instruments, in form of payments to USSs to cover the difference between market prices and regulated prices for vulnerable consumers each month (i.e. the financial PSO),
- or via nuclear/hydro-specific taxation, further redistributed through the state budget to vulnerable consumers directly. The taxation should not be excessive and leave Energoatom with a reasonable sales margin based on the DAM price benchmark.

Eliminate the Guaranteed Buyer as an unnecessary intermediary. Trading via GB does not add value to the design but instead creates additional risks and distortions. Make changes to the EML and abandon PSO financing via the transmission tariff.

2. Improve data transparency further

Tangible consequences should be implemented, e.g fines, for violating data disclosure requirements, both in quality and regularity, for all market participants both state-owned and private, as well as for institutions.

Data publishing should be also standardised – to eliminate the "checkbox" approach. Address small yet important details in data publishing (e.g. publish non-accepted block bids on the DAM, address the lack of historic data on the BM etc).

Adopt REMIT standards. It is important to provide sufficient transparency and information for authorities, like NEURC and AMCU, to make swift decisions regarding possible market manipulations and uncompetitive behaviour.

Market monitoring reports should be conducted and published more regularly, e.g. each month. The dataset used for the monitoring should be published on the NEURC website.

3. Reform price caps

Price caps limit the revenue of the market participants. They do not address their market power or ability to influence the supply and, in some case, even the demand for wholesale segments. The post-market opening bid caps for every bidder should be cancelled.

Price caps should be imposed only for situations when high prices are the result of market power exercised by certain players and only for these specific players.

Specific prices cap for each dominant supplier should be calculated based on the marginal cost of the most expensive generation unit. The reason being that in cases where it is an actual scarcity event, high prices should be allowed.

The link between caps on BM and DAM should be abandoned to eliminate excessive arbitrage trading by generators. BM caps should be calculated specifically for the BM individually and account for DAM results (e.g. current imbalance price methodology) to prevent gaming behaviour.

4. Fix balancing market rules

Eliminate incentive to submit overestimated physical schedules and subsequent overestimated balancing-down bids by the generators. Increase the spread between positive and negative imbalance prices. Introduce the non-compliance fine in the MMS software as soon as possible.

5. Introduce mechanisms to mitigate market power

Market power should be measured, assessed, and addressed on both individual market segments and across different segments.

Market power testing should be in place and exercised by the NEURC and the AMCU, to adopt informed decisions. Dynamic market concentration screening should be introduced on both wholesale and retail segments. This may include:

- Pivotal suppliers' tests – to evaluate the potential for the exercise of market power based on whether a particular company or group of companies is pivotal in meeting the demand in a certain hour.
- Conduct and impact tests – to evaluate whether offer prices likely reflect the exercise of market power based on whether the offer price level would materially impact either energy or reserve clearing prices.

Observed cases of market power should be addressed by:

- company/power block-specific bid caps based on ex-ante market power testing,
- ex-post revenue adjustments,
- prevention of all related parties/group of companies from using non-regulated segments, effective immediately.

To address intragroup trading and/or until market power can be effectively addressed, a centralised bilateral agreements' platform should be introduced with an obligation for all generators to trade a certain share of their traded volumes, not their physical output.

Special measures should be applied for the BEI trading zone. DTEK should be declared a monopolist and treated under special regulation. These may include:

- The output of Burshtyn TPP can only be sold via centralised regulated auctions. These auctions must not allow manipulations, identified in the existing auction rules for a state-owned generation.
- Access to Burshtyn TPP electricity should be limited, or completely banned, for DTEK-related suppliers.

6. Increase competition across different segments

Introduce a feed-in premium or "contract for difference" system for RES. Allow voluntary option for existing and oblige all newly built RES to directly market their power and choose the balancing group freely.

Improve access to volumes for smaller suppliers. E.g. following the British experience of defining the market makers, vertically integrated companies with market power, and obliging them to sell part of their output to smaller suppliers without a right to refuse them.

Provide a clear non-discriminatory definition for energy storage in the power market, in line with the EU's "Clean Energy for all Europeans". This, among other things, may also provide the right incentive for small-scale distributed generation to participate in the market and increase the supply of flexibility services.

Cancel the special EA trading sessions within PSO design targeted for big consumers only.

Redesign rules of auctions for state-owned enterprises.

Rules should be made simpler and more straightforward, eliminating risks of corruption and collusion. Fair and equal access to electricity volumes should be guaranteed, without in-built preferences for big buyers. Access for smaller suppliers should be promoted.

Do not allow the seller to influence the number of lots sold in one batch during the auction.

Shift to simple ascending auction design, with a limitation of purchase for one company or a single group of companies.

Ease access for smaller players, reducing financial guarantee requirements. Sellers should not be able to artificially increase guarantee requirements by stating a high starting price in advance.

Either allow competition between private exchanges or shift trade to the state-owned Prozorro system.

Improve cross-border trade.

Allow limited imports from Russia/Belarus in volumes that do not threaten the security of supply (which can be defined by CMU based on UE's assessment). A public auction for the right to import with a pre-defined baseload band (e.g. 10x100MW or 20x50MW) can be introduced for imports from countries who are not members of the Energy Community.

In the BEI trading zone, allow imports to meet up to 50% of balancing/reserves requirements. Improve control over the cross-border allocations concentration, do not allow manipulations using related parties.

7. Serve debts and eliminate the source of debt accumulation

Increase transmission tariff to finance the renewables support in full. Cross-financing via budget and transmission tariff creates a dangerous situation of political institutions being reluctant to finance their "share" in full and shifting responsibilities between each other.

The cost of political decisions should be socialised mildly and without shocks. However, RES investors should not bear all risks or at least should be compensated for delays in payments.

To avoid a sudden financial burden placed on the market via uplift, the growing gap in the balancing market payments should be stopped.

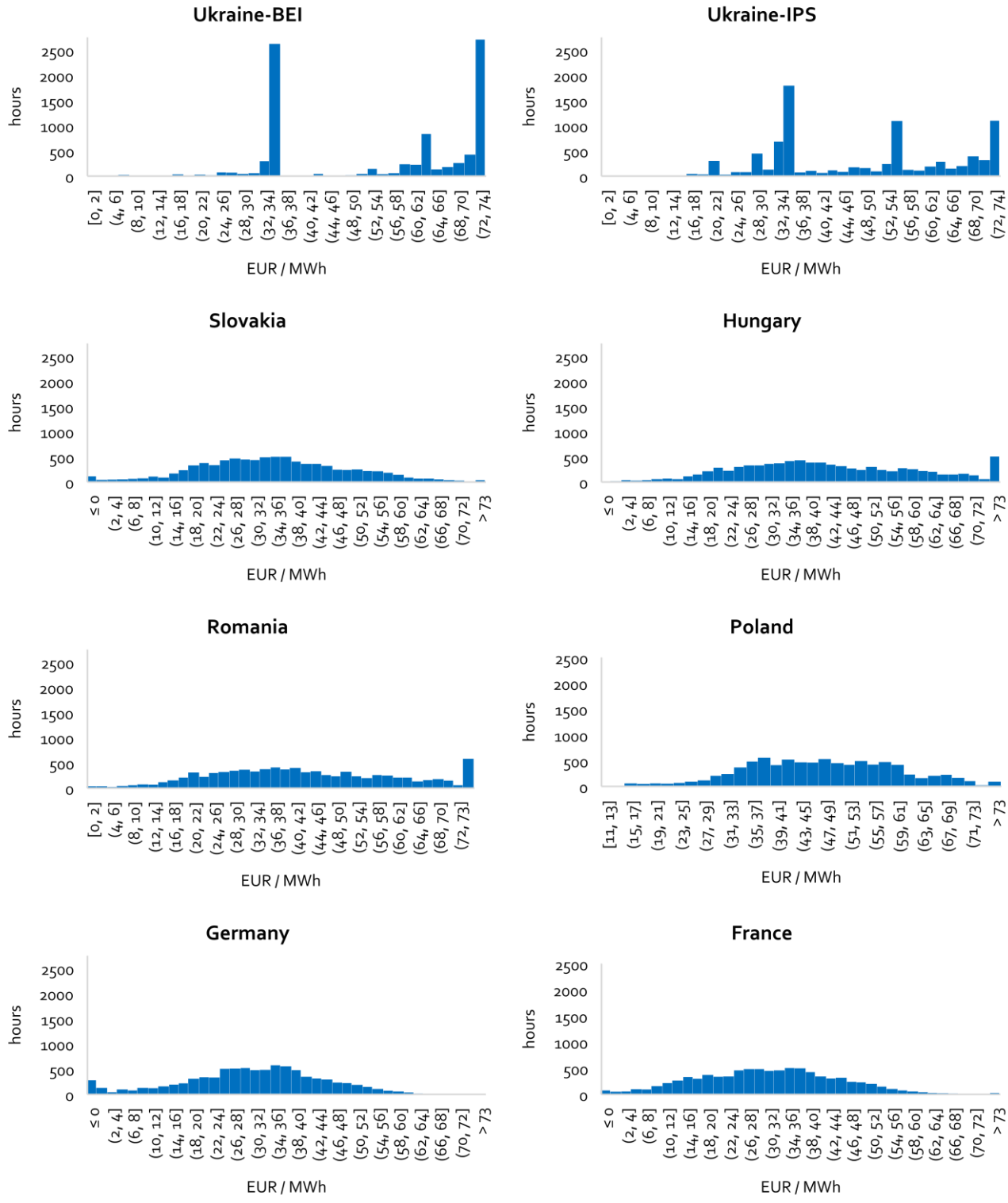
"Political" debt of consumers who cannot be disconnected due to social, ecological, or political reasons (state-owned mines, water supply in Donbas) should get a stable source of financing. The best solution would be to envisage special direct financing from the state budget into the following components:

- to finance the debt service,
- to invest in energy efficiency,
- and in case of Voda Donbasu, invest into infrastructure modernisation to stop supply to non-controlled territories.

All other consumers supplied by the supplier of the last resort should not be protected from disconnection from the grid according to existing market rules. If not disconnected by the DSO within a specified time frame, the cost of supply should be borne by the respective DSO.

DAM prices analysis

Figure 21. Statistical analysis of hourly DAM prices in Jul'19-Jun'20

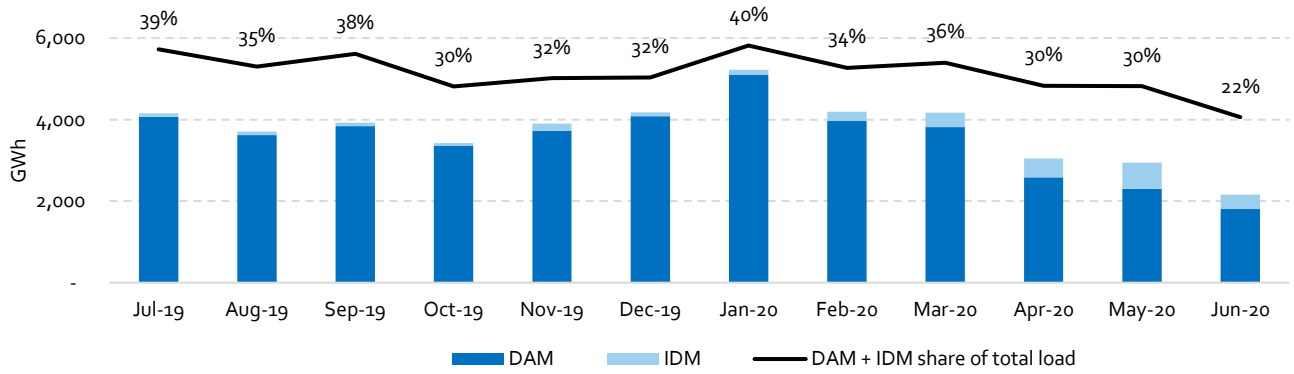


Source: Market Operator data, ENTSO-e transparency platform data, LCU estimations

The figures show histograms built based on DAM prices in different markets. Histograms show the distribution of price ranges, i.e. how frequently during the last 12 months a certain price occurred. In the European market, the price distribution is even, which is common for healthy competitive markets. In Ukrainian, prices tend to occur the most within certain ranges, which are equal or very close to regulatory price caps. This shows that the Ukrainian market is not competitive and that resulting prices do not represent the actual demand and supply interaction but rather are products of regulations.

DAM/IDM in details – IPS

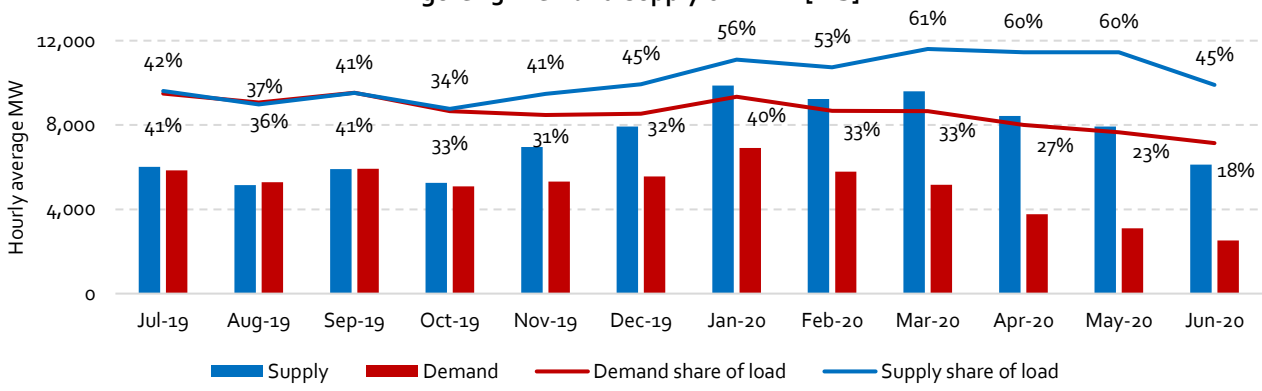
Figure 22. Trade volumes on DAM/IDM [IPS]



Source: Market operator, Ukrenergo data, LCU calculations

The figure shows the total monthly traded volumes on the DAM and the IDM and their share from the total load. Before 2020, the volumes were relatively stable. After changes to regulations in 2020, the demand from the DAM and IDM started shifting to other segments. Additionally, part of the DAM trades shifted to the IDM after Feb'20.

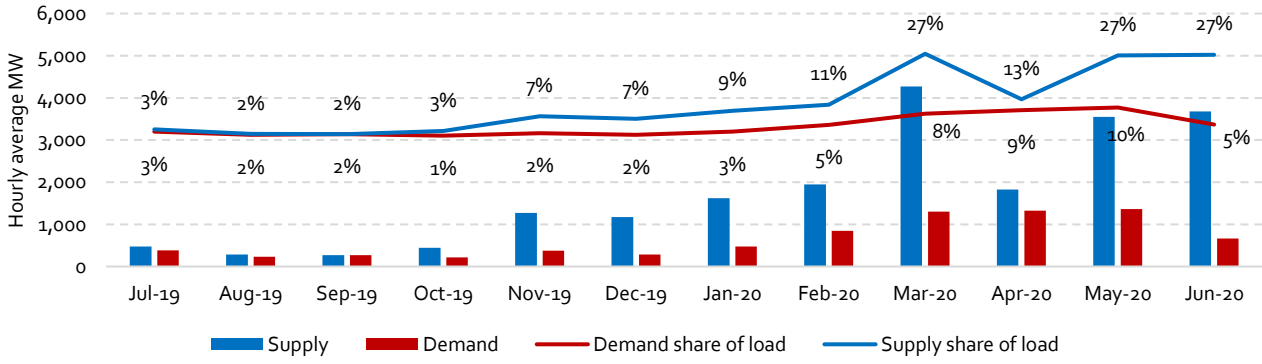
Figure 23. Demand-supply on DAM [IPS]



Source: Market operator, Ukrenergo data, LCU calculations

The figure shows the hourly average supply and demand on the DAM with their share from the total load. During Jun-Oct'19, the supply closely matched the demand. After Nov'19, the supply on the DAM has always exceeded the demand. The demand has shifted towards other segments after Mar'20 changes to the BM rules. Meanwhile, the supply remained relatively stable.

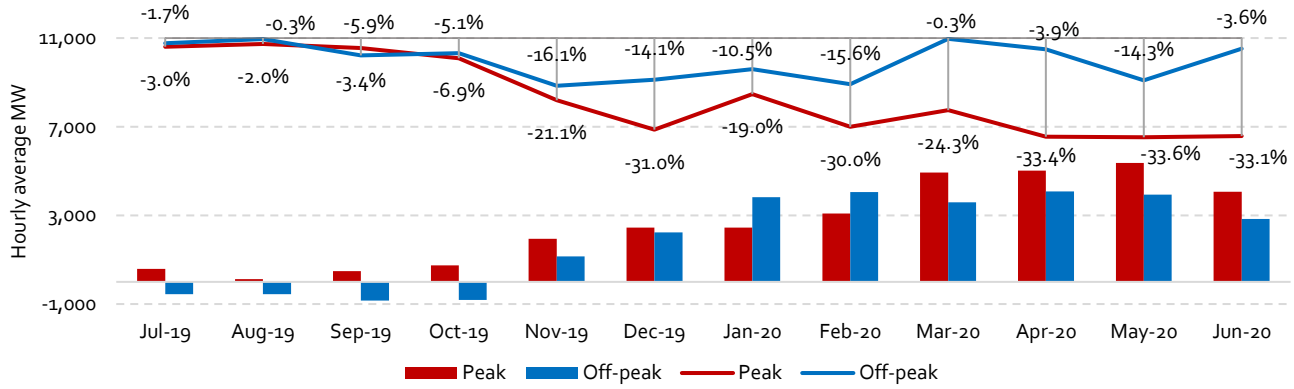
Figure 24. Demand-supply on IDM [IPS]



Source: Market operator, Ukrenergo data, LCU calculations

The figure shows the hourly average supply and demand on the IDM with their share from the total load. A surge in supply and demand in Mar'20 is likely linked to changes to BM rules and constant surplus on the market. The May-Jun'20 increase is likely linked to regulations which allowed GB to bid on the IDM at lower than DAM prices. The buyers were shifting their demand from the DAM to the IDM to get slightly lower prices.

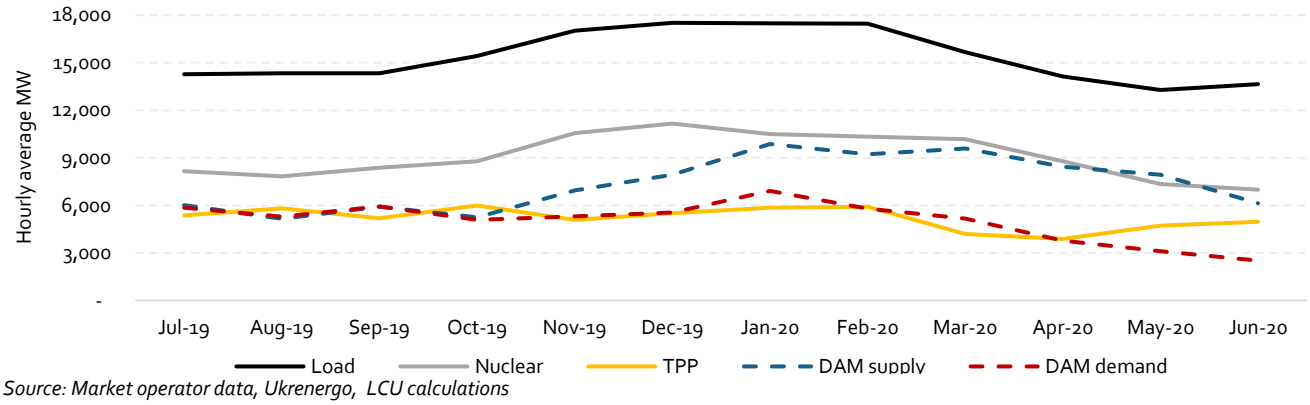
Figure 25. Supply-demand spreads and price deviations from caps on DAM [IPS]



Source: Market Operator data, LCU calculations

The figure shows an hourly average difference between supply and demand and price deviations from price caps on the DAM. Off-peak hours tend to be close to price caps, except for the Nov'19-Feb'20 period, when the BM rules allowed to exploit the imperfect imbalance price mechanism. There is a correlation between surplus and NPP generation starting from Nov'19. Peak prices after Feb'20 are close to the GB specific price caps, which is -25% from the market-wide cap.

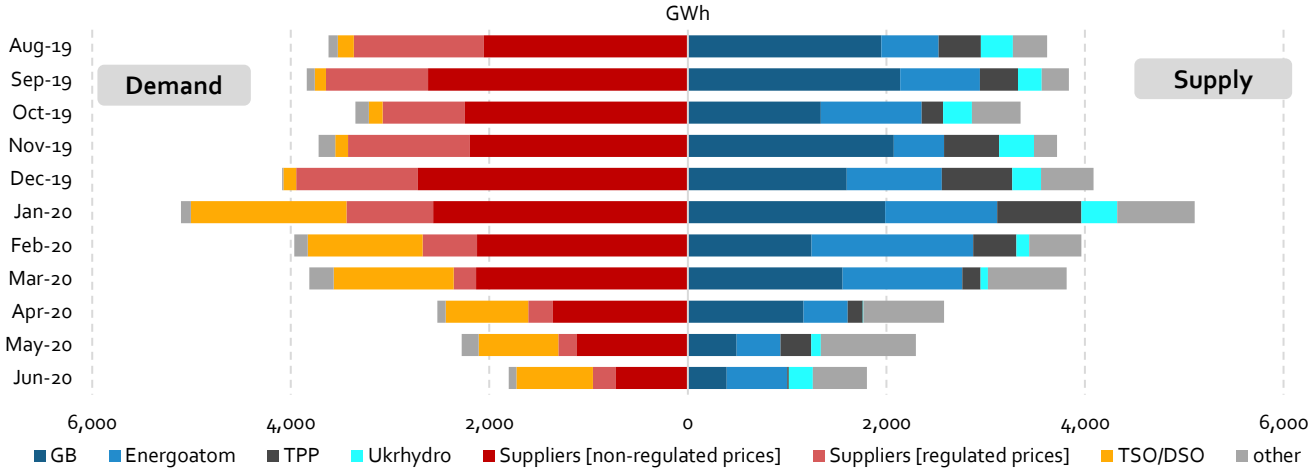
Figure 26. Average load profiles and DAM supply/demand [IPS]



Source: Market operator data, Ukrenergo, LCU calculations

The increase of nuclear generation caused an increase in the DAM supply volumes and contributed to DAM price decrease in Nov-Dec'19.

Figure 27. DAM participants structure [IPS]

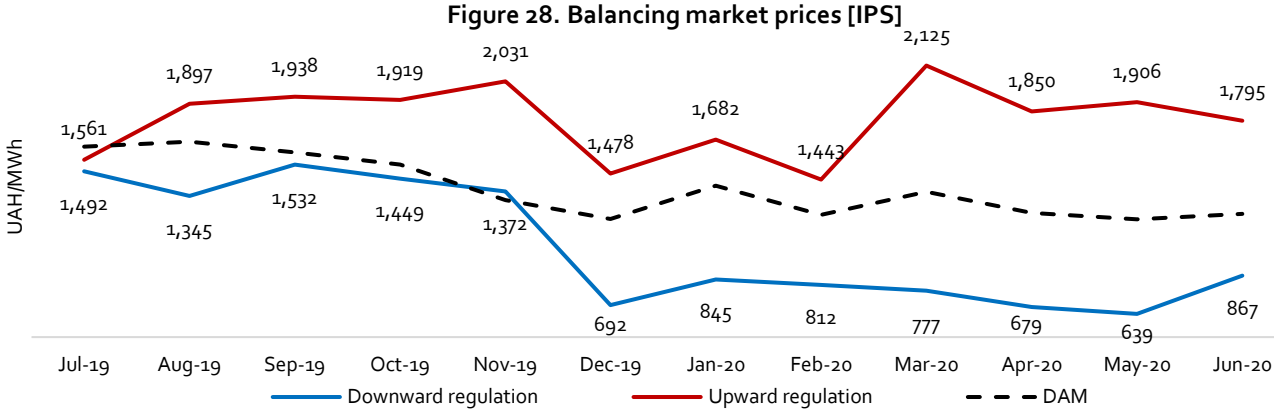


Source: Market operator data, LCU calculations

More than half of traded volumes are nuclear, marketed by GB and EA. Increase of TSO/DSO share is due to a change in the PSO in Jan'20 and has reached almost half in Jun'20. Share of thermal generation in the DAM sales has been steadily contracting.

Balancing market in details – IPS

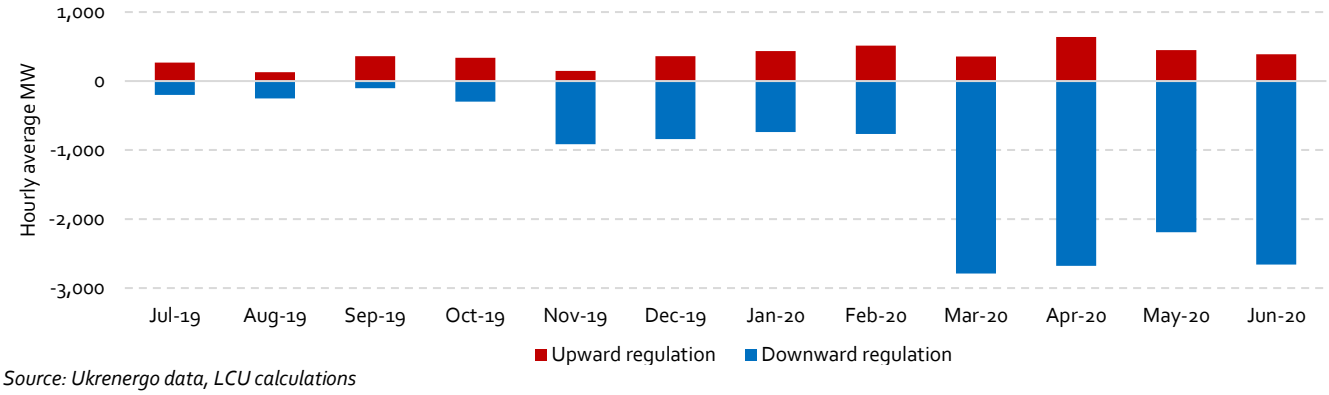
Figure 28. Balancing market prices [IPS]



Source: Ukrenergo data, LCU calculations

Jul-Nov'19 BM prices were linked to DAM caps. Dec'19 BM rules linked them to DAM prices. Mar'20 rules linked max price to DAM cap and min price to DAM price. Starting from Dec'19 the downward regulation price is lower than marginal costs of thermal generation.

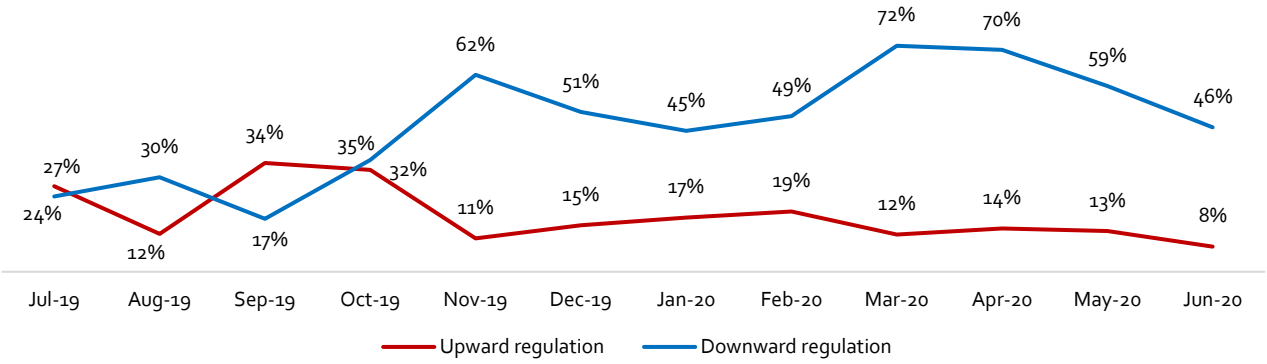
Figure 29. Balancing market activations [IPS]



Source: Ukrenergo data, LCU calculations

The figure shows the hourly-average volumes of the BM activations. A dramatic increase of downward activations occurred in Mar'20 after changes to the BM rules. The volume of downward activations (2-2.5GW compared to less than 1 GW before Mar'20) are hardly representative of actual physical ramping down of production. Most of these activations were made based on inflated downward regulation demand, resulting from inflated planned physical generation schedules submitted by balancing service providers.

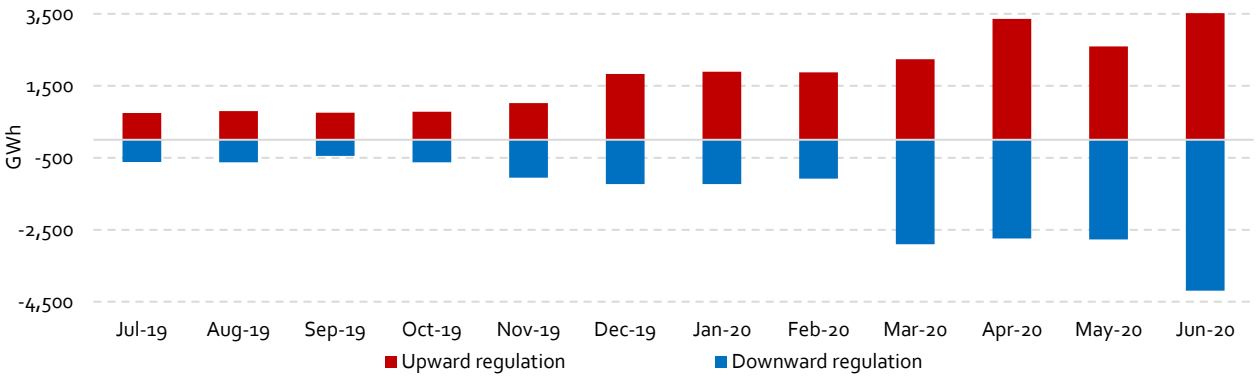
Figure 30. Share of balancing market activations from total suppply



Source: Ukrenergo data, LCU calculations

Share of downward activations significantly increased after each change to balancing market rules (Nov'19 and Mar'20). Decrease of upward regulation share from bids resulted from an increased supply on the market, while upward activations remained stable. An increase in downward regulation share shows that with the increase of supply, activations have increased as well. This trend points at problems in the balancing market rules.

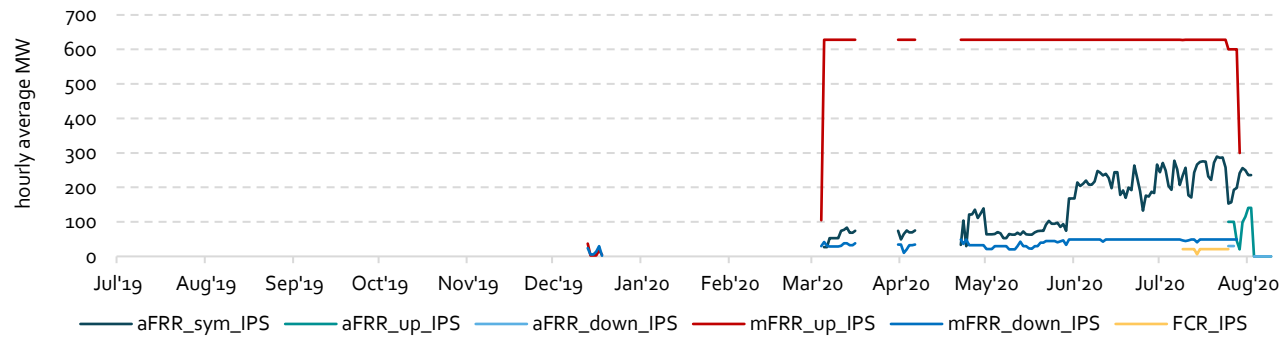
Figure 31. Balancing market bids [IPS]



Source: Ukrenergo data, LCU calculations

The figure shows the total volume of supply on the balancing market. The supply has significantly increased following the Mar'20 changes to the market rules. However, the actual physical downward regulation volume bid on the market is questionable.

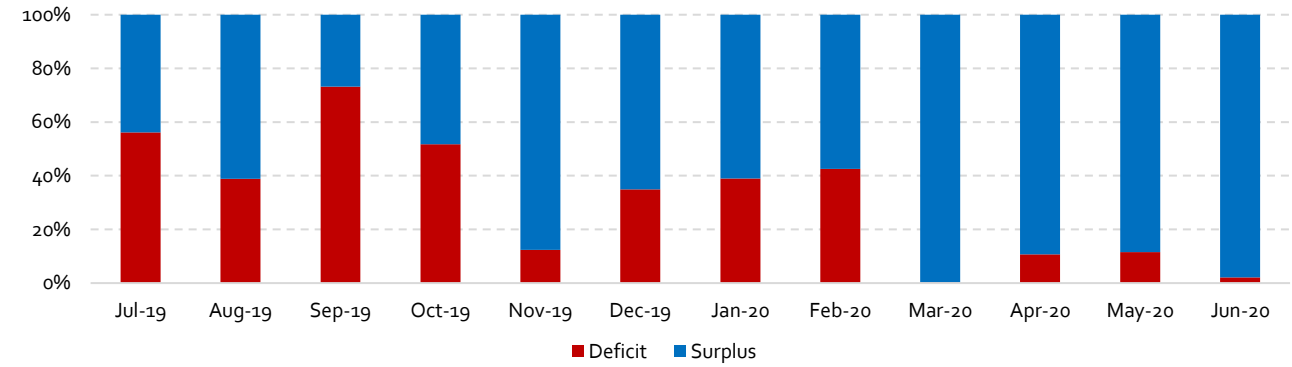
Figure 32. Ancillary services procurement [IPS]



Source: Ukrenergo data, LCU calculations

Ancillary services market was fully launched in late Apr'20, 10 months after the market opening and after all necessary amendments to grid codes, market rules and monitoring methodology. The supply of secondary up reserves is close to the required level, but down reserves are insufficient. Primary reserves are currently at ~ 17% of the required in grid codes amount.

Figure 33. Deficit/Surplus hourly distribution [IPS]

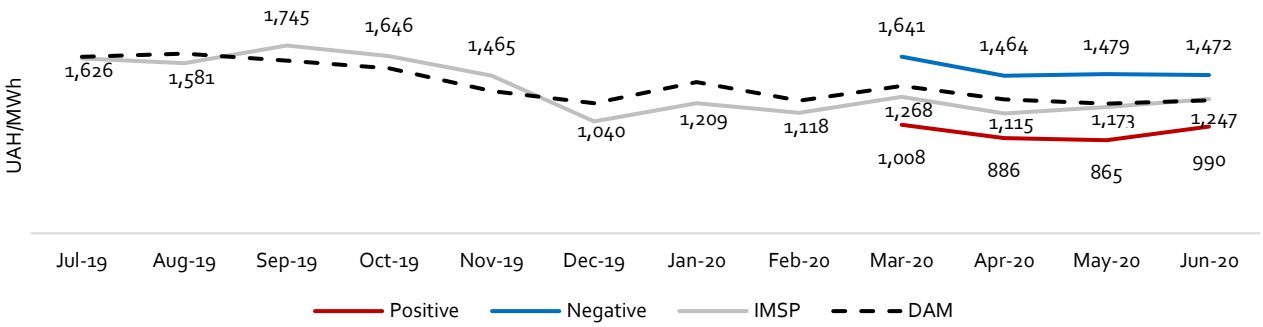


Source: Ukrenergo data, LCU calculations

The figure shows how many hours of the months the balancing market was in surplus (demand for downward regulations exceed the demand for upward ones) or in deficit (vice versa). Following the changes in the BM rules, the Ukrainian electricity market experienced more than 50% surplus in the BM starting from Nov'19 and more than 90% from Mar'20. This is due to inflated demand for downward regulations, which is not representative of actual physical balance.

Imbalances in details – IPS

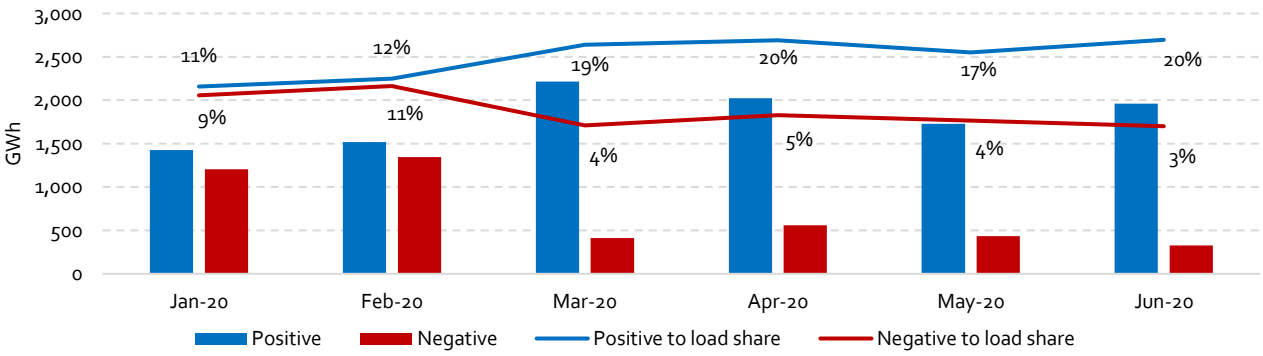
Figure 34. Imbalance price [IPS]



Source: Ukrenergo data, LCU calculations

IMPS is an imbalance price as defined in the market rules and is calculated based on the BM results. During Dec'19-Feb'20 the imbalance price was below the DAM price, which allowed traders to exploit the market rules. Starting from Mar'20, the dual imbalance price was introduced, for positive (to sell excess power) and negative (to buy power) imbalance balances respectively.

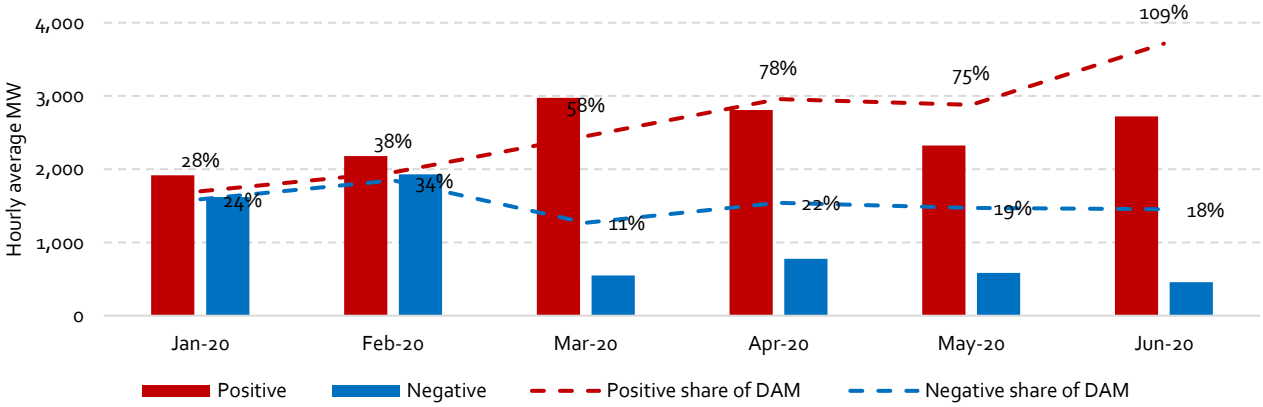
Figure 35. Total imbalances volume [IPS]



Source: Ukrenergo data, LCU calculations

The figure shows the total monthly volume of imbalances and their relative share from the total load. The data is available on the TSO's website only starting from Jan'20. The decrease of negative imbalances and the increase of positive ones from Mar'20 followed the update of the BM rules.

Figure 36. Hourly average imbalances volume [IPS]

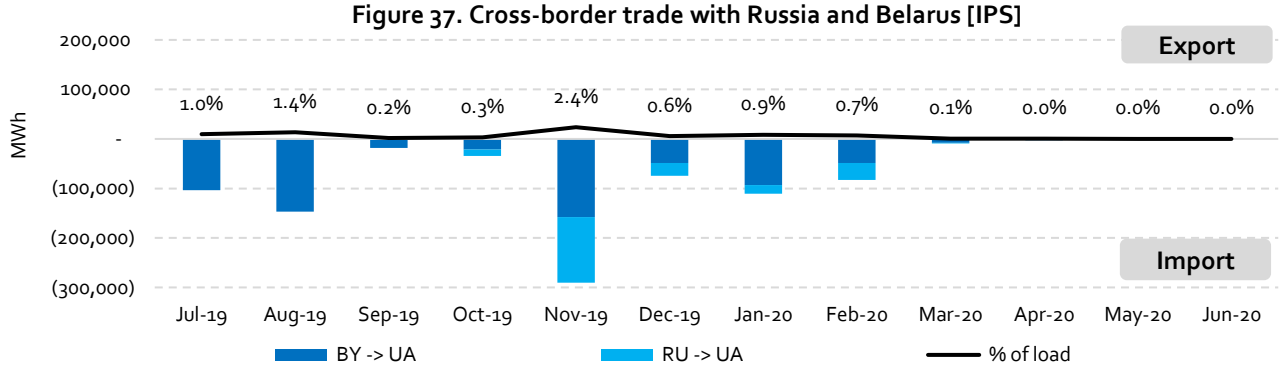


Source: Ukrenergo data, LCU calculations

The figure shows hourly average imbalances and relative share to the DAM turnover. The volume of positive imbalances sold was constantly growing after changes to the BM rules in Mar'20 and exceeded DAM turnover in Jun'20.

Cross-border trading – IPS

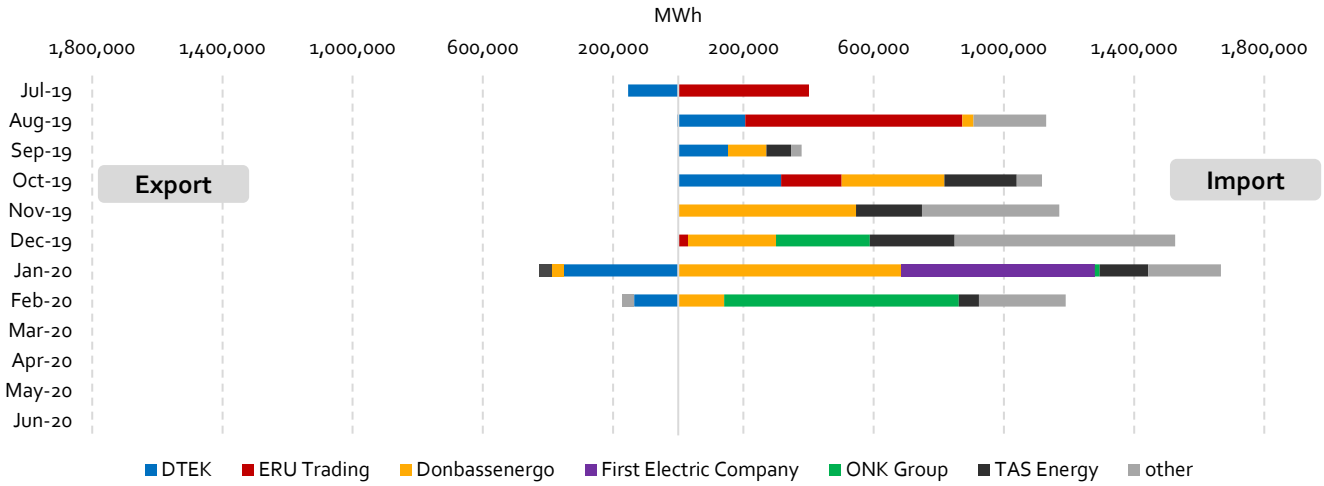
Figure 37. Cross-border trade with Russia and Belarus [IPS]



Source: Ukrenergo data, LCU calculations

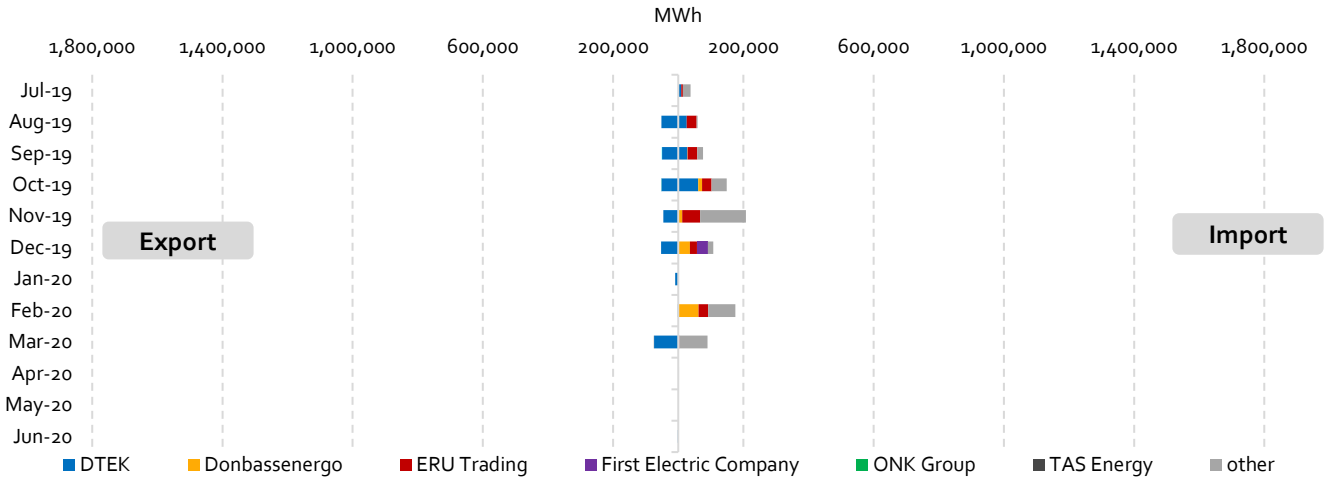
We disregard volumes traded across Moldova (as insignificant) and Poland (imports possible only directly from a single TPP, no exports are possible).

Figure 38. Capacity allocation on MONTHLY auctions in IPS



Source: Ukrenergo data, LCU calculations

Figure 39. Capacity allocation on DAILY auctions in IPS

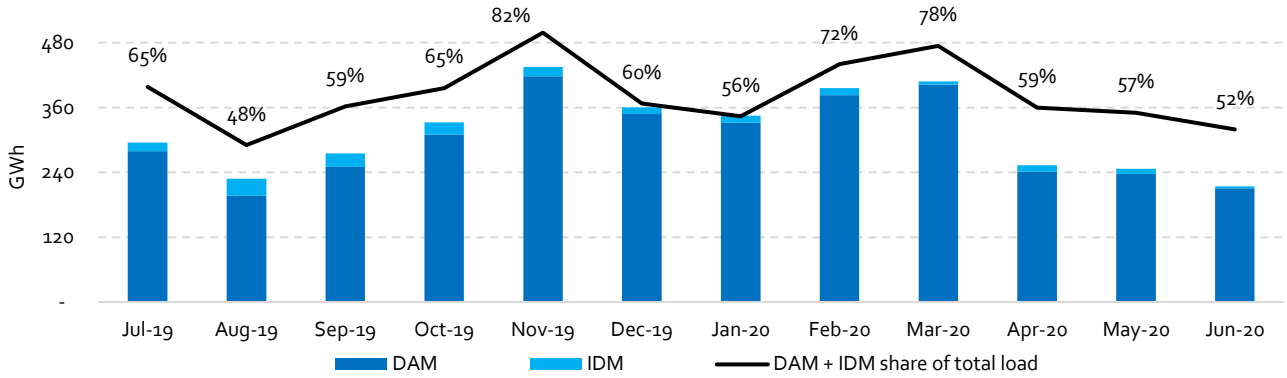


Source: Ukrenergo data, LCU calculations

The figures above show the main actors who secured cross-border capacity with Russia and Belarus (in total). Actors are presented as companies grouped under the name of the particular group. DTEK did not secure cross-border capacity from imports starting from Nov'19. Starting from Nov'19, DTEK was actively blaming imports from Russia a threat to the Ukrainian thermal generation. At the same time, a trader affiliated with Donbasenergo, a TPP operator, has been actively buying out imports' capacities.

DAM/IDM in details – BEI

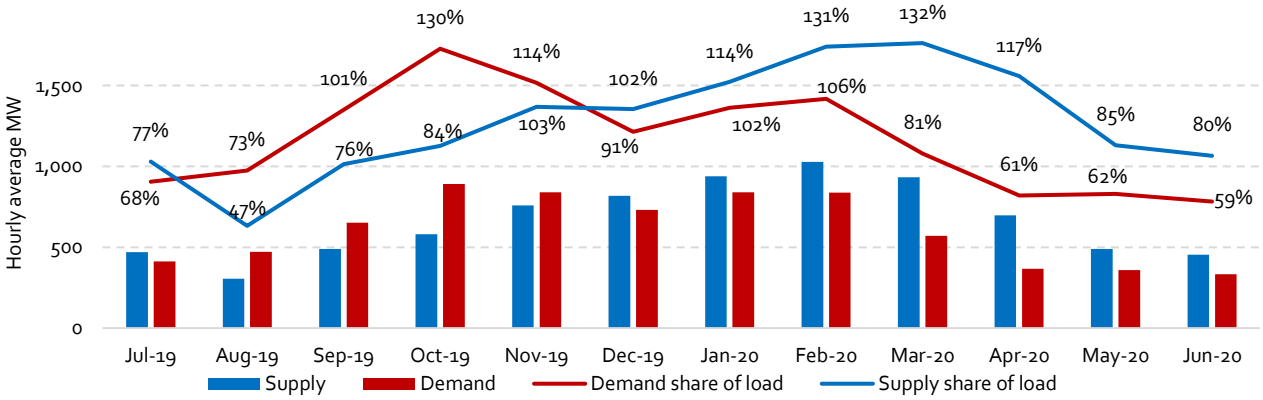
Figure 40. Trade volumes in DAM/IDM [BEI]



Source: Market operator, Ukrenergo data, LCU calculations

The figure shows the total monthly traded volumes on the DAM and the IDM and their share from the total load. The increase in turnover in Sep-Nov'19 and Feb-Mar'20 is linked with the increase in imports. Apr-Jun'20 data represents net turnover, as imports stopped during this period.

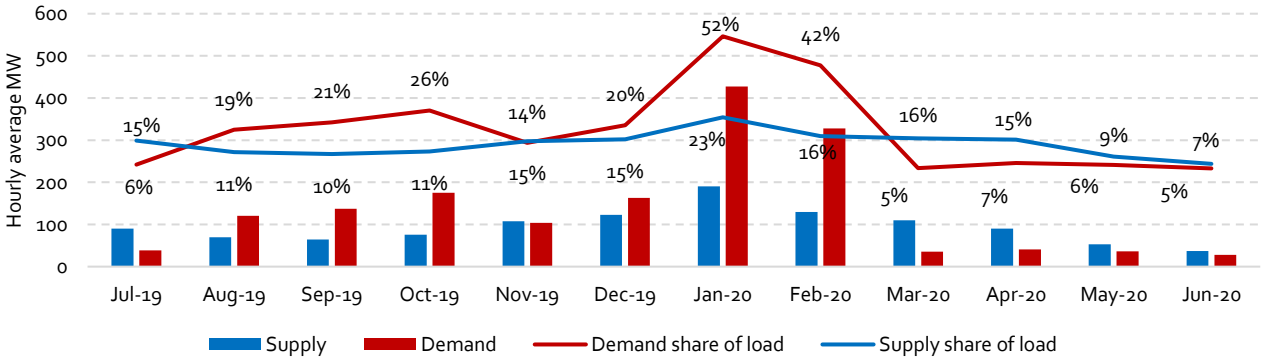
Figure 41. Demand-supply on DAM [BEI]



Source: Market operator, Ukrenergo data, LCU calculations

The demand in the DAM in Sep-Nov'19 and the supply in Nov'19-Apr'20 have exceeded total load in the BEI trading zone. This indicates possible re-export going through BEI.

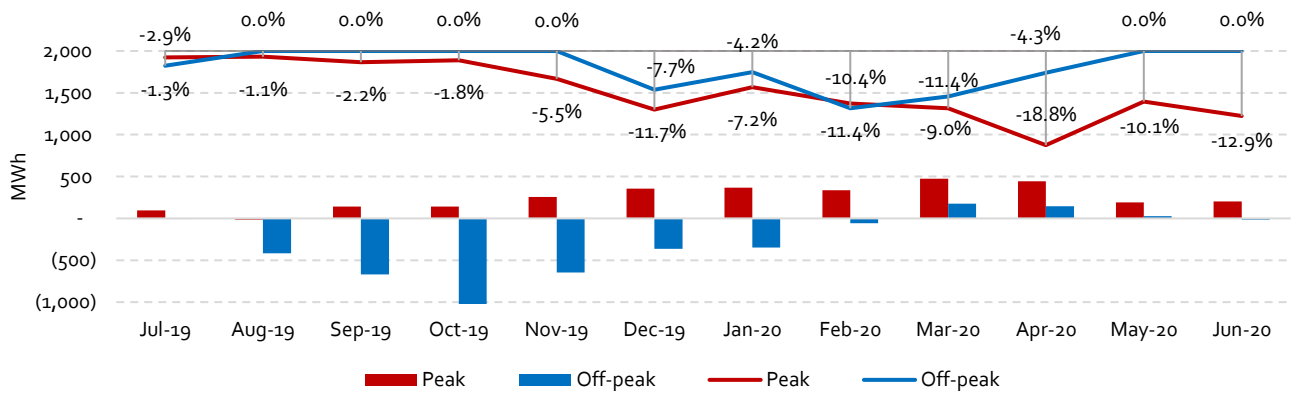
Figure 42. Demand-Supply on IDM [BEI]



Source: Market operator, Ukrenergo data, LCU calculations

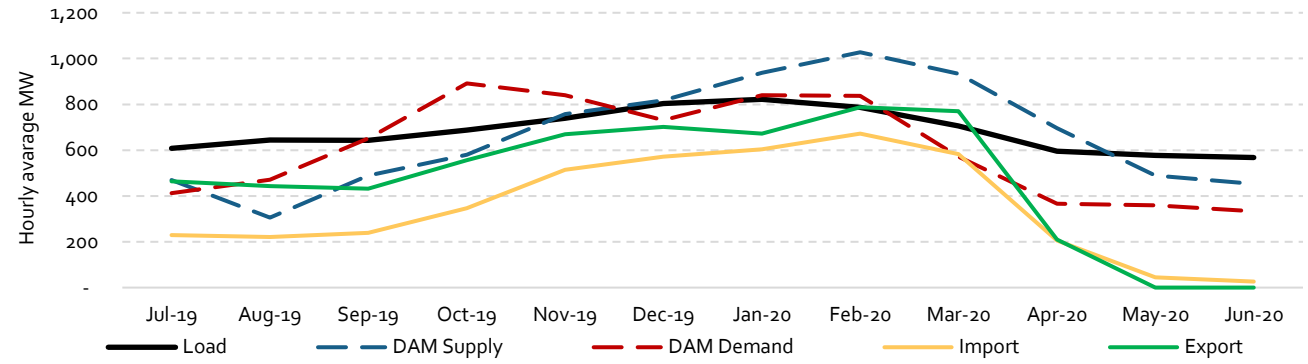
The demand has jumped in Jan-Feb'20 and then decreased back. After exports and imports stopped, the total volume of supply and demand on the IDM remained below 10% of the load.

Figure 43. Supply-demand spreads and price deviations from caps [BEI DAM]



Source: Market Operator data, LCU calculations

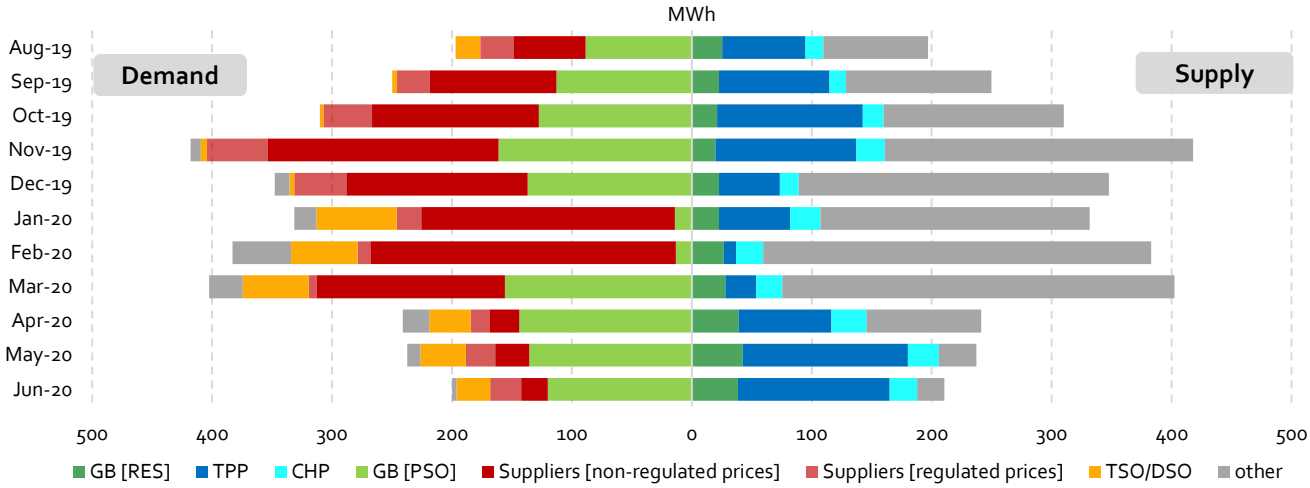
Figure 44. Average loads and supply/demand on DAM [BEI]



Source: Market operator data, Ukrenergo data, LCU calculations

From Jun'19 to Feb'20 the demand exceeded supply on the DAM during off-peak hours. Deviations from the price caps started with the increase in imports in Nov'19, mostly during peak hours. After imports stopped in Apr'20, off-peak price returned to capped levels, while peak price remains slightly lower due to increase supply from RES.

Figure 45. DAM participants structure [BEI]

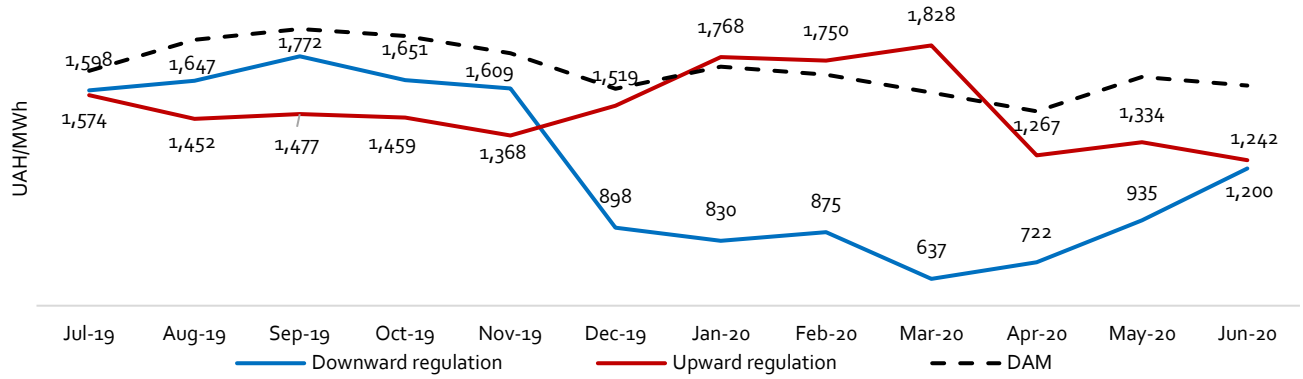


Source: Market operator data, LCU calculations

The Market Operator does not specify the actors classified as "others" on the supply side. We assume these are suppliers and importers, as their share correlates with suppliers share on the demand side and import-export volumes. Notably, the GB sells renewable electricity and buys electricity for households on the DAM within the PSO design. GB is the biggest buyer on DAM, covering more than half of demand from Mar'20. During peak import-export in Dec'19-Mar'20, Burshtyn TPP seemed to have sold power via related suppliers under bilateral agreements and shifted volumes to the balancing market rather than offered it in the DAM, as prices were going down.

Balancing market in details – BEI

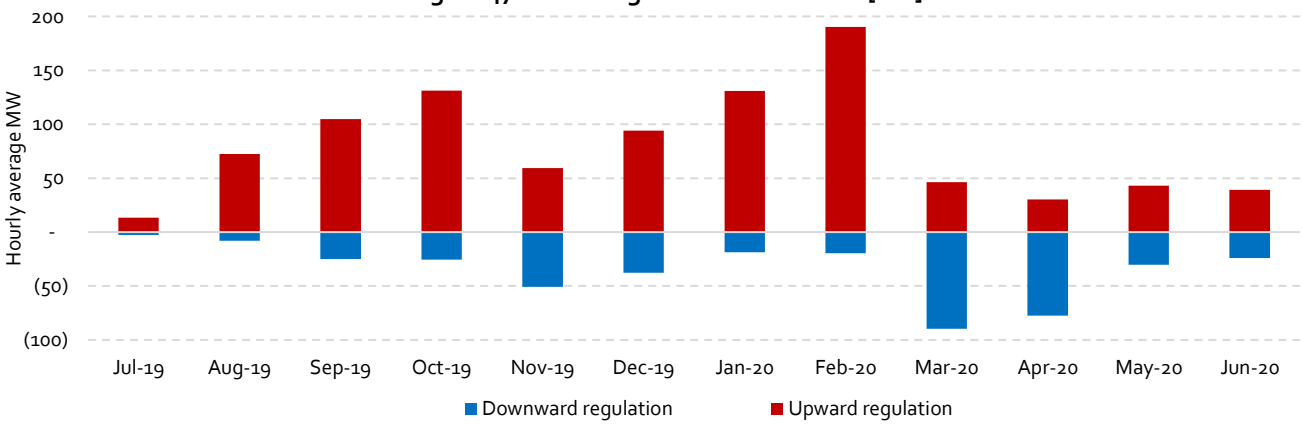
Figure 46. Balancing market prices [BEI]



Source: Ukrenergo data, LCU calculations

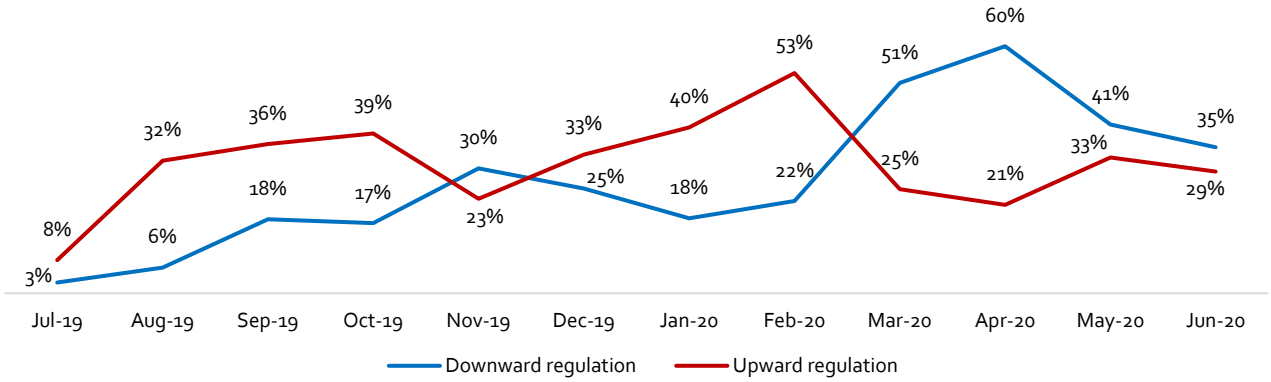
The DAM price was higher than the BM price during 2019, as most of the power on the DAM was traded during peak hours. During off-peak, DTEK shifted volumes to the BM market with higher prices.

Figure 47. Balancing market activations [BEI]



Source: Ukrenergo data, LCU calculations

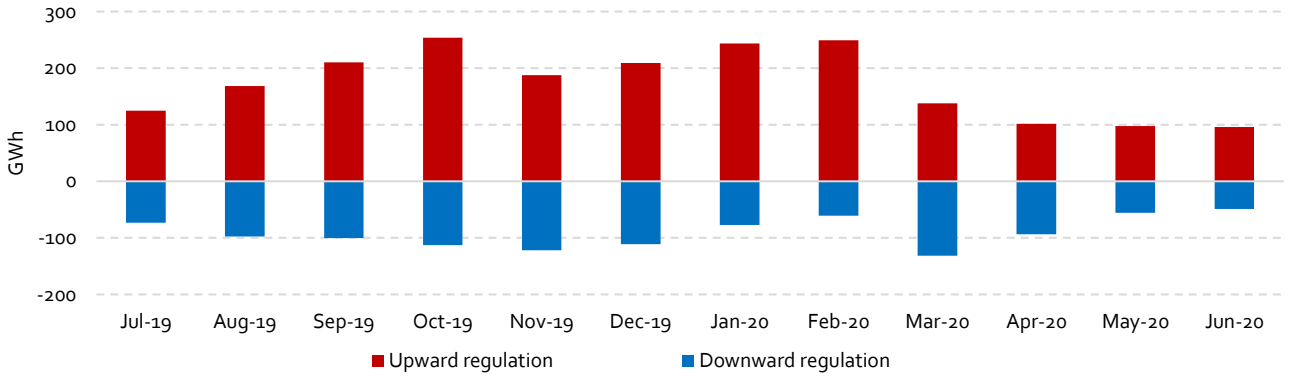
Figure 48. Share of balancing market activations from total bids [BEI]



Source: Ukrenergo data, LCU calculations

The upward activations were growing starting from Aug'19 and remained in the range of 20-25% of the total load until Mar'20. When prices for upward regulations became not attractive for the Burshtyn TPP, the supply decreased. When imports stopped, DTEK was able to keep DAM price high and partially shifted volumes there in May-Jun'20.

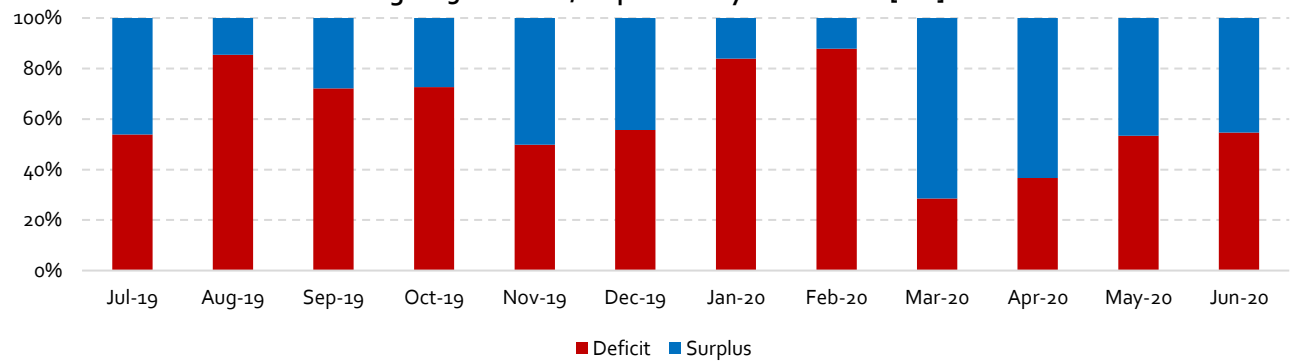
Figure 49. Balancing market bids [BEI]



Source: Ukrenergo data, LCU calculations

The figure shows the total supply on the BM. DTEK decreased its supply following the halt of exports and decrease in BEI total demand.

Figure 50. Defecit/Surplus hourly distribution [BEI]

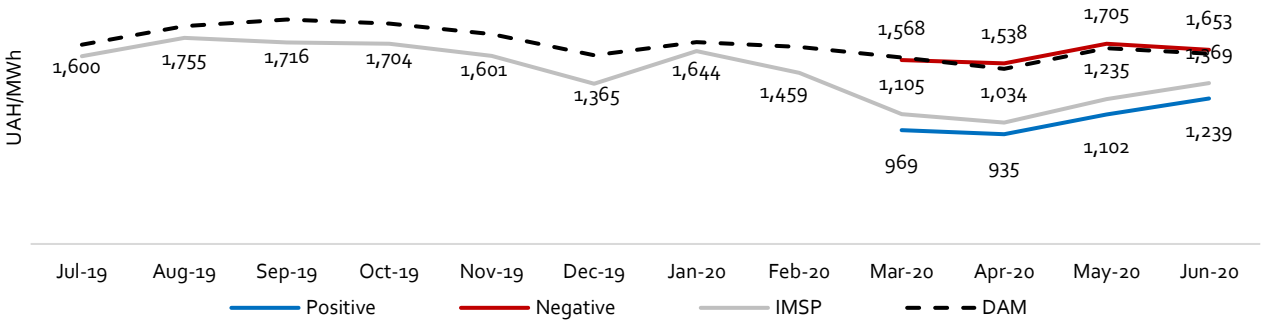


Source: Ukrenergo data, LCU calculations

The figure shows how many hours of the months the balancing market was in surplus (demand for downward regulations exceed the demand for upward ones) or in deficit (vice versa). In contrast to the IPS, most of the time before Mar'20 the BEI' balancing market was in the deficit. After changes to the rules in Mar'20 and half of imports, the BM was experiencing deficit and surplus evenly.

Imbalances in details – BEI

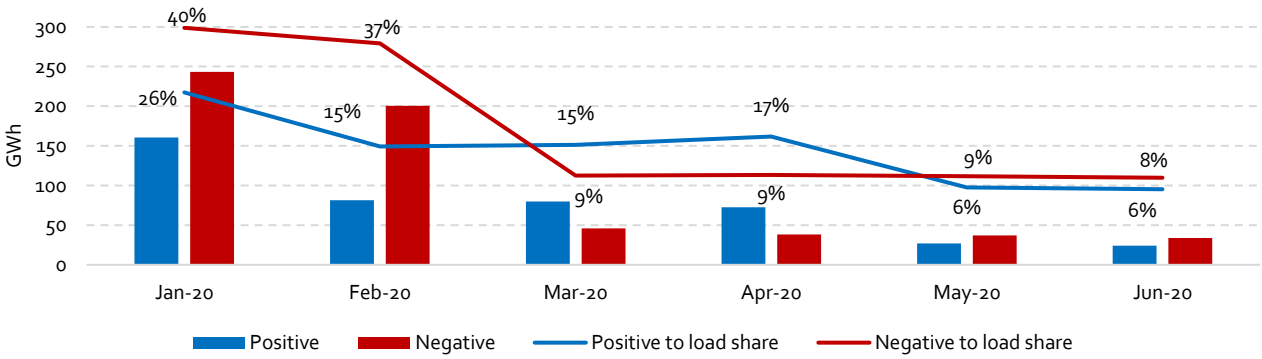
Figure 51. Imbalance prices [BEI]



Source: Ukrenergo data, LCU calculations

IMPS is an imbalance price as defined in the market rules and is calculated based on the BM results. Starting from Mar'20, the dual imbalance price was introduced, for positive (to sell excess power) and negative (to buy power) imbalance balances respectively.

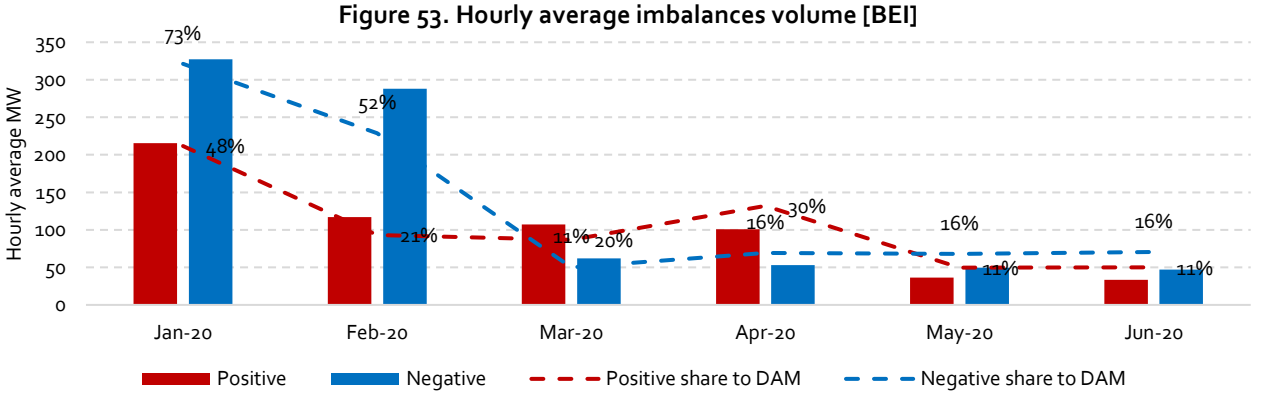
Figure 52. Total imbalances volume [BEI]



Source: Ukrenergo data, LCU calculations

The figure shows the total monthly volume of imbalances and their relative share from the total load. The data is available on the TSO's website only starting from Jan'20. The decrease of negative imbalances and the increase of positive ones from Mar'20 followed the update of the BM rules.

Figure 53. Hourly average imbalances volume [BEI]

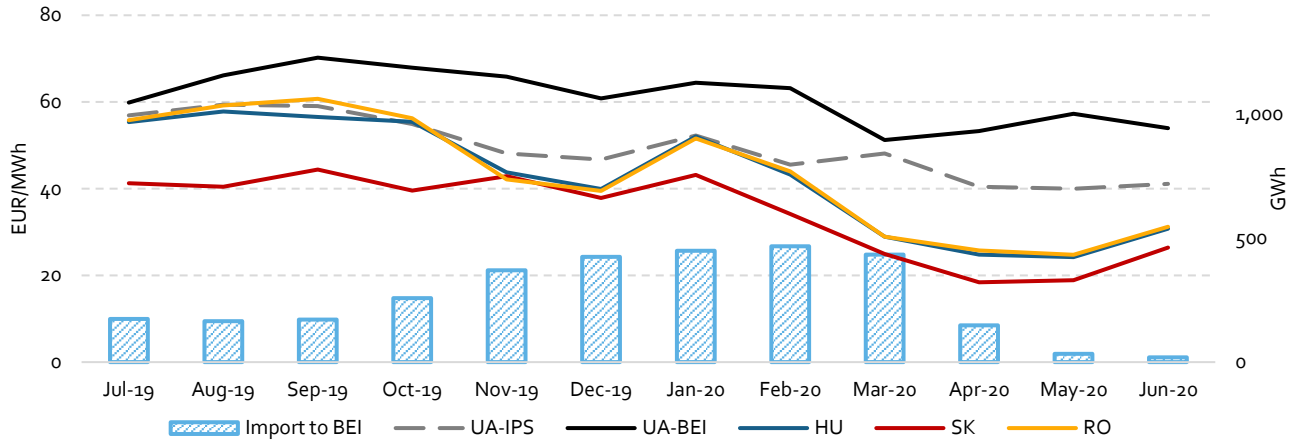


Source: Ukrenergo data, LCU calculations

The figure shows hourly average imbalances and relative share to the DAM turnover. The volume of negative imbalances bought was high during Jan'-Feb'20 and levelled down after changes to the BM rules in Mar'20.

Cross-border trading – BEI

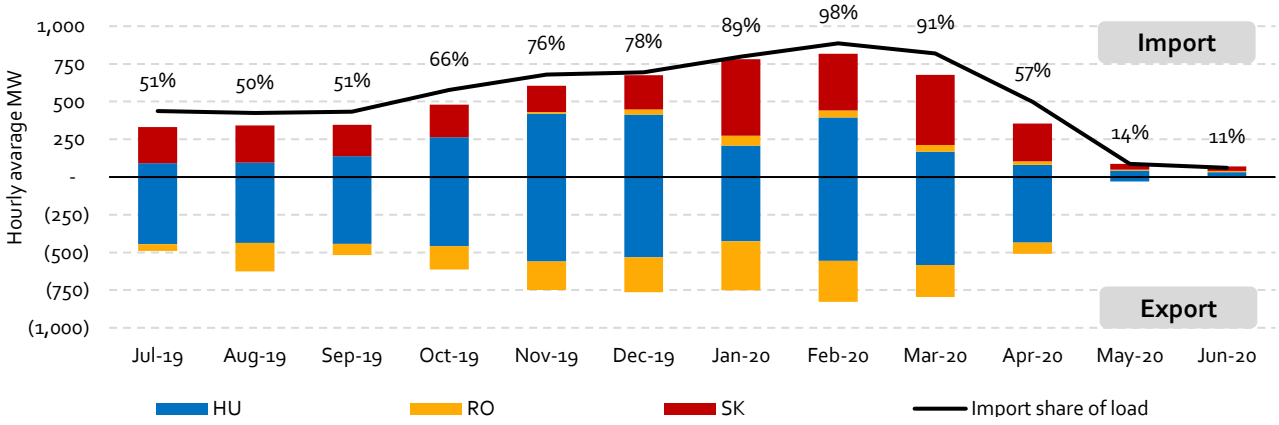
Figure 54. Average prices in Ukraine and neighbouring EU countries



Source: Ukrenergo, Market Operator, ENTSO-E, LCU calculations

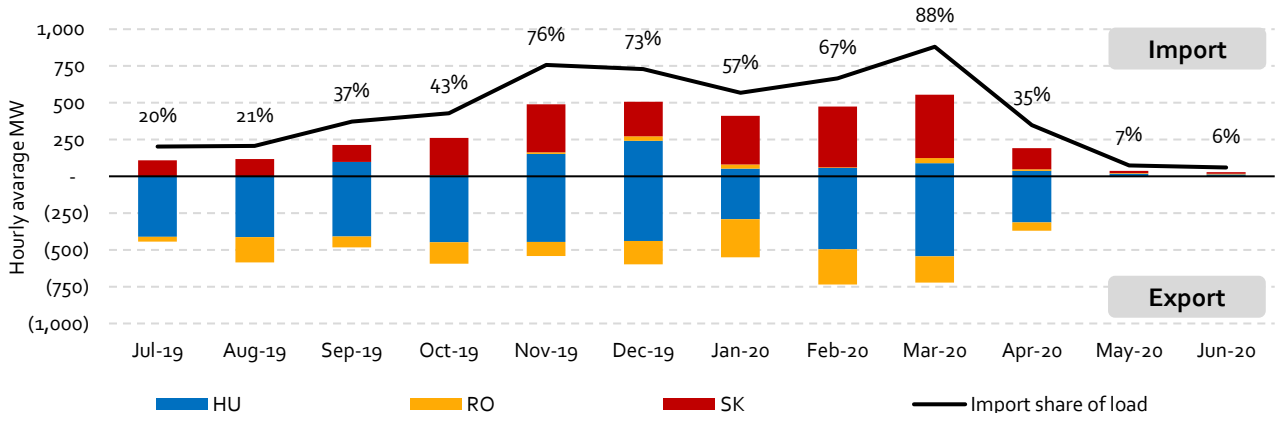
DAM prices in both IPS and BEI trading zones were higher than in the neighbouring EU markets. Imports did have an impact on UA-BEI price, however, due to reserves requirement limitations, its volume was not enough to provide more significant competition to DTEK. The price in BEI went up after imports stopped.

Figure 55. Cross-border commercial schedules - peak



Source: Ukrenergo data, ENTSO-E, LCU calculations

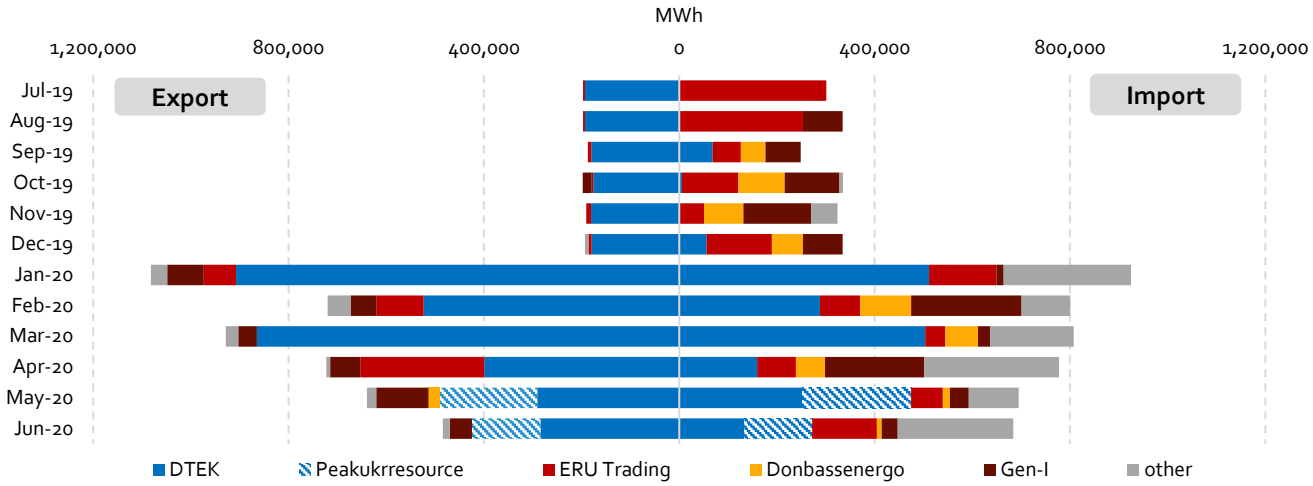
Figure 56. Cross-border commercial schedules - off-peak



Source: Ukrenergo data, ENTSO-E, LCU calculations

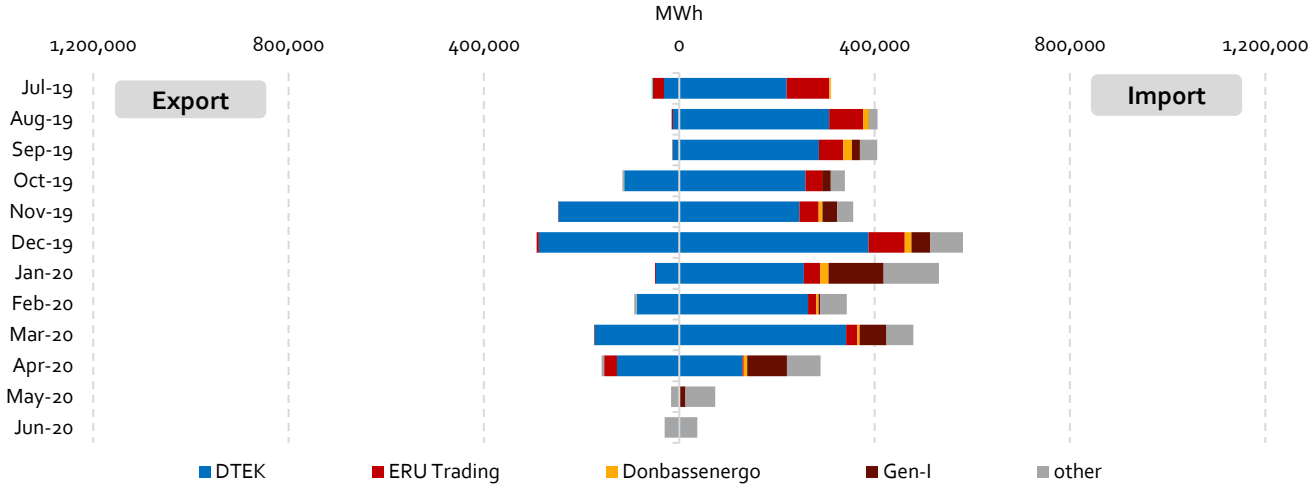
The figure shows monthly export/import volumes per each cross-border direction in BEI and share of imports from the total load. The high share of imports form load, both during peak and off-peak hours suggests that the increased imports from Slovakia were then re-exported to Romania, which was possible due to price difference, as seen on Figure 54.

Figure 57. Capacity allocation on MONTHLY auctions in BEI



Source: Ukrenergo data, LCU calculations

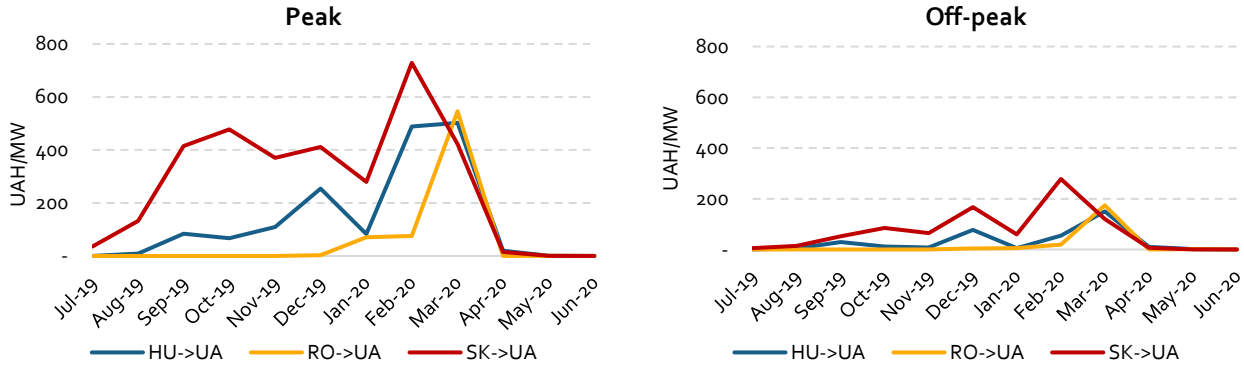
Figure 58. Capacity allocation on DAILY auctions in BEI



Source: Ukrenergo data, LCU calculations

The figures above show the main actors who secured cross-border capacity with BEI trading zone (all borders combined). Actors are presented as companies grouped under the name of the particular group. The high allocations on daily auctions indicate that a significant share of monthly allocations was not used. DTEK dominates exports capacities and has a significant share of imports capacities, which allows it to maintain its market power and keep prices high.

Figure 59. Import capacity allocations prices

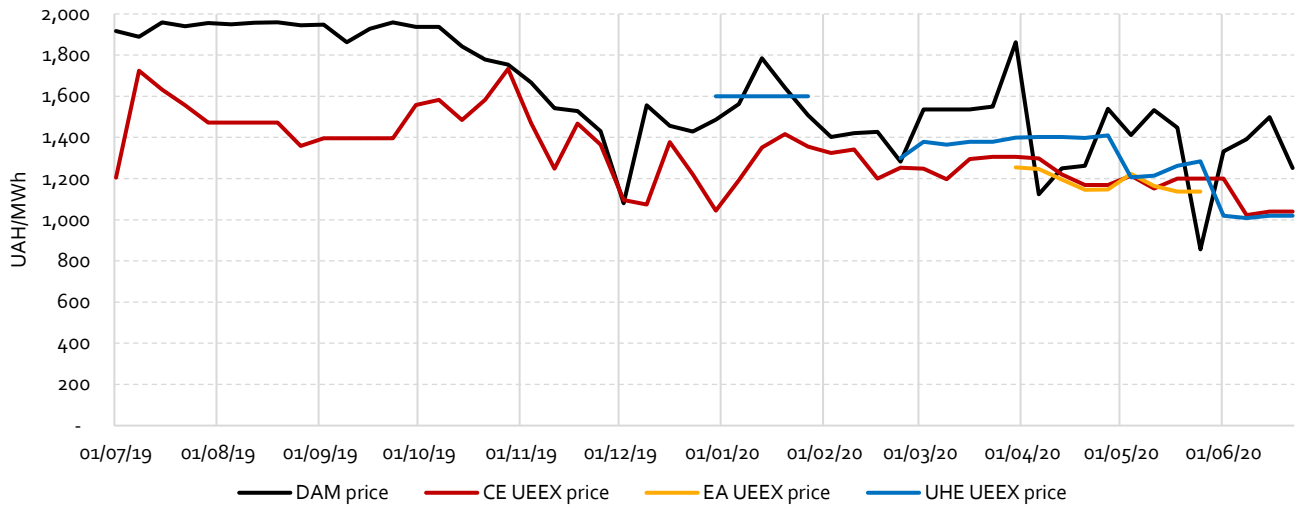


Source: Ukrenergo data, LCU calculations

The figure shows a weighted average price for cross-border capacity for imports to BEI. It is an indicator for the market's demand for import capacities.

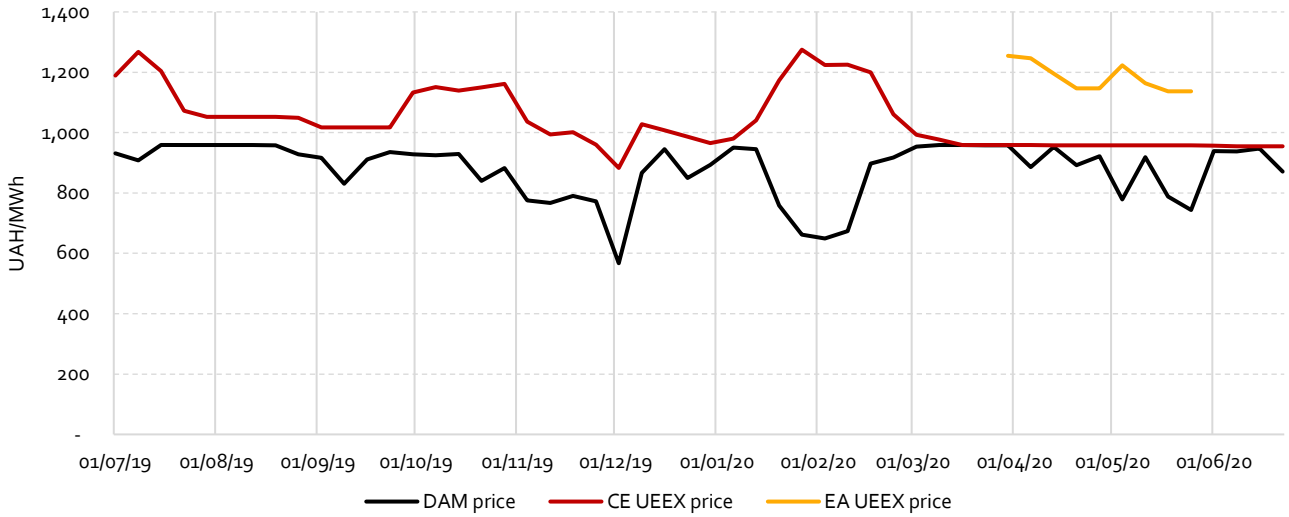
UEEX bilateral agreements trading results

Figure 60. DAM-UEEX prices comparison - peak



Source: UEEX data, LCU calculations

Figure 61. DAM-UEEX prices comparison - offpeak

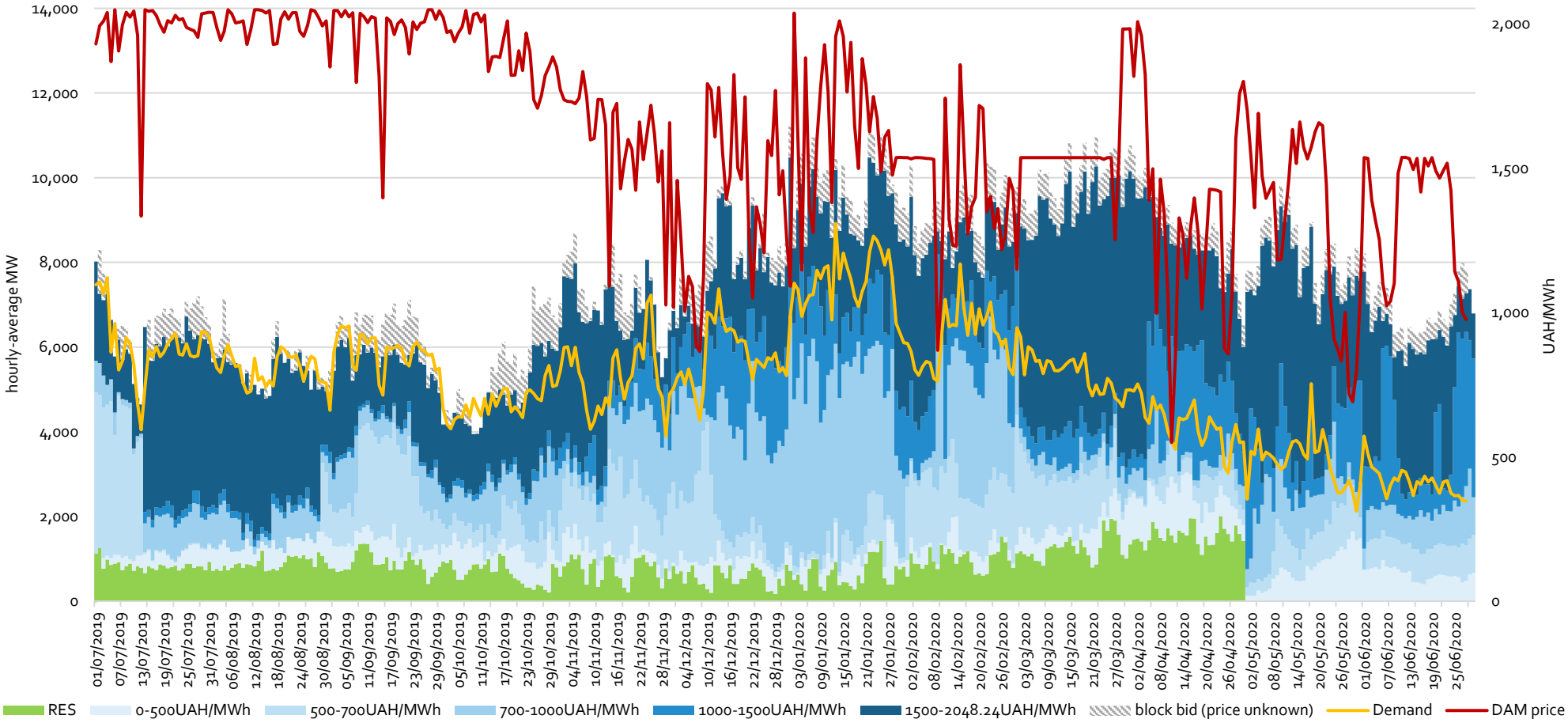


Source: UEEX data, LCU calculations

The figures show weighted average prices for a state-owned generation under bilateral auctions conducted on the UEEX. Centrenergo has sold at significantly lower prices for peak hours and slightly higher for off-peak. The average price was 10% lower than average DAM price. The peak prices at which EA sold its output were remarkably close to CE's prices. UHE has been selling power via bilaterals at higher prices than CE, which is irregular.

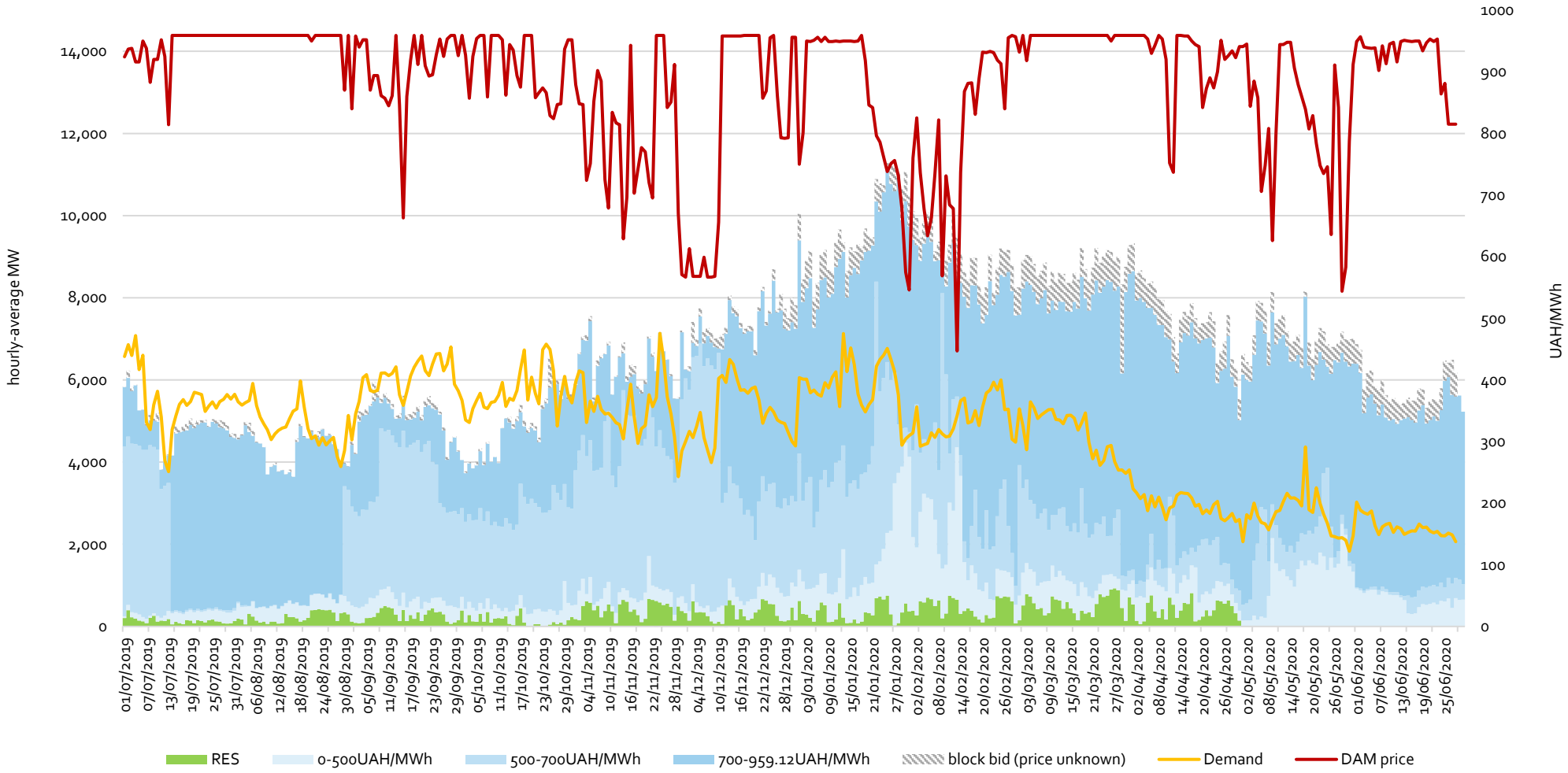
DAM supply bids analysis – IPS

Figure 62. DAM [IPS] supply bids structure - peak hours



The figures 62-65 represents the analysis of supply bids on the DAM in the IPS. The shaded areas represent the hourly average volume of bids, with each colour representing a specified price range for the submitted bids. 0-500 UAH/MWH are low-price bids, 500-700 UAH/MWh is a "PSO range", as EA and UHE PSO-regulated prices belong in this range. Block bids are not present in the Market Operators data, thus we don't know their prices. RES was bid at the lowest possible price by the GB until 1/05/20. After that, we can't tell for sure to which price range the RES power belongs. This figure shows the bidding pattern of the market players. The DAM price drops are correlated with the increase of low-price bids in Dec'19, in Jan-Feb'20 and in May'20.

Figure 63. DAM [IPS] supply bid structure - offpeak hours



Highlights: DAM price drops due to significant increase of low-price bids at the end of Jan'20 – the beginning of Feb'20 and in May'20.

Figure 64. DAM [IPS] supply bids structure - peak hours (distribution)

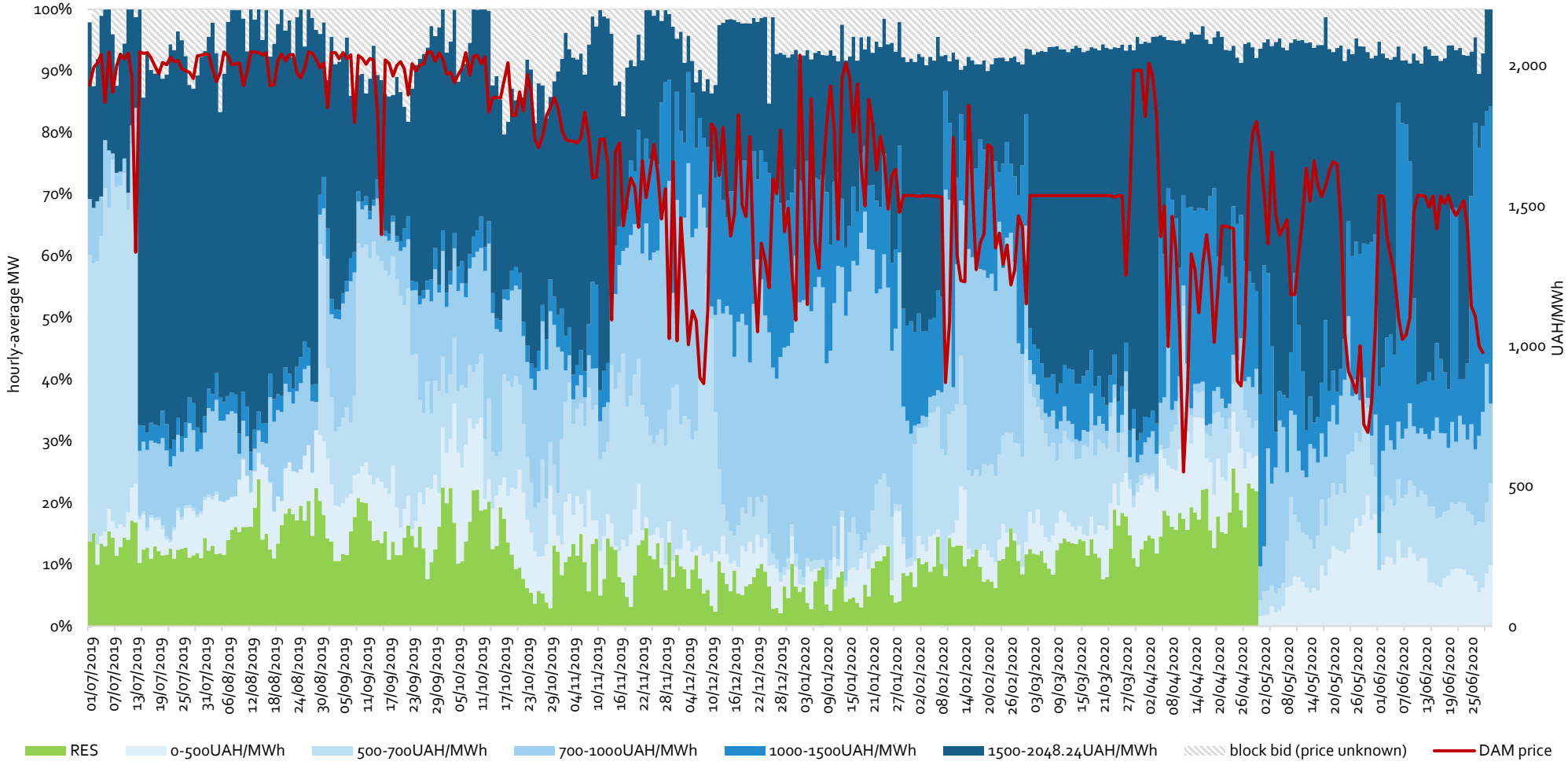


Figure 65. DAM [IPS] supply bid structure - offpeak hours (distribution)